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CONSULTING ENGINEERS

Industri Plex
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PRE-DESIGN INVESTIGATION
TASK S-4
FOUNDATION DATA
INTERIM FINAL REPORT

INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Prepared for:

Industri-Plex Site Remedial Trust
800 North Linbergh Boulevard
St. Louis, Missouri 63167

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September 1990 Project No.: 893-6255

Golder Associates Inc.
CONSULTING ENGINEERS

September 26, 1990 Project No. 893-6255

United States Environmental Protection Agency, Region 1
Waste Management Division
J.F.K. Federal Building HRS-CAN-3
Boston, Massachusetts 02203-2211

Attn: Joseph DeCola
Remedial Project Manager

RE: INDUSTRI-PLEX SITE PRE-DESIGN INVESTIGATION
TASK S-4 FOUNDATION DATA - INTERIM FINAL REPORT

Gentlemen:

On behalf of the Industri-Plex Site Remedial Trust, we are submitting the attached Foundation Data Interim Final Report for the Industri-Plex Site in Woburn, Massachusetts. This report is being submitted in accordance with the Pre-Design Investigation Work Plan (PDI) Task S-4 reporting requirements (PDI Sections 3.2.6.5 and 3.8.1.1.4, p. 55 and 127).

Please contact us if you have any questions.

Very truly yours,

GOLDER ASSOCIATES INC.

Kenneth R. Moser, Associate
Project Manager

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1.0 INTRODUCTION

This report is submitted in fulfillment of the Interim Final Report deliverable for the Pre-Design Investigation (PDI) Task S-4, Foundation Data, as specified in sections 3.2.6.5 (p. 55) and 3.8.1.1.4 (p. 127) of the PDI Work Plan.

1.1 Purpose

The purpose of this interim report is to provide the geotechnical characteristics of the soil in select locations for foundation design of the treatment plant(s) and future site development. A water treatment plant is required for the treatment of groundwater pumped from recovery wells prior to groundwater recharge. A gas treatment plant is necessary to treat gaseous emissions from the East Hide Pile and possibly from the groundwater treatment system. Geotechnical data was also collected to the East of Commerce Way in support of future site development.

This interim final report discusses the background and requirements set forth in the various governing documents; the field investigation methodology and laboratory testing protocol; and test results, interpretation and general recommendations for the foundations of the various structures.

1.2 Consent Decree Objectives

On April 24, 1989 a Consent Decree was entered between the Industri-Plex Site Remedial Trust (ISRT), the United States Environmental Protection Agency (USEPA), and the Massachusetts Department of Environmental Protection (MDEP), which defines the scope of remediation at the Industri-Plex Site in Woburn, Massachusetts. The objectives of the remediation are stated in the Record of

Decision (ROD) prepared by the USEPA in September 1986. Specifically, the ROD states, Page 21:

> "The overall objective of the remedial actions at the Site is to effectively mitigate and minimize threats to and provide adequate protection of public health, welfare and the environment. Specifically, the FS (Feasibility Study) evaluated alternatives which addressed the following three remedial objectives:
>
> 1. Protection of the public health and surface waters from direct contact exposure to soils/sludges contaminated with elevated levels of arsenic, lead and chromium.
>
> 2. Protection of the public health, welfare and environment from the contaminated soils, odors and leachate in or emanating from the East Hide Pile.
>
> 3. Protection of the public health and environment from groundwater contaminated with benzene and toluene."

The Consent Decree incorporates the Remedial Design Action Plan (RDAP) which outlines various remedial actions. The remedial actions as stated in the RDAP, include:

> (pgs. 7 & 8) "The remedial action for control of air emissions is intended to mitigate the release or threat of Hazardous Substances, including odors associated with decaying hide waste, in the East Hide Pile...The remedial action shall consist of stabilizing the side slopes of the East Hide Pile, installing a gas collection layer, capping with a synthetic membrane to establish impermeability, and soil cover in accordance with Attachment A, and treating gaseous emissions with either activated carbon or thermal oxidation."
>
> (p. 9) "Settlers shall design and implement an interim groundwater remedy that shall consist of several interceptor/recovery wells located to capture the identified plumes of Hazardous Substances (benzene and toluene) migrating in groundwater, construction of a treatment system, and operation and maintenance of these remedial components until the appropriate performance standards are achieved...Settlers shall

> pretreat recovered groundwater to control odors and remove dissolved or suspended Hazardous Substances, and shall subject the recovered groundwater to air stripping to remove volatile Hazardous Substances."

Implementation of the remedial actions for gases and groundwater described above, require the construction of a treatment plant or plants. The RDAP requires the execution of a Pre-Design Investigation (PDI) which includes the collection of foundation data for the design of these treatment plants. The objective, as stated on page 22 of the PDI Work Plan, is to :

> "Collect sufficient geotechnical data to determine the depths where good bearing capacity can be provided for foundation design of the groundwater and gas treatment plants, and future site development."

This interim final report constitutes the results of the foundation investigation, which has been conducted to meet the requirements set forth in the PDI.

2.0 PROJECT REQUIREMENTS

Foundation data is necessary for the design of the gas and groundwater treatment systems. In addition, foundation data is also convenient for planning of future site development. The following sections discuss the types of structures and appurtenances tentatively required for the treatment systems and typical structures associated with site development.

2.1 Groundwater Treatment System

The groundwater treatment system will consist of extraction, conveyance, treatment, and subsequent discharge systems. The treatment system is of interest since it is expected to require structures that will generate significant loads.

The Remedial Design Work Plan discusses possible structures associated with the treatment system. These are summarized below.

- An equalization tank which will accept water from the groundwater extraction system and will transfer it to the treatment system.
- Concrete containment dikes will be constructed around all tanks. The dikes will be located and sized to contain 120 percent of the tanks volumes.
- A process building of predesigned construction, consisting of steel framing. The building will house an office, laboratory, maintenance area, restroom and appurtenant structures.
- An air stripping column.
- Carbon polishing filters, if necessary.

In addition, items such as agitators, pumps, piping, level gauges, pressure gauges, flow meters, and control system may be needed.

The actual design of the groundwater treatment system is part of the Remedial Design. It should be noted that the air treatment associated with the groundwater treatment plant may be incorporated with the East Hide Pile gas treatment plant. However, a temporary gas treatment system may be necessary.

2.2 Gas Treatment System

The gas to be treated will be collected by means of a polyvinyl chloride (PVC) piping grid imbedded in a gas collection layer that will form part of the East Hide Pile impermeable cap. The grid will be interconnected and piped to a transfer pipe which will lead to the gas treatment system. The gas treatment system will comprise either a dual carbon adsorption unit or a thermal oxidation unit with auxiliary fuel. Both treatment systems are outlined in the ROD.

A typical dual carbon adsorption unit is shown in Figure 13 of the ROD and is included as Appendix E for reference. This unit consists of two tanks connected in series, containing activated carbon. The tanks are approximately 8 feet in diameter and 6 feet in height. An internal screen designed to support 6,000 pounds is indicated. The tanks are surrounded by a concrete dike. In addition a 12 foot high stack and blower are shown.

A typical thermal oxidation unit is shown in Figure 14 of the ROD (Appendix E). It consists of a burner with a 30 foot high stack. The system requires a fuel storage tank. Figure 14 of the ROD illustrates a 3000 gallon propane storage tank. A dike would be required around the tank.

The choice of a gas treatment system will not be made until the impermeable cover and gas collection system have been constructed and the East Hide Pile has reached equilibrium. The selection will be a function of gas characterization, flow rate, system safety, treatment efficiency and economics. A temporary gas treatment system will be necessary and could serve as the permanent treatment system with proper modifications.

2.3 Future Site Development

A conceptual site development Master Plan has been prepared by Sasaki Associates. Structures such as a hotel, offices, retail, and commercial buildings may be included in the Master Plan for future site development.

3.0 FIELD INVESTIGATION

A geotechnical investigation was conducted to assess the foundation characteristics of the in-situ soils. The specific objectives of this investigation included:

1. Determine the foundation characteristics of selected areas for potential location of gas and water treatment plants. These areas were delineated in the PDI and are shown in Figure 1.

2. Determine the foundation characteristics for future site development, particularly East of Commerce Way.

To evaluate the geotechnical properties of the soils, a field investigation was conducted which included a series of boreholes and test pits. A total of 8 boreholes, labelled T1 through T4 and SD1 through SD4, were drilled; and 19 test pits, denoted as P1 through P19, were excavated. The borehole and test pit locations are shown on Figure 1. The borehole logs are presented in Appendix A, and the test pit logs are included in Appendix B.

3.1 Boreholes

The boreholes for the foundation investigation were drilled by Geo Logic, Inc. of Watertown, Massachusetts under full-time supervision by Golder personnel. A Mobile B-57 ATV rubber-tired drill rig was used for drilling and sampling of all boreholes. Hollow stem augers (4 1/4 inch ID) were exclusively used for drilling. Four boreholes were drilled in three potential treatment plant locations and labelled T1 through T4. Four boreholes were drilled in areas for future site development and were labelled SD1 through SD4.

The drill rig, drilling equipment, and tools were steam cleaned at the decontamination pad before entering or leaving the fenced site area. Also, steam cleaning was performed if the rig moved from a borehole in an area of known contamination to an area not delineated as contaminated.

Air monitoring was conducted during drilling with an MSA 361 and Hnu or an organic vapor analyzer (OVA). Monitoring was conducted in the breathing zone above the boreholes, by means of spot readings taken each time the holes were advanced approximately 5-feet of depth.

Several borehole locations were modified from the PDI Work Plan Figure 23, based on field observations and access. This figure is included in Appendix E for reference. The field relocations were approved with a Field Change Documentation Form signed by the on-site USEPA representative from NUS Corporation (NUS). These forms are included in Appendix C. The changes included the following:

1. Borehole SD1 location was switched with test pit P16 because bedrock outcrops were noted in the vicinity of SD1's original location.

2. Borehole SD2 was relocated approximately 300 feet to the southeast, since the original location was near a delineated hide pile and between two ponds.

3. Borehole SD3 was moved approximately 800 feet to the East because bedrock outcrops were noted in the original location.

Borehole depths were scheduled using Table 7 of the PDI Work Plan as a guide, which is included in Appendix E as a reference. However, the actual borehole depths were modified to suit the actual soil conditions. The boreholes

were advanced to the depths estimated in the PDI Work Plan, or to auger and/or split spoon refusal, which indicated that a competent bearing strata had been reached. The borehole logs present the total depths and soils encountered for each specific borehole. Table 1 summarizes actual borehole depths and the depths anticipated in the PDI Work Plan. Boreholes such as T1 and T2 encountered bedrock near the surface. In this case, several boreholes were drilled in the vicinity to confirm the presence of bedrock. Boreholes SD2 and SD3 did not advance to the anticipated depth due to auger and/or split spoon refusal. It should be noted that these boreholes had encountered a competent bearing strata when the borehole was terminated.

Sampling of the foundation boreholes was accomplished by means of a split spoon in accordance with the Standard Penetration Test (SPT). The samples were described using Golder Associates soil logging system, which is based on the Unified Soils Classification System (USCS). This method is outlined in the PDI Work Plan and is summarized in Appendix A. Standard Penetration Tests were conducted in all boreholes at an average of 5-foot intervals of depth. The tests were performed in accordance with American Society for Testing and Materials (ASTM) Standard D1586. A 1.375 inch ID split spoon was typically driven 2 feet. Blow counts were recorded in 6-inch increments of penetration. The blow count from 6 to 18 inches of penetration were added to determine the penetration resistance values (N-values) to assess the relative density or consistency of the in-situ soils. Representative soil samples were collected from the split spoon sampler and placed in glass jars for laboratory testing and archive. The jars were labelled with sample number, borehole number, date, depth, N-value, Golder job number, and identification code as described in the PDI Work Plan.

Table 1 compares the total number of split spoon samples attempted with the number estimated in Table 7 of the PDI Work Plan. The actual number of split spoon samples attempted is lower than anticipated due to the lower total footage actually drilled, as previously described.

The sampling program described in Table 7 of the PDI Work Plan also outlines undisturbed sampling using Shelby tubes. However, dense to very dense outwash sand, glacial till, fill or bedrock were encountered in the foundation boreholes, and undisturbed Shelby tube sampling of these materials was not feasible. One Shelby tube was attempted in a soft zone in Borehole T3; however, no sample was recovered due to the presence of very soft, saturated soils.

The boreholes were decommissioned by backfilling the hole with cuttings generated from the drilling process. The abandoned borings were staked and flagged for subsequent surveying. The survey was conducted by SAIC Engineering Inc. of Lakeville, Massachusetts.

3.2 Test Pits

A total of 19 test pits were excavated and denoted as P1 through P19. Test pits P1 through P10 were excavated in the three potential treatment plant locations, and P11 through P19 were excavated in the eastern part of the site, for potential future development. The test pits were excavated by Cornerstone Construction of Saugus, Massachusetts, using a Kubota KH170L track mounted backhoe under full-time supervision of Golder personnel. The test pit locations are shown in Figure 1, and the test pit logs are presented in Appendix B.

The backhoe was steam cleaned at the decontamination pad upon entering and exiting the fenced area. The test pits were excavated in a sequence from areas not known to contain contaminants to areas with known contaminants, thus steam cleaning was not required between test pits.

Air monitoring was conducted during excavation using an MSA 361 and an Hnu or organic vapor analyzer (OVA). Monitoring was conducted in the breathing zone and inside the test pit during excavation.

Test pit locations were determined using Figure 23 of the PDI Work Plan as a guide (Appendix E). Some locations were modified based on field conditions. The following field changes were made as approved by the on-site USEPA representative from NUS and ISRT:

1. Test pit P16 was switched with the location of borehole SD1 due to bedrock outcrops in the vicinity of SD1.

2. Test pit P11 and P12 were moved south inside the fence line to facilitate access.

The Field Change Documentation Forms are included as Appendix C.

The test pits were excavated to a minimum depth of 8 feet unless bucket refusal or groundwater were encountered at shallower depths. Test pit P1 through P4 encountered bedrock at shallow depths, and P5 through P8 encountered groundwater near the surface.

Samples were obtained from the test pits for each soil type encountered. Generally, the samples were collected using a shovel and the soil was stored in sealed plastic bags. Bulk samples were collected and placed in 5-gallon buckets

from various test pits for additional sample material. Samples were described using the Golder Associates soil logging system, as previously mentioned. Samples were labelled with sample number, test pit number, date, depth interval, sampler, Golder job number, and identification code. Cross-sections of the test pits were drawn indicating location of different soil types, geometry of the test pit, ground water if encountered and samples taken.

Upon completion, the test pits were backfilled with the excavated soils. The location of each test pit was staked and flagged for subsequent surveying. The survey was conducted by SAIC Engineering Inc. of Lakeville, Massachusetts.

4.0 LABORATORY TESTING

A laboratory testing program was conducted to evaluate the geotechnical properties of selected soil samples collected during the field investigation. Soils testing was conducted at Golder Associates Geotechnical Laboratory in Mt. Laurel, New Jersey.

4.1 Testing Requirements

The testing program was designed to meet the objectives set forth in Table 7 of the PDI Work Plan and in the Data Quality Objectives (DQO) included as Table 16 of the PDI Work Plan. Both tables are included in Appendix E as a reference.

A comparison of the actual testing program with the requirements of the PDI Work Plan is presented in Table 2. The testing program was slightly modified to suit the soil types encountered during the field investigation. Three shear strength and three consolidation tests were conducted. Additional strength and consolidation testing was not warranted since dense to very dense sands, glacial till, fill and bedrock were encountered, in which undisturbed samples representative of the in-situ conditions can not be obtained, and laboratory tests on remolded samples of these materials would not represent in-situ conditions.

The three shear strength and three consolidation tests that were conducted, were run on sand samples remolded to approximately 95 percent of the Modified Proctor maximum density. These tests were done to evaluate potential use of this material as backfill around the foundations, or as general fill for grading or placement adjacent to retaining structures. Modified Proctor moisture/density relationship and specific gravity tests, not required in the Work Plan,

were conducted on the same samples that could be used as backfill or general fill, and that were also tested for strength and consolidation properties.

4.2 Testing Protocol

The following narrative discusses the types of tests conducted, their methodology and the samples tested.

1. Moisture content was determined on a total of 17 samples. The samples were tested in accordance with ASTM Standard D2217-85.

2. Mechanical grain size distribution tests were conducted on 15 samples; 13 of them also had hydrometer tests performed. The tests were performed in accordance with ASTM Standards D421, D422, and C136.

3. Atterberg limits (plastic and liquid limits) were conducted on 15 samples. The tests were performed in accordance with ASTM Standard D4318-84

4. Specific gravity was determined on those samples for which Modified Proctor and/or consolidation tests were conducted. A total of four tests were run. These tests were conducted in accordance with ASTM Standard D854-83.

5. Modified Proctor tests were conducted to establish moisture/density relationships. These samples are regarded as having potential for use as backfill or general fill during any local regrading operations. A total of four tests were conducted. The tests were performed according to ASTM Standard D1557.

6. Three remolded samples were chosen to conduct consolidated undrained (CU) triaxial strength tests with pore pressure measurement. These samples are regarded as having potential for use as backfill or general fill during any local regrading operations. The samples were compacted to approximately 95 percent of the maximum dry density and tested with 3, 6, and 9 pounds per square inch (psi) confining pressures. The tests were conducted in accordance with Army Corps of Engineers EM-1110-2-1906, Appendix 10 (with recent updates).

7. Consolidation tests were conducted on three remolded samples. These samples are regarded as having potential for use as backfill or general fill during any local regrading operations. The tests were run on the same samples as the strength tests. The tests were performed in accordance with ASTM Standard D2435-80

8. The organic content was determined for one sample. The test was performed in accordance with ASTM Standard D2974.

The results of all the laboratory tests are presented in Appendix D. The soil properties determined in these tests are discussed in Section 5.0.

5.0 GEOTECHNICAL CONDITIONS

5.1 Potential Treatment Plant Adjacent to West Hide Pile

A subsurface investigation was conducted in the potential area for a treatment plant located south of the West Hide Pile, as shown in Figure 2, to evaluate the characteristics of the in-situ soils for foundations design. One borehole, T3, was drilled and four test pits, P5 through P8, were excavated in this area. In addition, Boreholes 7 and 8 drilled during the PDI Task S-2 investigation, are located in the vicinity. Subsurface data in the area is also available from the shallow RI/FS boreholes 47/31, 48/32 and 48/34, that are approximately 0.8 to 6.0 feet deep. The location of all boreholes and test pits mentioned above are shown in Figure 2, and a cross section through the area is shown in Figure 5. Borehole logs are included in Appendix A and test pit logs are presented in Appendix B.

5.1.1 Subsurface Conditions

The units encountered in the area south of the West Hide Pile consist of an upper layer of fill overlying outwash sand, which in turn partially overlies glacial till.

Fill was encountered in all boreholes in the area, to depths ranging from 4.0 feet in Borehole 8, to 7.5 feet in Borehole 7. Fill was also encountered in all test pits; however, the tests pits did not penetrate the full thickness of the upper fill layer because of the existence of a shallow water table.

Two types of fill are distinguished in this area. First, a predominantly gravelly to sandy fill, with bricks and slag material, was encountered in Borehole 7, and test pits P5, P6 and P8. Penetration resistance values (N-values) were found to be 10 and 14, as recorded in Borehole 7, indicating a compact material. The second type of fill is

predominantly sandy silt to sandy clay, characterized by multiple colors ranging from beige to maroon to reddish brown, that was encountered in Boreholes 8, T3, 47/31, 48/32 and 48/34, and test pits P7 and P8; this material is referred to as "waste" in the RI/FS Figures 44 and 47 (see Appendix E), which are cross-sections drawn through the area. This second type of fill was found to be very soft as indicated by N-values of 2 in Boreholes T3 and 8.

Outwash sand was encountered underlying the fill in Boreholes T3, 7, 8, and 47/31. All other boreholes and test pits in this area reached total depths from 0.8 to 3.8 feet only and did not penetrate the total thickness of the upper fill layer. The full thickness of the outwash sand was penetrated by Boreholes 7 and T3, where it had a thickness of 5.0 and 6.5 feet, respectively. The outwash sand is characteristically grayish, medium to fine grained SAND, with a trace of silt. The penetration resistance test yielded N-values ranging from 23 to 38 with an average of 30. Outwash sand is indicated to be persistent through the area in Figures 44 and 47 of the RI/FS (see Appendix E).

Glacial till was encountered in Boreholes T3 and 7 at depths of 12.0 and 12.5 feet, respectively. The glacial till was found to be olive gray SAND, with varying amounts of gravel and silt. The glacial till is a very dense material, as indicated by N-values of 58 and 66 in Boreholes 7 and T3, respectively.

Groundwater was found within the upper fill layer, at or in close proximity to the ground surface throughout the area (0.3 to 3.5 feet deep). The area is adjacent to the pond between the East and West Hide Piles. Much of the area was observed to be inundated during the field investigation.

5.1.2 Laboratory Testing

Index tests (grain size distribution and Atterberg limits) were conducted on two samples of fill and one sample of outwash sand.

The first type of fill discussed was found to be a coarse to fine GRAVEL with some sand and non-plastic silt, which is classified as GM under the USCS system. The second type of fill (or waste) was found to be SAND and SILT, with little fine gravel; this soil is classified as a SM-ML under the USCS system. The outwash sand was found to be a poorly graded sand, medium to fine grained SAND, with a USCS classification of SP.

The laboratory data is presented in Appendix D and summarized in Table 3.

5.1.3 Foundations Alternatives

The upper layer consisting of fill of variable characteristics is not appropriate to support foundation loads, because of its heterogeneity and poor mechanical characteristics.

The outwash sand stratum that underlies the upper fill layer and overlies, in turn, the glacial till, has good mechanical characteristics and would provide a firm base of good bearing capacity to support foundations. However, the water table is typically 5 to 7 feet above the interface between the outwash sand the upper fill layer.

Two alternatives are possible for this site: spread footings and piles. The first consists of spread footings founded in the outwash sand. The excavations for the footings should penetrate a minimum of 1-foot within the outwash sand, so that its presence is verified. This

alternative would require significant dewatering of the excavations (6 to 8 feet) and therefore would be difficult to construct and is not economically efficient.

The second alternative would consist of pile foundations. The piles should be driven to refusal and designed to transfer the loads entirely to the outwash sand and/or glacial till; the friction component in the upper fill layer should be neglected.

Considering the significant depths of dewatering that would be required for the spread footings alternative, the pile foundations appears to be more convenient at this location.

For the preliminary analysis of foundations, the following soil parameters are recommended:

	Saturated Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Fill	100	0	0
Outwash Sand	125	36	0
Glacial Till	130	40	0

5.2 Potential Treatment Plant Adjacent to East Hide Pile

A subsurface investigation was conducted in the potential area for a treatment plant located east of the East Hide Pile, as shown in Figure 3, to evaluate the characteristics of the in-situ soils for foundations design. Two boreholes, T1 and T2, were drilled and four test pits, P1 through P4, were excavated in this area in fulfillment of Task S-4. No additional borings are present in this area from previous site investigations. The borehole and test pit locations are presented in Figure 3 and a cross section through the area is shown in Figure 6. The borehole logs

are presented in Appendix A and the test pit logs in Appendix B.

5.2.1 Subsurface Conditions

The units encountered in the area East of the East Hide Pile consist of overburden and bedrock.

The overburden is a combination of topsoil, weathered rock, and possibly glacial till and fill. The thickness of the overburden is highly variable ranging from non-existent in areas where bedrock crops out to about 12 to 14 feet locally as shown in Figure 6. The thicknesses encountered in the boreholes and test pits range from one foot in P3 to 4.5 feet in P-1A. The overburden is generally characterized by a 0.5 foot veneer of topsoil and roots. The remainder of the overburden is typically a brown becoming gray, medium to fine SAND with occasional cobbles. Standard Penetration Tests yielded N-values ranging from 8 in borehole T2, to 26 in borehole T1 indicating a loose to compact material.

The augers were able to advance 1.0 to 1.5 feet into weathered rock. Several locations were attempted in the vicinity of each borehole to confirm bedrock. All test pits were also terminated when bedrock was encountered. Groundwater was not encountered in any borehole or test pit.

5.2.2 Laboratory Testing

A minimal amount of samples were available to be tested due to the shallow depth of bedrock. Index properties were conducted on an overburden sample; the material was found to be a non-plastic SAND with little silt, which classified as an SP-SM under the USCS system. The laboratory data is presented in Appendix D and summarized in Table 3.

5.2.3 Foundation Alternatives

Considering the presence of shallow bedrock in this area, as well as the variable thickness and characteristics of the overburden, it is recommended that all structures be founded by means of shallow foundations (footings or mats) on slightly weathered rock, that will constitute a firm base of good bearing capacity to support foundations. Experience in this type of materials indicates that they provide a high bearing capacity to support shallow foundations, with typical allowable pressures on the order of 4 to 10 tons per square foot (tsf).

In no case should any structure be founded partly on overburden and partly on rock, because excessive differential settlements might occur. During construction, it must be verified that all the foundations are excavated until slightly weathered, moderately jointed rock is found. If significant local variations in depth to the slightly weathered rock are encountered, the bottom of the excavations may be stepped; in no case should foundations be constructed on an inclined rock surface.

The bottom of the excavations must be carefully inspected by an experienced Geotechnical Engineer to verify that slightly weathered, moderately jointed rock has been reached on the entire foundations area.

5.3 Potential Treatment Plant Adjacent to Chromium Lagoons

A subsurface investigation was conducted in the potential area for a treatment plant located northwest of the Chromium Lagoon, as shown in Figure 4, to evaluate the characteristics of the in-situ soils for foundations design. This investigation included one borehole, T4, and two test pits, P9 and P10. Several borings in the vicinity are available from the RI/FS investigation to supplement

the subsurface data. The borehole and test pit locations are shown in Figure 4 and a cross-section of the area is presented as Figure 7. In addition, Figure 24 of the RI/FS, included in Appendix E, shows a cross-section drawn through the area. All borehole logs are presented in Appendix A and test pit logs are found in Appendix B.

5.3.1 Subsurface Conditions

The units encountered in the area northwest of the Chromium Lagoons consist of an upper layer of fill overlying outwash sand, glacial till and bedrock; pockets of peat were encountered between the fill and the outwash sand.

The RI/FS Figure 24 cross-section (Appendix E) divides the material overlying the outwash sand into "fill" and "waste"; however, the difference in the material is unclear from the boring logs and these materials have been grouped in this report as a single layer and referred to as fill. The fill is highly variable with colors that include red, purple, yellowish orange and gray. Fill was encountered in all boreholes and test pits in this area. The fill was fully penetrated in all of the boreholes and the thickness ranges from 8 to 10 feet; the test pits did not penetrate the full thickness of the fill layer, because of the high water table. The fill is predominantly a silty sand and gravel with localized clay zones; the constituents include slag and bricks. The N-values range from 2 to 37 with an average of 11, indicating the variability of the fill. The blow counts were noted to decrease with depth in the fill.

Peat was encountered in this area in several of the RI/FS boreholes, as a thin, discontinuous layer. The peat, where encountered, was found between the fill and the underlying outwash sand. The layer appears to be generally less than

one foot thick with a maximum thickness of two feet. The peat is typically described as black or brown, and silty.

The outwash sand was encountered underlying the fill in six boreholes. Only Boreholes T4 and OW-14 penetrated the full thickness of the outwash sand, where it was found to be 6 feet and 25 feet thick, respectively. The cross-section shown in Figure 7, and the RI/FS cross-section (Figure 24, Appendix E) both indicate a thinning of the sand in a north/northwest direction. The outwash sand is characteristically a well graded, medium to fine grained SAND with a trace of silt. A standard penetration test in borehole T4 resulted in an N-value of 35, that indicates a dense soil.

Glacial till underlies the outwash sand. Boreholes T4 and OW-14 penetrated the full thickness of the glacial till and encountered 19 feet and 6 feet of glacial till, respectively. The glacial till is typically olive to gray SAND with minor amounts of gravel and silt. The standard penetration tests performed in Borehole T4 yielded N-values ranging from 84 to 247, that indicate a very dense material.

Groundwater was encountered between 0 and 2 feet above the top of the outwash sand, at depths ranging from 4 to 8.5 feet below ground surface.

5.3.2 Laboratory Testing

Laboratory testing was conducted on three samples of fill for grain size and plasticity characteristics. All samples were found to be coarse to fine grained SAND with some gravel and non-plastic fines ranging from 17.9 percent to 35.3 percent, which classified as a silty sand or SM under the USCS system. A specific gravity test and Modified

Proctor density was also performed on a fill sample. The sample was purple in color and yielded a specific gravity of 3.63. The maximum dry density was found to be 127.0 pounds per cubic foot (pcf) and the optimum moisture content is 15.0 percent. The results of tests conducted on outwash sand indicate a non-plastic, poorly graded SAND with a USCS classification of SP.

The laboratory test results are presented in Appendix D and summarized in Table 3.

5.3.3 Foundations Alternatives

The upper layer consisting of fill of variable characteristics is not appropriate to support foundation loads, because of its heterogeneity and poor mechanical characteristics.

The appropriate base of good bearing capacity for the foundations is provided at this location by the outwash sand, that underlies the upper fill layer and overlies, in turn, the glacial till. However, the water table is slightly above the outwash layer (0 to 2 feet).

Two alternatives are possible for this site: spread footings and piles. The first consists of spread footings founded in the outwash sand. The excavations for the footings should penetrate a minimum of 1-foot within the outwash sand, so that its presence is verified. This alternative would require some dewatering of the excavations (1 to 3 feet).

The second alternative would consist of pile foundations and is identical to that described in Section 5.1.3 for the area adjacent to the West Hide Pile.

The depth of dewatering required for the spread footings alternative is not considerable, therefore this alternative appears to be more appropriate at this location.

For the preliminary analysis of foundations, the following soil parameters are recommended:

	Saturated Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Fill	100	0	0
Outwash Sand	125	36	0
Glacial Till	130	40	0

5.4 Site Development

The subsurface investigation for potential site development was concentrated in the area East of Commerce Way. A total of four boreholes (SD-1 through SD-4) were drilled and eight test pits (P11 through P19) were excavated in fulfillment of Task S-4 of the PDI Work Plan. Additional subsurface information is available from the RI/FS borings OW-2, OW-3, OW-4, OW-5, OW-15 and OW-16, and RI/FS cross-sections shown in Figures 8, 9, 10 and 11 which are included in Appendix E. The borings and test pits locations are shown in Figure 1. The borings logs are included in Appendix A and the test pit logs are included as Appendix B.

5.4.1 Subsurface Conditions

The following narrative discusses the subsurface conditions East of Commerce Way. The site development area has been subdivided into North, central and South subsections as a function of the stratigraphy encountered.

NORTH

The subsurface conditions encountered in Task S-4 borehole SD-4 and test pits P11, P12, P13 and P14; Figure 8 of the RI/FS; and boreholes OW-2 and OW-3 of the RI/FS are typical of the Northern part of the area. The relief in parts of the area is relatively high and the surficial geologic units variable. The RI/FS Figure 8 (Appendix E) cross-section indicates that fill, sand, bedrock and possibly glacial till are exposed. All Task S-4 test pits and borehole SD4 encountered a layer of sand at the surface, with thickness ranging from 3.5 feet in P14 to more than 7 feet in P13. Test pits P11 and P13 were excavated entirely in sand, to depths of 5.8 and 7.0 feet, before encountering the water table. The sand is characteristically yellowish brown to orange, medium to fine grained SAND with little silt. A standard penetration test taken at the surface in SD4 yielded an N-value of 5.

Glacial till was encountered underlying the upper sand layer in borehole SD4 at a depth of 4.5 feet, and possibly in test pits P12 and P14 at 4.0 and 3.8 feet, respectively. The full thickness of the glacial till was not penetrated by any borehole or test pit. The till can be described as olive gray SAND with various amounts of gravel and silt. The N-values in the till ranged from 34 to 50 in borehole SD4.

The RI/FS cross-section (Figure 8, Appendix E) indicates bedrock exposed at the surface in the western side of this subsection and thinning of the overburden in the eastern side adjacent to Interstate 93 (I-93). Borehole OW-3 located at the East side of the subsection encountered bedrock at about 7 to 8 feet below ground surface.

Groundwater was encountered in test pits P11 and P13 at depths of 4.0 and 7.0 feet, respectively.

CENTRAL

The subsurface conditions in the central subsection of the site development area are illustrated by Task S-4 borehole SD1, and test pits P15 through P18; cross-section Figures 9 and 10 (Appendix E) of the RI/FS; and RI/FS borehole OW-4.

RI/FS Figure 9 (Appendix E) indicates a variety of units exposed at the surface including fill, sand, bedrock and possibly till. Test pit P15 encountered only sand and borehole SD1 encountered only till; the full thicknesses of these units were not penetrated. The sand was similar to that previously described for the north subsection of the Site Development area. The glacial till was found to be a GRAVEL and SAND with various amounts of silt. The N-values of the glacial till ranged from 68 to 136 in borehole SD1, indicating a very dense unit.

RI/FS Figure 10 (Appendix E) indicates that predominantly fill is exposed at the ground surface, with thickness on the order of 4 to 6 feet. Test pits P16, P17, and P18 also encountered fill, consisting predominantly of cobbles and boulders. The full thickness of the fill layer may have been penetrated in test pit P16 where bucket refusal was encountered at 7.0 feet. It should be noted that both Figures 9 and 10 of the RI/FS indicate thin discontinuous zones of peat between the fill and the underlying sand.

Groundwater was encountered in borehole SD1 and in test pits P15 and P17, at depths ranging from 2.3 to 4.9 feet below the ground surface.

SOUTH

The subsurface conditions in the southern area for potential site development are described by Task S-4 boreholes SD2 and SD3, and test pit P19; cross-section Figure 11 of the RI/FS (Appendix E); and RI/FS boreholes OW-4 and OW-15.

A quarry operation was known to exist in this subsection, where bedrock was mined. RI/FS Figure 11 (Appendix E) indicates that fill and bedrock are exposed through the majority of the area. Test pit P19 indicates predominantly boulders and cobbles, which is probably rock fill. Borehole SD2 encountered sand and glacial till. The N-values in the sand ranged from 9 to 12 indicating a loose to compact material. The glacial till was consistent with previous descriptions, with N-values ranging from 78 to 123, indicating the till to be very dense

RI/FS boreholes OW-4 and OW-15 and borehole SD3 were drilled adjacent to I-93. OW-4 and OW-15 encountered a fill - sand - till - bedrock sequence with bedrock at about 20.0 to 25.0 feet below ground surface. Borehole SD3 encountered only sand to about 28 feet before refusal occurred. The penetration resistance values in the sand indicated it to be compact, with N-values ranging from 15 to 21.

Groundwater was encountered in this subsection at depths ranging from 2.0 to 9.5 feet.

5.4.2 Laboratory Testing

Laboratory testing was conducted on sand and glacial till samples.

Index property tests conducted on outwash sand indicate a medium to fine grained SAND, with a non-plastic silt content ranging from 13.9 to 18.0 percent. The material is classified as an SM under the USCS system.

Index property tests indicated the till to be typically a coarse to fine SAND with various amounts of gravel and non-plastic silt. The fines content ranged from 9.6 percent to 27.2 percent. The glacial till is classified as a silty sand, or SM under the USCS system to a sandy gravel, or GW-GM.

Additional testing was conducted on bulk outwash sand samples including specific gravity, Modified Proctor, shear strength and consolidation. The shear strength and consolidation tests were conducted on specimens remolded to 95 percent of the Modified Proctor maximum density. These tests were conducted to assess the materials as potential fill for grading operations. The specific gravity of the sand ranged from 2.51 to 2.63. The maximum dry density values determined in the Modified Proctor tests ranged from 117.2 to 123.4 pcf, and optimum moisture contents from 8 to 11.5 percent. Shear strength testing indicates the effective friction angle to range from 35.6 degrees to 36.7 degrees. Consolidation tests found the compression index (C_c) to range from 0.013 to 0.09.

The laboratory data is presented in Appendix D and summarized in Table 3.

5.4.3 Conclusions

The investigation performed in the Site Development area shows the existence of firm soils at relatively shallow depths (3 to 10 feet), that are appropriate to provide good bearing capacity for shallow foundations, such as spread

footings or mat foundations. Given the size of this area (approximately 70 acres), the low density of the site investigation conducted, and the significant variability of the surficial soils, it is not appropriate at this stage to provide more specific foundation recommendations.

6.0 SUMMARY

This report is submitted in fulfillment of the reporting requirements set forth in the PDI Work Plan, Task S-4, Foundations Data. An investigation was conducted by Golder to evaluate the foundation characteristics in select areas for gas and water treatment plants, and future site development. The field investigation conducted as part of this PDI task consisted of 8 borings and 19 test pits. Subsurface information from the RI/FS was used to supplement the data obtained during the PDI field investigation.

This report has outlined the following:

1. Background information from various governing documents and requirements of the PDI;
2. The PDI field investigation methodology and laboratory testing protocol;
3. Interpretation of laboratory testing and subsurface conditions; and,
4. Preliminary foundation alternatives.

As specified in Section 3.2.6.2 , page 51 of the PDI Work Plan, the investigation and alternatives provided in this report are preliminary and should be used for site selection and preliminary dimensioning of structures only. Final foundation investigations should be conducted in the exact locations selected for each structure, when the loads and other characteristics of the structures are defined.

C:REPORTS:FOUNDTXT

REFERENCES

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D421-85 Dry Preparation of Soil Samples for Particle Size Analysis and Determination of Soil Constants, pp. 89-90.

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D854-83 Specific Gravity of Soils, pp. 168-170.

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TABLE 1
SUMMARY OF PDI TASK S-4 FOUNDATION BOREHOLES

BOREHOLE NO.	DEPTH		DISTURBED SAMPLES		UNDISTURBED SAMPLES			REMARKS
	ANTICIPATED	ACTUAL	ANTICIPATED	ACTUAL	ANTICIPATED	ATTEMPTED	RECOVERED	
T1	15.0	3.5	4	1	2	0	0	Bedrock hit, several borings attempted
T2	15.0	4.0	4	1	2	0	0	Bedrock hit, several borings attempted
T3	15.0	16.0	4	4	2	1	0	Very soft ground
T4	35.0	33.5	8	7	2	0	0	Fill over sand and till
SD1	20.0	22.0	6	5	2	0	0	Very dense till encountered
SD2	40.0	16.5	9	4	2	0	0	Sand and till, auger/spoon refusal
SD3	40.0	27.8	9	7	2	0	0	Sand encount., auger/spoon refusal
SD4	15.0	17.0	4	4	2	0	0	Very dense till encountered
TOTAL	195.0	140.3	48	33	16	1	0	

Note: Anticipated borehole depths and sampling quantities taken from Table 7 of the PDI Work Plan.

TABLE 2
SUMMARY OF PDI TASK S–4 LABORATORY TEST REQUIREMENTS

LABORATORY TEST	NUMBER ANTICIPATED	NUMBER PERFORMED
GRAIN SIZE DISTRIBUTION		
MECHANICAL	15	15
HYDROMETER	0	13
ATTERBERG LIMITS	15	15
SHEAR STRENGTH	6	3
CONSOLIDATION	4	3
MODIFIED PROCTOR	0	4
ORGANIC CONTENT	0	1
SPECIFIC GRAVITY	0	4

Note: Number of tests anticipated taken from Tables 7 and 16 of the PDI Work Plan.

TABLE 3
TASK S-4 LABORATORY TESTING SUMMARY

					ATTERBERG LIMITS			GRAIN SIZE				MODIFIED PROCTOR		SHEAR STRENGTH		CONSOLIDATION				
BOREHOLE/ TEST PIT	DEPTH (FT-BGS)	SAMPLE NO.	SAMPLE TYPE	NATURAL WATER CONT.(%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	% PASSING 200 SIEVE	HYDROMETER TEST	ORGANIC CONTENT	SPECIFIC GRAVITY	MAX. D.D. (PCF)	OPT. MOIST. CONTENT	C'	PHI'	Eo	Cc	USCS CLASS.	GEOLOGIC UNIT	FOUNDATION LOCATION
T1	0-2	S-1	DO	4.1	NP	NP	NP	7.0	*	-	-	-	-	-	-	-	-	SP-SM	Surficial	East Hide
T3	0-2	S-1	DO	92.7	NP	NP	NP	48.6	*	11.8	-	-	-	-	-	-	-	SM-ML	Waste	West Hide
T3	9-11	S-3	DO	25.6	NP	NP	NP	0.1	*	-	-	-	-	-	-	-	-	SP	Sand	West Hide
T3	14-16	S-4	DO	10.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Till	West Hide
T4	0-2	S-1	DO	24.0	NP	NP	NP	22.0	*	-	-	-	-	-	-	-	-	SM	Fill	Chromium
T4	5.5-7.5	S-2	DO	27.5	NP	NP	NP	17.9	*	-	-	-	-	-	-	-	-	SM	Fill	Chromium
T4	10.5-12.5	S-3	DO	20.0	NP	NP	NP	3.7	*	-	-	-	-	-	-	-	-	SP	Sand	Chromium
T4	25.5-27.5	S-6	DO	18.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Till	Chromium
SD1	14-16	S-4	DO	9.5	NP	NP	NP	9.6	*	-	-	-	-	-	-	-	-	GW-GM	Till	Site Develop
SD2	5-7	S-2	DO	8.7	NP	NP	NP	18.0	*	-	-	-	-	-	-	-	-	SM	Sand	Site Develop
SD2	10-12	S-3	DO	11.5	NP	NP	NP	17.7	*	-	-	-	-	-	-	-	-	SM	Till	Site Develop
P8	2.5-3.5	-	BULK	43.0	NP	NP	NP	12.5	*	-	-	-	-	-	-	-	-	GM	Fill	West Hide
P10	0-3	-	BULK	24.3	NP	NP	NP	35.3	*	-	3.63	127.0	15.0	-	-	-	-	SM	Fill	Chromium
P12	4-7	-	BULK	7.0	NP	NP	NP	27.2	*	-	-	-	-	-	-	-	-	SM	Till	Site Develop
P13	0-7	-	BULK	10.6	NP	NP	NP	13.9	*	-	2.61	120.3	8.0	0.0	36.7	0.440	.090	SM	Sand	Site Develop
P14	0.0-3.5	-	BULK	7.9	NP	NP	NP	14.0	-	-	2.51	123.4	8.7	0.0	35.8	0.349	.013	SM	Sand	Site Develop
P15	0-6	-	BULK	14.3	NP	NP	NP	14.5	-	-	2.63	117.2	11.5	0.0	35.6	0.470	.066	SM	Sand	Site Develop

* Test Performed
\- Test Not Performed
NP Non-Plastic
PHI' Effective Frictional Angle

C' Effective Cohesion
Eo Initial Void Ratio
Cc Compression Index
DO Split Spoon Sample

LEGEND

- EXTENT OF HIDE RESIDUE
- POTENTIAL TREATMENT PLANT LOCATION
- APPROXIMATE BOUNDARY OF THE BOSTON EDISON COMPANY RIGHT-OF-WAY NO. 14
- SITE BOUNDARY
- STREAMS OR WATERCOURSES
- T2 — PDI TASK S-4 TREATMENT PLANT BOREHOLE
- SD3 — PDI TASK S-4 SITE DEVELOPMENT HOLE
- P10 — PDI TASK S-4 TEST PIT
- OW-3 — RI/FS BOREHOLE

NOTES

1.) EXTENT OF HIDE RESIDUE AND POTENTIAL TREATMENT PLANT LOCATIONS TAKEN FROM FIGURE 23 OF THE PDI.

2.) SEE FIGURES 2 THROUGH 4 FOR LOCATIONS OF RI/FS BOREHOLES IN THE VICINITY OF THE POTENTIAL TREATMENT PLANTS.

3.) RI/FS BOREHOLE LOCATIONS TAKEN FROM FIGURES 4 AND 6 OF THE RI/FS BY ROUX ASSOCIATES INC.

REFERENCE

1.) TOPOGRAPHIC SURVEY PERFORMED BY SAIC ENGINEERING, INC. DATE OF SURVEY APRIL, 1990.

SEP 25 1990

200 0 200 400
scale feet

REV	DATE	DESCRIPTION	DR BY	RVW BY

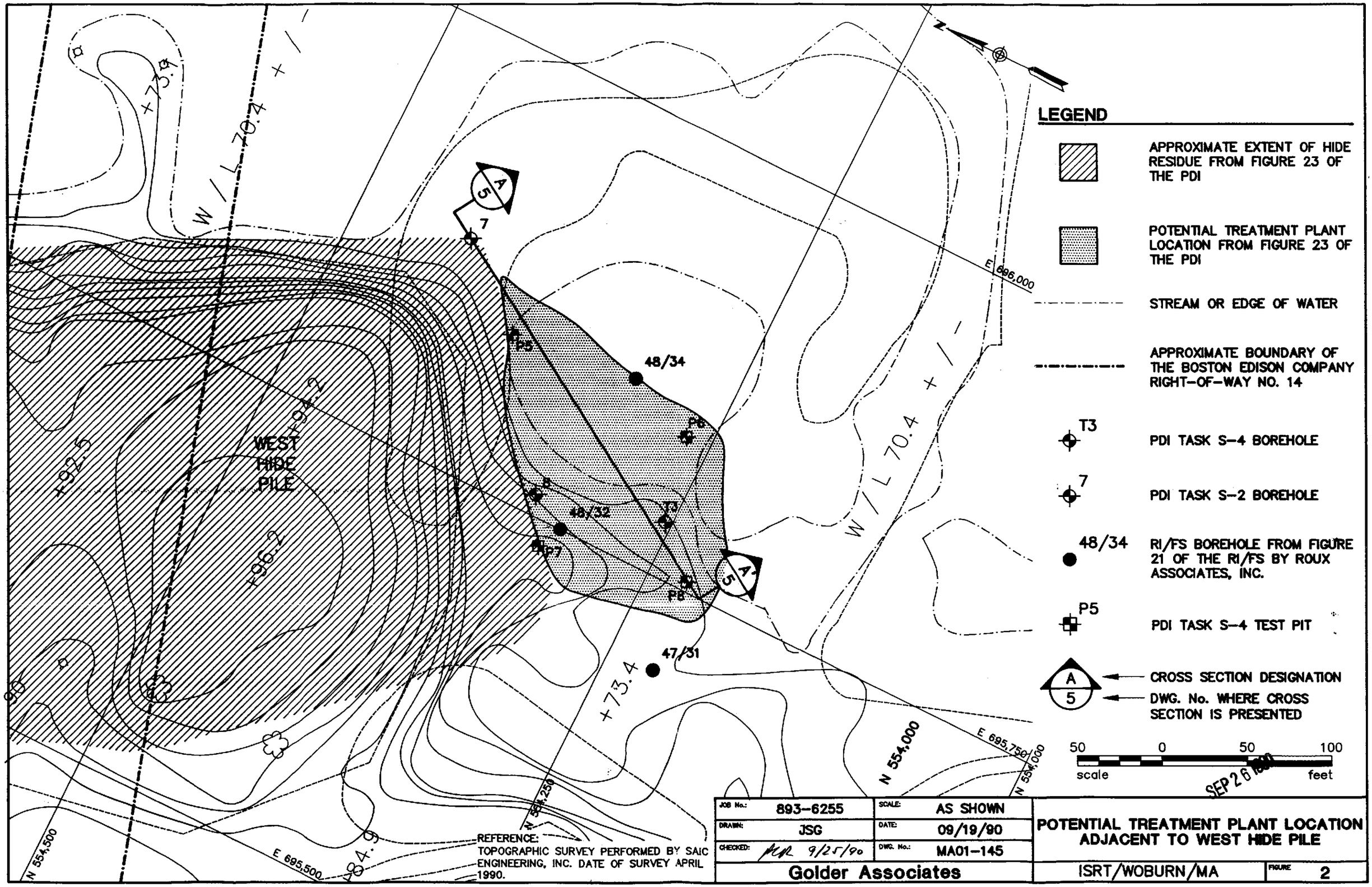
SCALE: AS SHOWN		PROJECT: INDUSTRI-PLEX REMEDIAL TRUST WOBURN, MASSACHUSETTS
PROJECT No. 893-6255		
DES BY	RJI	09/20/90
DR BY	JSG	09/21/90
CHK BY	RAS	9/25/90
RVW BY	PCR	9/25/90

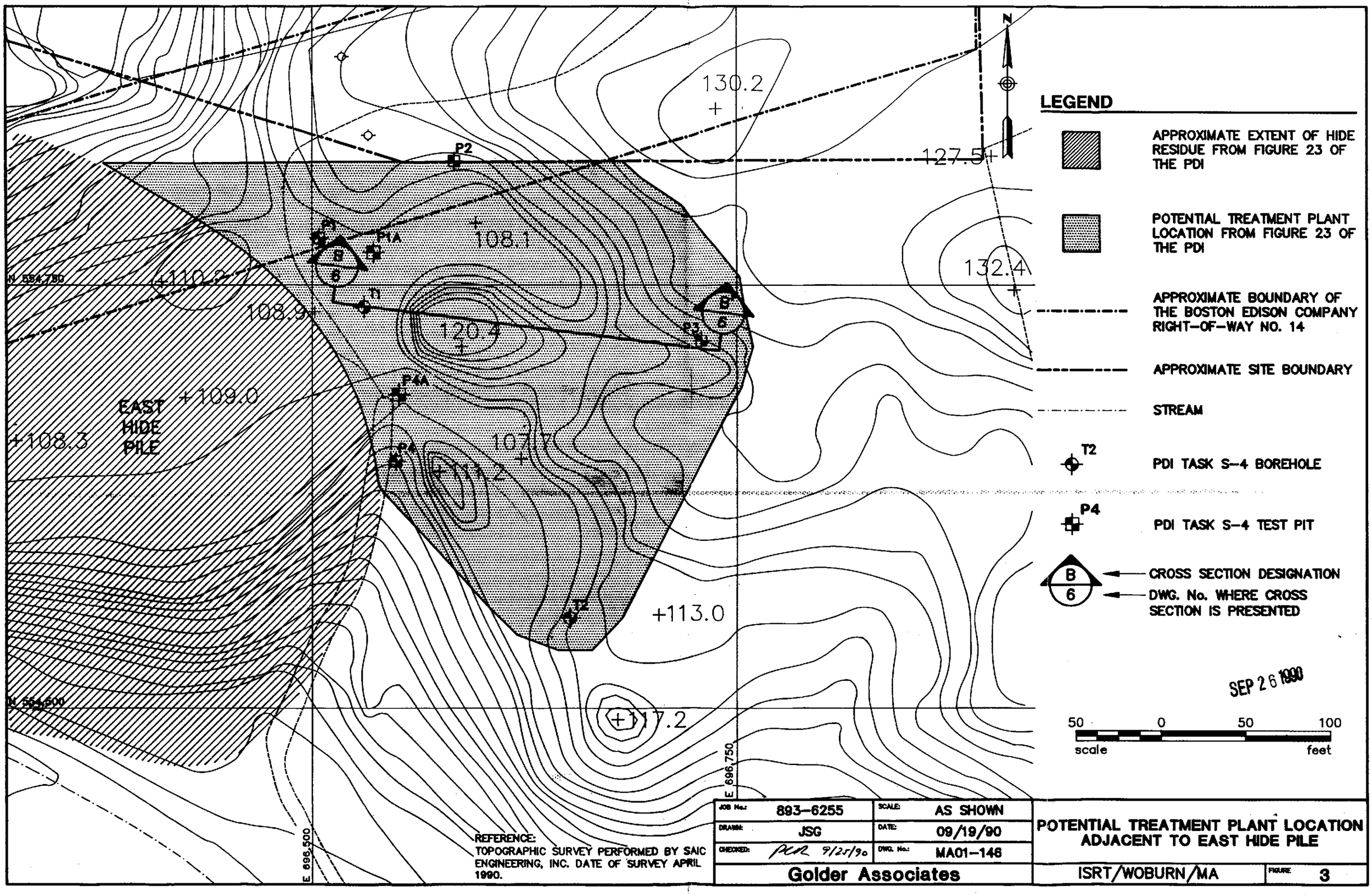
SHEET TITLE: BOREHOLE LOCATION PLAN FOR TREATMENT PLANT AND FUTURE DEVELOPMENT

Golder Associates
Mt. Laurel, New Jersey

SHEET OF
DRAWING No. MA01-144

FIGURE 1


W/L 70.4 +/-
+73.4
+92.5
+96.7
WEST HIDE PILE
48/34
48/32
47/31
P5
P6
P7
P8
5
7
T3
5A
E 696,000
N 554,500
E 695,500
N 554,250
N 554,000
E 695,750
LEGEND
APPROXIMATE EXTENT OF HIDE RESIDUE FROM FIGURE 23 OF THE PDI
POTENTIAL TREATMENT PLANT LOCATION FROM FIGURE 23 OF THE PDI
STREAM OR EDGE OF WATER
APPROXIMATE BOUNDARY OF THE BOSTON EDISON COMPANY RIGHT-OF-WAY NO. 14
T3 PDI TASK S-4 BOREHOLE
7 PDI TASK S-2 BOREHOLE
48/34 RI/FS BOREHOLE FROM FIGURE 21 OF THE RI/FS BY ROUX ASSOCIATES, INC.
P5 PDI TASK S-4 TEST PIT
A / 5 CROSS SECTION DESIGNATION
DWG. No. WHERE CROSS SECTION IS PRESENTED
50 0 50 100
scale feet
REFERENCE:
TOPOGRAPHIC SURVEY PERFORMED BY SAIC ENGINEERING, INC. DATE OF SURVEY APRIL 1990.
JOB No.: 893-6255
SCALE: AS SHOWN
DRAWN: JSG
DATE: 09/19/90
CHECKED: 9/25/90
DWG. No.: MA01-145
Golder Associates
POTENTIAL TREATMENT PLANT LOCATION ADJACENT TO WEST HIDE PILE
ISRT/WOBURN/MA
FIGURE 2
SEP 26



REFERENCE:
TOPOGRAPHIC SURVEY PERFORMED BY SAIC ENGINEERING, INC. DATE OF SURVEY APRIL 1990.

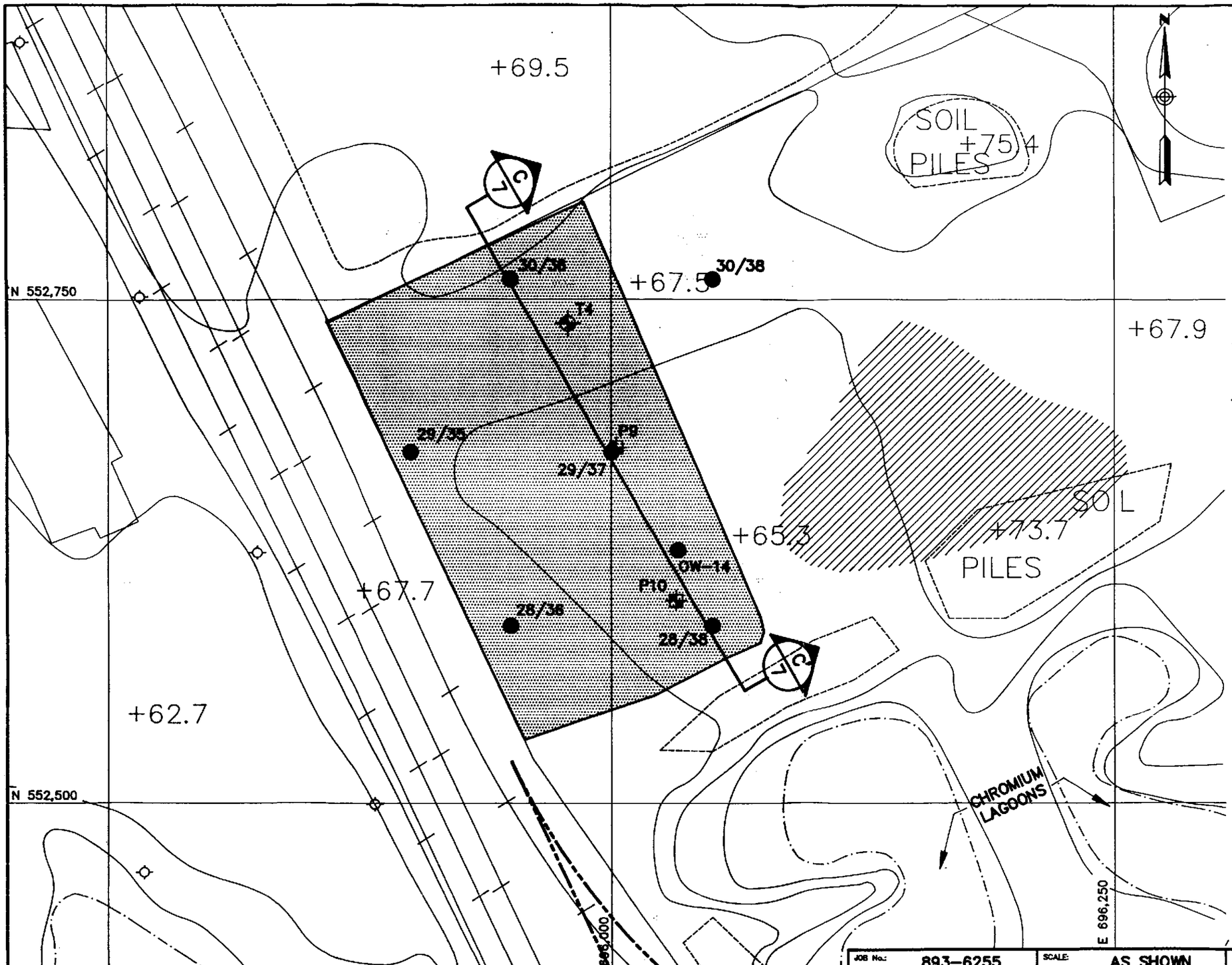
JOB No.:	893-6255	SCALE:	AS SHOWN
DRAWN:	JSG	DATE:	09/19/90
CHECKED:	PCR 9/25/90	DWG. No.:	MA01-148

Golder Associates

POTENTIAL TREATMENT PLANT LOCATION ADJACENT TO EAST HIDE PILE

ISRT/WOBURN/MA

FIGURE 3



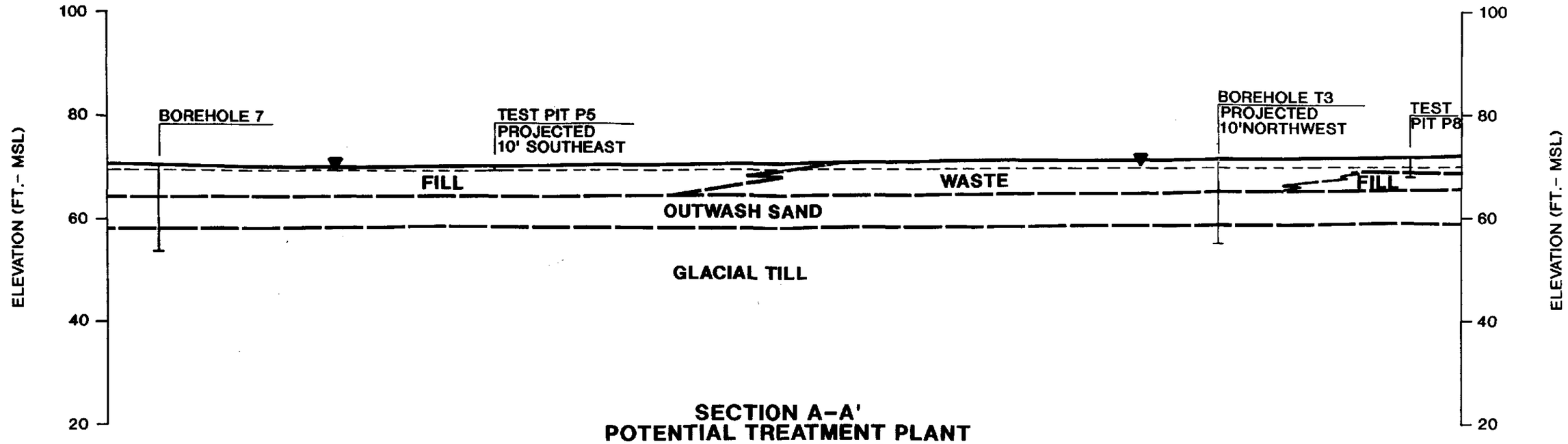
LEGEND

- APPROXIMATE EXTENT OF HIDE RESIDUE FROM FIGURE 23 OF THE PDI
- POTENTIAL TREATMENT PLANT LOCATION FROM FIGURE 23 OF THE PDI
- STREAM OR EDGE OF WATER
- APPROXIMATE SITE BOUNDARY
- T4 — PDI TASK S-4 BOREHOLE
- OW-14 — RI/FS BOREHOLE FROM FIGURE 6 & 21 OF THE RI/FS BY ROUX ASSOCIATES, INC.
- P9 — PDI TASK S-4 TEST PIT
- C / 7 — CROSS SECTION DESIGNATION; DWG. No. WHERE CROSS SECTION IS PRESENTED

SEP 26 1990

50 0 50 100
scale feet

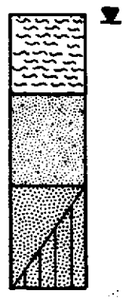
JOB No.: 893-6255	SCALE: AS SHOWN	POTENTIAL TREATMENT PLANT LOCATION ADJACENT TO CHROMIUM LAGOONS	
DRAWN: JSG	DATE: 09/19/90		
CHECKED: PLR 9/25/90	DWG. No.: MA01-147		
Golder Associates		ISRT/WOBURN/MA	FIGURE 4



SECTION A-A'
POTENTIAL TREATMENT PLANT
LOCATION ADJACENT TO WEST HIDE PILE

20 0 20 40
scale feet

GEOLOGIC UNIT	USCS CLASS.	AVERAGE N VALUE	RANGE OF THICKNESS	TYPICAL SOIL PROFILE
FILL	GM W/BRICK & SLAG	12		
WASTE	ML TO SM	2	4-7.5 FT	
OUTWASH SAND	SP	30	5-6.5 FT.	
GLACIAL TILL	SW TO SM	62	—	



NOTE

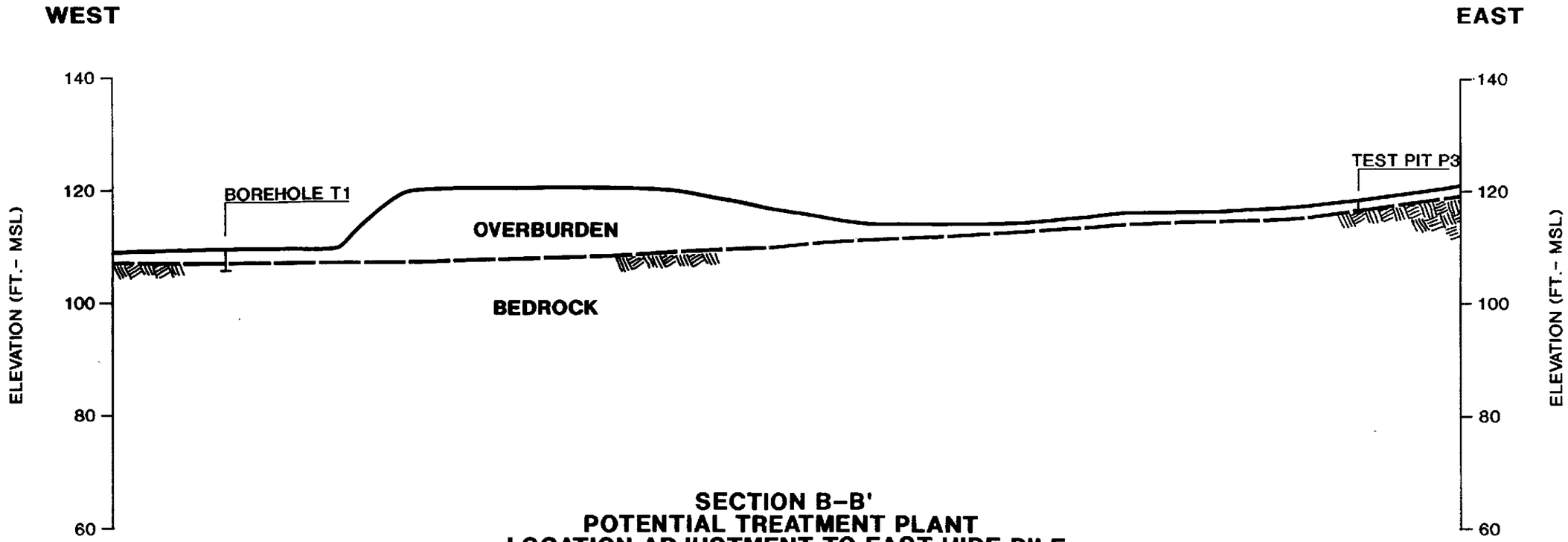
1.) CROSS SECTION LOCATION CAN BE FOUND ON FIGURE 2.

2.) TYPICAL SOIL PROFILE TAKEN FROM AVERAGE CONDITIONS ENCOUNTERED IN BOREHOLES AND TEST PITS SHOWN IN FIGURE 2.

SEP 26 1990

JOB NO. 893-6255	SCALE AS SHOWN	CROSS SECTION A-A'	
DRAWN RDT	DATE 09/20/90		
CHECKED 9/21/90	DWG. NO. MA01-181		
Golder Associates		ISRT/WOBURN/MA.	FIGURE 5

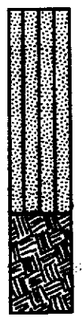
152110



SECTION B–B'
POTENTIAL TREATMENT PLANT
LOCATION ADJUSTMENT TO EAST HIDE PILE

20 0 20 40
scale feet

GEOLOGIC UNIT	USCS CLASS.	AVERAGE N VALUE	RANGE OF THICKNESS	TYPICAL SOIL PROFILE
OVERBURDEN	SM	17	0.0–14.0 FT.	
BEDROCK	—	—	—	



NOTES

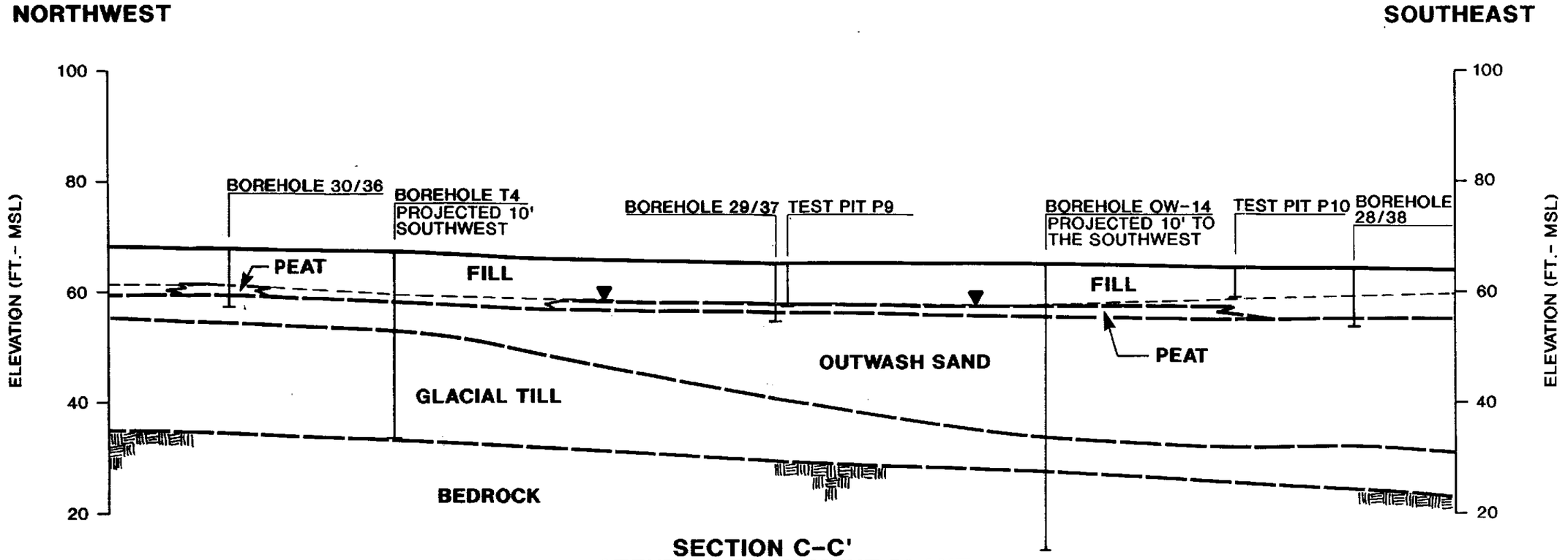
1.) CROSS SECTION LOCATION CAN BE FOUND ON FIGURE 3.

2.) TYPICAL SOIL PROFILE TAKEN FROM AVERAGE CONDITIONS ENCOUNTERED IN BOREHOLES & TEST PITS SHOWN ON FIGURE 3.

SEP 26 1990

JOB NO. 893-6255	SCALE AS SHOWN	CROSS SECTION B–B'
DRAWN RDT	DATE 09/20/90	
CHECKED PCR 9/25/90	DWG. NO. MA01-182	
Golder Associates	ISRT/WOBURN/MA.	FIGURE 6

152110

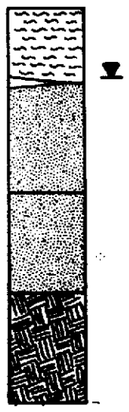


SECTION C-C'
POTENTIAL TREATMENT PLANT
LOCATION ADJACENT TO CHROMIUM LAGOONS

20 0 20 40
scale feet

GEOLOGIC UNIT	USCS CLASS.	AVERAGE N VALUE	RANGE OF THICKNESS
FILL	SM TO ML (WITH SLAG)	11	8-10 FT.
PEAT	—	—	0-2 FT.
OUTWASH SAND	SP	35	6-25 FT.
TILL	SP	119	6-19 FT.
BEDROCK	—	—	—

TYPICAL SOIL PROFILE



NOTES

1.) CROSS SECTION LOCATION CAN BE FOUND ON FIGURE 4.

2.) TYPICAL SOIL PROFILE TAKEN FROM AVERAGE CONDITIONS ENCOUNTERED IN BOREHOLES & TEST PITS SHOWN ON FIGURE 4.

DEC 6 1990

JOB NO. 893-6255	SCALE AS SHOWN	CROSS SECTION C-C'	
DRAWN RDT	DATE 09/20/90		
CHECKED PCR 9/25/90	DWG. NO. MA01-183		
Golder Associates		ISRT/WOBURN/MA.	FIGURE 7

182110

APPENDIX A

Borehole Logs

PDI Task S-4 Borehole Logs

Unified Soil Classification System

Criteria for Assigning Group Symbols and Names			Soil Classification Generalized Group Descriptions	
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 Sieve	CLEAN GRAVELS Less than 5% fines	GW	Well-graded Gravels
			GP	Poorly-graded gravels
		GRAVELS WITH FINES More than 12% fines	GM	Gravel and Silt Mixtures
			GC	Gravel and Clay Mixtures
	SANDS 50% or more of coarse fraction passes No. 4 Sieve	CLEAN SANDS Less than 5% fines	SW	Well-graded Sands
			SP	Poorly-graded Sands
		SANDS WITH FINES More than 12% fines	SM	Sand and Silt Mixtures
			SC	Sand and Clay Mixtures
FINE-GRAINED SOILS 50% or more passes the No. 200 sieve	SILTS AND CLAYS Liquid limit less than 50	INORGANIC	CL	Low-plasticity Clays
			ML	Non-plastic and Low-Plasticity Silts
		ORGANIC	OL	Non-plastic and Low-Plasticity Organic Clays Non-plastic and Low-Plasticity Organic Silts
	SILTS AND CLAYS Liquid limit greater than 50	INORGANIC	CH	High-plasticity Clays
			MH	High-plasticity Silts
		ORGANIC	OH	High-plasticity Organic Clays High-plasticity Organic Silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat

Component Definitions by Gradation

Component	Size Range
Boulders	Above 12 in.
Cobbles	3 in. to 12 in.
Gravel	3 in. to No. 4 (4.76mm)
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 (4.76mm)
Sand	No. 4 (4.76mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.76mm) to No. 10 (2.0mm)
Medium sand	No. 10 (2.0mm) to No. 40 (0.42mm)
Fine sand	No. 40 (0.42mm) to No. 200 (0.074mm)
Silt and Clay	*Smaller than No. 200 (0.074mm)*

Samples

SS	SPT Sampler (2.0" OD)
HD	Heavy Duty Split Spoon
SH	Shelby Tube
P	Pitcher Sampler
B	Bulk
C	Cored

Unless otherwise noted, drive samples advanced with 140 lb. hammer with 30 in. drop.

Relative Density or Consistency Utilizing Standard Penetration Test Values

Cohesionless Soils (a)			Cohesive Soils (b)		
Density (c)	N, blows/ft. (c)	Relative Density (%)	Consistency	N, blows/ft. (c)	Undrained Shear Strength (d) (psf)
Very loose	0 to 4	0 - 15	Very soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250-500
Compact	10 to 30	35 - 65	Firm	4 to 8	500-1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000-2000
Very Dense	over 50	>85	Very Stiff	15 to 30	2000-4000
			Hard	over 30	>4000

(a) Soils consisting of gravel, sand, and silt, either separately or in combination, possessing no characteristics of plasticity, and exhibiting drained behavior.

(b) Soils possessing the characteristics of plasticity, and exhibiting undrained behavior.

(c) Refer to text of ASTM D 1586-84 for a definition of N; in normally consolidated cohesionless soils Relative Density terms are based on N values corrected for overburden pressures.

(d) Undrained shear strength = 1/2 unconfined compression strength.

Laboratory Tests

Test	Designation
Moisture	(1)
Density	D
Grain Size	G
Hydrometer	H
Atterberg Limits	(1)
Consolidation	C
Unconfined	U
UU Triax	UU
CU Triax	CU
CD Triax	CD
Permeability	P

(1) Moisture and Atterberg Limits plotted on log.

Descriptive Terminology Denoting Component Proportions

Descriptive Terms	Range of Proportion
Trace	0-5%
Little	5-12%
Some or Adjective (a)	12-30%
And	30-50%

(a) Use Gravelly, Sandy or Silty as appropriate.

Silt and Clay Descriptions

Description	Typical Unified Designation
Silt	ML (non-plastic)
Clayey Silt	CL-ML (low plasticity)
Silty Clay	CL
Clay	CH
Plastic Silt	MH
Organic Soils	OL, OH, Pt

Golder Associates

SOIL CLASSIFICATION/LEGEND

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE T1

BORING DATE: 04/26/90

BORING LOCATION: N: 554,737
E: 696,530

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (10 20 30 40 50 60 70 80 90) / WATER CONTENT, PERCENT (Wp W Wl)	PIEZOMETER OR STANDPIPE INSTALLATION
					109.20							
0		0.0-2.0 ft. Compact, light-olive to medium gray, m-f SAND, little silt, little f-gravel,roots to .5 ft., (SP-SM).	SP-SM		0.00 / 107.20	1	DO	3,7,19,39	26	75	■	
		2.0-3.5 ft. Weathered bedrock.			2.00 / 105.70							
		BORING TERMINATED AT 3.5 FT. BELOW GROUND SURFACE.			3.50							
5		NOTES: 1.) Drill rig was moved 5.0 ft. and hole redrilled. Rock was encountered at 2.0 ft. depth and rig augered to 3.0 ft. A third boring was attempted 10.0 ft. from the initial borings. Rock was encountered at 1.5 ft. depth and the borehole extended to 3.5 ft.										
10												
15												
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE T2

BORING DATE: 04/26/90

BORING LOCATION: N: 554,553
E: 696,651

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 10 20 30 40 50 60 70 80 90 / WATER CONTENT, PERCENT Wp W Wl 10 20 30 40 50 60 70 80 90	PIEZOMETER OR STANDPIPE INSTALLATION
0					109.60							
		0.0-3.0 ft. Loose, moderate to dark brown, m-f SAND, some silt, roots to .5 ft., (SM).	SM		0.00	1	DO	1,1,7,15	8	40	■	
		3.0-4.0 ft. Weathered bedrock.			106.60 3.00							
5		BORING TERMINATED AT 4.0 FT. BELOW GROUND SURFACE.			105.60 4.00							
		NOTE: 1.) Drilling was moved up 5.0 ft. to the East and borehole redrilled. Rock was encountered at 2.5 ft. and auger continued to 3.0 ft.										
10												
15												
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE T3

BORING DATE: 05/01/90

BORING LOCATION: N: 554,254
E: 696,782

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (10 20 30 40 50 60 70 80 90) / WATER CONTENT, PERCENT Wp C W Wl (10 20 30 40 50 60 70 80 90)	PIEZOMETER OR STANDPIPE INSTALLATION
					71.00							
0		0.0-5.5 ft. Soft, pale reddish-brown, m-f SAND, and SILT little f-gravel, few roots (SM-ML). Water encountered at approximately 0.5 ft.	SM-ML		0.00	1	DO	0,0,2,0	2	60	■	
						ST-1	TO	SHELBY TUBE		0		
5					65.50							
		5.5-12.0 ft. Compact to dense, olive-gray, f-SAND, (SP). OUTWASH SAND.	SP		5.50	2	DO	3,11,15,20	26	100	■	
10						3	DO	13,16,19,27	35	100	■	
					59.00							
		12.0-16.0 ft. Very dense, olive-gray, c-f SAND, some silt, trace f-gravel, (SM), GLACIAL TILL.	SM		12.00							
15						4	DO	38,31,35,51	66	100	■	
					55.00							
		BORING TERMINATED AT 16.0 FT. BELOW GROUND SURFACE.			16.00							
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE T4

BORING DATE: 05/03/90

BORING LOCATION: N: 552,738
E: 695,968

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 10 20 30 40 50 60 70 80 90 / WATER CONTENT, PERCENT Wp W Wl 10 20 30 40 50 60 70 80 90	PIEZOMETER OR STANDPIPE INSTALLATION
					66.90							
0		0.0-4.5 ft. Dense, dark red, m-f SAND, some silt, some f-gravel, few roots, (SM). FILL.	SM		0.00	1	DO	2,15,18,25	33	30	■	
					62.40							
5		4.5-8.5 ft. Loose, dark gray to yellowish-orange, c-f SAND, some silt, some f-gravel, (SM). CINDER/ASH FILL. Water encountered at approximately 8.50 ft.	SM		4.50	2	DO	8,7,5,4	12	80	■	
					58.40							
10		8.5-14.5 ft. Dense, medium gray, m-f SAND, trace silt, trace fine gravel (SP). OUTWASH SAND.	SP		8.50	3	DO	23,24,11,14	35	55	■	
					52.40							
15		14.5-33.5 ft. Very dense, olive to medium gray, c-m SAND, trace to little silt, trace to little f-gravel, (SP). GLACIAL TILL.	SP		14.50	4	DO	26,46,90,100	136	100	■	
20						5	DO	46,147,100	247	100	■	
25						6	DO	27,28,56,95	84	75	■	
30						7	DO	14,40,49,80	89	45	■	
					33.40							
35		AUGER REFUSAL AT 33.5 FT. BELOW GROUND SURFACE.			33.50							
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE SD1

BORING DATE: 04/30/90

BORING LOCATION: N: 554,342
E: 698,101

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE: BLOWS/FT ■ (10 20 30 40 50 60 70 80 90) / WATER CONTENT, PERCENT (Wp ○ W Wl; 10 20 30 40 50 60 70 80 90)	PIEZOMETER OR STANDPIPE INSTALLATION
0					71.10							
		0.0-1.0 ft. Topsoil.			0.00							
		1.0-22.0 ft. Very dense, olive to medium gray, f-GRAVEL and c-f SAND, little to some silt (GM-GP to GM), GLACIAL TILL. Water encountered at approximately 4.9 ft.			70.10 1.00	1	DO	2,12,13,21	25	55	■	
5						2	DO	80,125/5"	>100	100		■
10			GP-GM to GM			3	DO	93,73,63,	136	45		■
15						4	DO	34,39,52,29	91	70		■
20						5	DO	16,32,36,31	68	55	■	
					49.10							
		BORING TERMINATED AT 22.0 FT. BELOW GROUND SURFACE.			22.00							
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE SD2

BORING DATE: 05/02/90

BORING LOCATION: N: 553,544
E: 697,709

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ / WATER CONTENT, PERCENT Wp C W Wl	PIEZOMETER OR STANDPIPE INSTALLATION
0					74.20							
		0.0-4.5 ft. Compact, moderate brown, f-SAND, some silt, few roots, slight organic odor, (SM).	SM		0.00	1	DO	1,4,6,6	12	100	■	
					69.70							
5		4.5-7.0 ft. Loose, grayish-orange, m-f SAND, some silt, trace f-gravel, (SM). OUTWASH SAND.	SM		4.50 / 67.20	2	DO	3,5,4,14	9	90	■	
		7.0-12.5 ft. Very dense, olive gray, c-f SAND, some silt, trace f-gravel, (SM). GLACIAL TILL. Water encountered at approximately 9.50 ft.	SM		7.00 / 61.70	3	DO	18,48,75,95	123	90		
10												
		12.5-16.5 ft. Very dense, olive-gray, f-GRAVEL, some c-f sand, little silt, (GW-GM). GLACIAL TILL.	GW-GM		12.50 / 57.70	4	DO	39,40,38,60	78	65		
15												
		AUGER AND SPOON REFUSAL AT 16.5 FT. BELOW GROUND SURFACE.			16.50							
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE SD3

BORING DATE: 05/02/90

BORING LOCATION: N: 553,557 E: 698,598

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (10 20 30 40 50 60 70 80 90) / WATER CONTENT, PERCENT (Wp, W, Wl)	PIEZOMETER OR STANDPIPE INSTALLATION
0					65.30							
		0.0-0.7 ft. Topsoil.			64.60 0.00							
		0.7-15.5 ft. Compact, moderate yellowish-brown, c-f SAND, little to some silt, trace to little fine gravel, (SW-SM to SM). OUTWASH SAND. Water encountered at approximately 2.0 ft.	SW-SM to SM		0.70	1	DO	1,6,10,10	16	60	■	
						2	DO	2,7,10,13	17	45	■	
5												
						3	DO	7,10,11,14	21	50	■	
10												
						4	DO	4,8,8,11	16	55	■	
15					49.80 15.50							
		15.5-27.75 ft. Compact, olive to medium gray, f-SAND, little to some silt, (SP-SM). OUTWASH SAND.	SP-SM			5	DO	4,5,10,10	15	75	■	
20												
						6	DO	8,8,16/.2'	24/7'	92		
25						7	DO	100/.25'	>100	100		■
					37.55 27.75							
		AUGER AND SPOON REFUSAL AT 27.75 FT. BELOW GROUND SURFACE.										
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE SD4

BORING DATE: 04/26/90

BORING LOCATION: N: 554,795
E: 697,445

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 In	N	REC/ATT	PENETRATION RESISTANCE: BLOWS/FT ■ (10 20 30 40 50 60 70 80 90) / WATER CONTENT, PERCENT (Wp ○ W Wl)	PIEZOMETER OR STANDPIPE INSTALLATION
0					89.60							
		0.0-4.5 ft. Loose, dark to yellowish brown, m-f SAND, little silt, roots and organic odors from 0.0-1.0 ft., (SP-SM).	SP-SM		0.00	1	DO	2,2,3,5	5	90	■	
					85.10							
5		4.5-17.0 ft. Dense to very dense, yellowish brown becoming olive gray, c-f SAND, little to some f-gravel increasing with depth, some silt, (SM). *GLACIAL TILL.* **Sample saturated at 5.0'.**	SM		4.50	2	DO	15,19,21,24	40	75	■	
10						3	DO	20,26,24,34	50	60	■	
15						4	DO	11,15,19,27	34	50	■	
					52.60							
		BORING TERMINATED AT 17.0 FT. BELOW GROUND SURFACE.			17.00							
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/30/90

PDI Task S-2 Borehole Logs

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE 7

BORING DATE: 04/25/90

BORING LOCATION: N: 554,431
E: 695,882

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 10 20 30 40 50 60 70 80 90 / WATER CONTENT, PERCENT Wp W Wl 10 20 30 40 50 60 70 80 90	PIEZOMETER OR STANDPIPE INSTALLATION
0					70.80 / 0.00							
		0.0-6.5 ft. Compact, medium gray to medium brown, c-f SAND, some f-gravel, little clayey silt, some roots, few pieces of red brick, (SW). FILL. Water encountered at approximately 1.2 ft. Difficult drilling at 0.0-5.0 ft.	SW			1	DO	3,4,6,6	10	40	■	
5						2	DO	7,8,6,1	14	20	■	
					64.30 / 6.50							
		6.5-7.5 ft. Very soft, black, CLAYEY SILT, some m-f sand, organic odor, (ML).	ML		63.30 / 7.50							
		7.5-12.5 ft. Compact, medium gray becoming grayish orange, m-f SAND, trace silt, trace f-gravel, (SP). OUTWASH SAND.	SP									
10						3	DO	5,7,16	23	60	■	
					58.30 / 12.50							
		12.5-17.0 ft. Very dense, olive gray, c-f SAND and c-f GRAVEL, little silt, (SW), GLACIAL TILL	SW									
15						4	DO	26,26,32,36	58	75	■	
					53.80 / 17.00							
		BORING TERMINATED AT 17.0 FT. BELOW GROUND SURFACE.										
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/29/90

PROJECT: INDUSTRI-PLEX

PROJECT LOCATION: WOBURN

PROJECT NUMBER: 893-6255

RECORD OF BOREHOLE 8

BORING DATE: 04/24/90

BORING LOCATION: N: 554,330
E: 695,762

SHEET: 1 OF 1

DATUM: MSL

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (10 20 30 40 50 60 70 80 90) / WATER CONTENT, PERCENT (Wp, W, Wl)	PIEZOMETER OR STANDPIPE INSTALLATION
					71.00							
0		0.0-4.0 ft. Very soft, reddish brown to black, CLAYEY SILT, some f-sand, few roots, (ML to CL). Water encountered at approximately 3.5 ft.	ML to CL		0.00	1	DO	0,1,1,4	2	75		
					67.00							
5		4.0-8.4 ft. Dense, moderately brown to yellowish orange, m-f SAND, trace silt, (SP). OUTWASH SAND.	SP		4.00	2	DO	N/A		75		
						3	DO	1,14,24,22	38	100		
					62.60	4	DO	100/0	100	0		
		AUGER REFUSAL AT 8.4 FT. BELOW GROUND SURFACE.			8.40							
10		NOTES: 1.) A shelby tube was attempted from 3.50-5.50 ft. No recovery was obtained. A split spoon was then driven in this interval. 2.) A second shelby tube attempted from 1.0-3.0 ft. by moving rig up after completion of borehole. No recovery was obtained.										
15												
20												
25												
30												
35												
40												

DRILL RIG: Mobile B-57 ATV

DRILLING CONTRACTOR: Geologic

DRILLER: T. Paquette

Golder Associates

LOGGED: RJI

CHECKED: JEW

DATE: 05/29/90

RI/FS Borehole Logs

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page 1 Of 1
Date Prepared 10/26/83 By A. Jaroszewski
Owner:
Well No. 28/36
Loc. Near Chrome Lagoons
M.P. Elevation:
Drilling Started 9/14/83, Ended 9/14/83
Driller Parratt Wolff
Type Of Rig Hollow Stem Auger

WELL DATA
Hole Diam. 6.0"
Final Depth 12.0'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER
Type Split Spoon
Hammer 140 lb.
Fall 30"

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows @	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
	1	8"	0 - 2'	1,1,2,5	Fill (A)	Dark brown organic zone Maroon silty sand, few granules of slag
2	2	12"	2 - 4'	4,5,5,3	(R)	
4	3	12"	4 - 6'	2,2,1,1	(A)	Maroon sandy slag; scattered pods of orange clayey pasty substance
6	4	6"	6 - 8'	1,1,1,5	(R)	Maroon sand sized slag Black silty f sand, organics
8	5	6"	8 - 10'	4,7,10,9	Fill (A) Till	Green f-m sand, pebbles Pebbles and cobbles in cohesive green-gray clayey p.s. sand
10	7	24"	10 - 12'	8,22,19,22	Till (R)	
12						
14						
16						

REMARKS: DOF = 9.0'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page 1 Of 1
Date Prepared 10/26/83 By A. Jaroszewski
Owner:
Well No. 28/38
Loc. North of West Chrome Lagoon
M.P. Elevation:
Drilling Started 9/14/83, Ended 9/14/83
Driller Parratt Wolff
Type Of Rig Hollow Stem Auger

WELL DATA
Hole Diam. 6.0"
Final Depth 10.0'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER
Type Split Spoon
Hammer 140 lb.
Fall 30"

DEVELOPMENT

Depth In ft.	Sample No.	Sample Rec.	Sample Depth	Sample Blows @	Strata Chg. & Gen. Desc.	Sample Description
0	1	12"	0 - 2'	3,5,9,6	Fill (A)	Brown silty sand, roots, stems, scattered pebble
2						Brown cohesive silty sand, pebbles
						Maroon sandy silt, granules, few pebbles, pods of yellow silt
	2	12"	2 - 4'	7,8,9,8	(A)	Same as last unit
						Steel gray sandy, slag, occasional pebble
4	3	8"	4 - 5'	2,2,2,2	(R)	Steel gray sand slag; pods of beige pasty substance
6	4	12"	6 - 8'	1,1,6,11	(A)	Wet gray sandy slag
8	5	12"	8 - 10'	3,4,4,6	Sand (R)	Wet gray w.s. m sand, few pieces of wood
10						
12						
14						
16						

REMARKS: DOF - 8.0'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 10/25/83 By: A. Jaroszewski
Owner:
Well No.: 29/35
Loc.: Chrome Lagoon area
M.P. Elevation:
Drilling Started: 9/10/83, Ended: 9/10/83
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA
Hole Diam.: 6.0"
Final Depth: 10.0'
Casing Diam.: 2.0'
Casing Length: 12.0'
Screen Setting: 7.0 - 12.0'
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER
Type: Split Spoon
Hammer: 140 lb.
Fall: 30"

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows @	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
	1	12"	0 - 2'	3,3,4,5	Fill (A)	Maroon and blue sandy slag, scattered pebbles
2	2	12"	2 - 4'	5,3,5,5	Fill (R)	Maroon, yellow and blue sandy slag, scattered pebbles
4	3	6"	4 - 6'	4,4,5,5	Fill (A)	Same as above; wet
6	4	6"	6 - 8'	6,5,3,2	Fill (A)	
8	5	10"	8 - 10'	7,4,3,4	Peat (R)	Dark brown silty peat
10						
12						
14						
16						

REMARKS: Installed piezometer; DOF - 8.5'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 10/25/83 By: A. Jaroszewski
Owner:
Well No.: 29/37
Loc.: Chrome Lagoon area
M.P. Elevation:
Drilling Started: 9/10/83, Ended: 9/10/83
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA
Hole Diam.: 6.0"
Final Depth: 10.0'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER
Type: Split Spoon
Hammer: 140 lb.
Fall: 30"

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows &	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
0	1	14"	0 - 2'	3,6,12,12	Fill (A)	Maroon clayey sand, pebbles Maroon silty f sand, pebbles Black-maroon sandy slag Brown silty sand, brick fragments Maroon silty sand
2	2	12"	2 - 4'	13,22,15,8	(A)	Black sandy slag with pods of yello silt Brick fragments in maroon silty f sand
4	3	6"	4 - 6'	5,2,1,2	(R)	Maroon sandy slag, brick fragments Steel gray sandy slag
6	4	14"	6 - 8'	3,2,1,1	Fill (A)	Steel gray sandy slag Wet maroon silty f sand Maroon clayey pasty substance
8	5	18"	8 - 10'	3,7,5,6	Sand (R)	Dark brown to black peat Black silty peat Wet gray w.s. f-m sand
10						
12						
14						
16						

REMARKS: DOF - 7.0'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 10/25/83 By: A. Jaroszewski
Owner:
Well No.: 30/36
Loc.: Chrome Lagoon Area
M.P. Elevation:
Drilling Started: 9/10/83, Ended: 9/10/83
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA
Hole Diam.: 6.0"
Final Depth: 10.0'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER
Type: Split Spoon
Hammer: 140 lb.
Fall: 30"

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
2	1	7"	0 - 2'	4,6,8,11	Fill (A)	Maroon silty sand, organics Light brown p.s. sand, granules Maroon p.s. sand, granules, scattered pebbles Brown p.s. sand, pebbles, cobbles, few granules of slag
4	2	12"	2 - 4'	13,11,11,14	(R)	Maroon p.s. sand, few granules of slag
6	3	12"	4 - 6'	4,4,7,7	(A)	Steel gray sandy slag, cinders in yellow pasty matrix
8	4	12"	6 - 8'	3,3,2,2	Fill (A)	Steel gray sandy slag, pebbles in brown p.s. sand matrix Wet black-gray sandy slag in dark gray p.s. sand matrix
10		7"	8 - 9'	1,1,3,11		Wet gray sandy slag Maroon clayey paste
12	5	7"	9 - 10'		Sand (R)	Black peat Wet gray w.s. f-m sand
14						
16						

REMARKS: DOF - 8.3'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 10/25/83 By: A. Jaroszewski
Owner:
Well No.: 30/38
Loc.: Chrome Lagoon Area
M.P. Elevation:
Drilling Started: 9/10/83, Ended: 9/10/83
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA

Hole Diam.: 6.0"
Final Depth: 8.0'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER

Type: Split Spoon
Hammer: 140 lb.
Fall: 30"

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
0	1	14"	0 - 2'	3,9,16,27	Fill (A)	Brown silty sand, organics Maroon silty f-sand, pebbles, brick fragments Brown p.s. sand, scattered pebbles, cobbles
2	2	12"	2 - 4'	20,10,15,16	(A)	White clayey silt, granules Steel gray sandy slag Dark brown silty f sand, pieces of wood Brick fragments
4	3	16"	4 - 6'	3,1,1,3	(R)	Maroon silty sand, scattered pebble White clayey silt
6	4	14"	6 - 8'	3,2,2,4	Fill (A)	White clayey sandy cement like material White pasty clay Maroon pasty clay Maroon silty sand
8					Sand	Dark brown peat Gray w.s. f-m sand
10						
12						
14						
16						

REMARKS: DOF - 7.5'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of: 1
Date Prepared: 10/25/83 By: A. Jaroszewski
Owner:
Well No.: 47/31
Loc.: Southwest of west hide pile- by mound
M.P. Elevation:
Drilling Started: , Ended:
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA
Hole Diam.: 2.0"
Final Depth: 6.0'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER
Type: Split Spoon
Hammer: lb.
Fall: By hand

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
	1	16"	0 - 2'	Taken with sledge hammer	Fill (A)	Beige clayey pasty substance Maroon clayey silt; occasional pebble
2		12"	2 - 4'		(A)	Maroon clayey silt; occasional blotches of beige clayey silt
4		12"	4 - 5'		Fill (A)	Wet maroon p.s. sand; few pebbles
		12"	5 - 6'		Sand (R)	Wet gray w.s. f-m sand
6						
8						
10						
12						
14						
16						

REMARKS: DOF - 5.0'

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 11/2/83 By: S. Sucharski
Owner:
Well No.: 48/32
Loc.: South of west hide pile
M.P. Elevation:
Drilling Started: 10/13/83, Ended: 10/13/83
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA

Hole Diam.:
Final Depth: .8'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
	1		0 - .8'	Sample taken by hand	Fill (A)	Brown sandy loam Beige & red sandy clay material

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS
ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 11/2/83 By: S. Sucharski
Owner:
Well No.: 48/34
Loc.: South of west hide pile
M.P. Elevation:
Drilling Started: 10/13/83, Ended: 10/13/83
Driller: Parratt Wolff
Type Of Rig: Hollow Stem Auger

WELL DATA

Hole Diam.:
Final Depth: .8'
Casing Diam.:
Casing Length:
Screen Setting:
Screen Slot & Type:
Well Status:

G-W READINGS

Date	DTW MP	Elev.W.T.

SAMPLER

Type: Split Spoon
Hammer: 140 lb.
Fall: 30 inches

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
	1		0 - .8'	Sample taken by hand	Fill (A)	Brown sandy loam Beige & red sandy clay material

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page 1 Of 1
Date Prepared 10/1/82 By J. DeMartinis
Owner: Stauffer Chemical Company
Well No.: OW - 2
Loc.: North end of Site
M.P. Elevation: 128.02'
Drilling Started 8/16/82, Ended 8/17/82
Driller: Domestic Wells, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 8 3/4"-16';5 3/4"-100
Final Depth: 100'
Casing Diam.: 6.0"
Casing Length: 17.0'
Screen Setting:
Screen Slot & Type:
Well Status: Observation

G-W READING

Date	DTW MP	Elev.W
8/83	20.54'	107.
10/83	44.68'	83.3
12/83	5.10'	122.
1/84	7.31'	120.

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
					Till	Brown-black organic zone Brown sandy loam with organic material
5						Gray poorly sorted mixture of sil sand and gravel Boulders at 6.0'
10					Fractured Bedrock	Gray meta-gabbro containing green minerals and quartz; fractured bedrock
15					Bedrock	Bedrock; Greenish-gray meta-gabbr with veins of pink and white quartz throughout
20						
25						
30						

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 10/1/82 By: J. DeMartinis
Owner: Stauffer Chemical Company
Well No.: OW - 3
Loc.: East of Commerce Way near I-93
M.P. Elevation: 74.76'
Drilling Started: 8/3/82, Ended: 8/3/82
Driller: Domestic Wells, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 13"-12'; 5 3/4"-83'
Final Depth: 83'
Casing Diam.: 6.0"
Casing Length: 13.5'
Screen Setting:
Screen Slot & Type:
Well Status: Observation

G-W READING

Date	DTW MP	Elev.
8/83	9.75'	65.0
10/83	9.79'	64.9
12/83	6.52'	68.2
1/84	7.24'	67.5

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
5					Sand	Moist, brown, fine-medium sand; well sorted; quartzose
						Moist, gray, poorly sorted gravel sand; cobbles of quartz and maf rock
						Moist, gray boulders and cobbles a sand matrix
10					Bedrock	Bedrock-dark gray meta-gabbro wit gneissic texture; thin layers of quartz (white to pink) and green minerals (chlorite, epidate and amphibole)
15						47' - 50'; soft, black, rusty zone
						73' - 75'; pink quartz vein
20						75' - 80'; rosy quartz vein - wate bearing
25						
30						

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page 1 Of 2
Date Prepared: 10/1/82 By: J. DeMartinis
Owner: Stauffer Chemical Company
Well No.: OW - 4
Loc.: Roma Stone near I-93
M.P. Elevation: 71.54'
Drilling Started: 8/4/82 Ended: 8/5/82
Driller: Domestic Wells, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 13"-25'; 5 3/4"-44'
Final Depth: 44.0'
Casing Diam.: 6.0"
Casing Length: 26.0'
Screen Setting:
Screen Slot & Type:
Well Status: Observation

G-W READING

Date	DTW MP	Elev.W
8/83	8.89'	62.6
10/83	9.38'	62.1
12/83	5.19'	66.3
1/84	6.25'	65.2

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
					Fill	Moist, brown sandy fill with pebb and cobbles
						Moist, grayish-brown cobble and boulder fill
5					Sand	Moist-wet, brown, fine-medium san well sorted; scattered pebbles
					Till	Moist, dark gray, poorly sorted mixture of grave (boulders,cobb and pebbles) in a sandy matrix Gravel clasts are exclusively of quartz and meta-gabbro
10						
15						
20					Bedrock	Fractured bedrock-rusty quartz ir fracture zones with abundant epidote and plagioclase-water bearing at 26'
25						
30						Rock is grayish-green in color

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 2 Of 2
Date Prepared: 10/1/82 By: J. DeMartinis
Owner: Stauffer Chemical Company
Well No.: OW - 4
Loc.: Roma Stone near I-93
M.P. Elevation: 71.54'
Drilling Started: 8/4/82, Ended: 8/5/82
Driller: Domestic Wells, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 13"-25'; 5 3/4"-44'
Final Depth: 44.0'
Casing Diam.: 6.0"
Casing Length: 26.0'
Screen Setting:
Screen Slot & Type:
Well Status: Observation

G-W READING

Date	DTW MP	Elev.W

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
35						Zone of platey green minerals
40						Zone of pink and white quartz Green meta-gabbro with thin quart veins

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 1 Of 1
Date Prepared: 10/4/82 By: S. Sucharski
Owner: Stauffer Chemical Company
Well No.: OW - 5
Loc.: Harvey Industries
M.P. Elevation: 68.08'
Drilling Started: 8/26/82 Ended: 8/27/82
Driller: Domestic Wells, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 8.0"
Final Depth: 49.5'
Casing Diam.: 4.0"
Casing Length: 10.0'
Screen Setting: 9.0'-49.0'
Screen Slot & Type: .010 PVC
Well Status: Observation

G-W READINGS

Date	DTW MP	Elev.W
8/83	9.45'	58.6
10/83	9.19'	58.8
12/83	8.52'	59.5
1/84	8.86'	59.2

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

2 Hr. - Air/water

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
					Fill	Brown, hard packed sand, fill
5					Peat	Moist black silty peat
10						
15					Sand	Well sorted; coarse sand and gran brown-wet
20						33' - 37' - Cobble zone - Till 37' - 41' - Poorly sorted sand, granules, and gravel 41' - Bedrock - dark green meta-gabbro
25						
30						

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page 1 Of 2
Date Prepared 10/4/82 By S. Sucharski
Owner: Stauffer Chemical Company
Well No.: OW - 14
Loc.: Near Chrome Lagoons
M.P. Elevation: 65.54'
Drilling Started 9/21/82, Ended 9/22/82
Driller: Domestic Well, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 8.0"
Final Depth: 52.0'
Casing Diam.: 4.0"
Casing Length: 8.0'
Screen Setting: 5.0' - 50.0'
Screen Slot & Type: .010 PVC
Well Status: Observation

G-W READING

Date	DTW MP	Elev.
8/83	8.12'	57.4
10/83	8.58'	56.9
12/83	6.28'	59.2
1/84	6.95'	58.5

SAMPLER

Type:
Hammer: lb.
Fall:

DEVELOPMENT

1 Hr. - Air/water

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
0					Fill	Poorly sorted sand and pebbles; purple in color changing to bri red with depth
5						Poorly sorted, multi colored, cru fill; sand, pebbles, cobbles, bricks, glass
						Black peat
10						Poorly sorted sand, cobbles, slag and cinder; multi-colored
15					Sand	Multi-colored coarse sand and granules; well sorted
20						
25						
30						

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Company
Page: 2 Of 2
Date Prepared: 10/4/82 By: S. Sucharski
Owner: Stauffer Chemical Company
Well No.: OW - 14
Loc.: Near Chrome Lagoons
M.P. Elevation: 65.54'
Drilling Started: 9/21/82, Ended: 9/22/82
Driller: Domestic Wells, Inc.
Type Of Rig: Air/Mud Rotary

WELL DATA

Hole Diam.: 8.0"
Final Depth: 52.0'
Casing Diam.: 4.0"
Casing Length: 8.0'
Screen Setting: 5.0' - 50.0'
Screen Slot & Type: .010 PVC
Well Status: Observation

G-W READING

Date	DTW MP	Elev.W

SAMPLER

Type: Split Spoon
Hammer: 140 lb.
Fall: 30"

DEVELOPMENT

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
35					Till	Poorly sorted gray; mixture of sa silt, pebbles and cobbles
					Fractured Bedrock	Fractured bedrock; dark green met gabbro
40						
45					Bedrock	Bedrock; dark green meta-gabbro
50						
55						

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project Woburn
Client Stauffer Chemical Company
Page 1 Of 1
Date Prepared 9/2/83 By S. Sucharski
Owner Stauffer Chemical Company
Well No. OW-15
Loc. Roma Stone
M.P. Elevation 64.60'
Drilling Started 8/16/83, Ended 8/17/83
Driller D.L. Maher
Type Of Rig Mud Rotary

WELL DATA

Hole Diam. 12.0"
Final Depth 28.0'
Casing Diam. 6.0"
Casing Length 8.5'
Screen Setting 8.0' - 28.0'
Screen Slot & Type .010 P.V.C.
Well Status Observation

G-W READINGS

Date	DTW MP	Elev.W.
8/83	4.94'	59.66
10/83	4.84	59.76
12/83	4.26	60.34
1/84	4.42	60.18

SAMPLER

Type
Hammer lb.
Fall

DEVELOPMENT

½ hr. - Air/water
2 hr. 20 min.- submersible

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
4.5					Fill	Brown, sandy loam with small cobbles, asphalt, bricks
5						Gray, pebbles and cobbles in a sand matrix
9.5						
10						Ledge boulder, gray-green meta-gabbro with thin veins of calcite and quartz, at 10.0' rock turns lighter in color-feldspar rich
13.5						
15					Sand	Out of ledge-wet, brown, poorly sorted sand and pebble gravel: scattered cobbles; angular grains: immature in places-pea gravel 12.5'-better sorted; coarse sand and pebble gravel; loose cobbles
20						
22.5					Till	Cobbly zone-cobbles in a sandy matrix
24.5						
25					Bedrock	Metagabbro with dense, quartz veins
30						

REMARKS:

CONSULTING GROUND-WATER GEOLOGISTS

ROUX ASSOCIATES INC

WELL LOG

Project: Woburn
Client: Stauffer Chemical Co.
Page: 1 Of 1
Date Prepared: 9/2/83 By: S. Sucharski
Owner: Stauffer Chemical Co.
Well No.: OW-16
Loc.: North of E.P.A. trailer
M.P. Elevation: 67.29'
Drilling Started: 8/25/83, Ended: 8/25/83
Driller: D.L. Maher
Type Of Rig: Air Rotary

WELL DATA

Hole Diam.: 8.25
Final Depth: 38.0'
Casing Diam.: 4.0"
Casing Length: 16.75'
Screen Setting: 15.75 - 35.75
Screen Slot & Type: .010 P.V.C.
Well Status: Observation

G-W READINGS

Date	DTW MP	Elev.W.T.
8/83	4.90'	62.39'
10/83	5.17'	62.12'
12/83	4.41'	62.88'
1/84	4.22	63.07'

SAMPLER

Type: Split Spoon
Hammer: ____ lb.
Fall: Pressed

DEVELOPMENT

45 min. - Air/Water
1½ hr. - Submersible

Depth in ft.	SAMPLE No.	Rec.	Depth	Blows 6	Strta Chg. & Gen. Desc.	SAMPLE DESCRIPTION
					Fill	Brown sandy loam with pebbles and cobbles
8					Sand	Gravel; gray, fractured rock fragments and sand
12	1	2'	12' - 14'	Pressed		Boulder and cobble zone
						Gray, poorly-sorted, fine to coarse sand with granules, and pebble gravel (odoriferous)
20	2	2'	20 - 22'	Pressed		
26					Till	Boulder and cobble zone
					Bedrock	34' metagabbro with dense, quartz veins

REMARKS:

APPENDIX B

Test Pit Logs

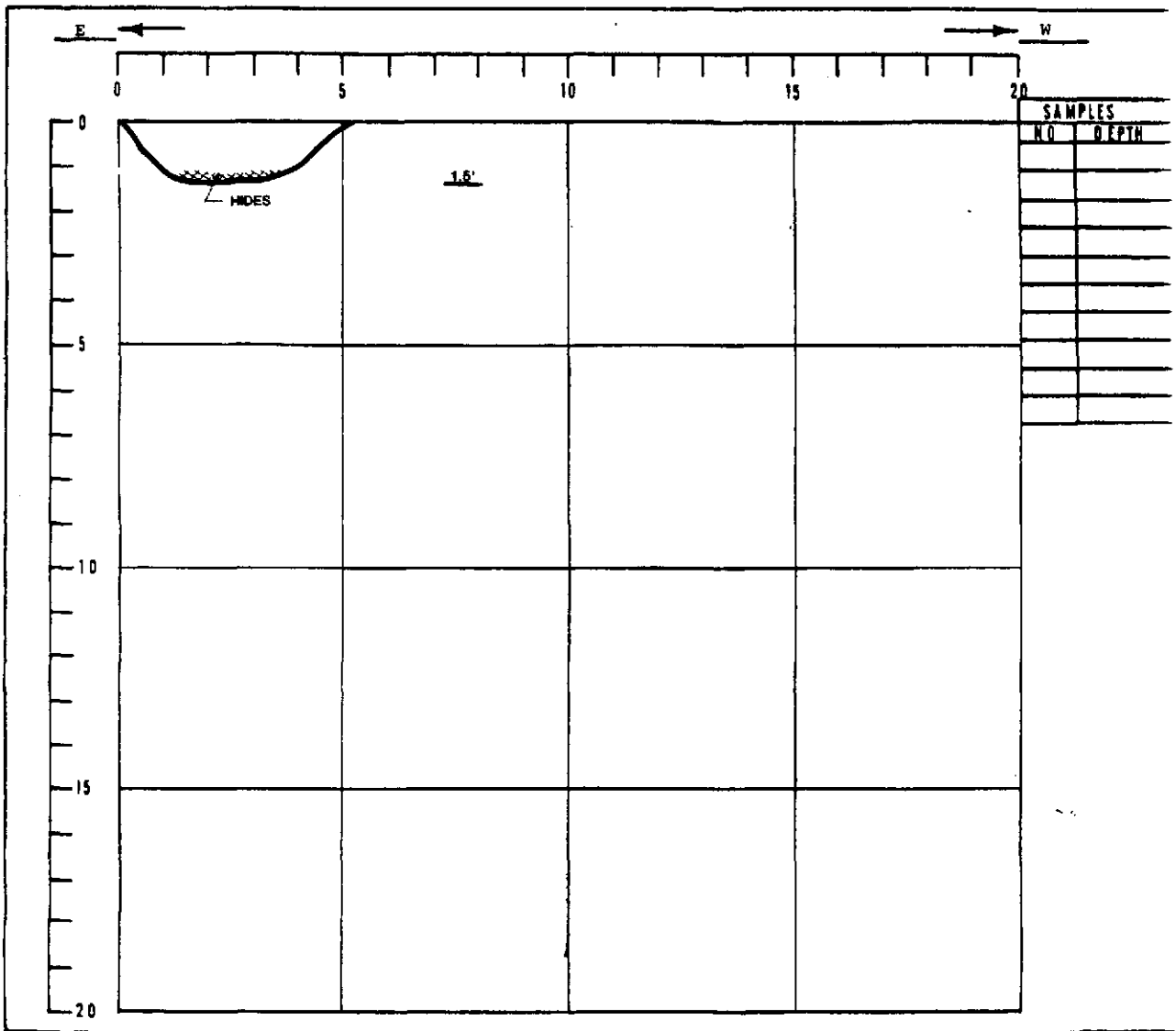
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P 1

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,777 E 696,504 ELEVATION 109.5 ft. DATUM MSL JOB 893-6255.



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
		1.5'	Not encountered.

SPECIAL NOTES:

P1 - encountered hides at 1.5' - test pit backfilled immediately. Moved approximately 25' to the east and excavated P1A.

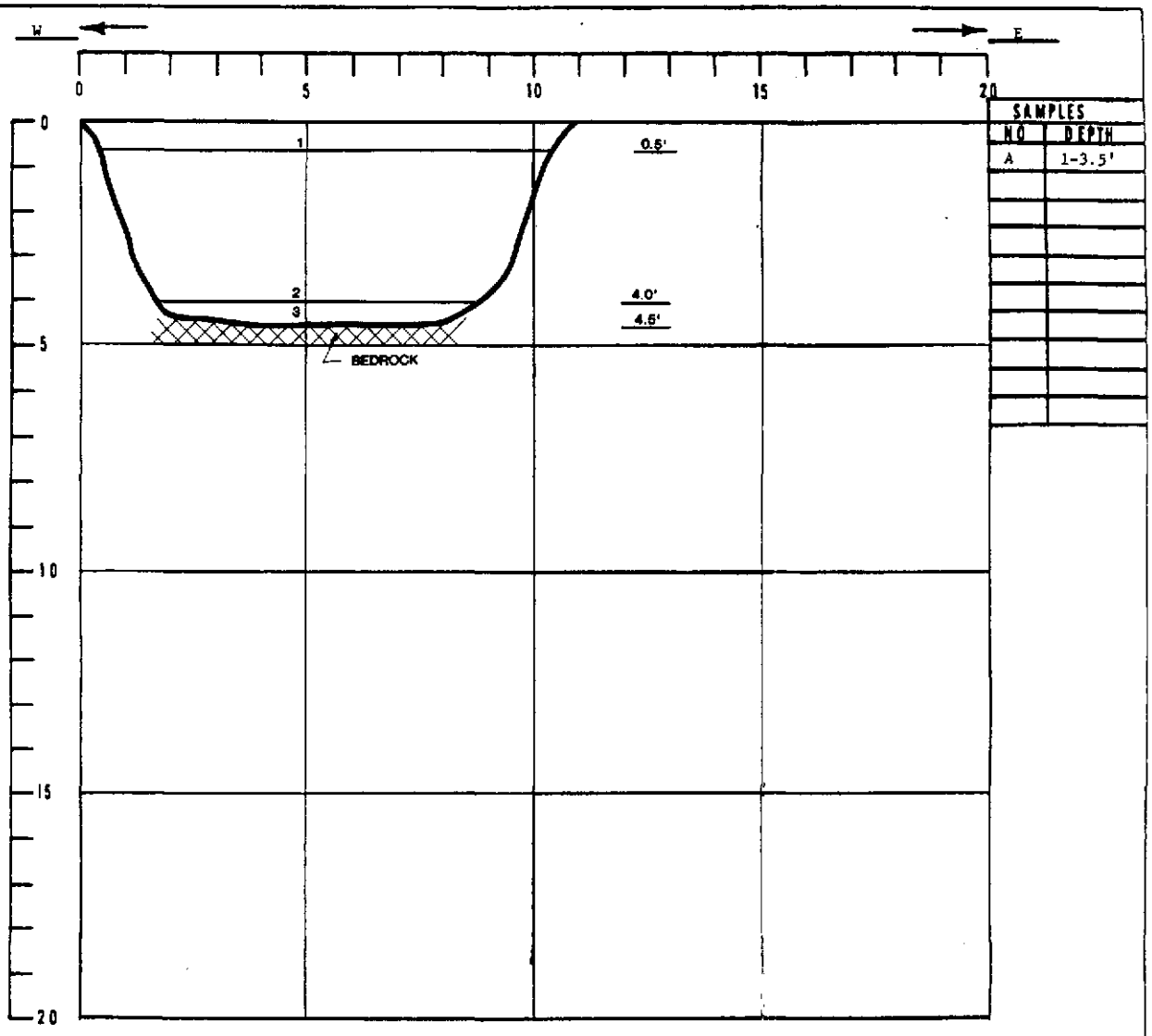
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P1A

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION B 554,769 . E 696,536 ELEVATION 109.6 ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	1-3.5'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-0.5' topsoil
2) 0.5-4' mod. yellowish brown becoming med. gray, c-f SAND, little silt, tr. f. gravel, few cobbles and boulders (<5%) from 2.5' (SW-SM) OVERBURDEN
4-4.5' Weathered Bedrock

TIME	DEPTH OF HOLE	DEPTH TO W/L
	4.5.'	Not encountered.

SPECIAL NOTES:

Difficult excavating 3.5'-4.5'.

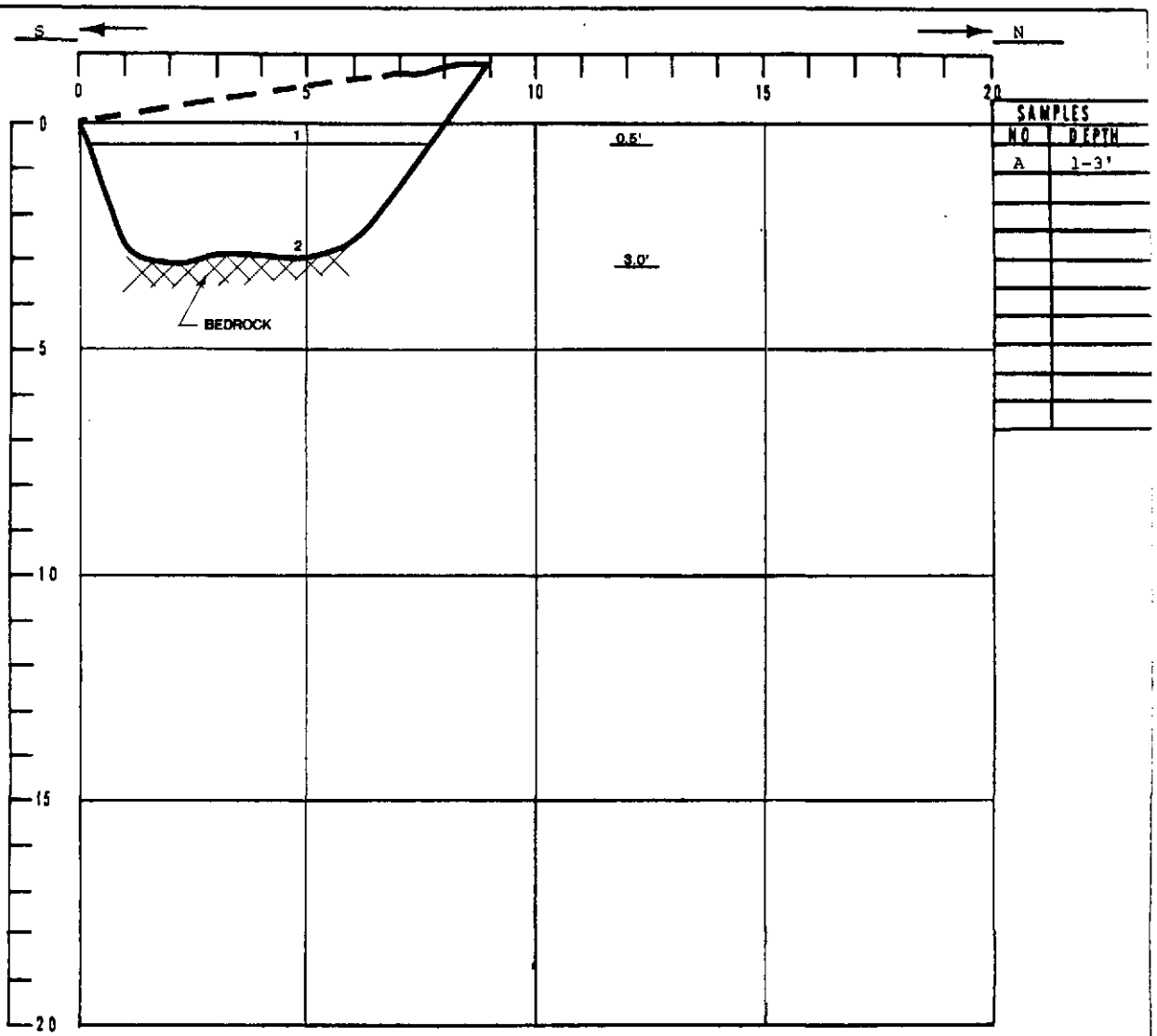
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER P. sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P2

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,822 E 696,583 ELEVATION 112.2 ft. DATUM MSL JOB 893-6255.



SAMPLES	
NO	DEPTH
A	1-3'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-.5 topsoil and rootmass
2) 0.5-3' mod. yellowish brown becoming olive gray, c-f SAND, some clayey silt, tr. f. gravel, few cobbles (<5%) (SM) OVERBURDEN
3' BEDROCK

TIME	DEPTH OF HOLE	DEPTH TO W/L
	3.0'	Not encountered.

SPECIAL NOTES:

Test pit was moved ~50' to the west from anticipated location due to bedrock outcrops.

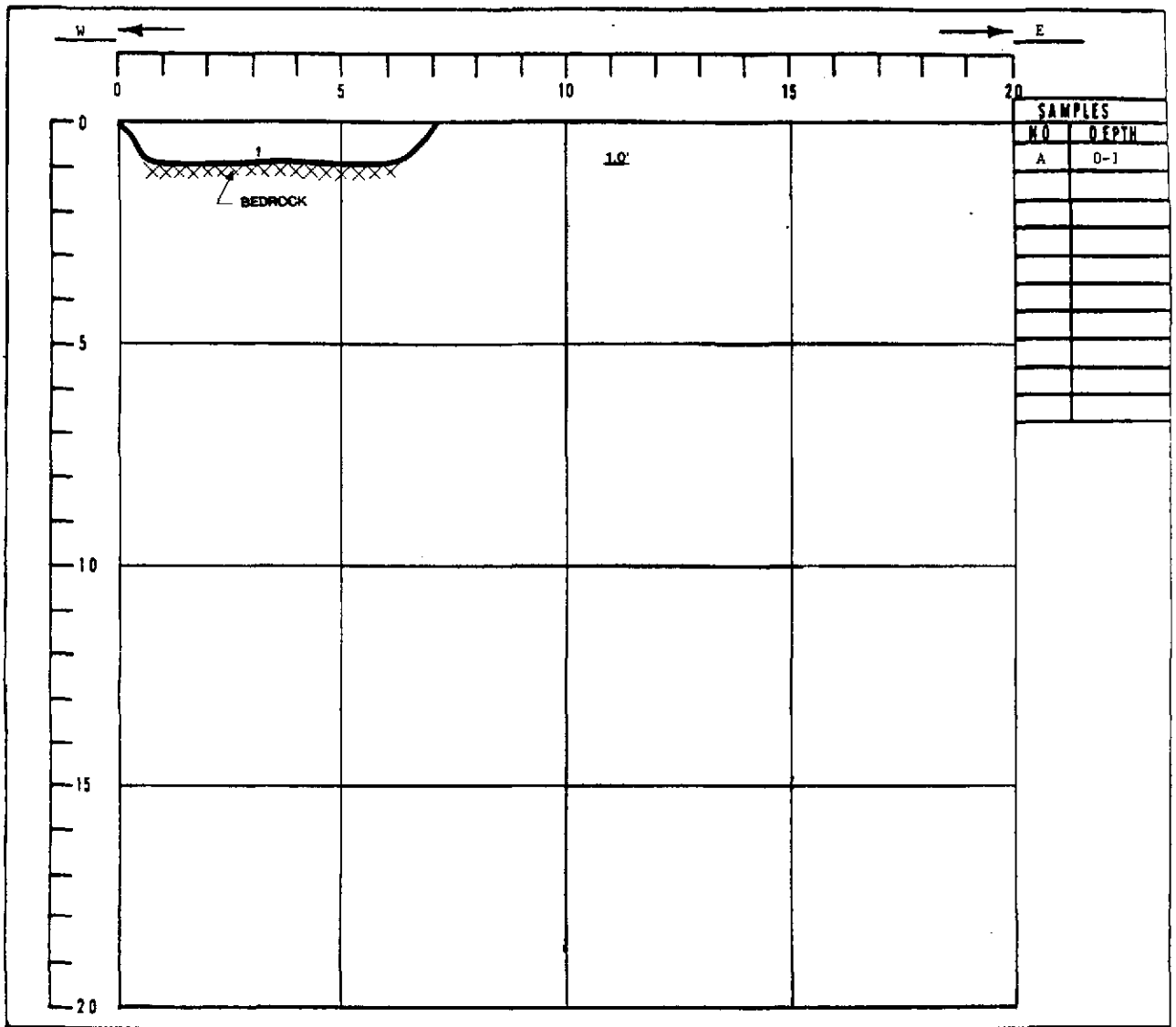
Golder Associates

FIELD TEST PIT LOG

TEMP 70 F WEATHER P. Cloudy ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P3

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,717 E 696,729 ELEVATION 117.2 ft. DATUM MSL JOB 893-6255.



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-1' dark yellowish brown, m-f SAND, some clayey silt, little f. gravel, few cobbles (<5%) (SM) few roots. OVERBURDEN		1.0'	Not encountered.
1.0' BEDROCK			

SPECIAL NOTES:

Bedrock outcrops everywhere in the vicinity of P3.

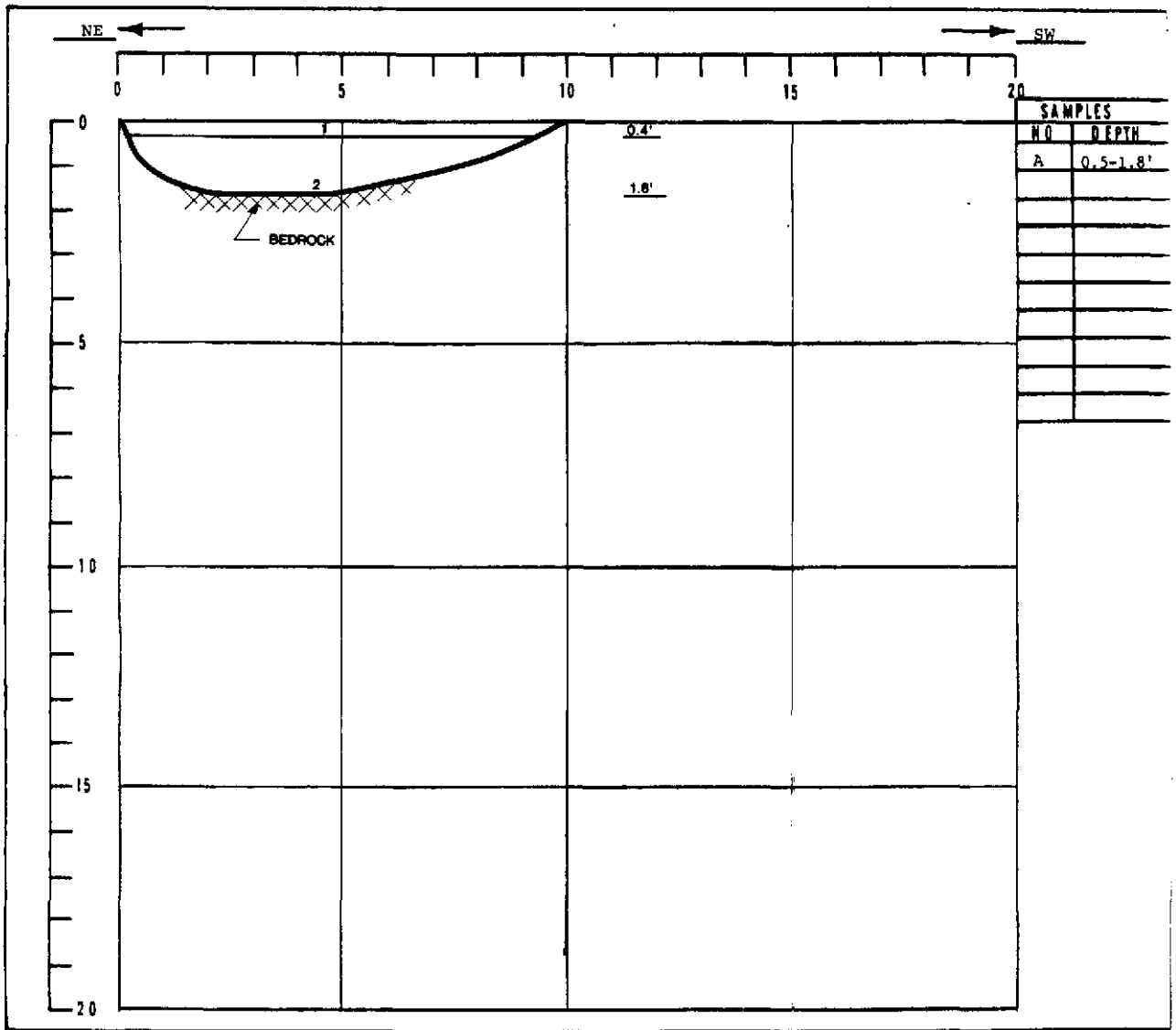
Golder Associates

FIELD TEST PIT LOG

TEMP 60 F. WEATHER cloudy, Rain ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P4

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,646 E 696,549 ELEVATION 101.7 ft. DATUM MSL JOB 893-6255.



SAMPLES	
NO	DEPTH
A	0.5-1.8'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-.4' topsoil and roots
2) 0.5-1.8' mod. yellowish brown to med. gray, m-f SAND, some clayey silt, tr. f. gravel, few cobbles (5%) some rootmass (SM) OVERBURDEN
1.8' BEDROCK

TIME	DEPTH OF HOLE	DEPTH TO W/L
	1.8'	Not encountered.

SPECIAL NOTES:

Moved north ~25' and excavated P4A.

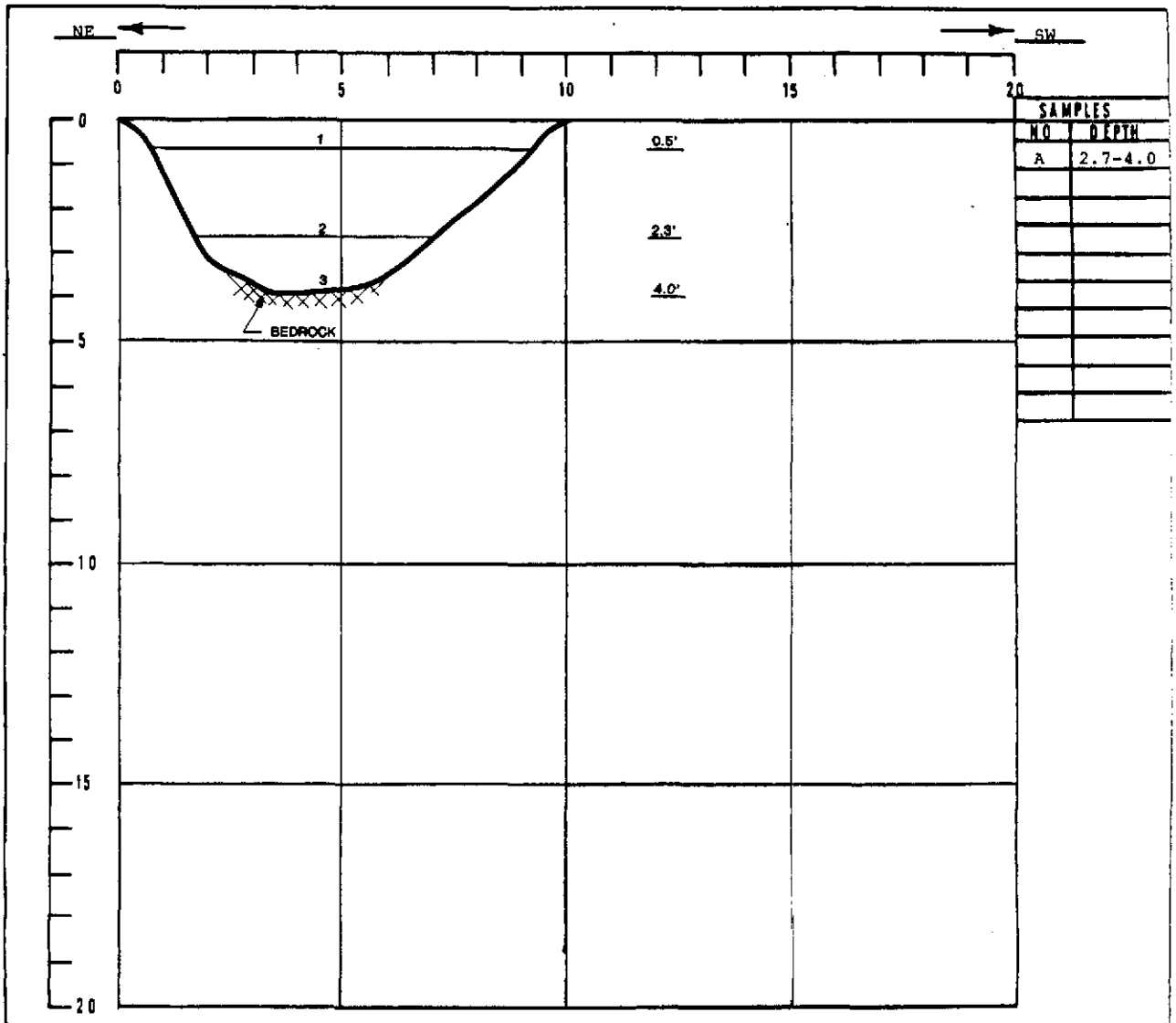
Golder Associates

FIELD TEST PIT LOG

TEMP 66 F. WEATHER Rain ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P4A

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N554,685 E 696,551 ELEVATION 106.2 ft. DATUM MSL JOB 893-6255.



SAMPLES	
NO	DEPTH
A	2.7-4.0

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-.5' topsoil
2) 0.5-2.3' mod. yellowish brown, m-f SAND, some clayey silt, tr. gravel, few cobbles (5%) some rootmass (SM)
3) 2.3-4.0' olive gray, c-f SAND, little to some clayey silt, little gravel, few cobbles and boulders (max 3') (SM) OVERBURDEN
4.0' - BEDROCK

TIME	DEPTH OF HOLE	DEPTH TO W/L
	4.0'	Not encountered.

SPECIAL NOTES:

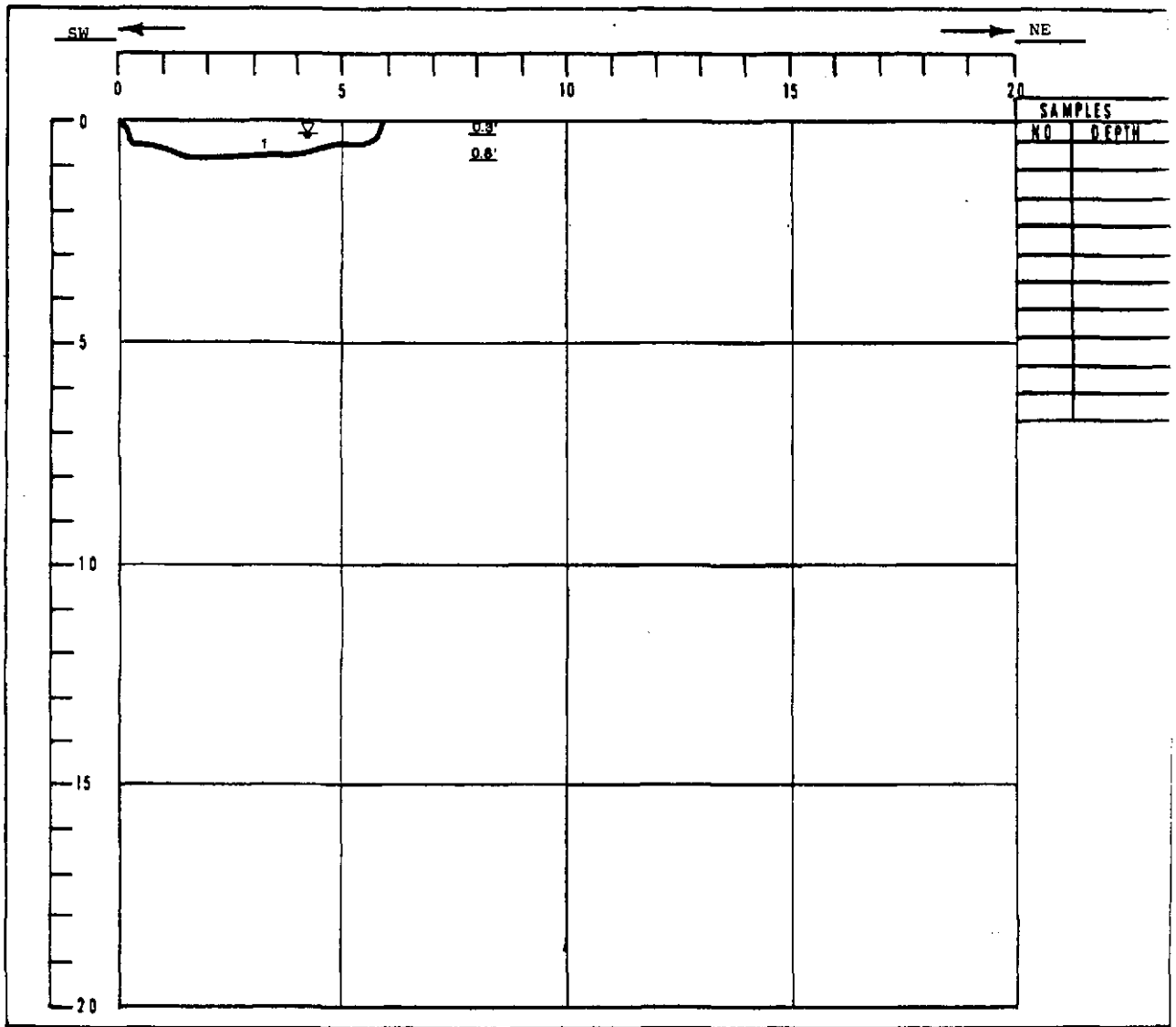
Golder Associates

FIELD TEST PIT LOG

TEMP 70 F. WEATHER Sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P5

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,384 E 695,841 ELEVATION 69.8 ft. DATUM MSL 1 (0893-6255.



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) Fill - 50% bricks 50% black, c-f SAND and CLAYEY SILT, some f. gravel (SM) FILL		0.8'	0.3'

SPECIAL NOTES: Test pit excavation terminated due to encountering of groundwater

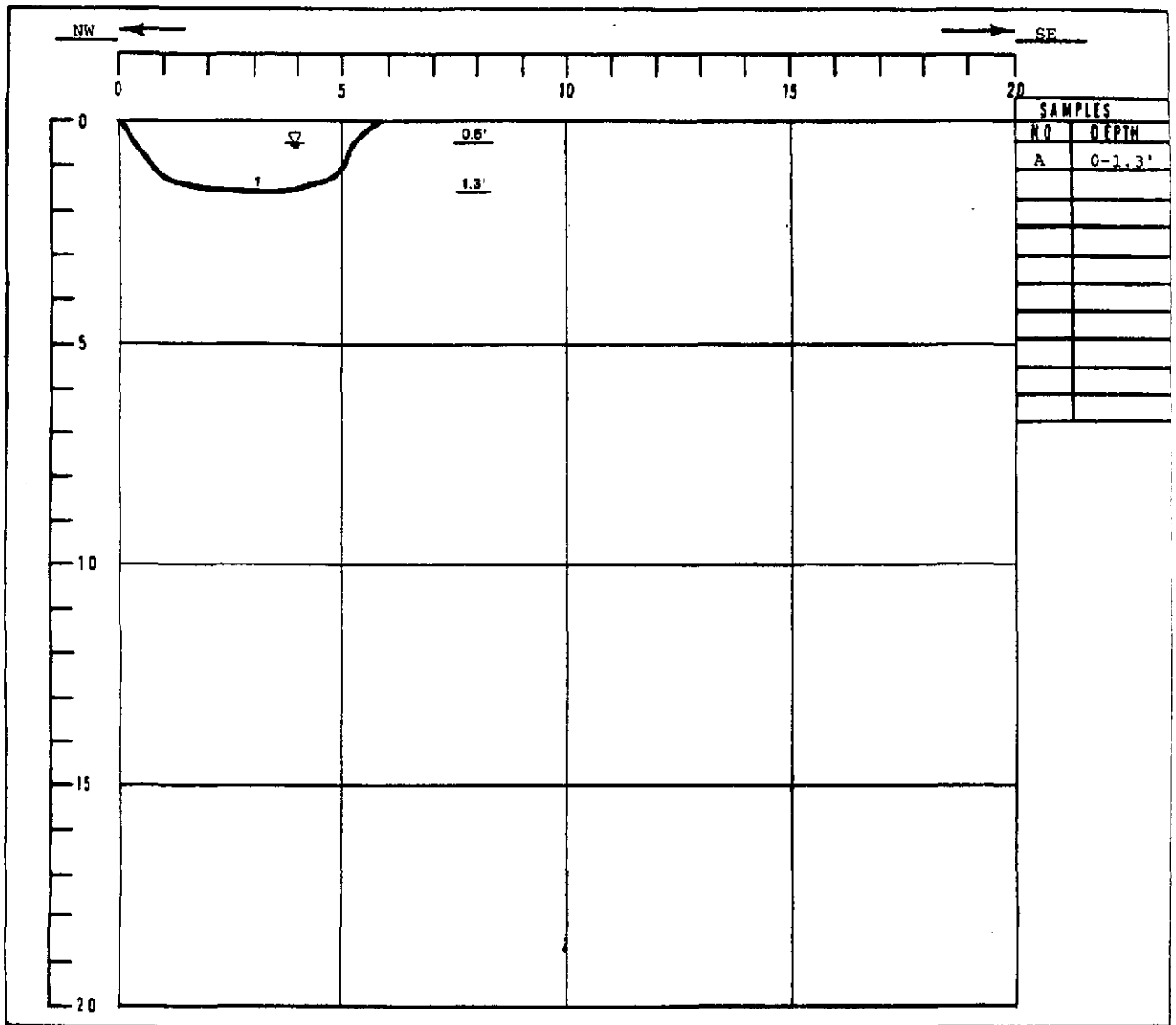
Golder Associates

FIELD TEST PIT LOG

TEMP 70 F. WEATHER Sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P6

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,266 E 695,833 ELEVATION 70.2 ft. DATUM MSL JOB 893-6255.



SAMPLES	
NO	DEPTH
A	0-1.3'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-1.3' mod. brown to dark gray, f. GRAVEL and c-f SAND, some clayey silt, (GM) gravel is cinder or ash FILL		1.3'	.5'

SPECIAL NOTES:

Bulk sample (5 gal. bucket) taken

Test pit terminated due to encountering of groundwater.

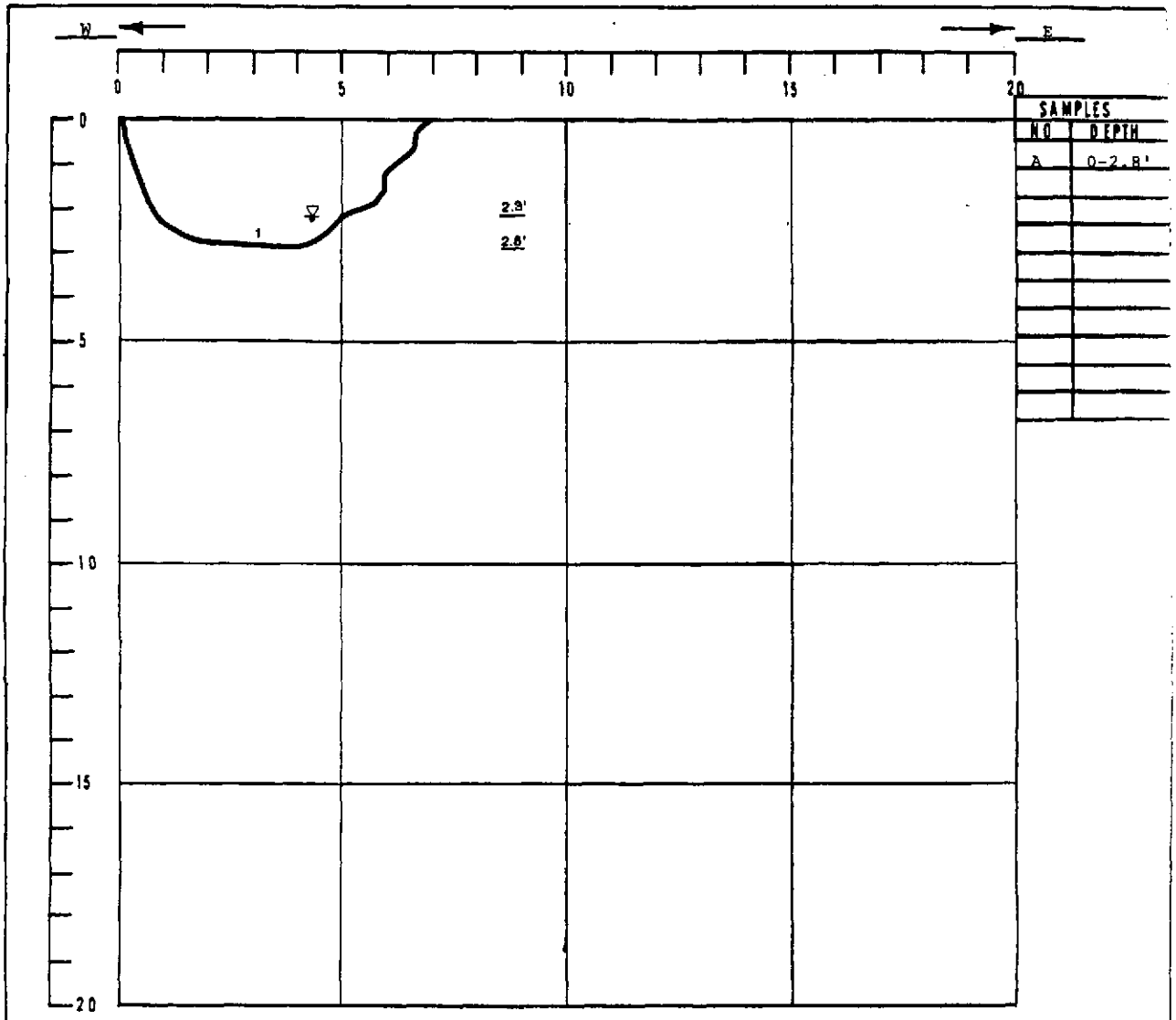
Golder Associates

FIELD TEST PIT LOG

TEMP. 70 F. WEATHER Sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P7

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554, 314 E 695,735 ELEVATION 70.7 ft. DATUM MSL JOB 893-6255



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) reddish brown, CLAYEY SILT, some f. sand, rootmass present throughout (ML to CL) FILL	1115	2.8'	2.3'

SPECIAL NOTES: Bulk sample taken (5 gal. bucket)

Test pit terminated due to encountering of groundwater.

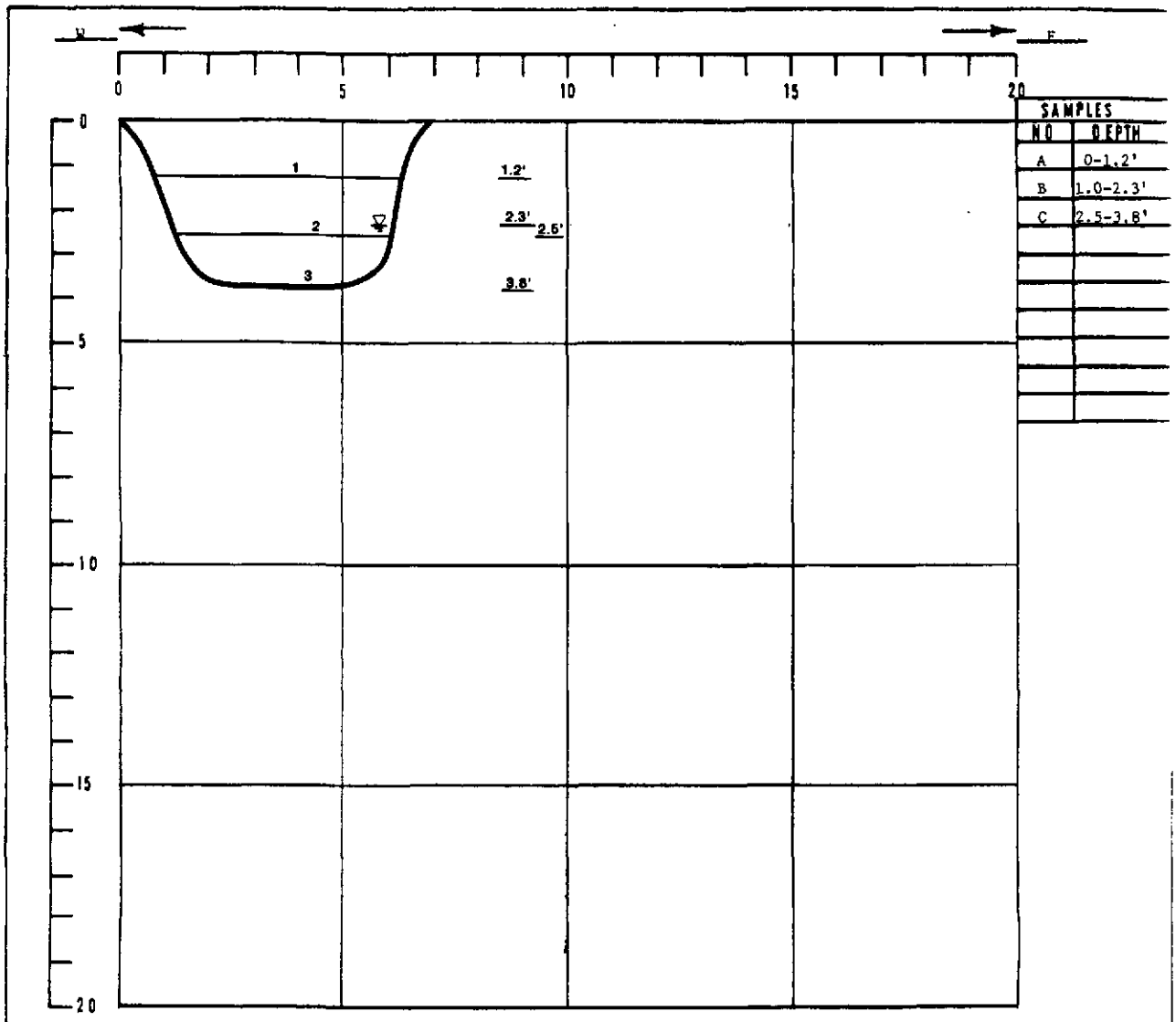
Golder Associates

FIELD TEST PIT LOG

TEMP 70 F WEATHER Sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P8

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 554,227 E 695,755 ELEVATION 72.1 ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	0-1.2'
B	1.0-2.3'
C	2.5-3.8'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-1.2' mod. orange pink, SILTY CLAY, trace f. sand, (CL to CH) FILL
2) 1.2-2.3' reddish brown to mod. orange pink CLAYEY SILT, little f. sand (ML to CL) FILL
3) 2.5-3.8' med. grav. GRAVEL, some c-m sand some silt (GM) gravel is cinders or ash FILL

TIME	DEPTH OF HOLE	DEPTH TO W/L
	3.8'	2.3'

SPECIAL NOTES:

Test pit moved approximately 30' west as borehole T3 was drilled in P8's original location. T3 was relocated as its planned location was under water.

Test pit terminated due to encountering of groundwater.

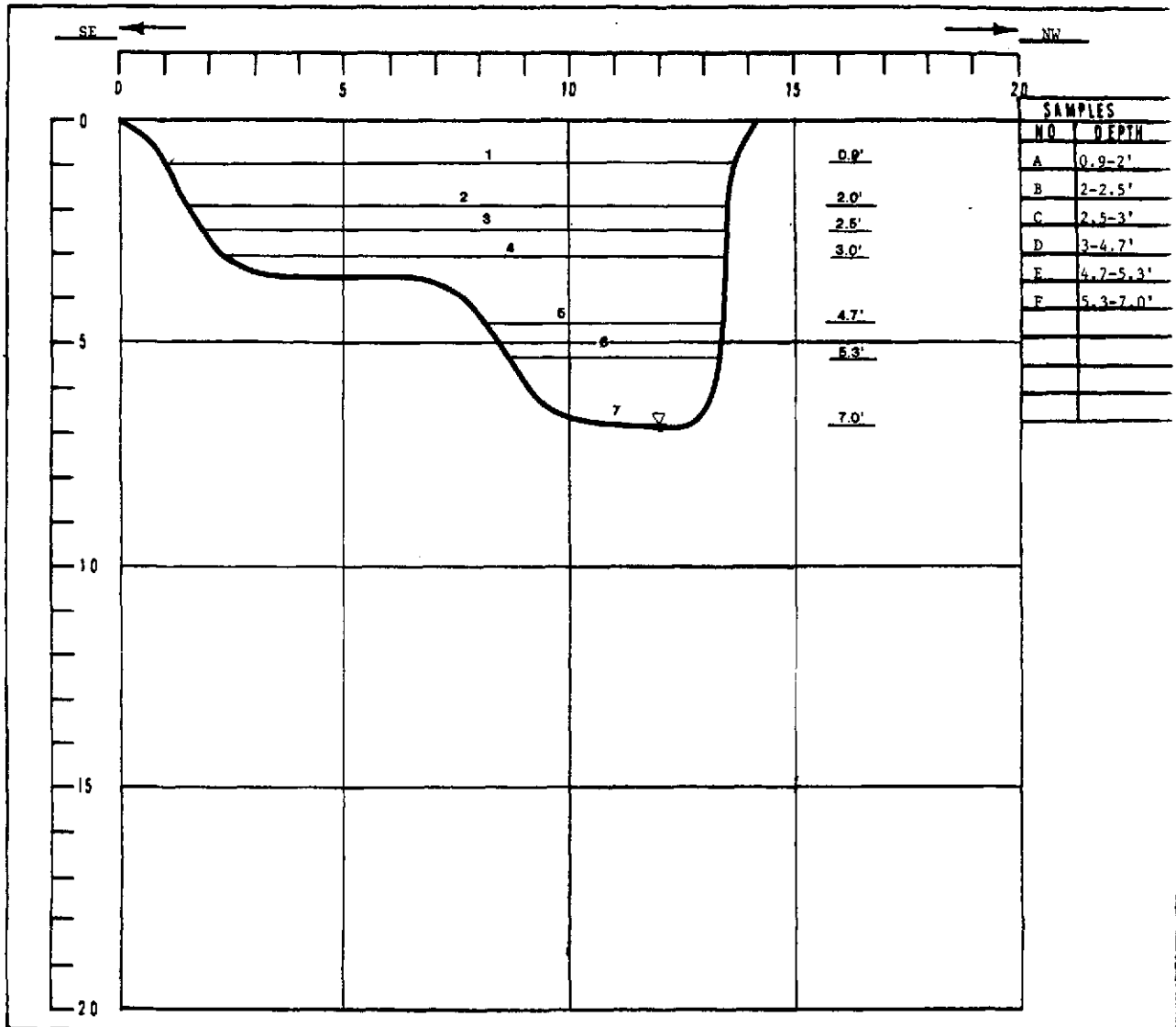
Golder Associates

FIELD TEST PIT LOG

TEMP 75 F. WEATHER Sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P9

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 552,675 E 696,002 ELEVATION 65.2 ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	0.9-2'
B	2-2.5'
C	2.5-3'
D	3-4.7'
E	4.7-5.3'
F	5.3-7.0'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-0.9' topsoil
2) 0.9-2' very dark to dusky red to purple, m-f SAND, little silt, tr. gravel (SP-SM) 1.4-1.7 : lense of mod. brown w/yellow patches, c-f SAND, little silt (SP-SM). FILL
3) 2-2.5' black to dark gray, f. SAND, little silt (SP-SM) FILL
4) 2.5-3' brick-red brick and altered brick to a yellow/orange color. FILL
5) 3-4.7' very dark to dusky red, f. SAND, some silt (SM)
6) 4.7-5.3' dark gray to yellowish orange, c-f SAND, little silt, little f. gravel (SW-SM) cinder/ash? FILL
7) 5.3-7.0' same as #6; however, more yellowish orange, rust. FILL

TIME	DEPTH OF HOLE	DEPTH TO W/L
	7.0'	7.0'

SPECIAL NOTES:

Bulk sample (5 gal. bucket) 0.9-2'.

Water at 7.0'

Test pit terminated due to encountering of groundwater.

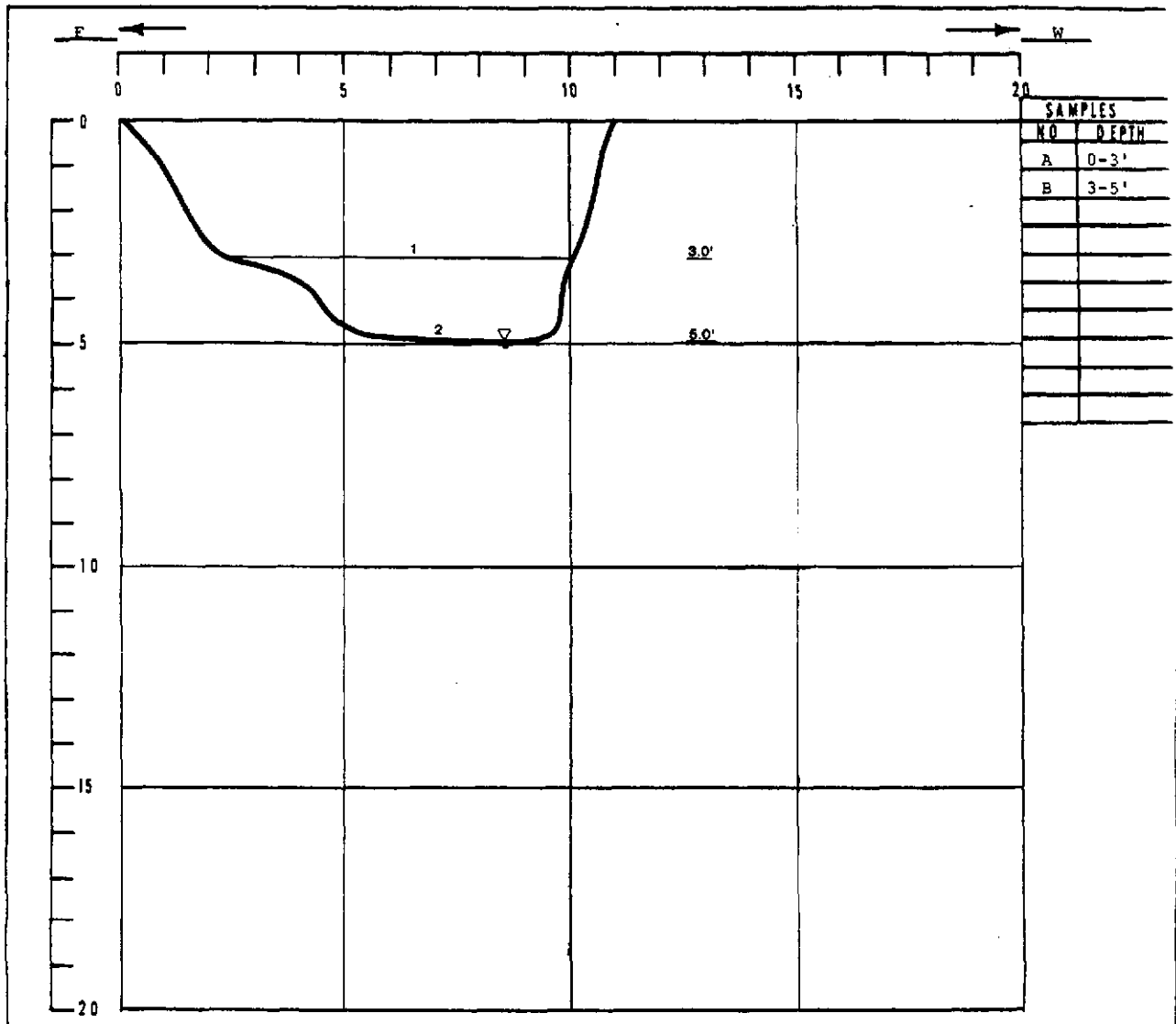
Golder Associates

FIELD TEST PIT LOG

TEMP 70 F. WEATHER Sunny ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P10

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/7/90

LOCATION N 552,600 E 696,032 ELEVATION 63.7 ft. DATUM MSL JOB 893-6255.



SAMPLES	
NO	DEPTH
A	0-3'
B	3-5'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-3' dusky red, c-f SAND, and SILT, some gravel (SM) FILL		5'	5'
2) 3-5' mod. brown to dusky red to dark gray to yellowish orange, c-f SAND, some f. gravel, some silt (SM) cinder/ash? FILL			

SPECIAL NOTES:

Pipe and concrete casing from 3-4'.

Bulk sample (5 gal. bucket) 0-3'.

Test pit moved east of original location due to existence of large concrete slab foundation.

Test pit terminated due to encountering of groundwater.

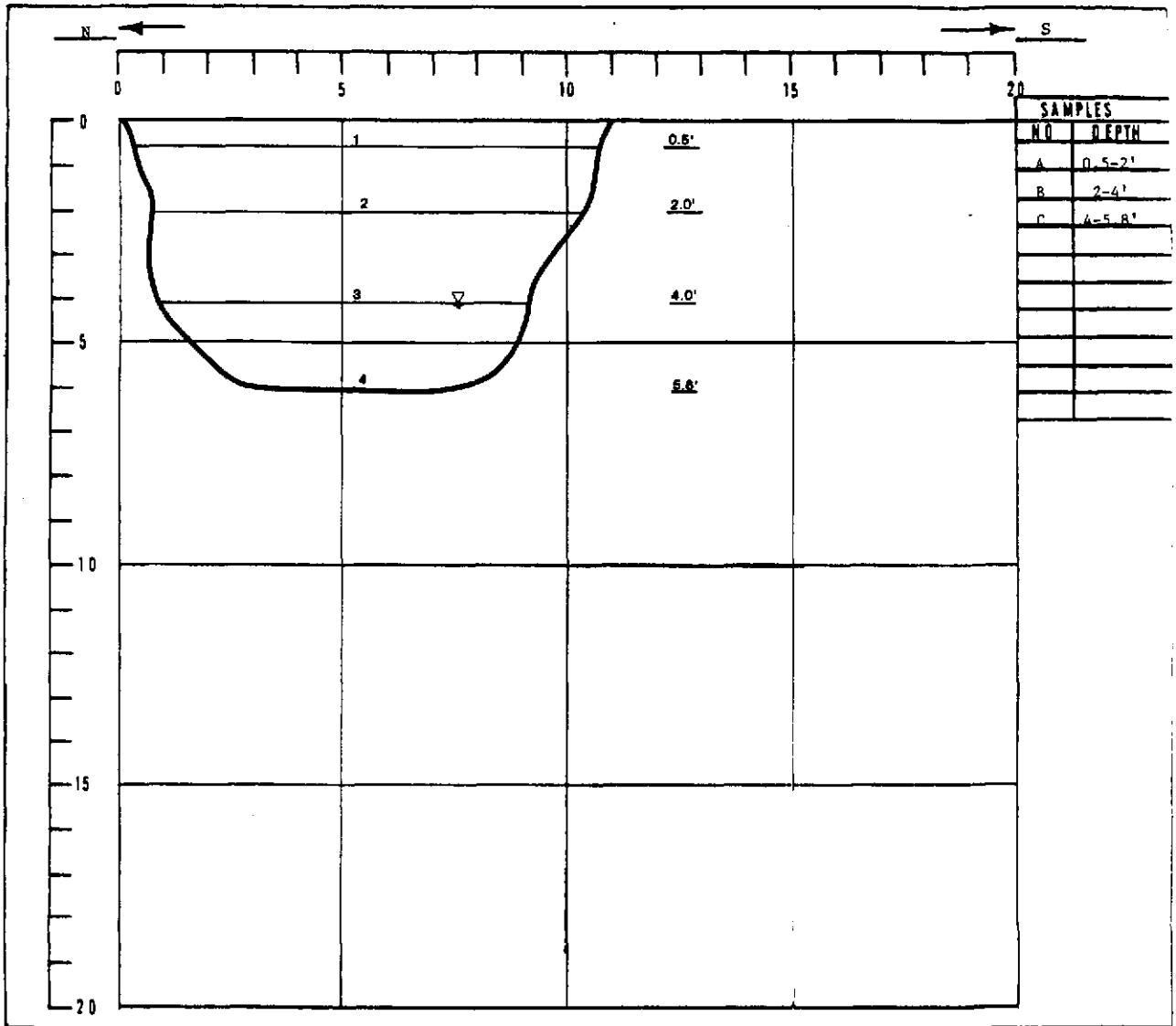
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P11

EQUIPMENT Kubota KH170I CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 555,055 E 697,502 ELEVATION 70.6 Ft. DATUM MSL JOB 893-6255



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-.5' Topsoil	1500	5.8'	4.0'
2) 0.5-2' dk yellowish orange m-f SAND little silt (SP-SM) OUTWASH SAND			
3) 2-4' mod. yellowish brown m-f SAND little silt (SP-SM) OUTWASH SAND			
4) 4-5.8' mod. yellowish brown c-m SAND, some f. gravel, tr. silt (SP) OUTWASH SAND			

SPECIAL NOTES: Test pit terminated due to encountering of groundwater.

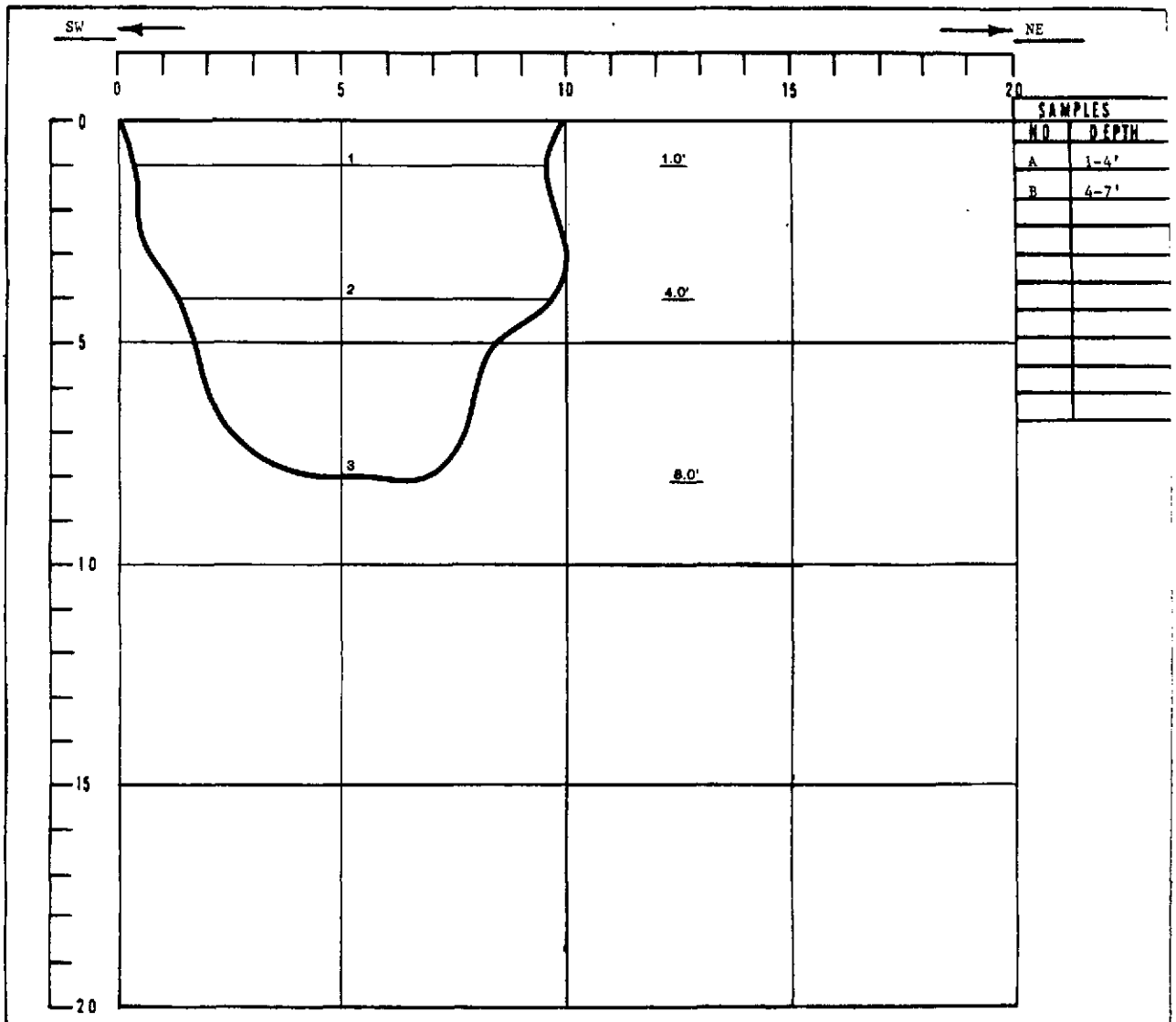
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P12

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 555,056 E 697,909 ELEVATION 73.9 Ft. DATUM MSL JOB 893-6255.



SAMPLES	
NO	DEPTH
A	1-4'
B	4-7'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-1' Topsoil		8.0'	Not encountered.
2) 1-4' yellowish orange, m-f SAND, little silt, tr. f. gravel (SP-SM) OUTWASH SAND			
3) 4-8' olive to med. gray c-f SAND, some f. gravel, some clayey silt occasional cobble & boulder (5-10%) (SM) TILL?			

SPECIAL NOTES:

Difficult excavating from 5-8'.

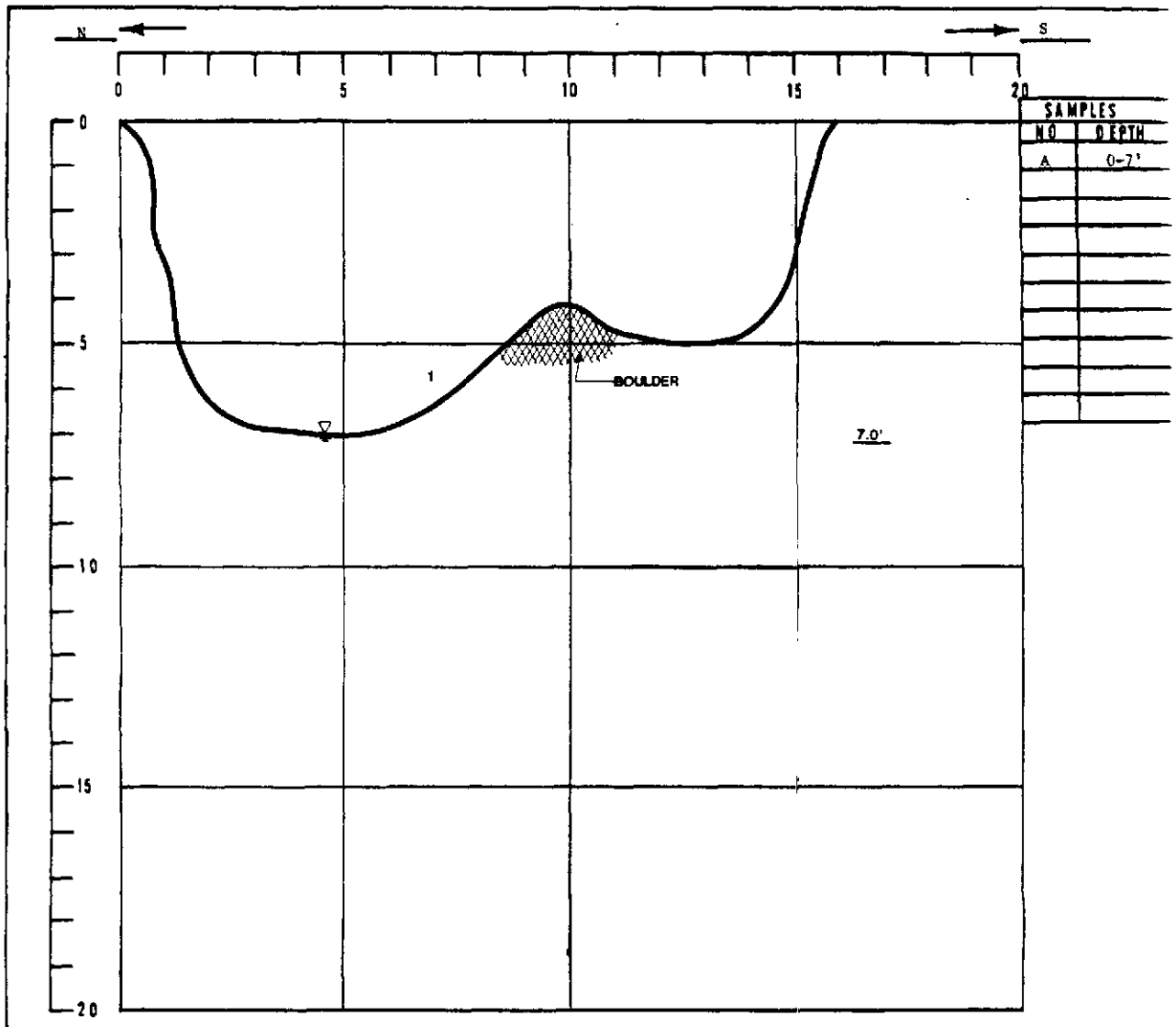
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P13

EQUIPMENT Kobota KH170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 554,373 E 697,246 ELEVATION 72.5 Ft. DATUM MSL JOB 893-6255.



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1). 0-7' mod. yellowish brown, m-f SAND, little silt, tr f. gravel (SP-SM) OUTWASH SAND	1530	7'	7'

SPECIAL NOTES:

Bulk sample taken (5 gal Bucket).

Test pit terminated due to encountering of groundwater.

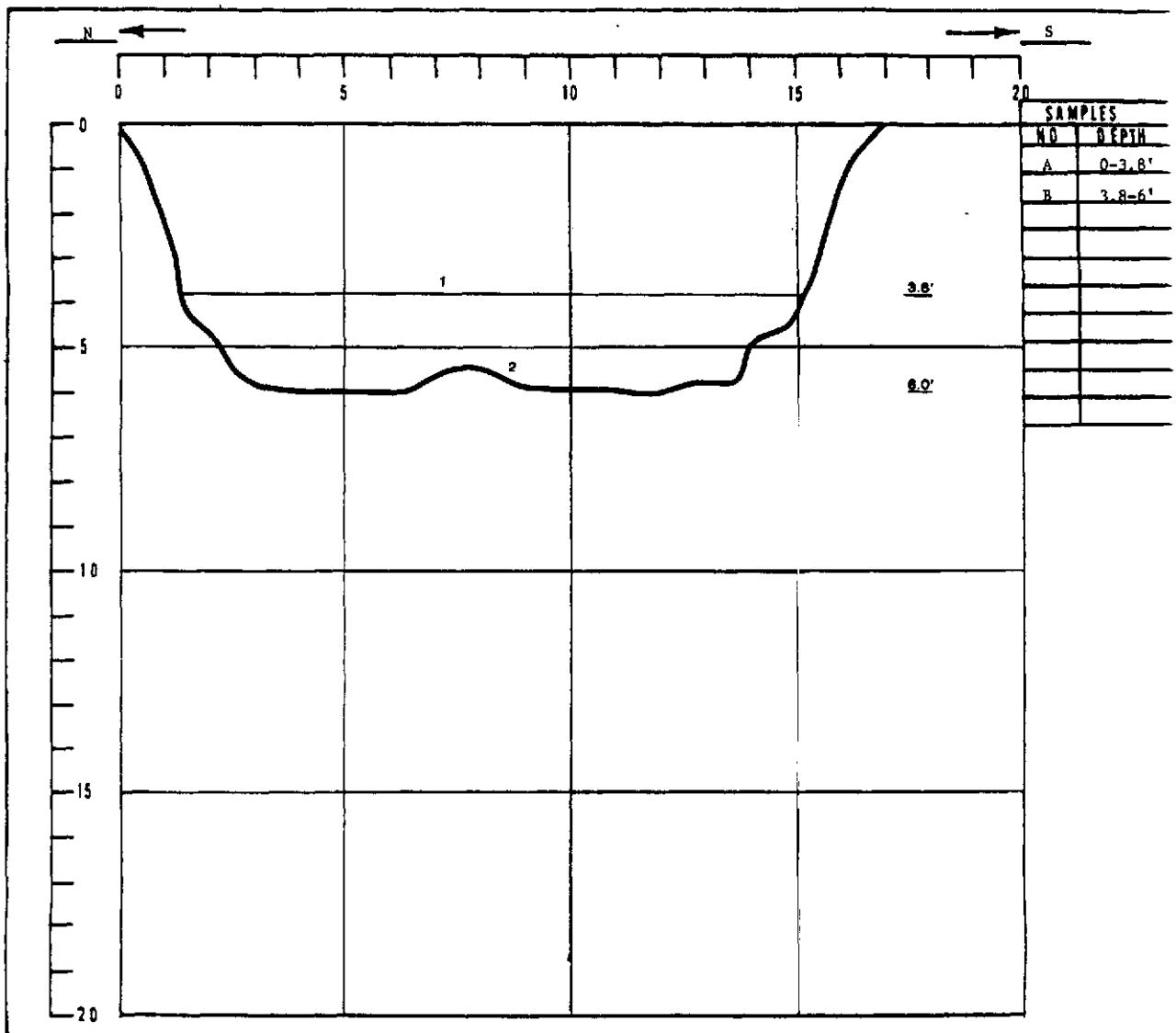
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P14

EQUIPMENT Kubota KH 170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 554,701 E 697,906 ELEVATION 71.2 Ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	0-3.8'
B	3.8-6'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-3.5' dk. yellowish orange, f. SAND, little silt, tr. gravel, occasional cobbles and boulders (SP-SM) OUTWASH SAND		6.0'	Not encounterd
2) 3.8-6.0' Weathered bedrock - possible till? 50% cobbles 30% boulders 20% broken rock & soil			

SPECIAL NOTES:

Rock encountered at 3.8' over entire length of test pit. Excavated to 6' in areas.

Bulk sample taken (5 gal bucket) at 3.8'.

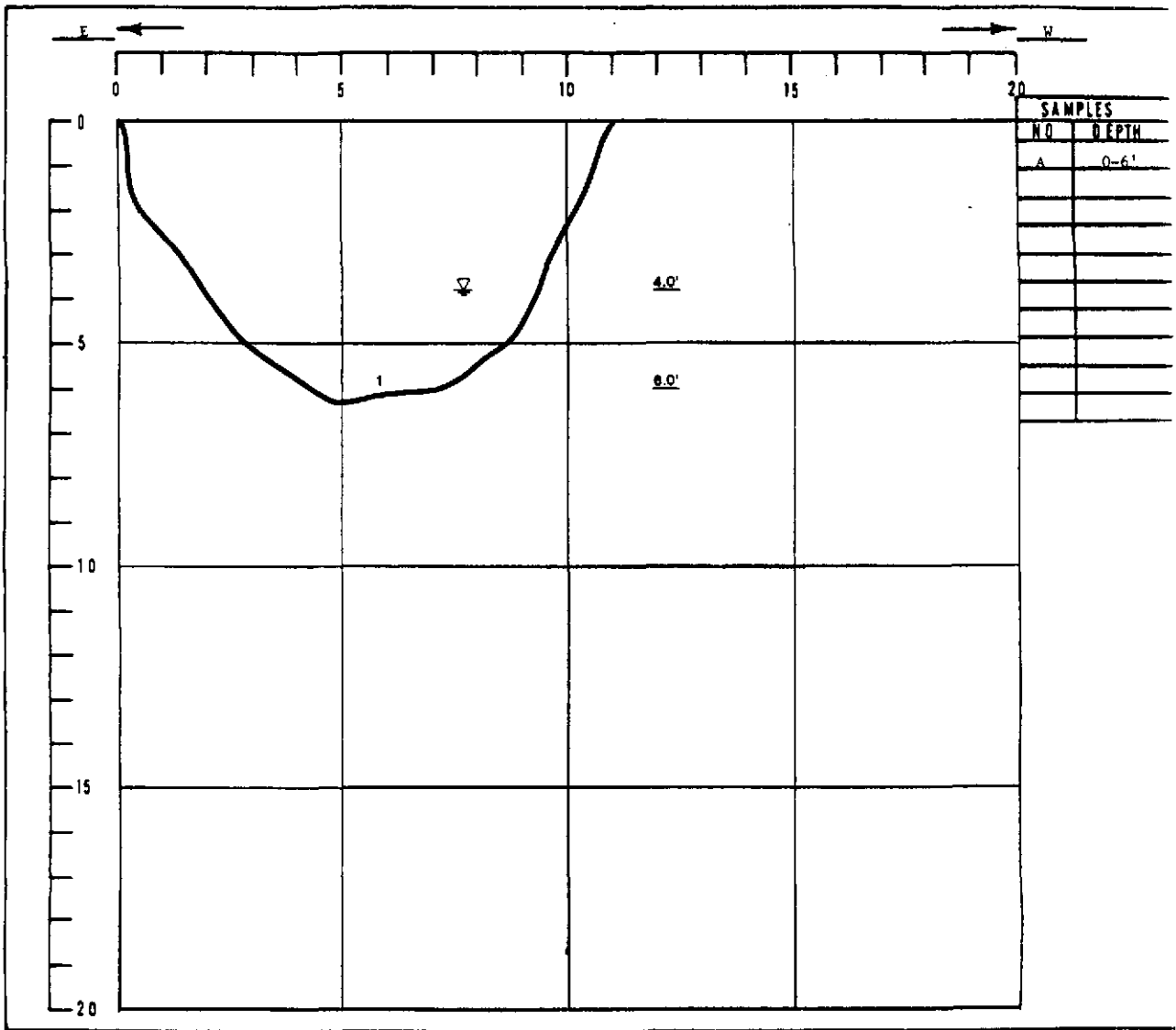
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER P. Cloudy ENGINEER R. Illes OPERATOR H. Jensen TEST PIT P15

EQUIPMENT Kubota KH 170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 554,195 E 697,659 ELEVATION 69.3 ft. DATUM MSL JOB 891-6255



SAMPLES	
NO	DEPTH
A	0-6'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-6' mod. to dk. yellowish brown m-f SAND, little silt, tr. f. gravel, occasional cobble (SP-SM) OUTWASH SAND

TIME	DEPTH OF HOLE	DEPTH TO W/L
1115	6'	4.5'

SPECIAL NOTES:

Bulk sample (5 gal. bucket) taken.

*Waited 1 hour and measured water level at 4.5'. However, seepage noted at 4.0'.

Test pit terminated due to encountering of groundwater.

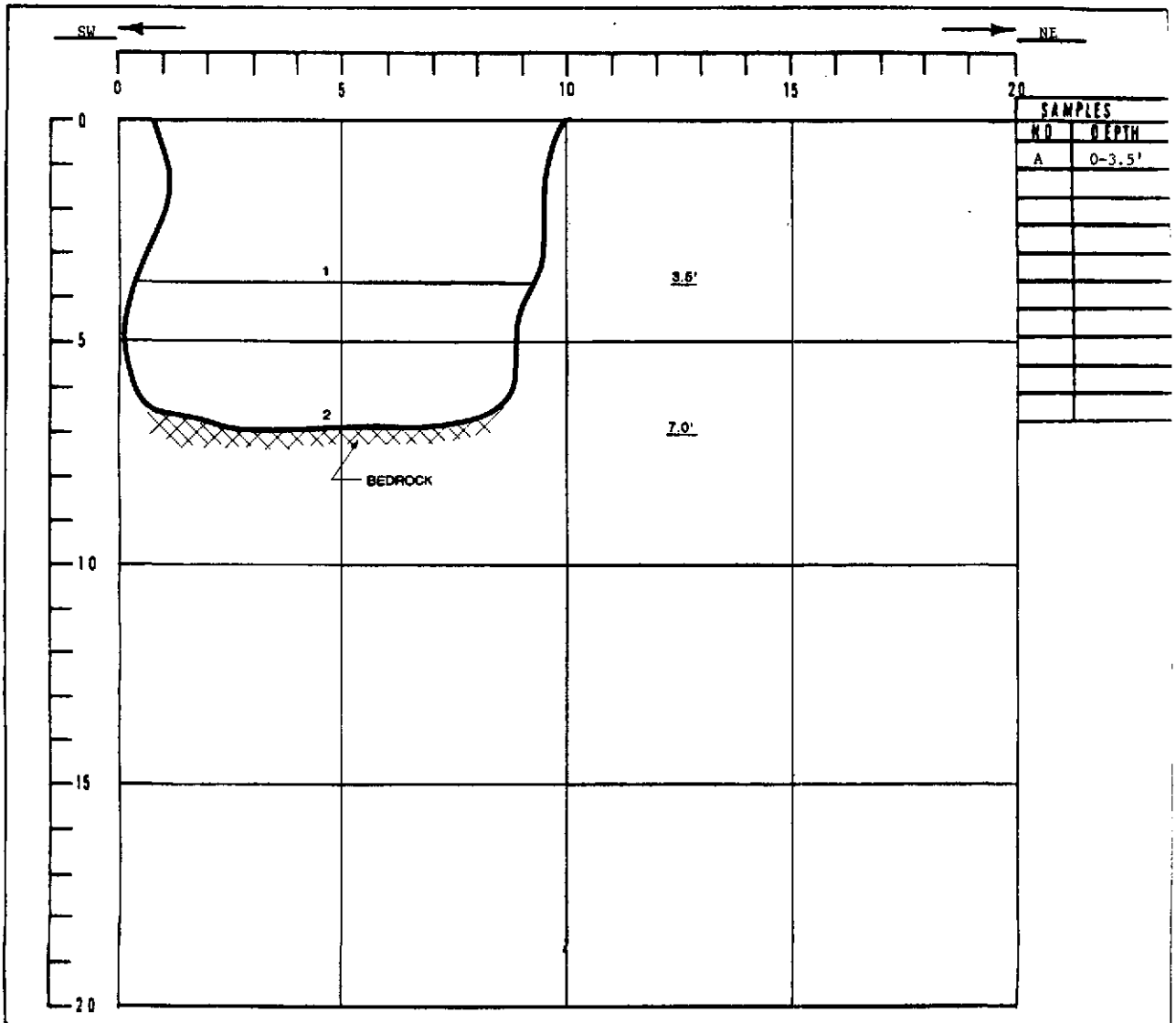
Golder Associates

FIELD TEST PIT LOG

TEMP. 65 F. WEATHER P. Sunny ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P16

EQUIPMENT Kubota KH 170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 554,093 E 698,148 ELEVATION 73.9 ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	0-3.5'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) 0-3.5' olive gray, c-f SAND and c-f GRAVEL, little silt, few cobbles (5%) (SP-SM) FILL (?)
2) 3.5-7.0' weathered bedrock or rockfill 50% cobbles 25% boulders 25% - as described in sample #1
3) 7.0' Bucket refusal - bedrock (?)

TIME	DEPTH OF HOLE	DEPTH TO W/L
	7.0'	Not encountered

SPECIAL NOTES:

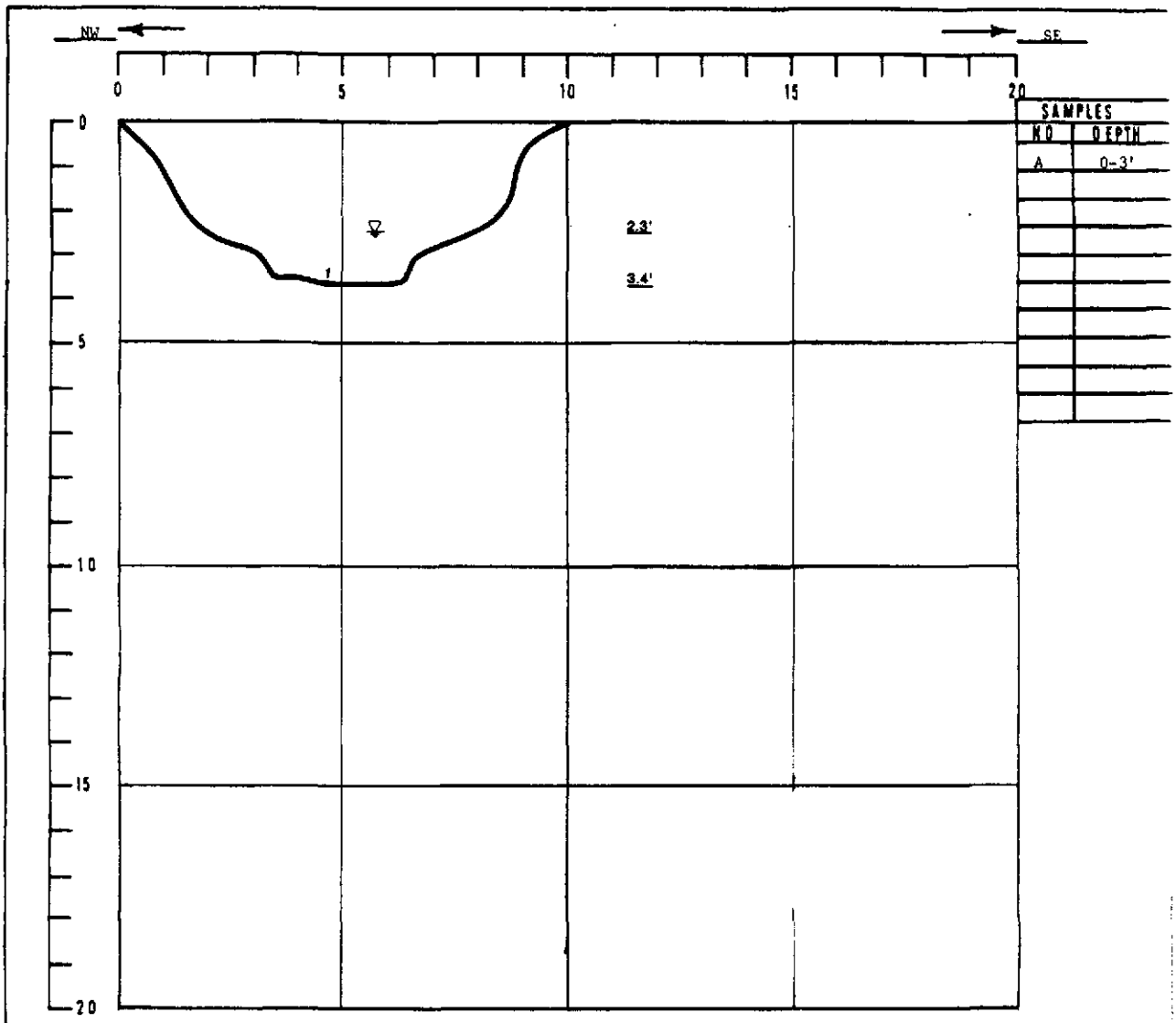
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Cloudy ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P17

EQUIPMENT Kubota KH 170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 553, 726 E 697,446 ELEVATION 74.8 ft. DATUM MSL JOB 893-6255



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-3.4' weathered bedrock or rockfill	1150	3.4'	2.3'
50% cobbles			
25% boulders			
25% olive gray, c-f GRAVEL and			
c-f SAND, little silt	SPECIAL NOTES:		
(GP-GM TO SP-SM)			
Bucket refusal at 3.4'	Soil wet at 1.3',		

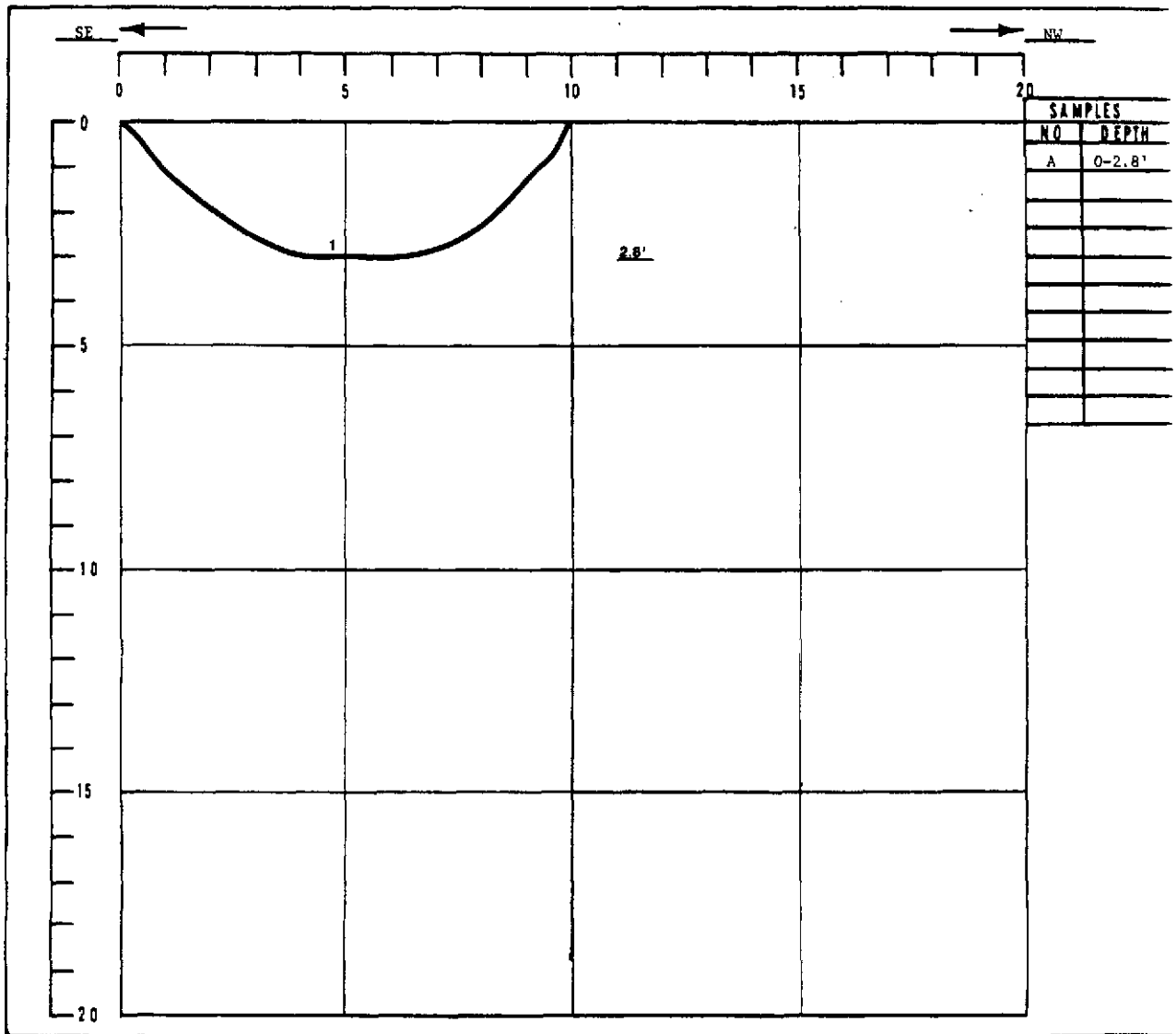
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER Sunny ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P18

EQUIPMENT Kubota KH 107L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 553,970 E 697,909 ELEVATION 72.5 ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	0-2.8'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES
1) olive gray, c-f SAND, some f. gravel little silt, few cobbles (10-15%) (SP-SM) becoming moist at 1.4', occasional yellowish brown staining 0-.5'. FILL (?)

TIME	DEPTH OF HOLE	DEPTH TO W/L
0910	2.8'	Not encountered

SPECIAL NOTES:

Hit bucket refusal at 2.8'. Moved 20' to the north & excavated P18A.

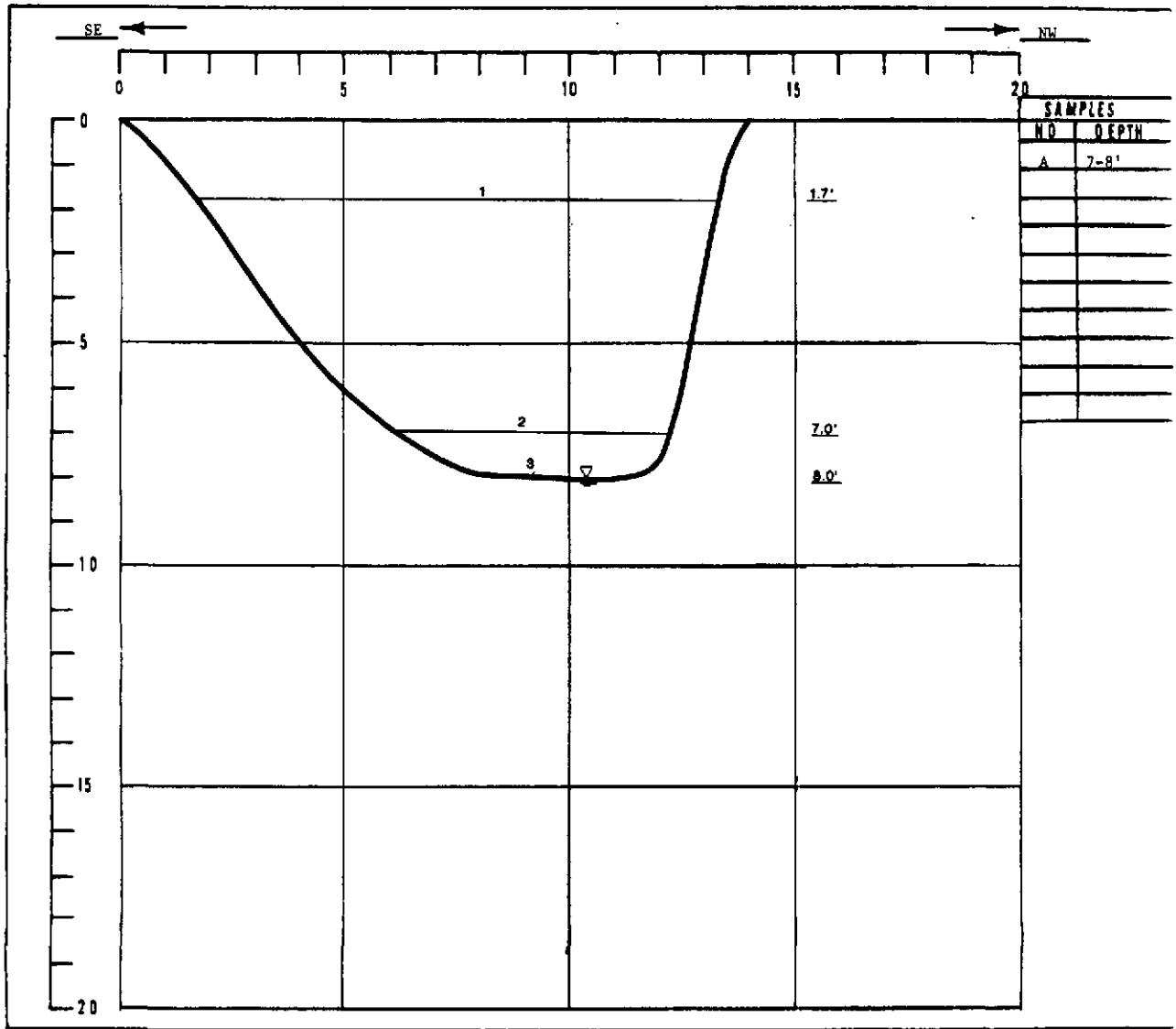
Golder Associates

FIELD TEST PIT LOG

TEMP 65 F. WEATHER P. Sunny ENGINEER B. Illes OPERATOR H. Jansen TEST PIT P-18A

EQUIPMENT Kubota KH170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 554,004 E 697,896 ELEVATION 72.5 ft. DATUM MSL JOB 893-6255



SAMPLES	
NO	DEPTH
A	7-8'

SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) 0-1.7' yellowish brown m-f SAND, some clayey silt (SM) FILL (?)	0930	8.0'	7.8'
2) 1.7-7.0' olive gray, c-f SAND, some f. gravel, little silt, few cobbles (10-15%) (SP-SM) FILL (?)			
3) 7.0-8.0' olive gray, c-f GRAVEL, some c-f sand, little silt, few cobbles (10%) (GW-GM) FILL (?)			

SPECIAL NOTES:

Sample moist to wet at 7'.

Test pit terminated due to encountering of groundwater.

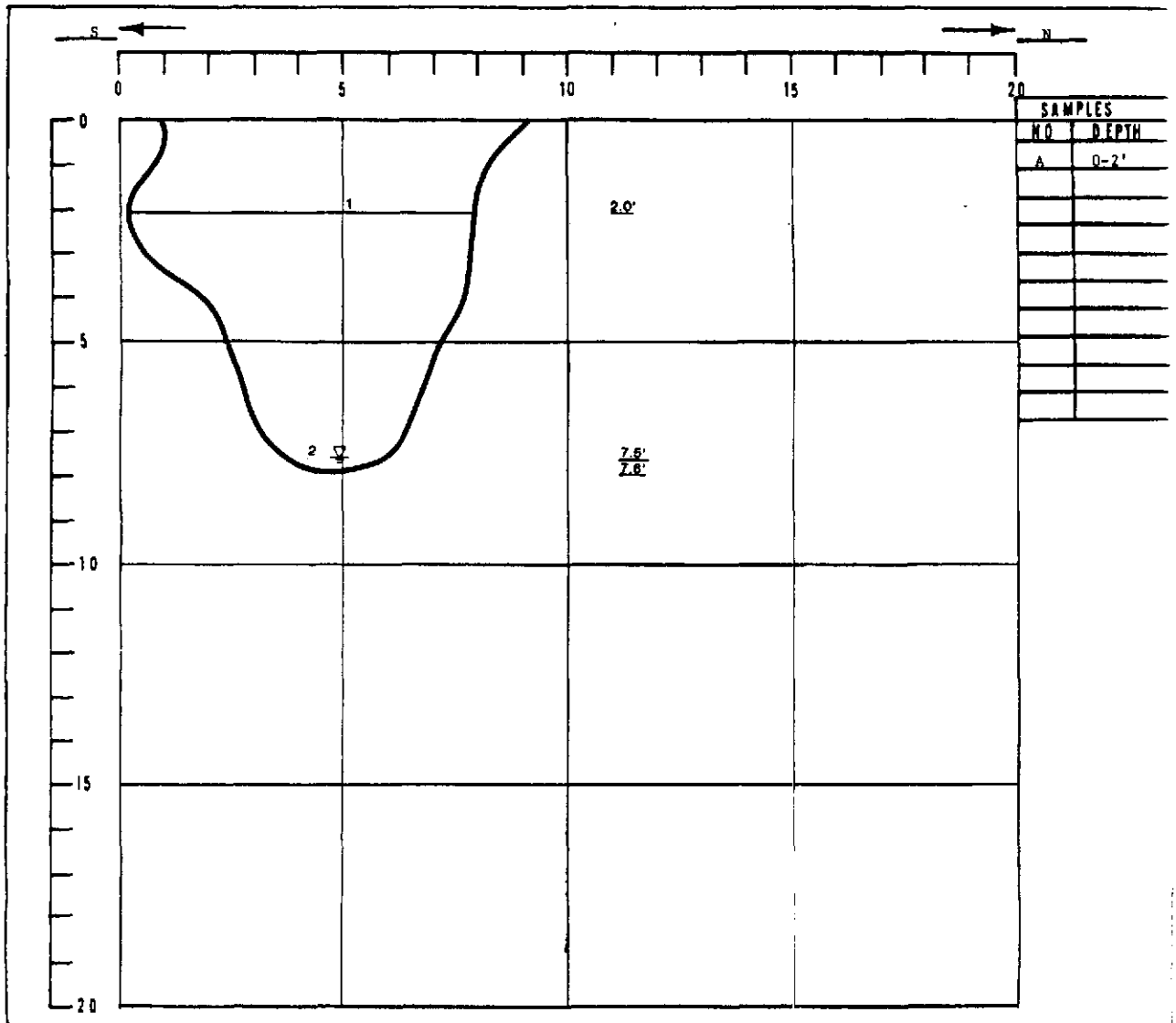
Golder Associates

FIELD TEST PIT LOG

TEMP 60 F. WEATHER Sunny ENGINEER B. Illes OPERATOR H. Jensen TEST PIT P19

EQUIPMENT Kubota KH 170L CONTRACTOR Cornerstone Construction DATE 6/6/90

LOCATION N 553,760 E 698,119 ELEVATION 73.9 ft. DATUM MSL JOB 893-6255



SAMPLE DESCRIPTIONS AND EXCAVATION NOTES	TIME	DEPTH OF HOLE	DEPTH TO W/L
1) olive gray, c-f SAND, some f. gravel little silt (SP-SM) FILL	0835	7.6'	7.5'
2) rock fill or weathered bedrock 90% cobbles & boulders (max 2') 10% as described in Sample # 1			

SPECIAL NOTES:

Samples moist to wet from 7-7.5'

Test pit terminated due to encountering of groundwater.

APPENDIX C

Field Change Documentation Forms

FIELD CHANGE DOCUMENTATION

DATE: 5/2/00 FIELD CHANGE #:

PERSON REQUESTING CHANGE: R. Files

COMPANY/TITLE: Golder Associates

FIELD CHANGE: Switch the locations of SD1 with P16. (Task 5-4)

REASON FOR FIELD CHANGE:

Bedrock outcrops are noted in the original location of SD1

ACKNOWLEDGEMENT

ISRT: C. DEVINE

NUS/USEPA/MDEP: Michael Moriarty

WORK PLAN ADDENDUM REQUIRED (Y/N):

ADDENDUM SUBMITTED TO ISRT (Y/N):

ADDENDUM SUBMITTED TO NUS/USEPA/MDEP (Y/N):

FIELD CHANGE DOCUMENTATION

DATE: 5/2/90 FIELD CHANGE #:

PERSON REQUESTING CHANGE: R. Ellis

COMPANY/TITLE: Golder Associates

FIELD CHANGE:

Move P11 & P12 south inside the fence lines (Task 5-4)

REASON FOR FIELD CHANGE:

Access is not available to the south side of the fence line.

ACKNOWLEDGEMENT

ISRT: C. DeVine

NUS/USEPA/MDEP: Mindy Mandy

WORK PLAN ADDENDUM REQUIRED (Y/N):

ADDENDUM SUBMITTED TO ISRT (Y/N):

ADDENDUM SUBMITTED TO NUS/USEPA/MDEP (Y/N):

FIELD CHANGE DOCUMENTATION

DATE: 5/2/90 FIELD CHANGE #:

PERSON REQUESTING CHANGE: R. Illes

COMPANY/TITLE: Golder Assoc.

FIELD CHANGE: move SD2 to the south side of pond outside trailers. (Task 5-4)

REASON FOR FIELD CHANGE:

hole located between 2 ponds & near a delineated hide pile

ACKNOWLEDGEMENT

ISRT: C. DEVINE

NUS/USEPA/MDEP: M. J. Morandy

WORK PLAN ADDENDUM REQUIRED (Y/N):

ADDENDUM SUBMITTED TO ISRT (Y/N):

ADDENDUM SUBMITTED TO NUS/USEPA/MDEP (Y/N):

FIELD CHANGE DOCUMENTATION

DATE: 5/2/90 FIELD CHANGE #:

PERSON REQUESTING CHANGE: R. Files

COMPANY/TITLE: Golder Associates

FIELD CHANGE: move SB3 east to the vicinity of OW15 & OW04. (Task 5-4)

REASON FOR FIELD CHANGE:

Bedrock ~~outcrop~~ is known to be at the surface in SB3's original location

ACKNOWLEDGEMENT

ISRT: C. DEVINE

NUS/USEPA/MDEP: Mary Mundy

WORK PLAN ADDENDUM REQUIRED (Y/N):

ADDENDUM SUBMITTED TO ISRT (Y/N):

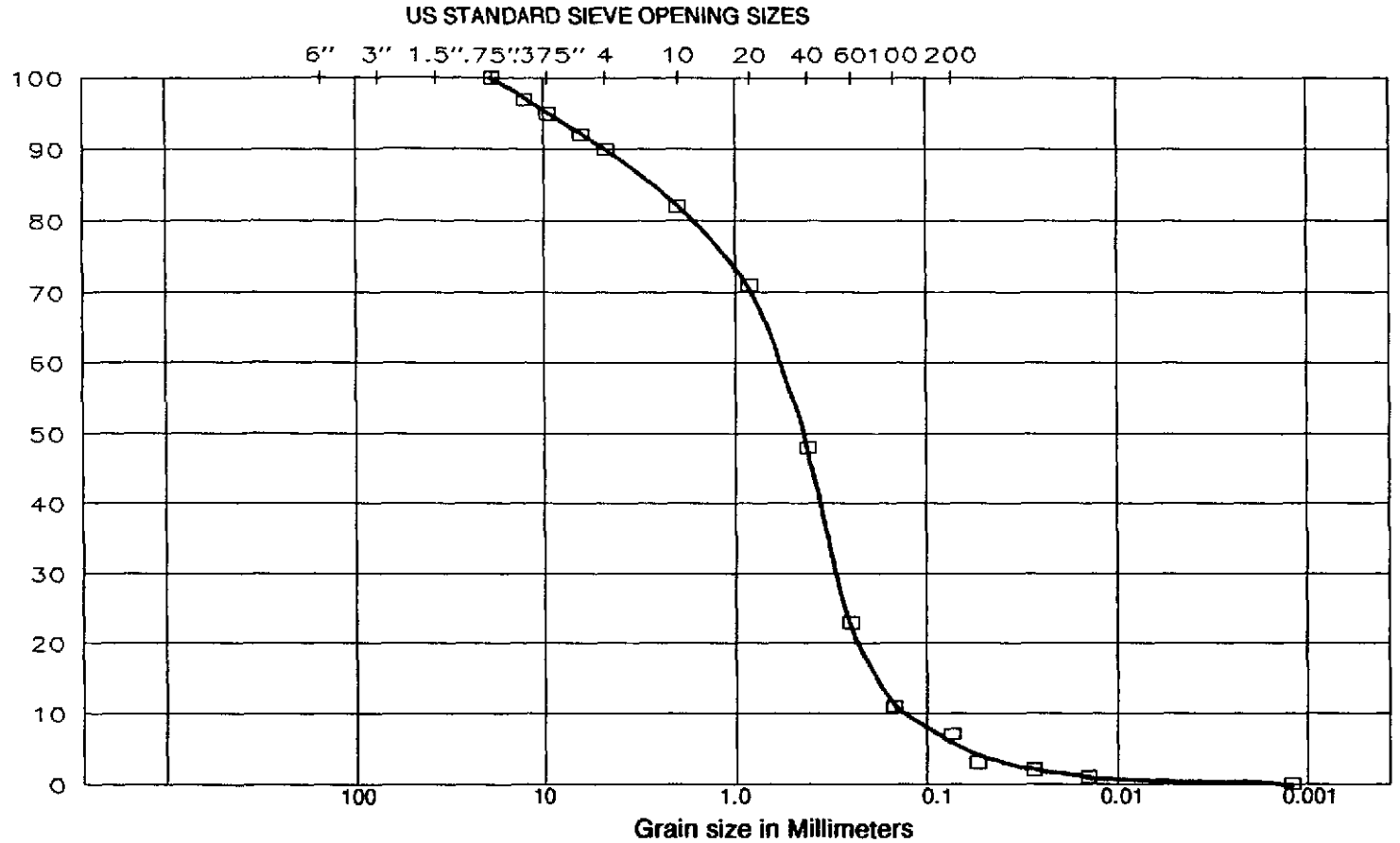
ADDENDUM SUBMITTED TO NUS/USEPA/MDEP (Y/N):

APPENDIX D

Laboratory Test Results

Grain Size Distribution

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	coarse GRAVEL	fine GRAVEL	c SAND	med SAND	fine SAND	SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-1 T-1	4.1	NP	NP	NP		Pale yellowish orange m-f SAND, little f gravel, little silt (SP-SM)

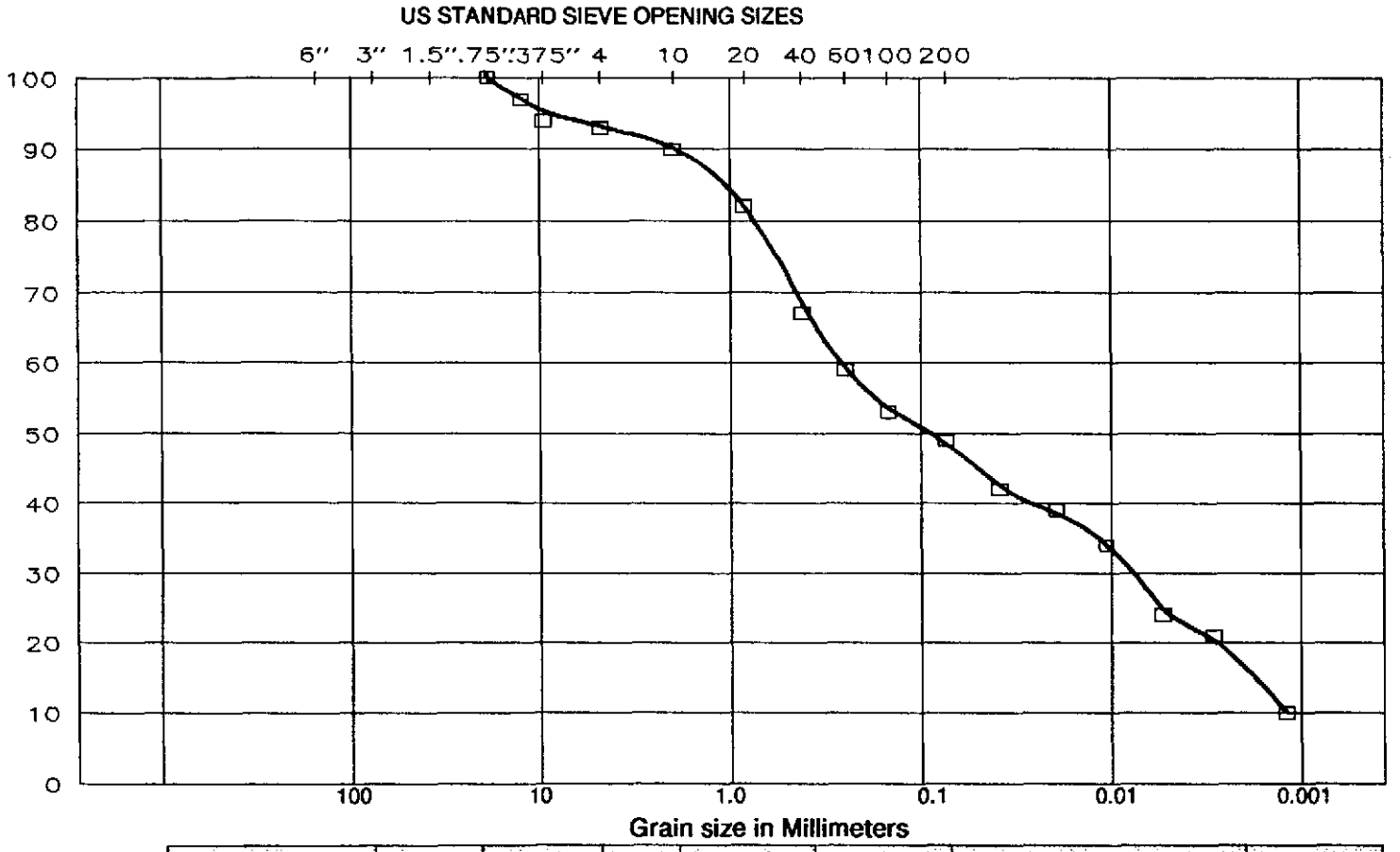
Sample Type: DO Date Tested: 08/03/90

ISRT/WOBURN/MA

893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

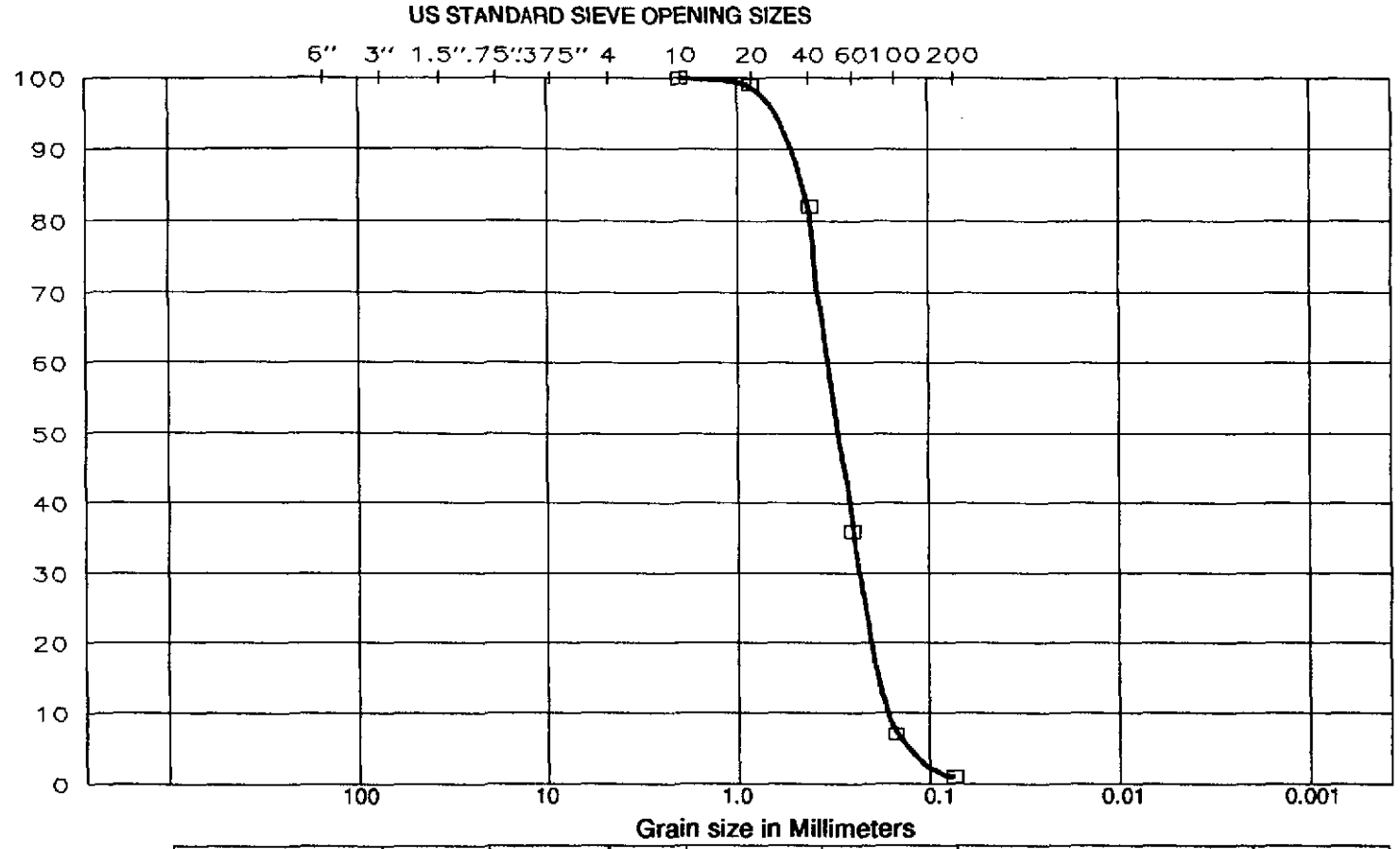
SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-1 T-3	92.7	NP	NP	NP		Moderate reddish brown m-f SAND and SILT, little f gravel (SM-ML)
Sample Type:	DO	Date Tested:	08/06/90			

ISRT/WOBURN/MA

893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-3 T-3	25.6	NP	NP	NP		Grayish red m-f SAND (SP)
Sample Type:	DO	Date Tested:	08/03/90			

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893-6255.12

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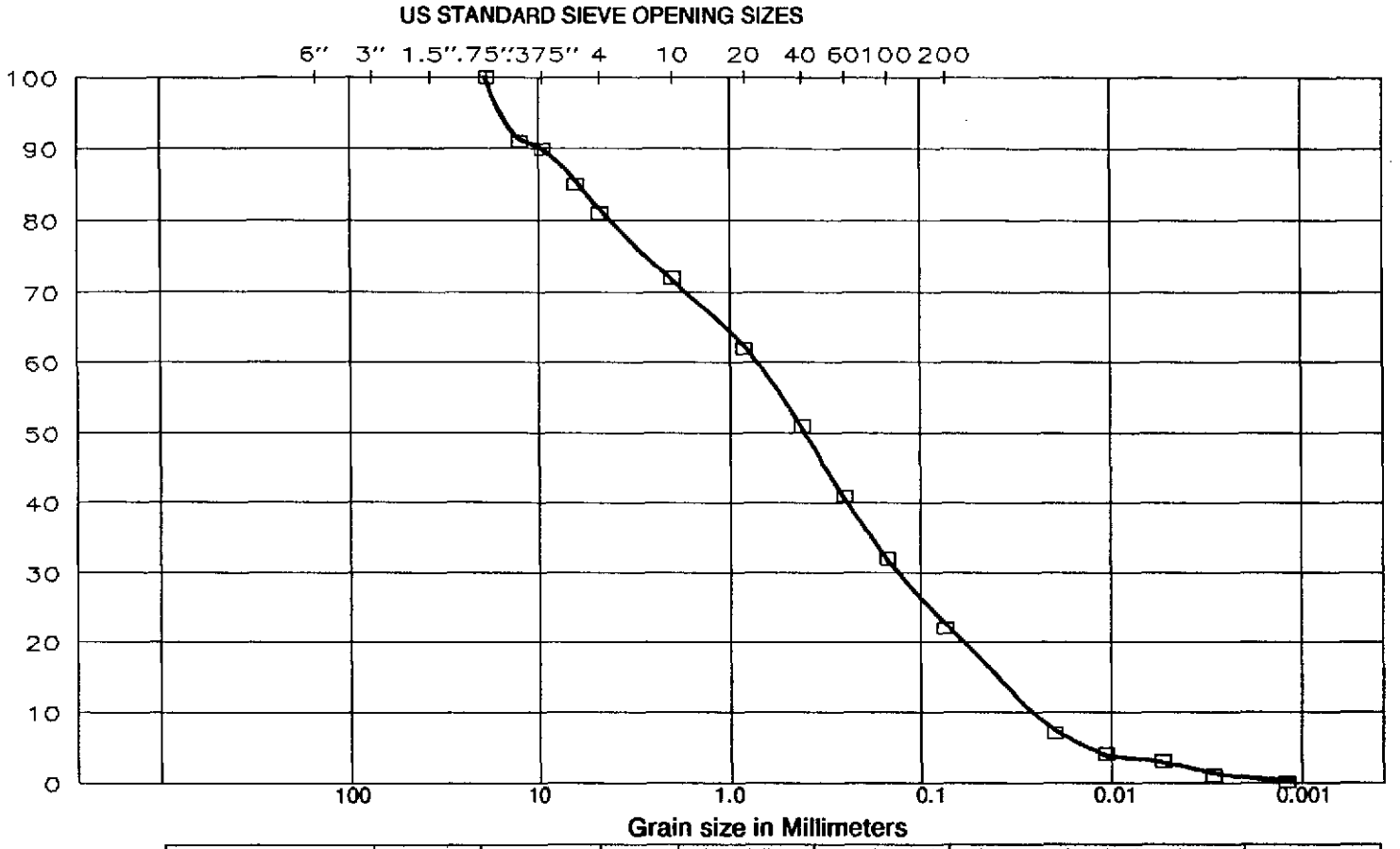
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	coarse	fine	c	med	fine	SILT	CLAY
	GRAVEL		SAND				

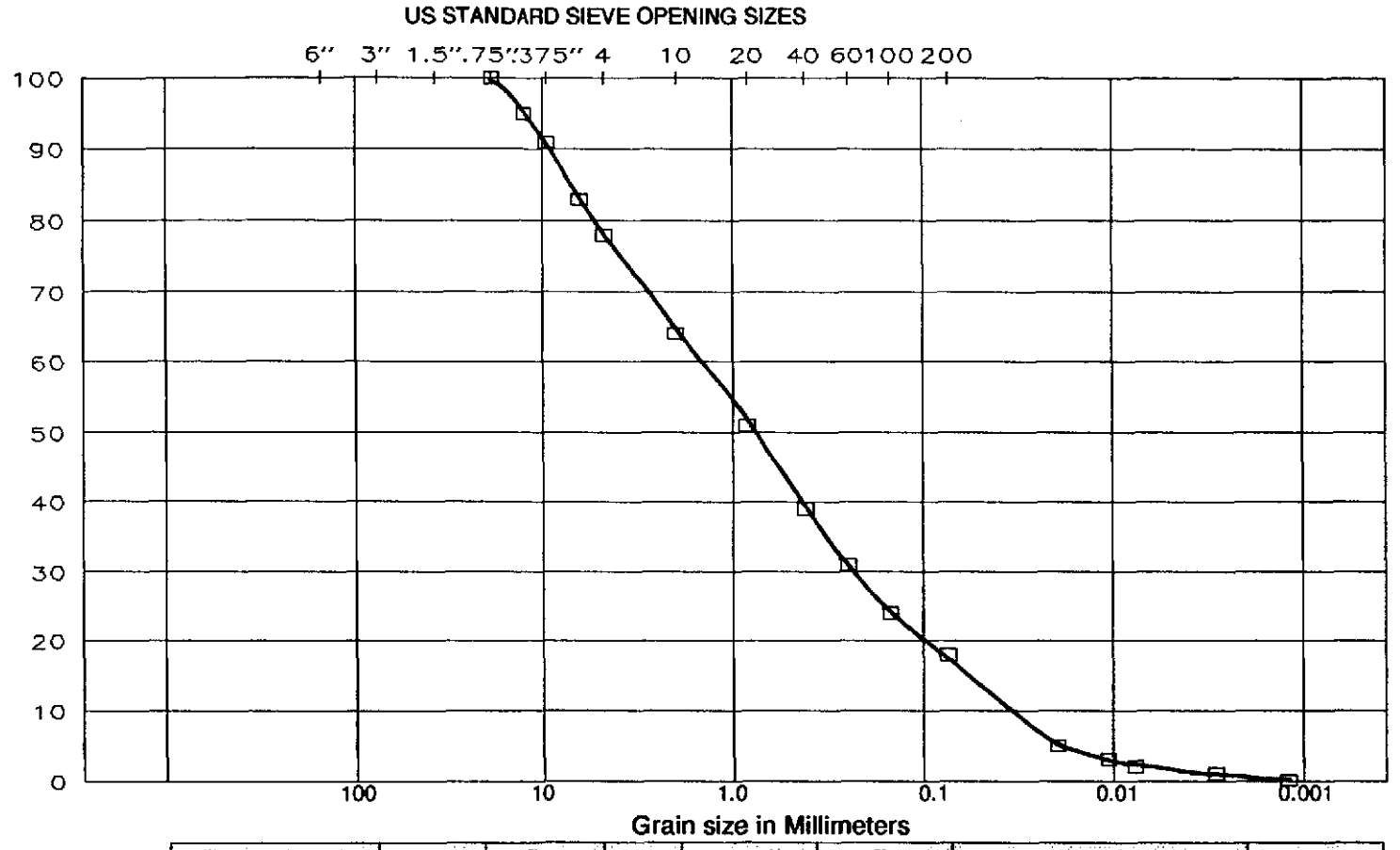
SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-1 T-4	24.0	NP	NP	NP		Moderate brown m-f SAND,some silt, some f gravel (SM)
Sample Type:	DO	Date Tested:	08/03/90			

ISRT/WOBURN/MA

893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

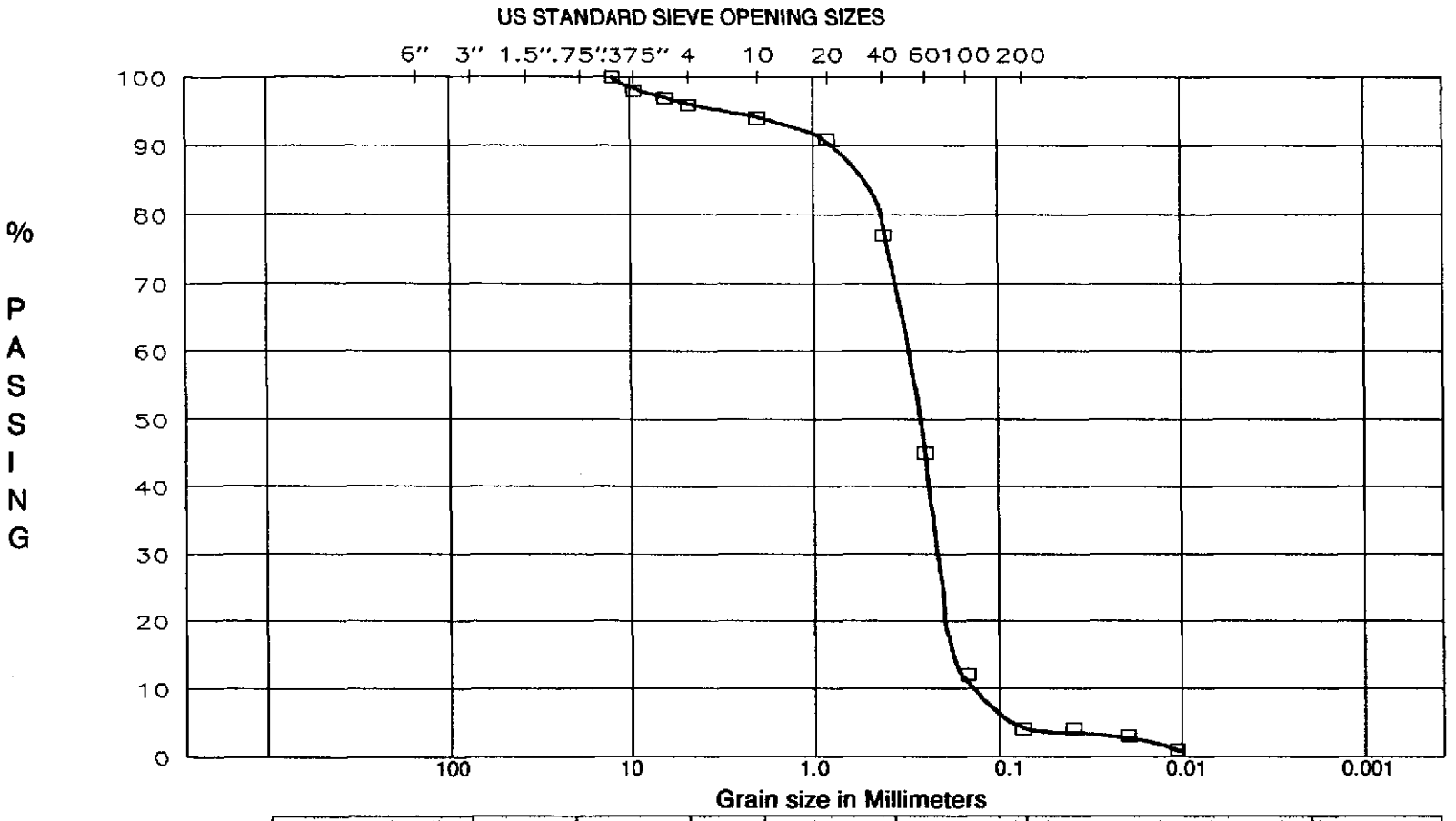
SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-2 T-4	27.5	NP	NP	NP		Gray/Black/Pale yellow/orange c-f SAND,some f gravel, some silt (SM)
Sample Type:	DO	Date Tested:	08/02/90			

ISRT/WOBURN/MA

893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	GRAVEL: coarse	GRAVEL: fine	SAND: c	SAND: med	SAND: fine	SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-3 T-4	20.0	NP	NP	NP		Grayish brown m-f SAND, trace silt, trace f gravell (SP)

Sample Type: DO Date Tested: 08/03/90

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893-6255.12

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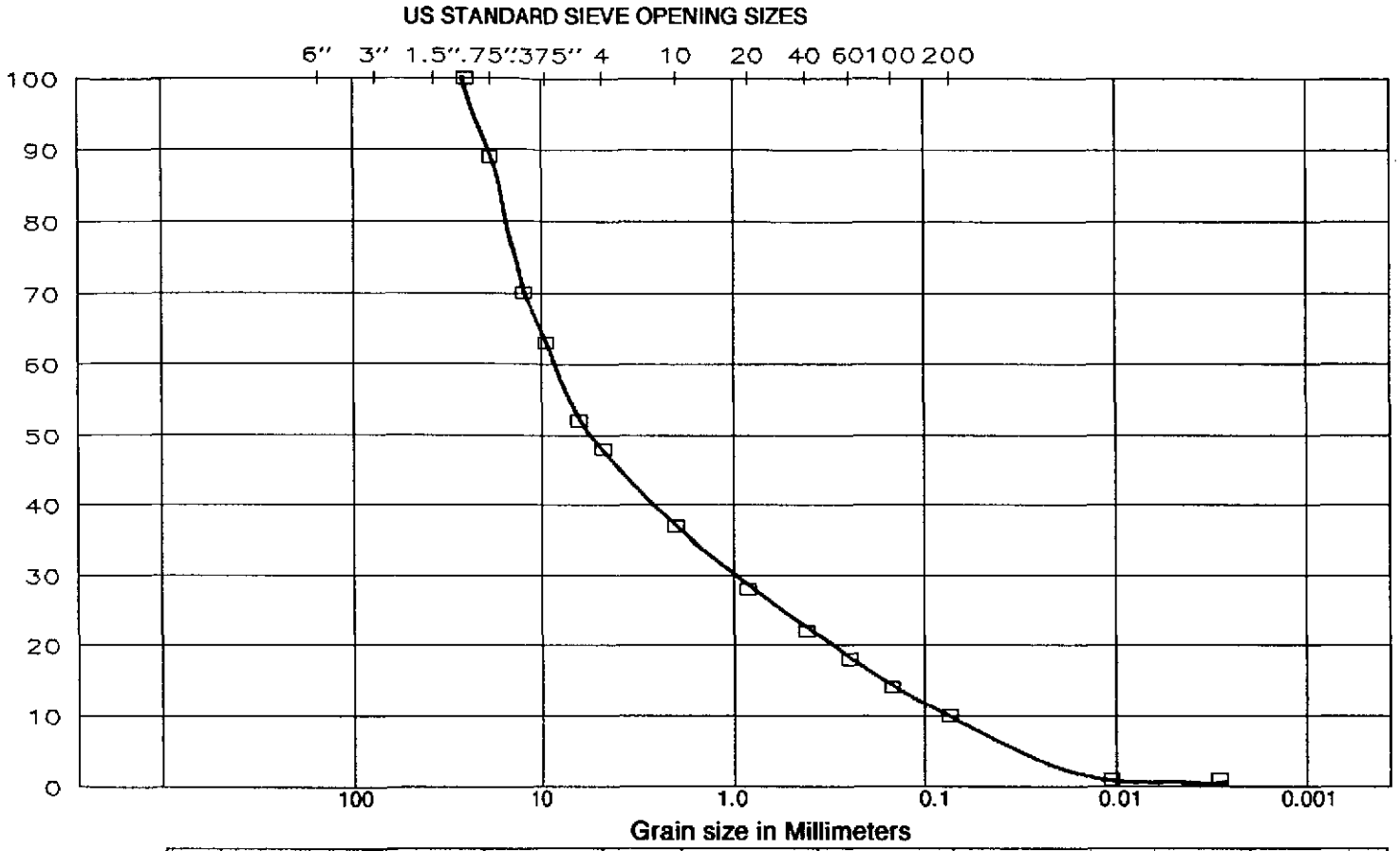
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	coarse GRAVEL	fine GRAVEL	c SAND	med SAND	fine SAND	SILT	CLAY

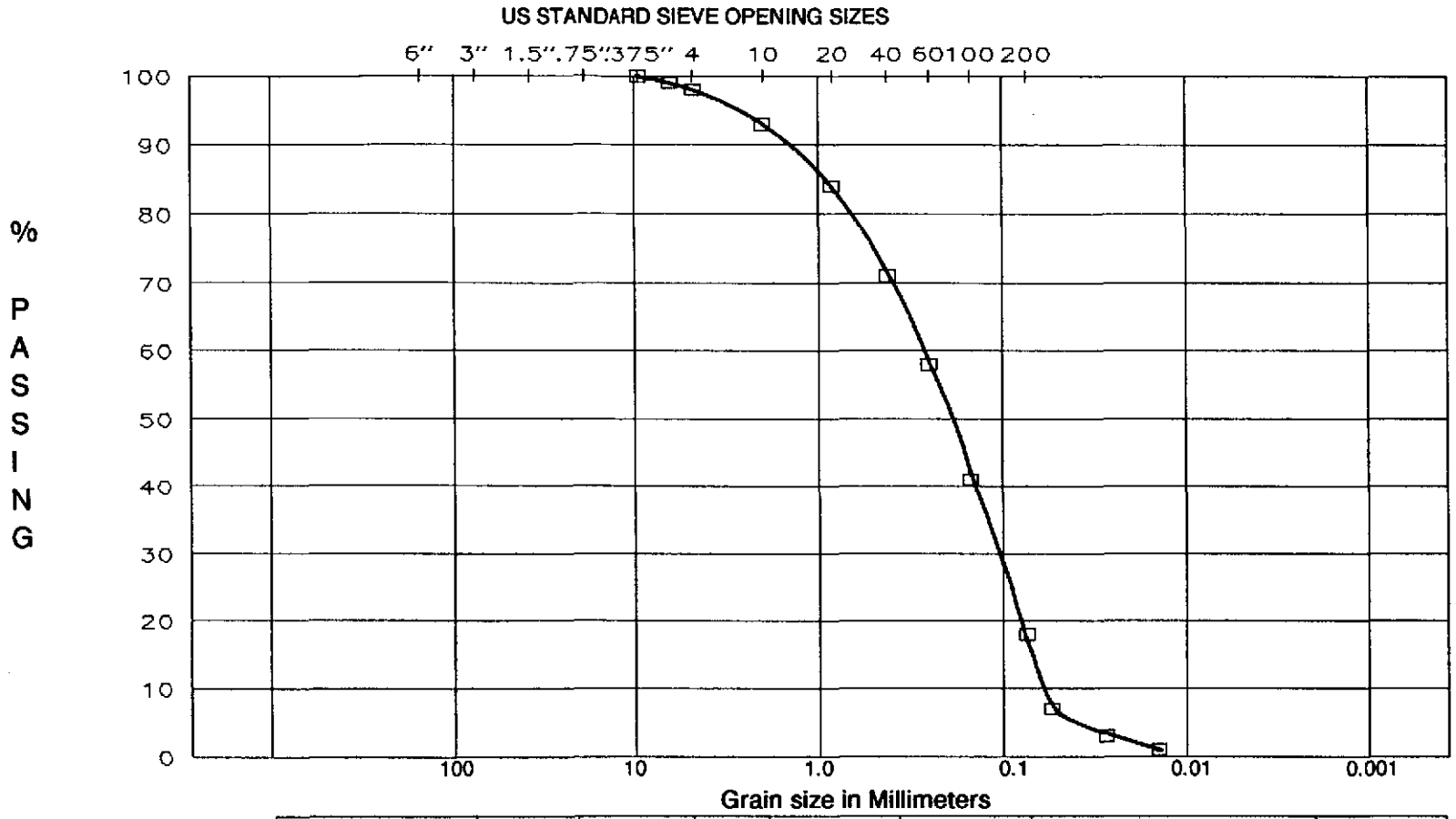
SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-4 SD-1	9.5	NP	NP	NP		Medium dark gray f GRAVEL and c-f SAND, little silt (GW-GM)
Sample Type:	DO	Date Tested:	08/03/90			

ISRT/WOBURN/MA

893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-2 SD-2	8.7	NP	NP	NP		Pale yellowish orange m-f SAND,some silt, trace f gravel (SM)
Sample Type:	DO	Date Tested:	08/03/90			

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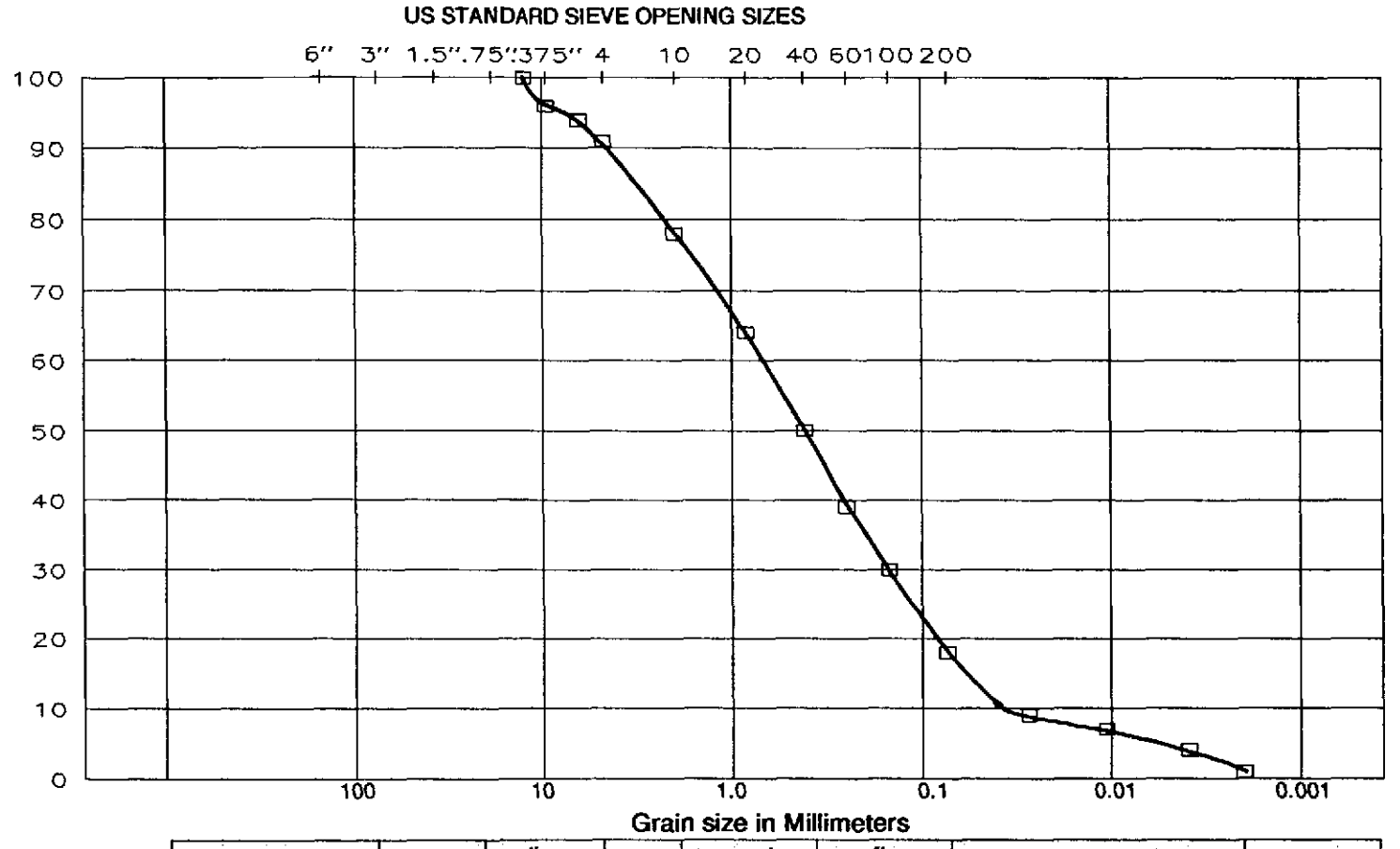
893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	coarse	fine	c	med	fine	SILT	CLAY
	GRAVEL		SAND				

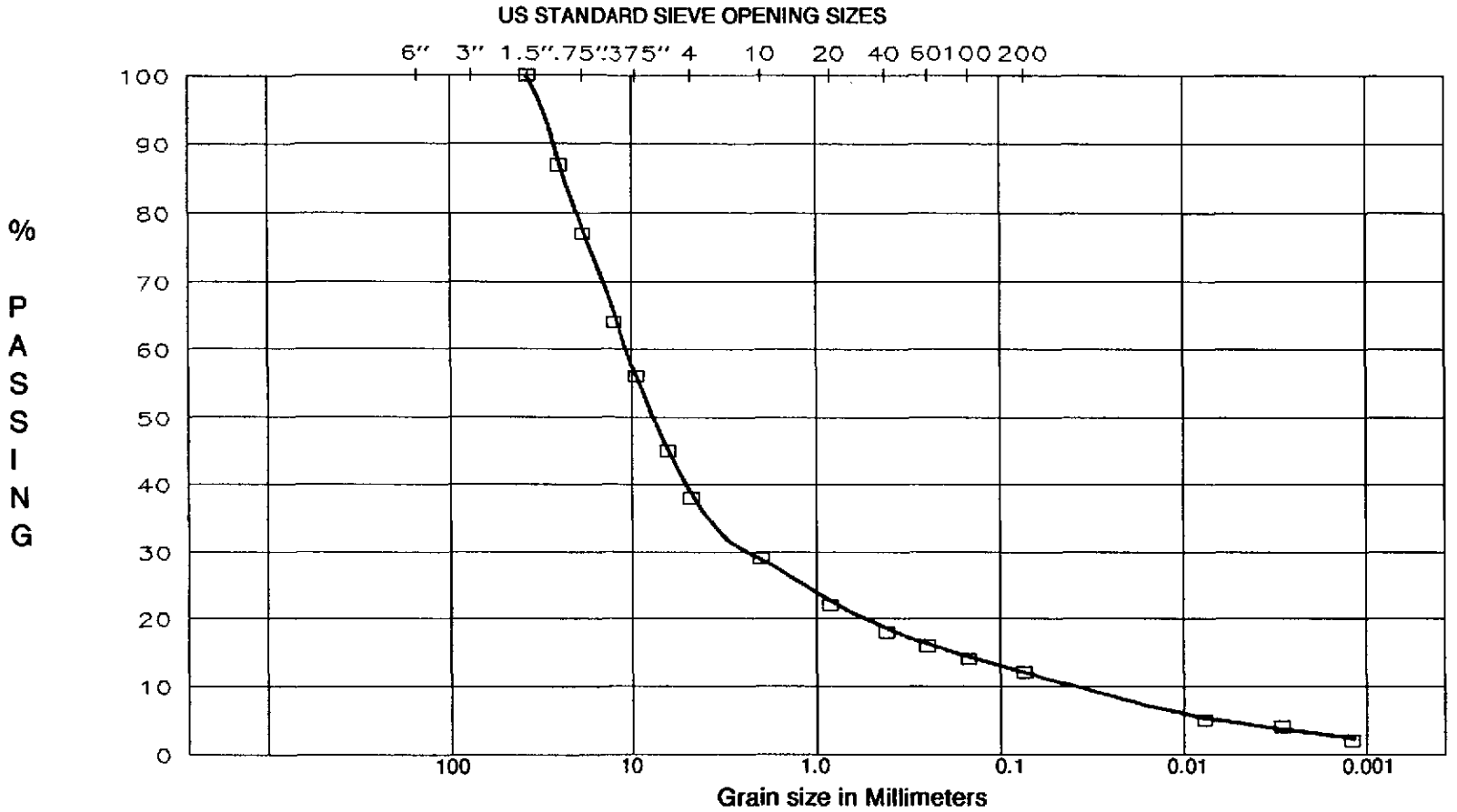
SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
S-3 SD-2	11.5	NP	NP	NP		Medium gray c-f SAND,some silt, little f gravel (SM)
Sample Type:	DO	Date Tested:	08/03/90			

ISRT/WOBURN/MA

893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	GRAVEL: coarse	GRAVEL: fine	SAND: c	SAND: med	SAND: fine	SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
P-8 2.5'-3.8'	43.0	NP	NP	NP		Multicolored slag c-f GRAVEL,some c-f sand, some silt (GM)

Sample Type: BULK Date Tested: 08/03/90

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893-6255.12

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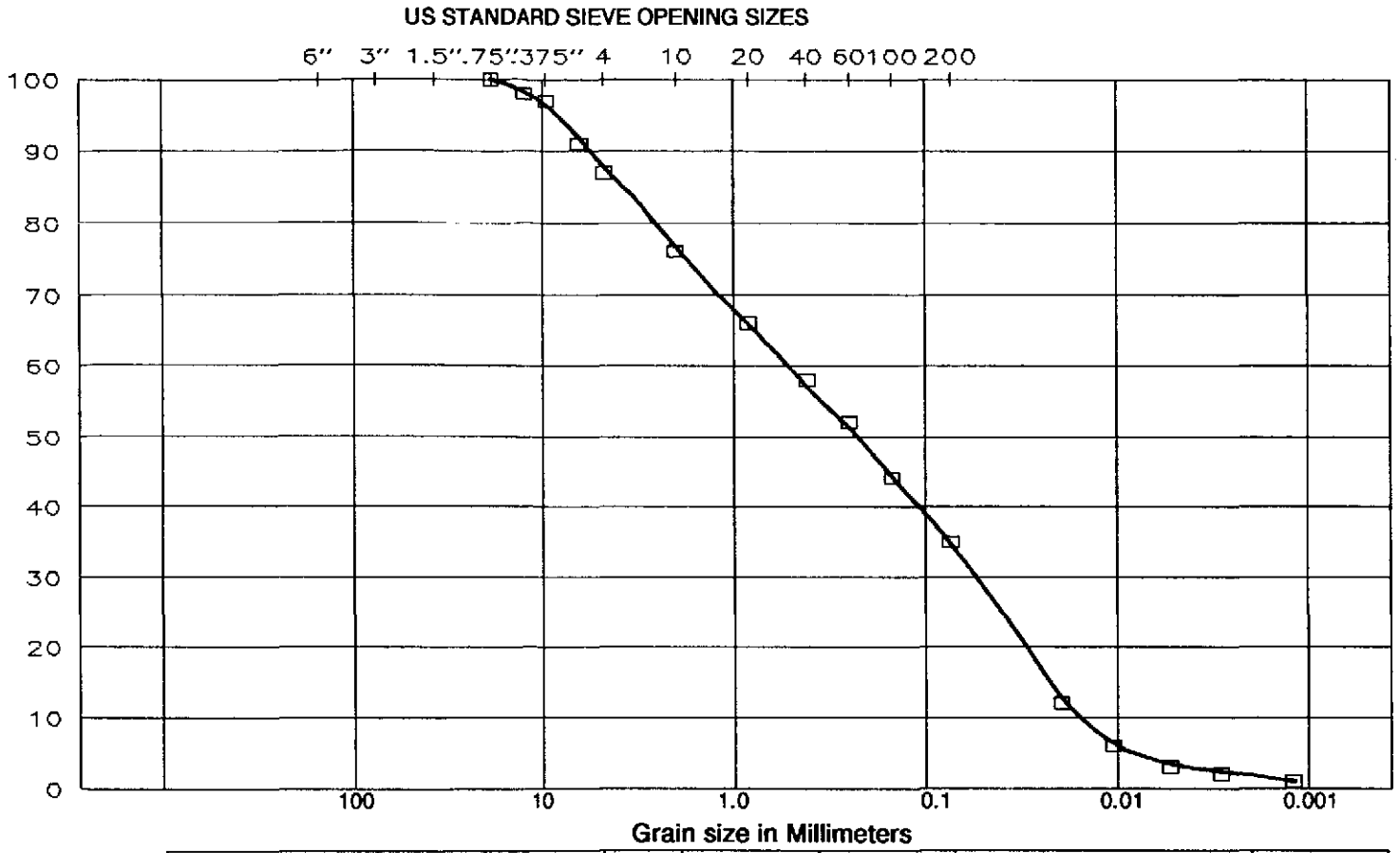
PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
P-10 0.0-3.0'	24.3	NP	NP	NP	Gs=3.63	Purple c-f SAND and SILT, some f gravel (SM)
Sample Type: BULK		Date Tested:	08/06/90			

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893-6255.12

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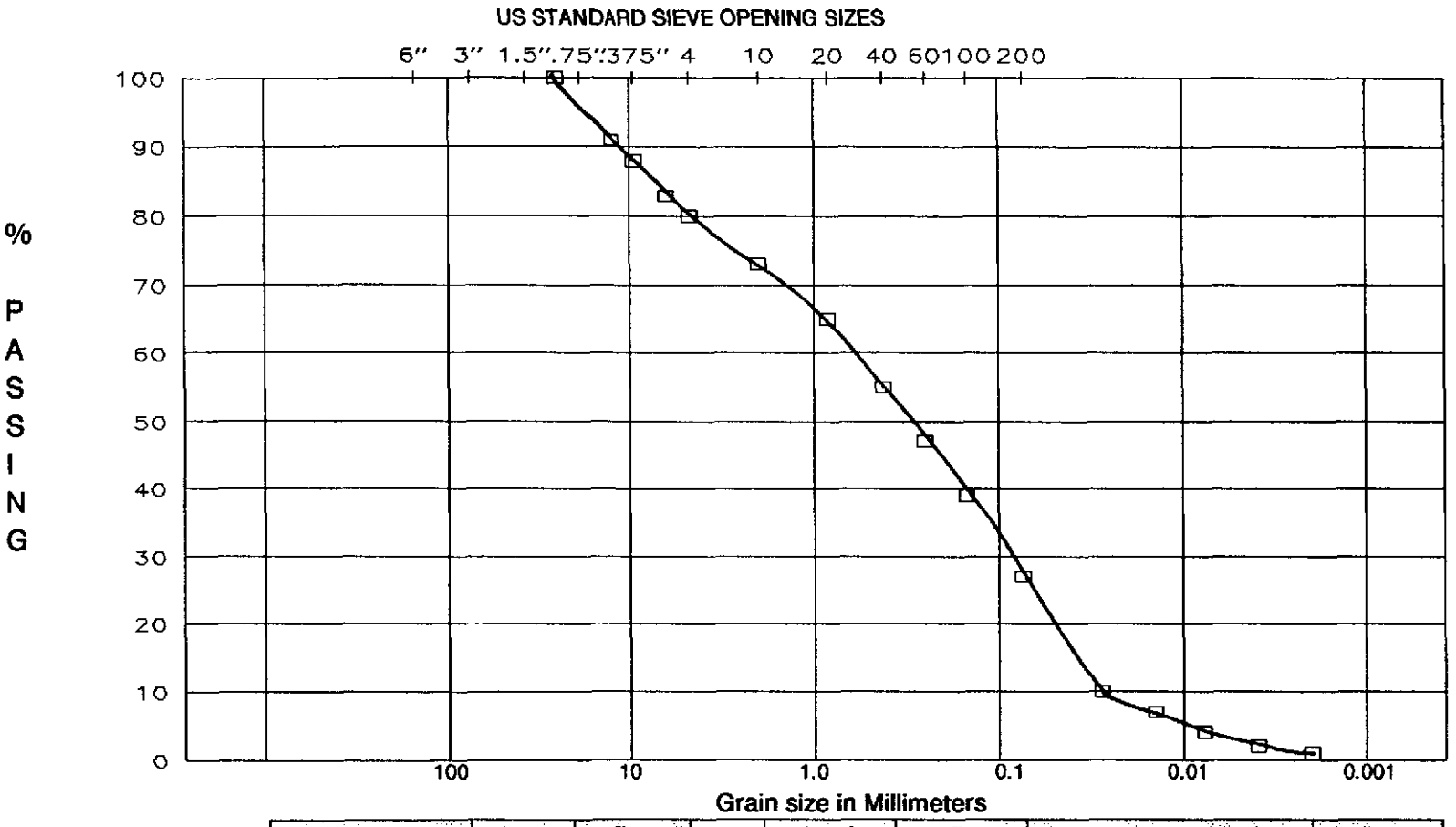
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
P-12 4.0'-7.0'	7.0	NP	NP	NP		Mod. yellowish brown/med. gray m-f SAND,some silt, some c-f gravel (SM)
Sample Type:	BULK	Date Tested:	08/03/90			

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893-6255.12

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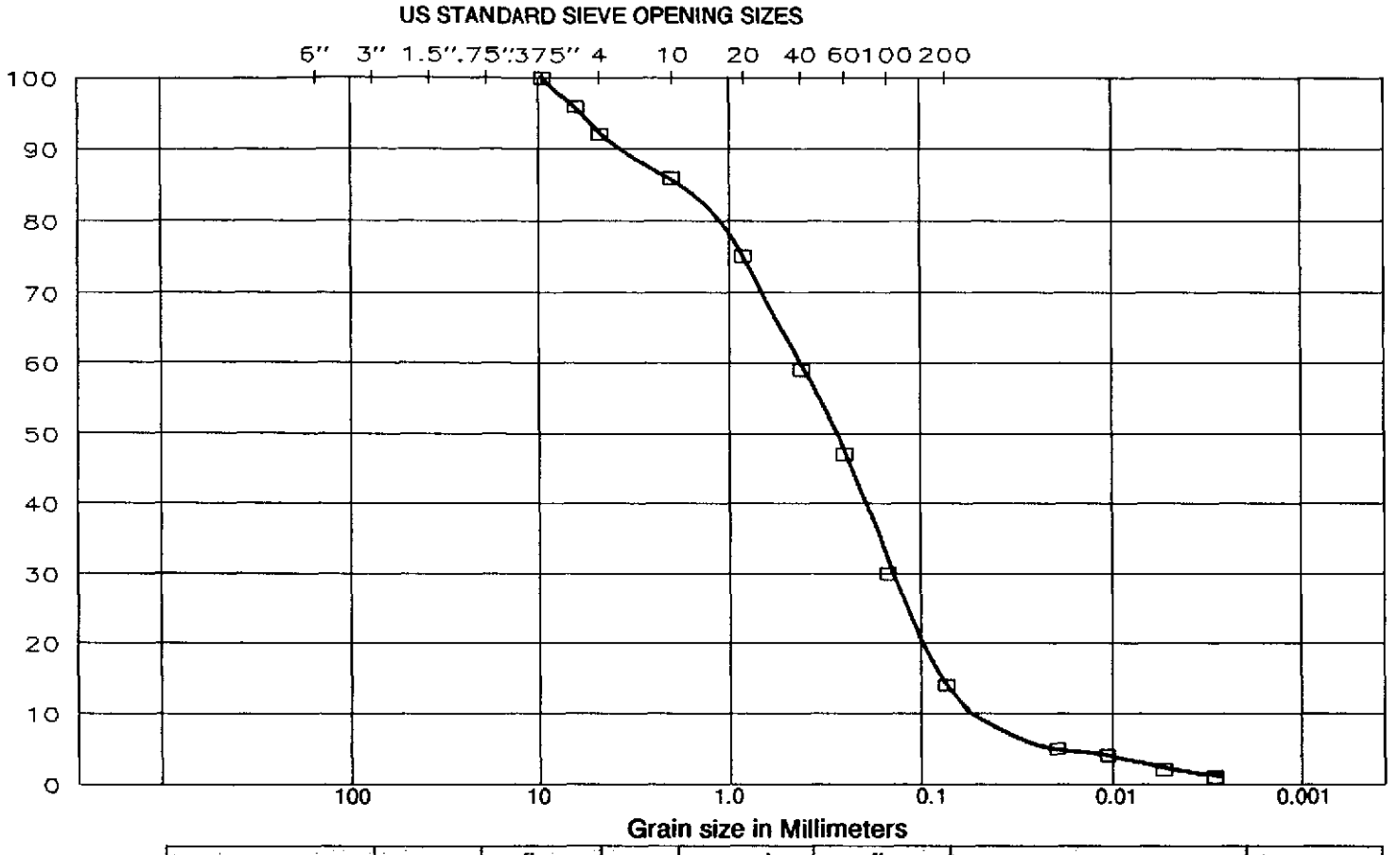
PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
P-13 0.0-7.0'	10.6	NP	NP	NP	Gs=2.61	Tan m-f SAND,some silt, little f gravel (SM)
Sample Type:	BULK	Date Tested:	08/22/90			

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893-6255.12

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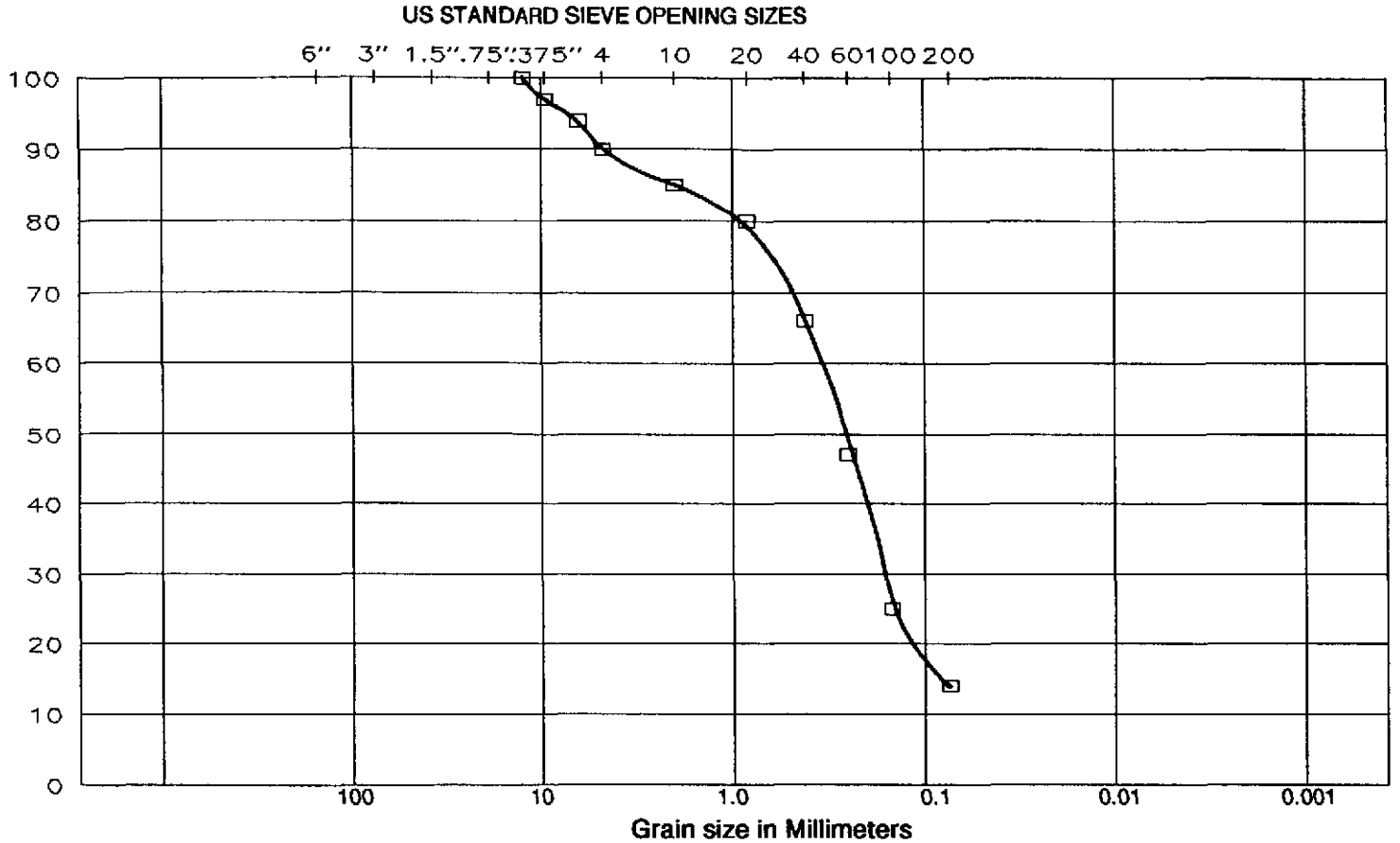
PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



COBBLES	GRAVEL: coarse	GRAVEL: fine	SAND: c	SAND: med	SAND: fine	SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
P-14 0.0-3.8'	7.9	NP	NP	NP	Gs=2.51	Brown m-f SAND,some silt, little f gravel (SM)

Sample Type: BULK Date Tested: 09/06/90

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893-6255.12

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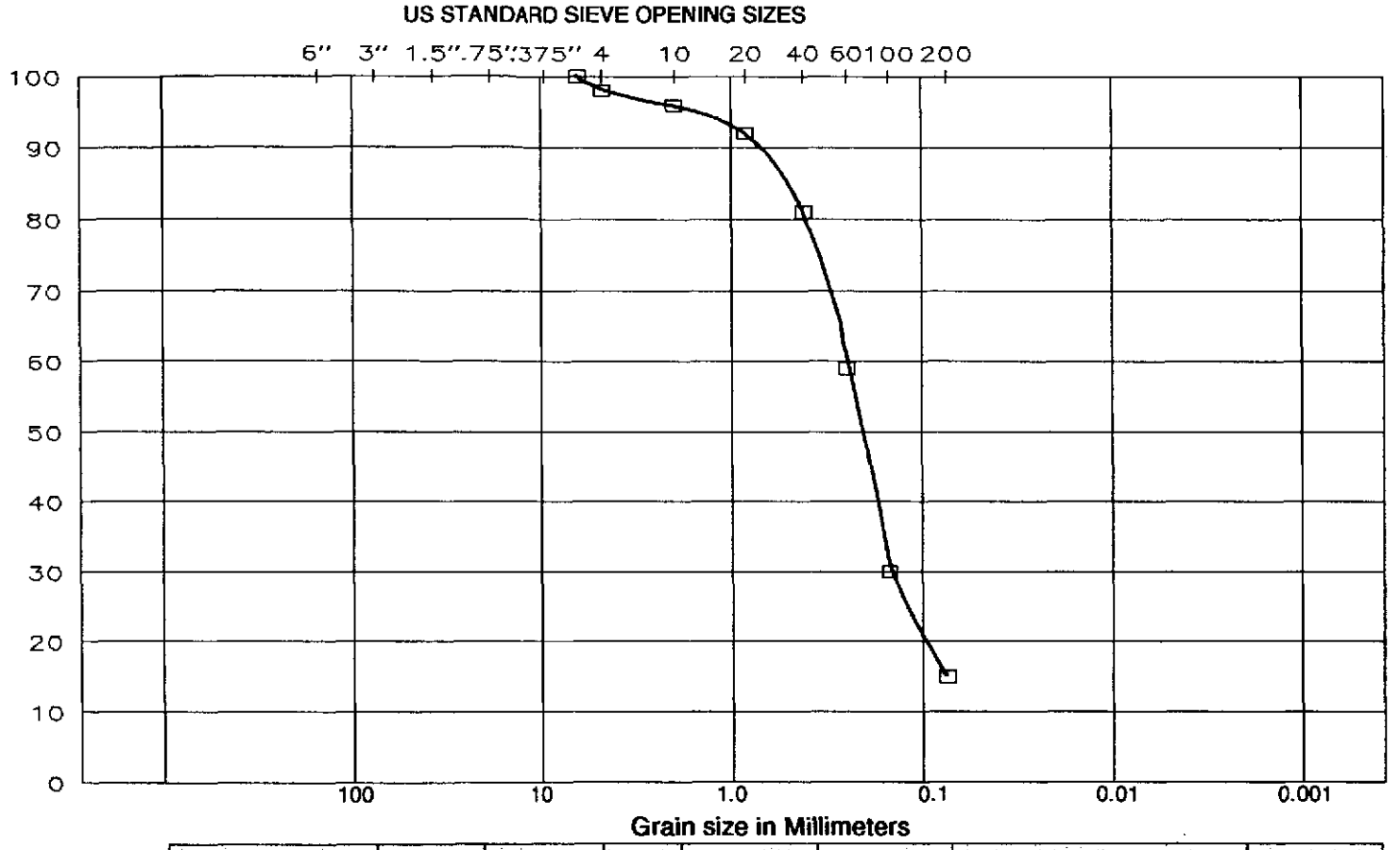
Consulting Engineers

PARTICLE SIZE DISTRIBUTION ASTM D-421 AND 422



	coarse	fine	c	med	fine		
COBBLES	GRAVEL		SAND			SILT	CLAY

SAMPLE ID	W%	LL	PL	PI	Other	DESCRIPTION
P-15 0.0-6.0'	14.3	NP	NP	NP	Gs=2.63	Tan m-f SAND,some silt, trace f gravel (SM)

Sample Type: BULK Date Tested: 08/28/90

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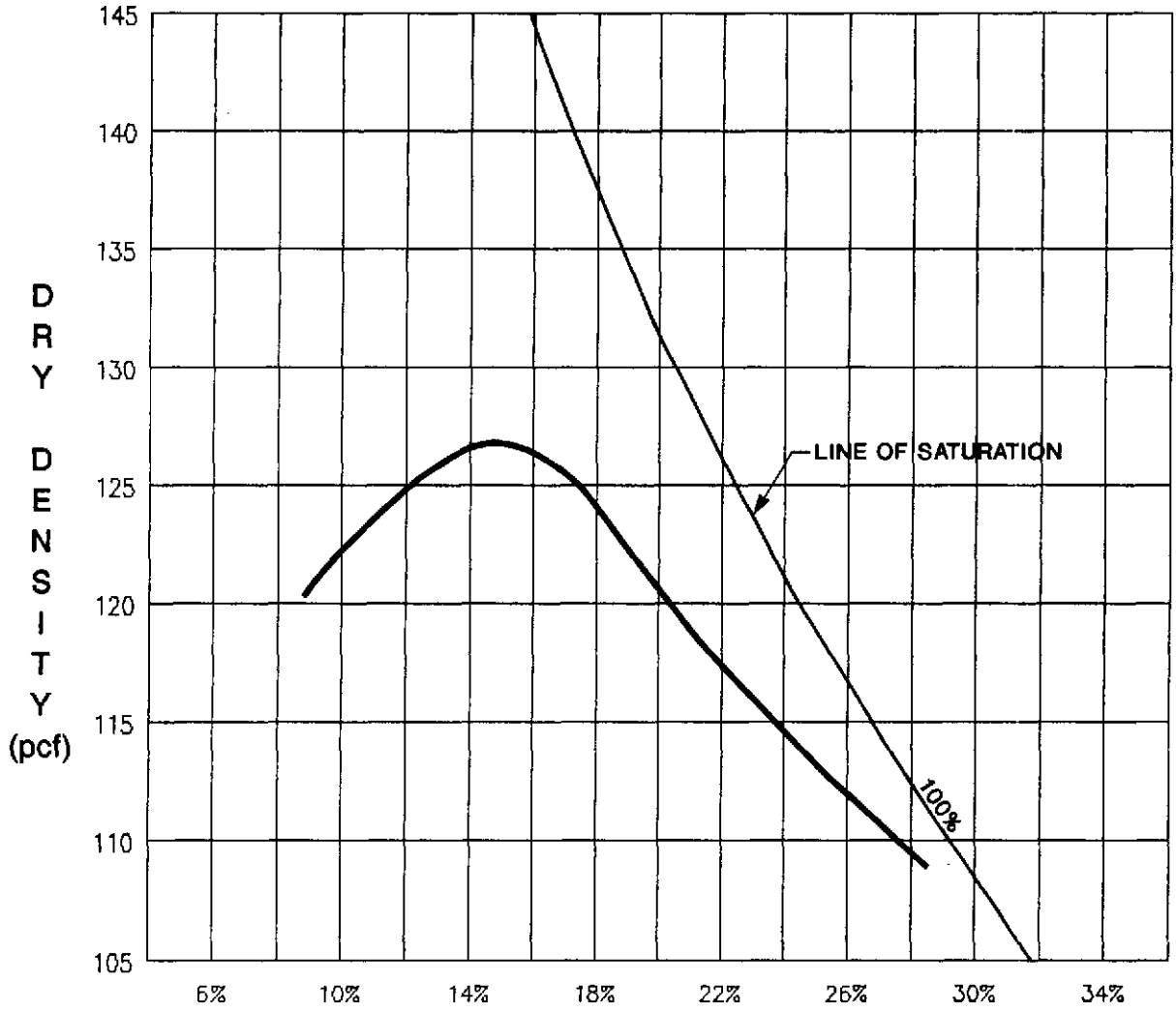
893-6255.12

GOLDER ASSOCIATES INC.
Consulting Engineers

Modified Proctor Moisture/Density

MOISTURE/DRY DENSITY CURVE

ASTM D-1557



SAMPLE IDENTITY	Wn%	WL	WP	IP	DESCRIPTION
P-10 0.0'-3.0'	24.3%	NP	NP	NP	Purple c-f SAND and SILT,some f gravel (SM) Gs=3.63
	MAXIMUM DRY DENSITY (pcf)			127.0	
	OPTIMUM MOISTURE (%)			15.0%	
SAMPLE TYPE	Bulk		DATE TESTED		8/06/90

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893-6255.12

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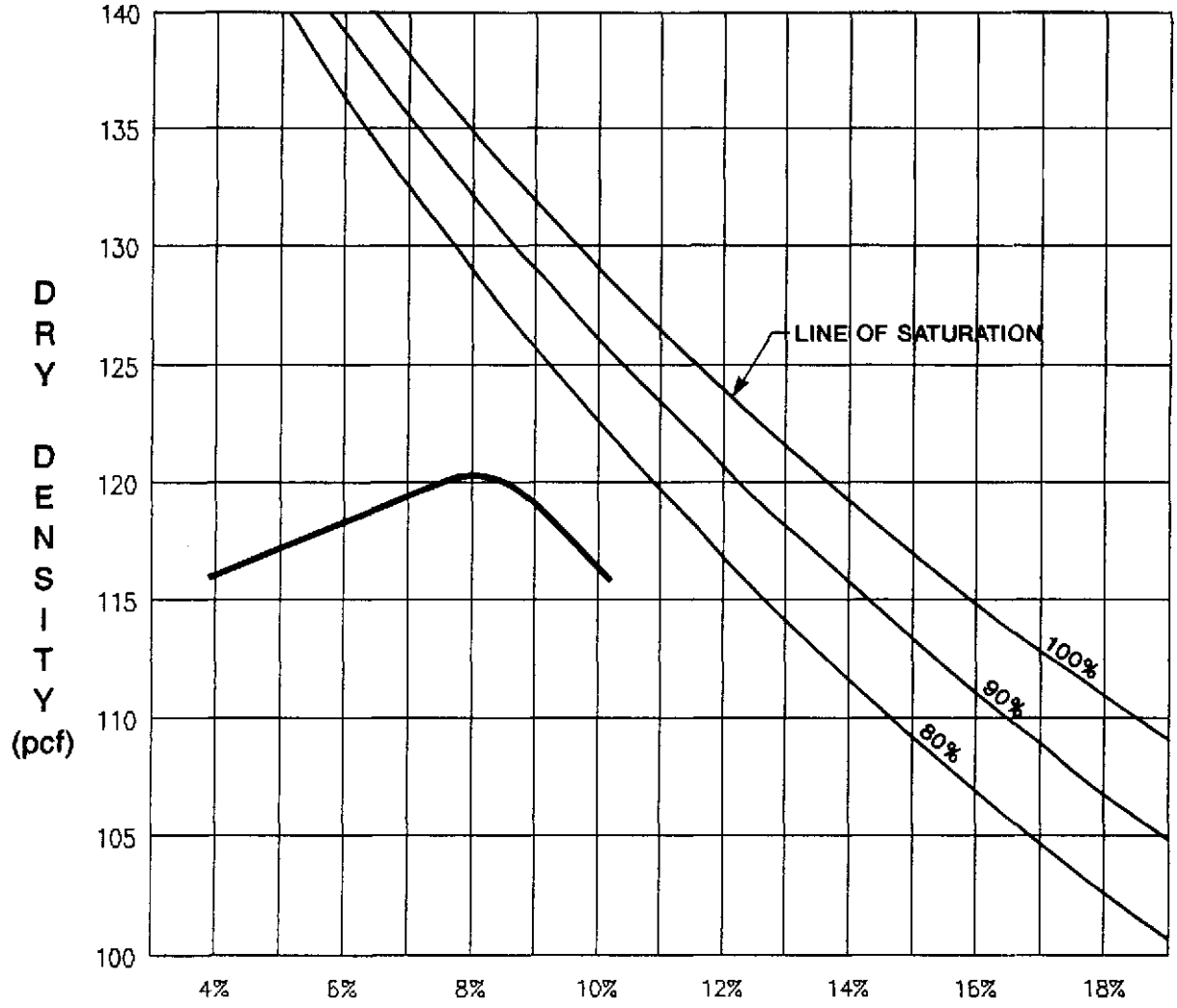
Consulting Engineers

MOISTURE/DRY DENSITY CURVE

ASTM D-1557



SAMPLE IDENTITY	Wn%	WL	WP	IP	DESCRIPTION
P-13 0.0'-7.0'	10.6%	NP	NP	NP	Tan m-f SAND,some silt,little f gravel (SM) Gs=2.61
	MAXIMUM DRY DENSITY (pcf)			120.3	
	OPTIMUM MOISTURE (%)			8.0%	
SAMPLE TYPE	Bulk		DATE TESTED		8/16/90

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893-6255.12

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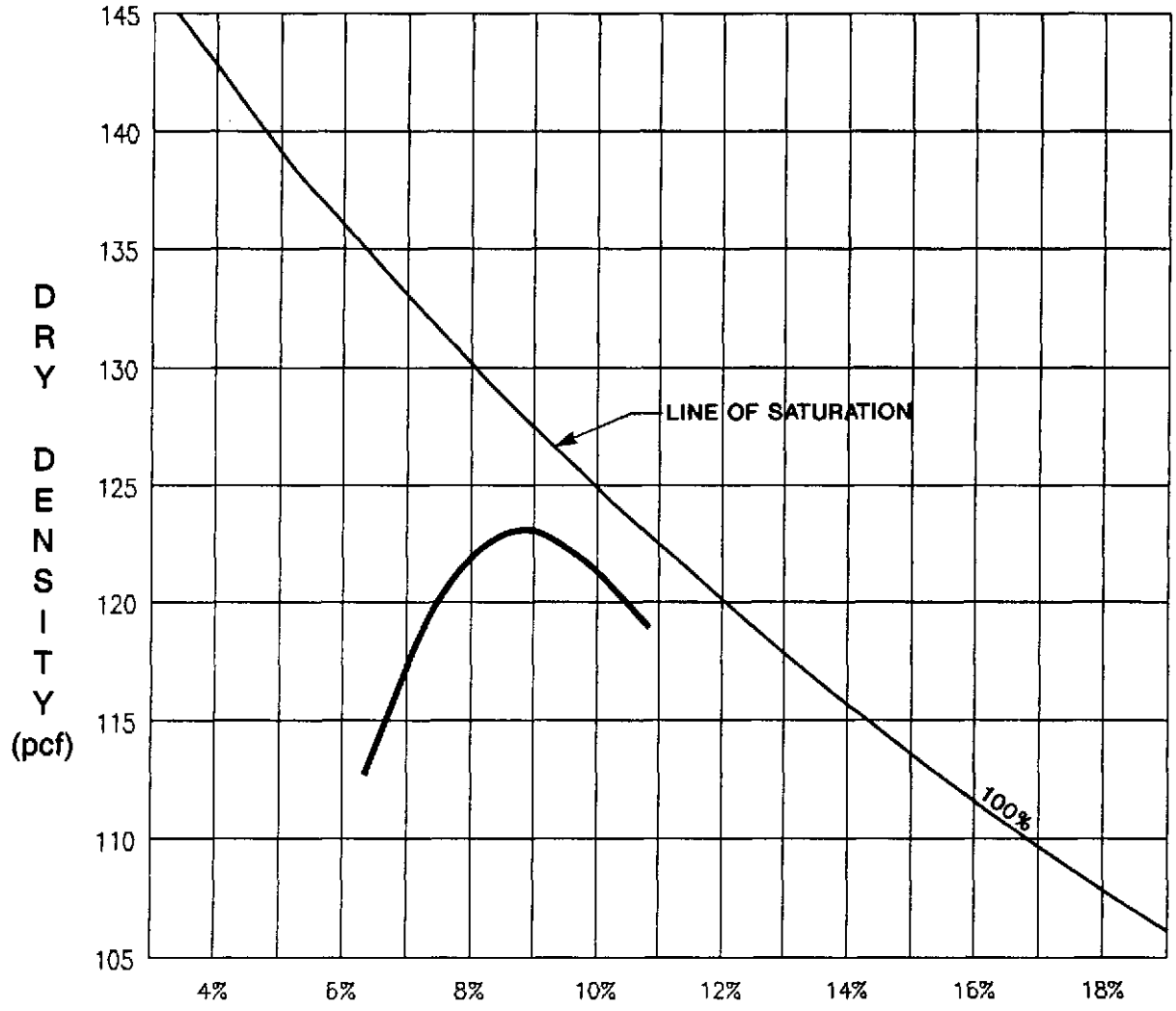
Consulting Engineers

MOISTURE/DRY DENSITY CURVE

ASTM D-1557



SAMPLE IDENTITY	Wn%	WL	WP	IP	DESCRIPTION
P-14 0.0'-3.8'	7.9%	NP	NP	NP	Brown m-f SAND,some silt,little f gravel (SM) Gs=2.51
	MAXIMUM DRY DENSITY (pcf)			123.4	
	OPTIMUM MOISTURE (%)			8.7%	
SAMPLE TYPE	Bulk		DATE TESTED		7/23/90

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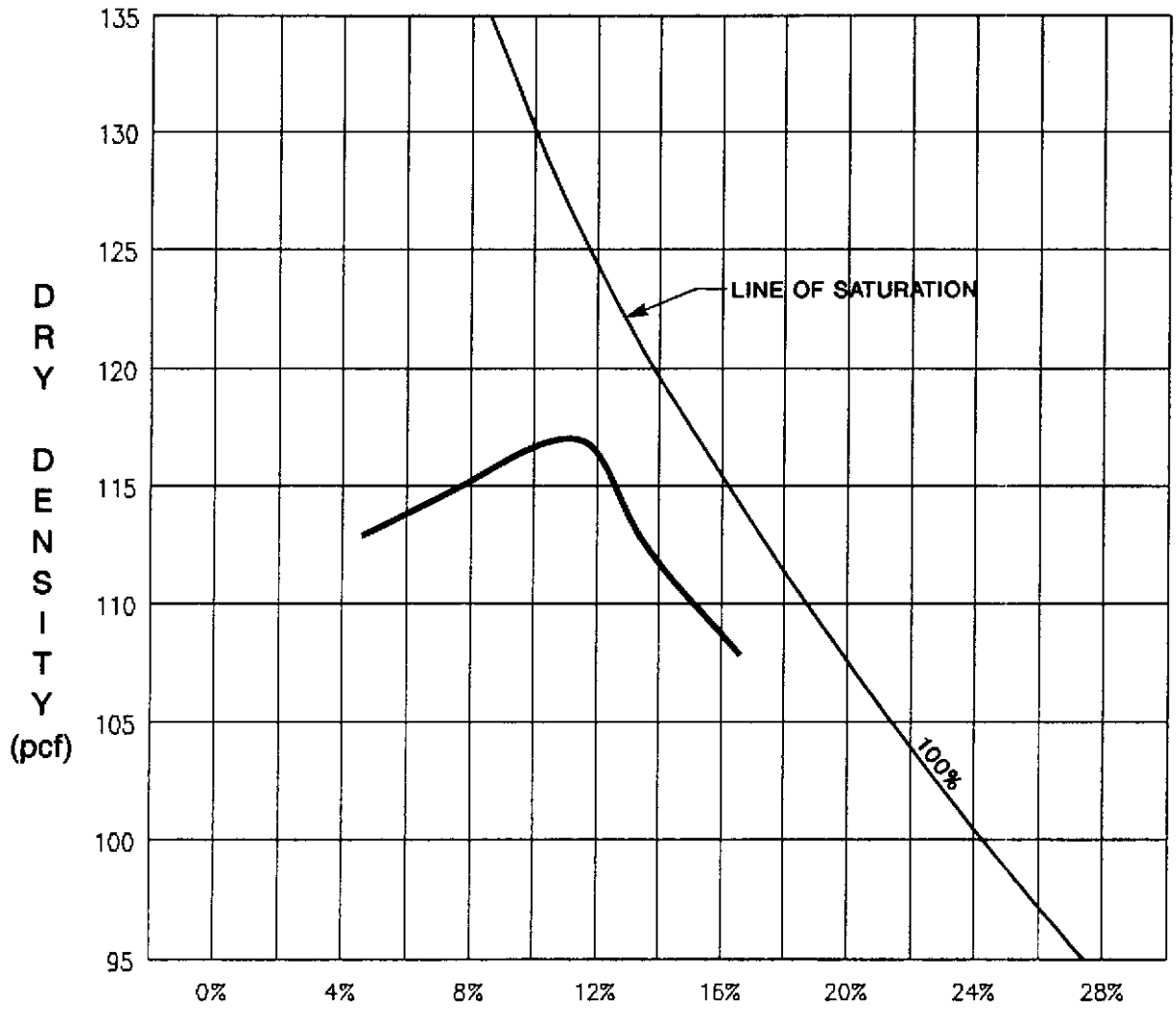
893-6255.12

GOLDER ASSOCIATES,INC

Consulting Engineers

MOISTURE/DRY DENSITY CURVE

ASTM D-1557



SAMPLE IDENTITY	Wn%	WL	WP	IP	DESCRIPTION
P-15 0.0'-6.0'	14.3%	NP	NP	NP	Tan m-f SAND,some silt,trace f gravel (SM) Gs=2.63
	MAXIMUM DRY DENSITY (pcf)			117.2	
	OPTIMUM MOISTURE (%)			11.5%	
SAMPLE TYPE	Bulk		DATE TESTED	7/18/90	

ISRT/WOBURN/MA

893-6255.12

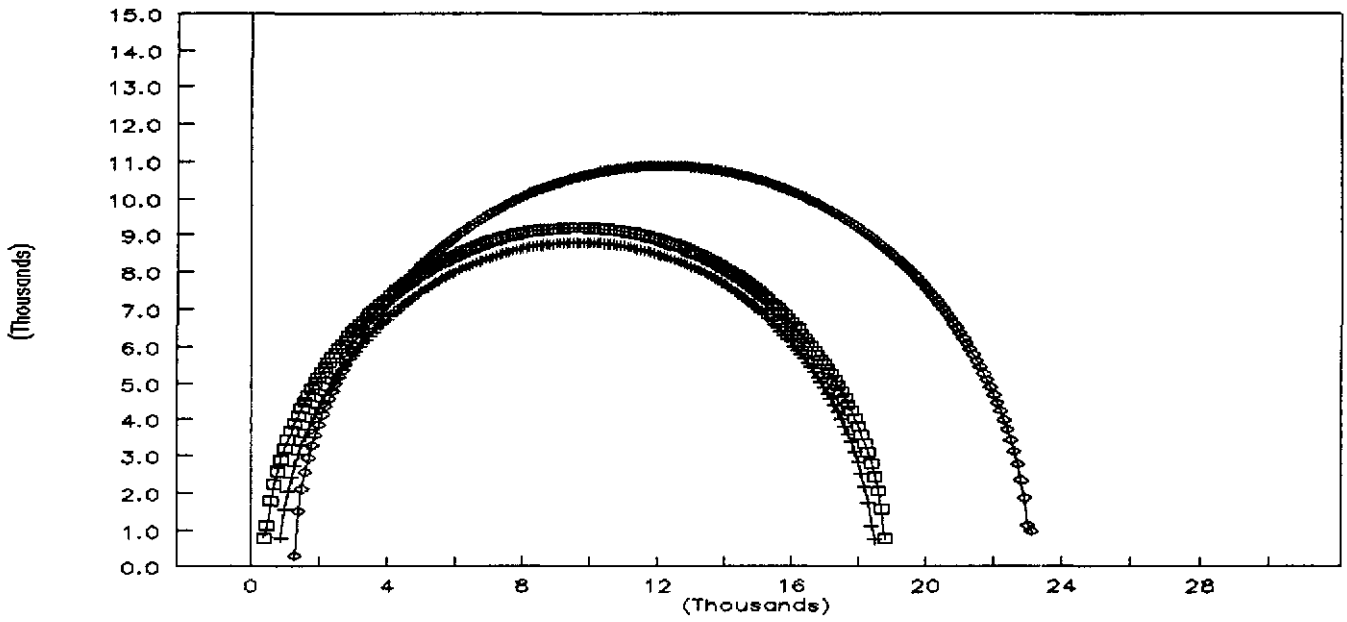
GOLDER ASSOCIATES,INC

Consulting Engineers

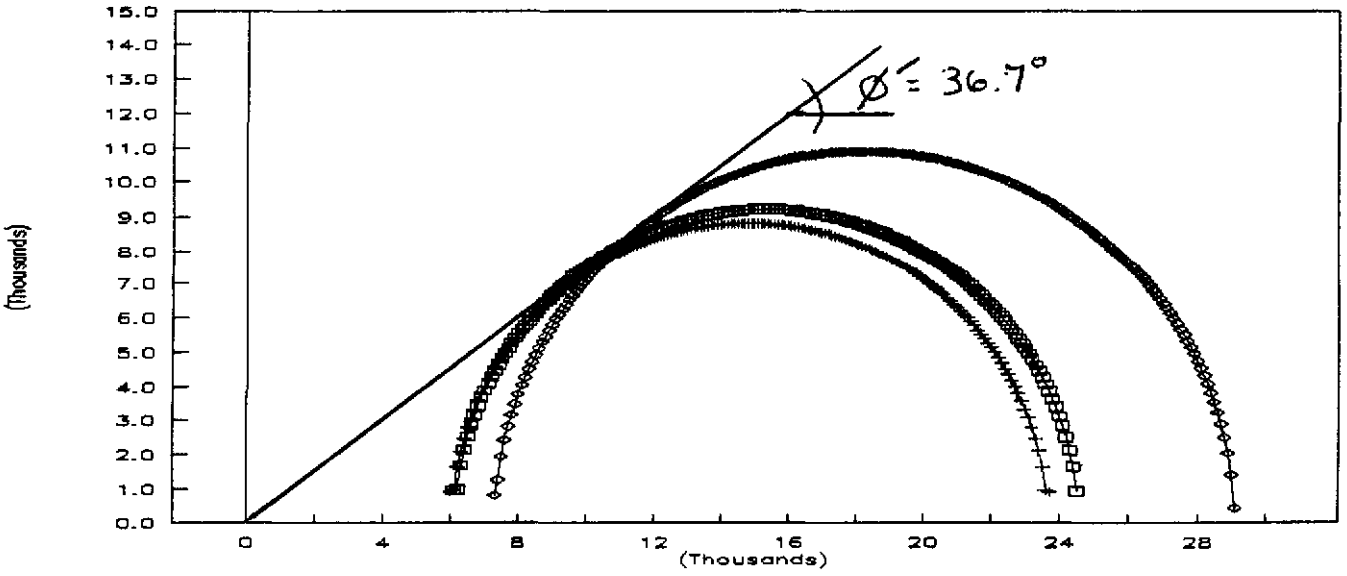
Shear Strength

TRIAXIAL COMPRESSION STRENGTH TEST
CONSOLIDATED/UNDRAINED WITH PORE PRESSURE MEASUREMENT
P-13,Bulk

TOTAL STRESS MOHR'S STRENGTH CIRCLES (in psf)



EFFECTIVE STRESS MOHR'S STRENGTH CIRCLES (in psf)



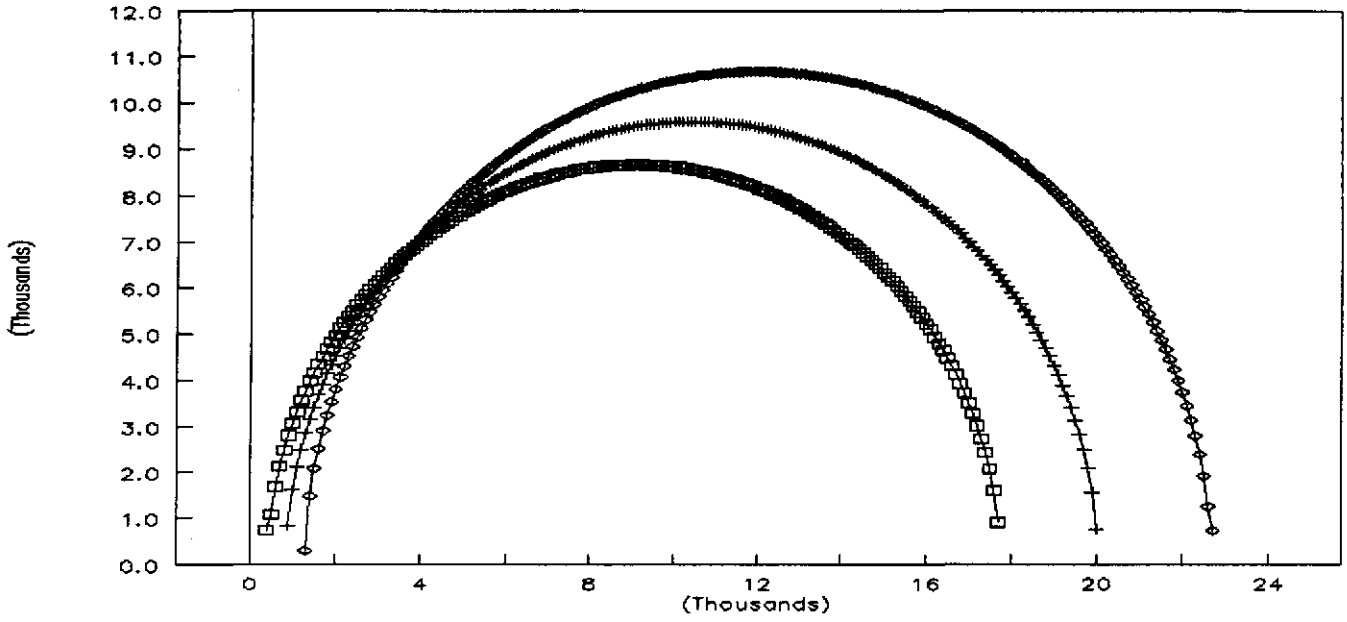
Consolidation Pressure	Initial Moisture	Initial Moist Density
(psi)	(%)	(pcf)
3	10.9	127.0
6	10.5	127.0
9	11.1	126.3

ISRT/WOBURN/MA
893-6255

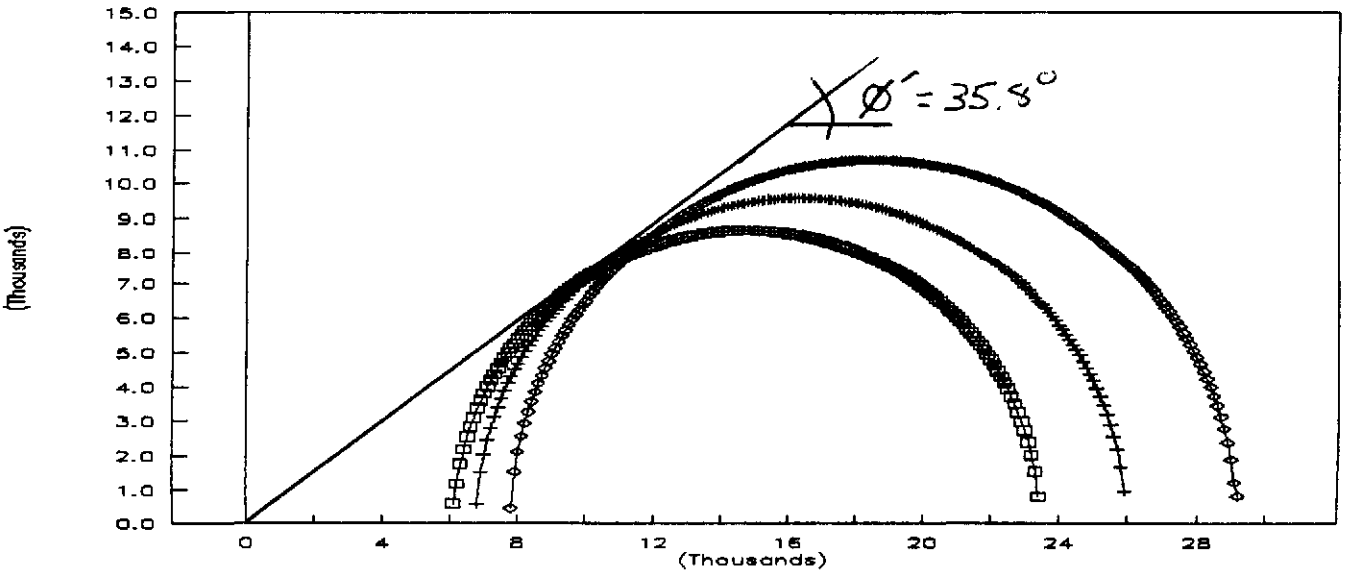
GOLDER ASSOCIATES INC.
MT. LAUREL, N.J.

TRIAXIAL COMPRESSION STRENGTH TEST
CONSOLIDATED/UNDRAINED WITH PORE PRESSURE MEASUREMENT
P-14,BULK

TOTAL STRESS MOHR'S STRENGTH CIRCLES (in psf)



EFFECTIVE STRESS MOHR'S STRENGTH CIRCLES (in psf)



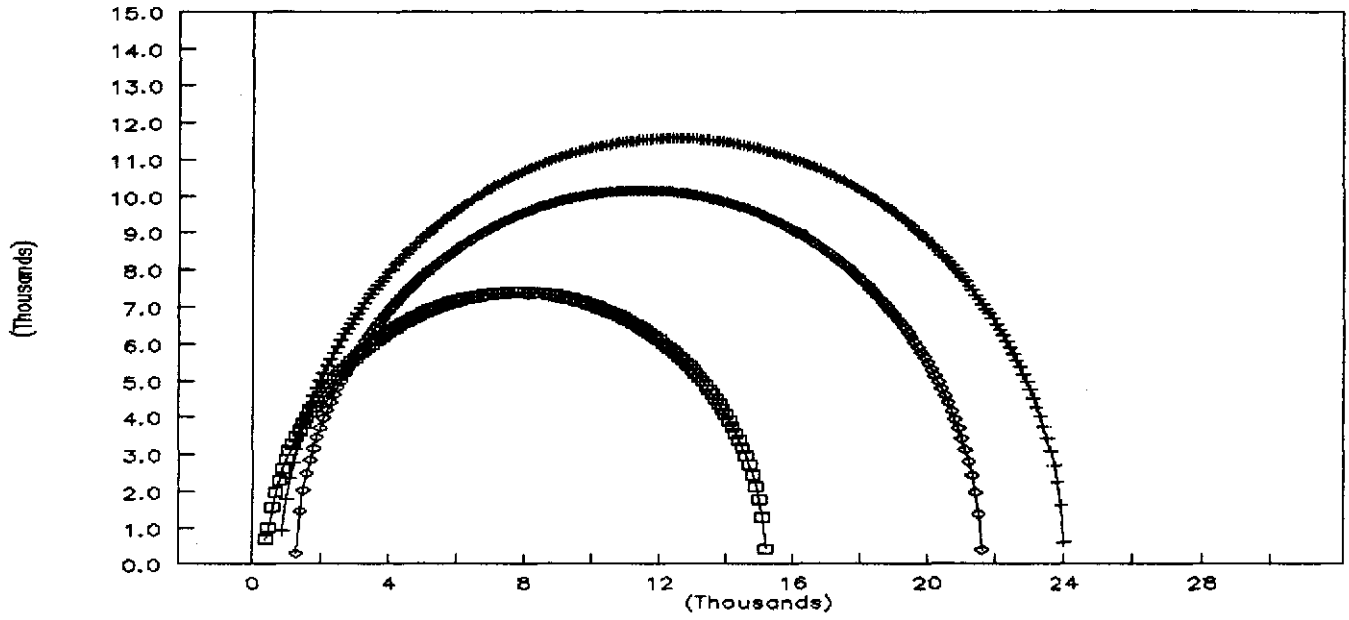
Consolidation Pressure	Initial Moisture	Initial Moist Density
(psi)	(%)	(pcf)
3	11.3	130.4
6	11.0	130.5
9	11.5	130.5

ISRT/WOBURN/MA
893-6255

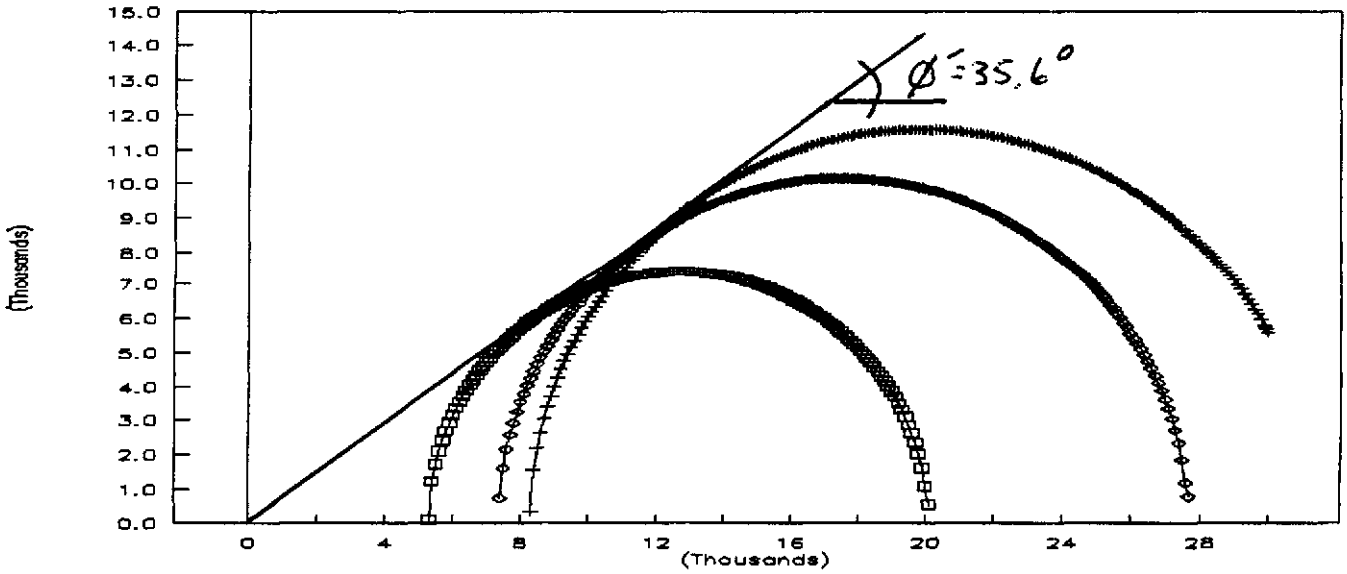
GOLDER ASSOCIATES INC.
MT. LAUREL, N.J.

TRIAXIAL COMPRESSION STRENGTH TEST
CONSOLIDATED/UNDRAINED WITH PORE PRESSURE MEASUREMENT
P-15,BULK

TOTAL STRESS MOHR'S STRENGTH CIRCLES (in psf)



EFFECTIVE STRESS MOHR'S STRENGTH CIRCLES (in psf)



Consolidation Pressure	Initial Moisture	Initial Moist Density
(psi)	(%)	(pcf)
3	13.8	126.0
6	13.8	126.7
9	13.9	127.1

ISRT/WOBURN/MA
893-6255

GOLDER ASSOCIATES INC.
MT. LAUREL, N.J.

Consolidation

Not need Consol^n data for Topsoil

Only need preconsolidation that is Cc

CONSOLIDATION TEST

FIGURE

PROJECT ISRT/Woburn/MA

BORING NO. P13 SAMPLE NO. _____ DEPTH 0-7 feet ELEV. 72.5 - 65.5 (MSL)

DESCRIPTION _____

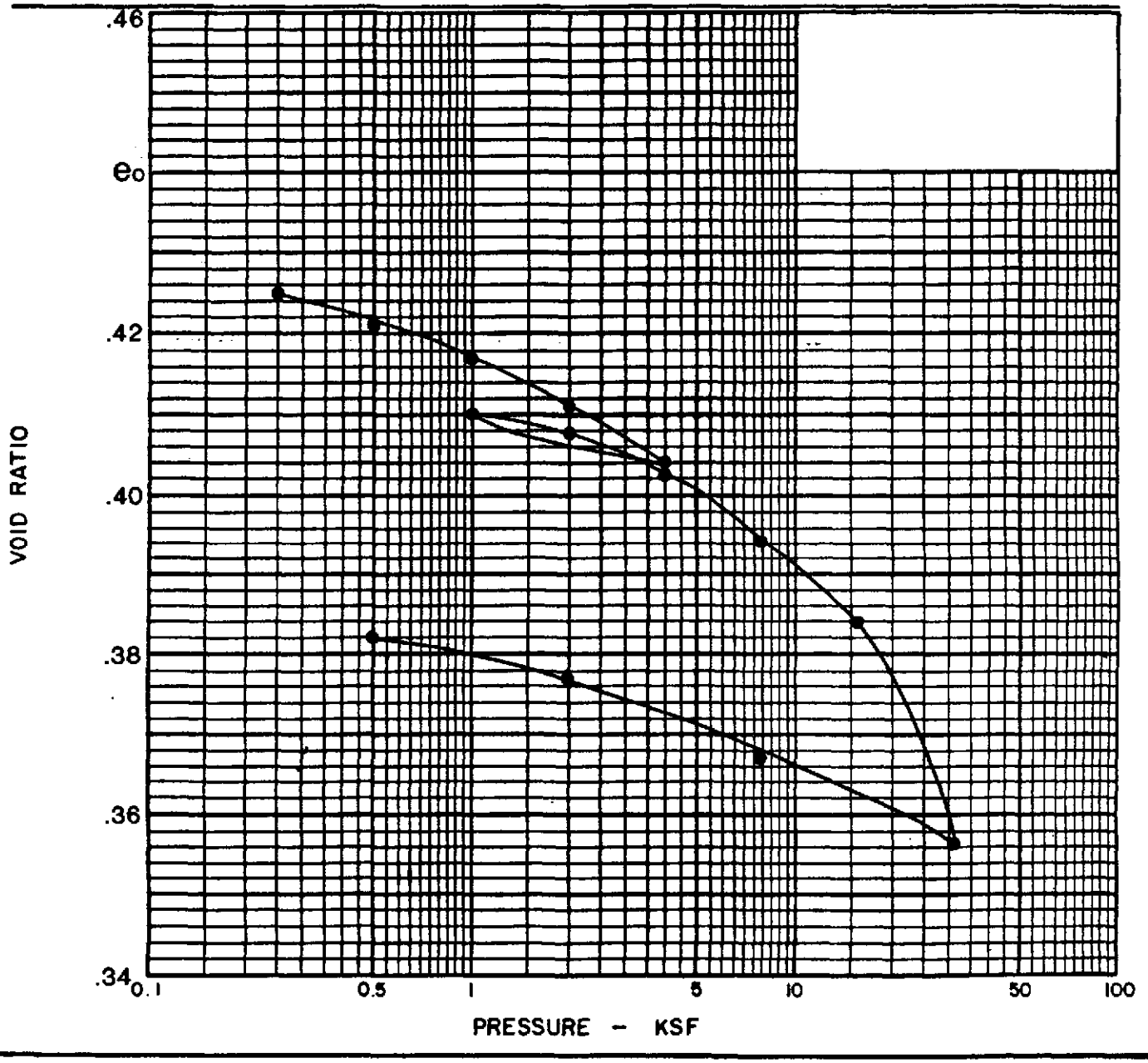
INITIAL SAMPLE HEIGHT 0.748 IN. SAMPLE AREA 4.897 SQ. IN. SPECIFIC GRAVITY 2.61

INITIAL MOISTURE CONTENT 14.0 % INITIAL BULK DENSITY 128.96 PCF INITIAL DRY DENSITY 116.72 PCF

INITIAL VOID RATIO 0.44 INITIAL SATURATION 75.0 % FINAL SATURATION 100.0 %

ATTERBERG LIMITS: L_w NP % I_w NP % P_w NP %

REMARKS: _____



Scale AS SHOWN

Date 09/18/90

Job No. 893-6255

Golder Associates

Drawn RT

Checked RJI

Reviewed PCR

CONSOLIDATION TEST

FIGURE

PROJECT ISRT/Woburn/MA

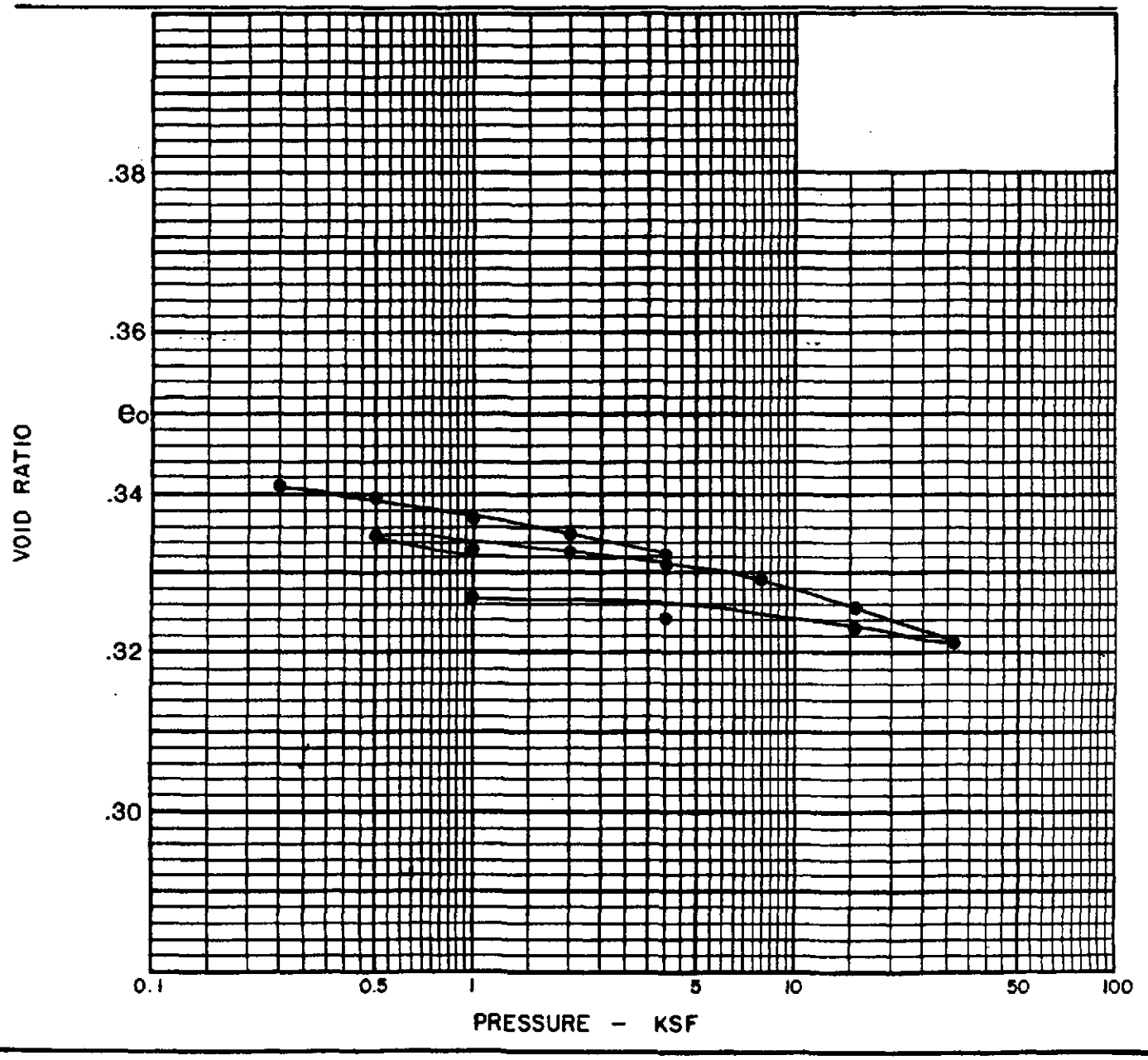
BORING NO. P14 SAMPLE NO. _____ DEPTH 0-3.8 feet ELEV. 71.2-67.4 (MSL)

DESCRIPTION _____

INITIAL SAMPLE HEIGHT	0.749 IN.	SAMPLE AREA	4.901 SQ. IN.	SPECIFIC GRAVITY	2.51
INITIAL MOISTURE CONTENT	11.52 %	INITIAL BULK DENSITY	127.81 PCF	INITIAL DRY DENSITY	114.80 PCF
INITIAL VOID RATIO	0.3493	INITIAL SATURATION	82.8 %	FINAL SATURATION	100.0 %

ATTERBERG LIMITS: L_w NP % I_w NP % P_w NP %

REMARKS: _____



Scale AS SHOWN
Date 09/18/90
Job No. 893-6255

Golder Associates

Drawn RT
Checked RJI
Reviewed PCR

CONSOLIDATION TEST

FIGURE

PROJECT ISRT/Woburn/MA

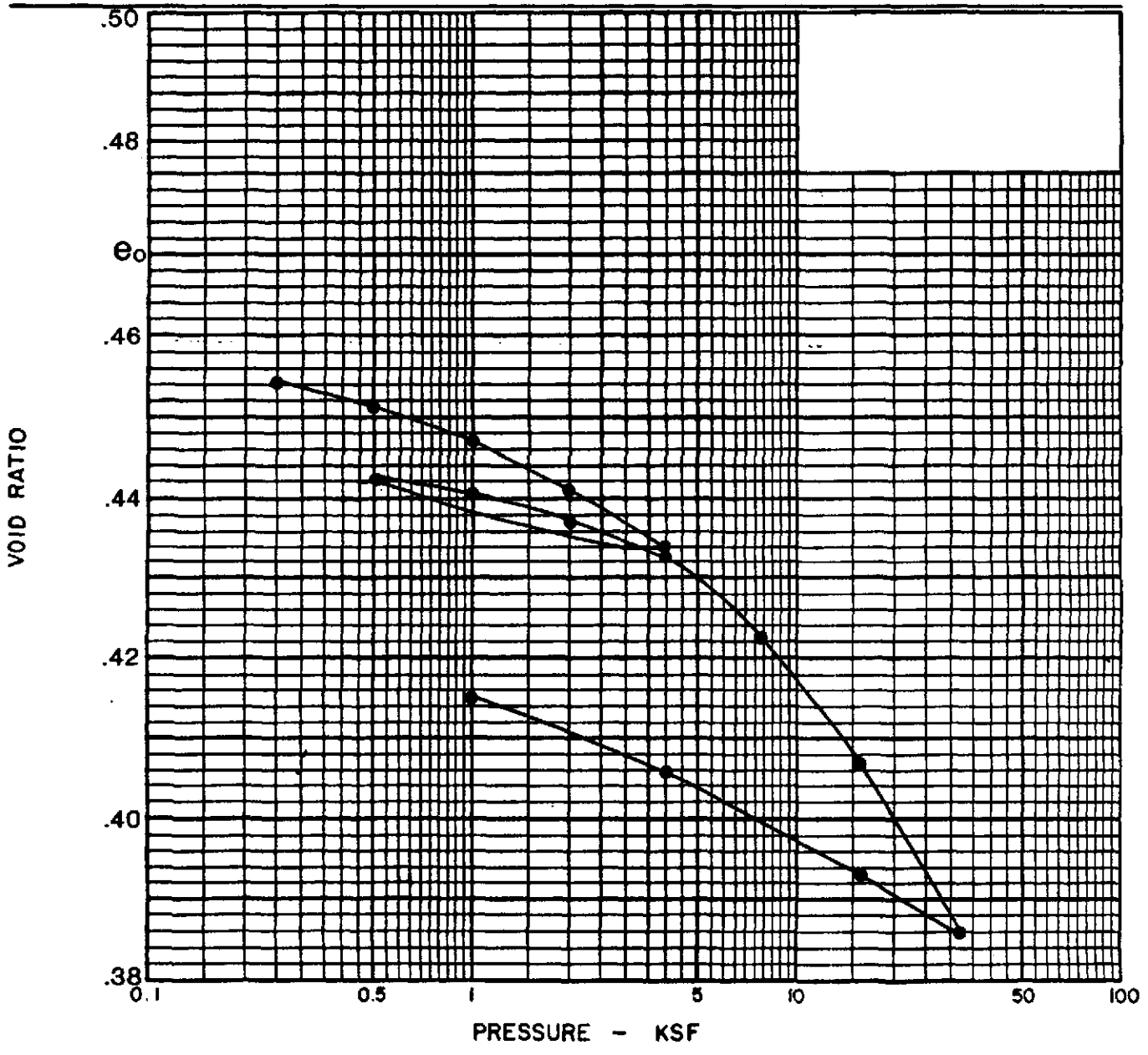
BORING NO. P15 SAMPLE NO. _____ DEPTH 0-6 feet ELEV. 69.3 - 63.3 (MSL)

DESCRIPTION _____

INITIAL SAMPLE HEIGHT	0.752 IN.	SAMPLE AREA	4.901 SQ. IN.	SPECIFIC GRAVITY	2.63
INITIAL MOISTURE CONTENT	13.87 %	INITIAL BULK DENSITY	126.41 PCF	INITIAL DRY DENSITY	111.01 PCF
INITIAL VOID RATIO	0.47	INITIAL SATURATION	77.3 %	FINAL SATURATION	100 %

ATTERBERG LIMITS: L_w NP % I_w NP % P_w NP %

REMARKS: _____



Scale AS SHOWN
Date 09/18/90
Job No. 893-6255

Golder Associates

Drawn RT
Checked RJI
Reviewed PCR

APPENDIX E

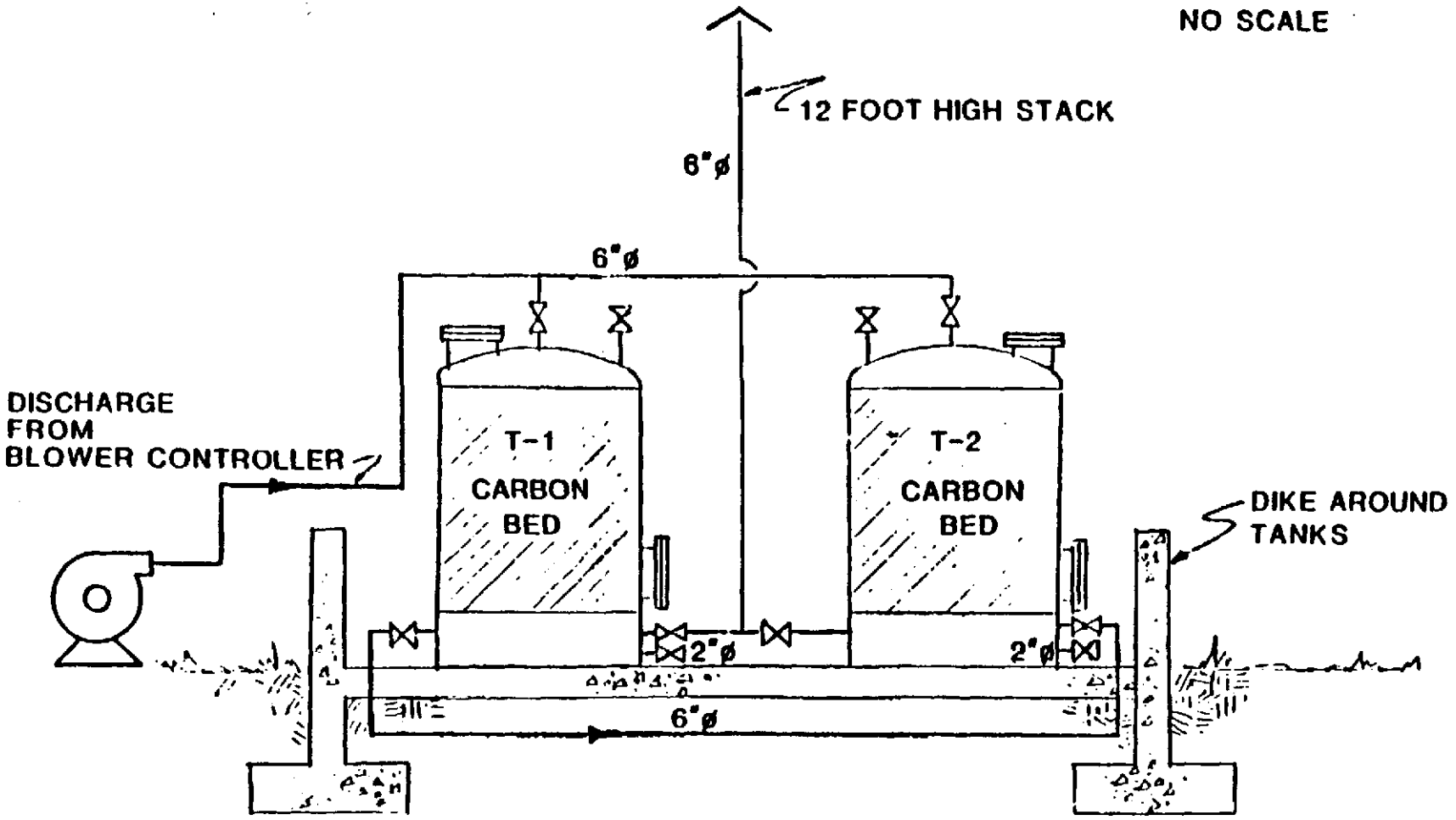
Background Information

Record of Decision Figure 13 and 14

ALTERNATIVE A-3

(CARBON ADSORPTION)

NO SCALE



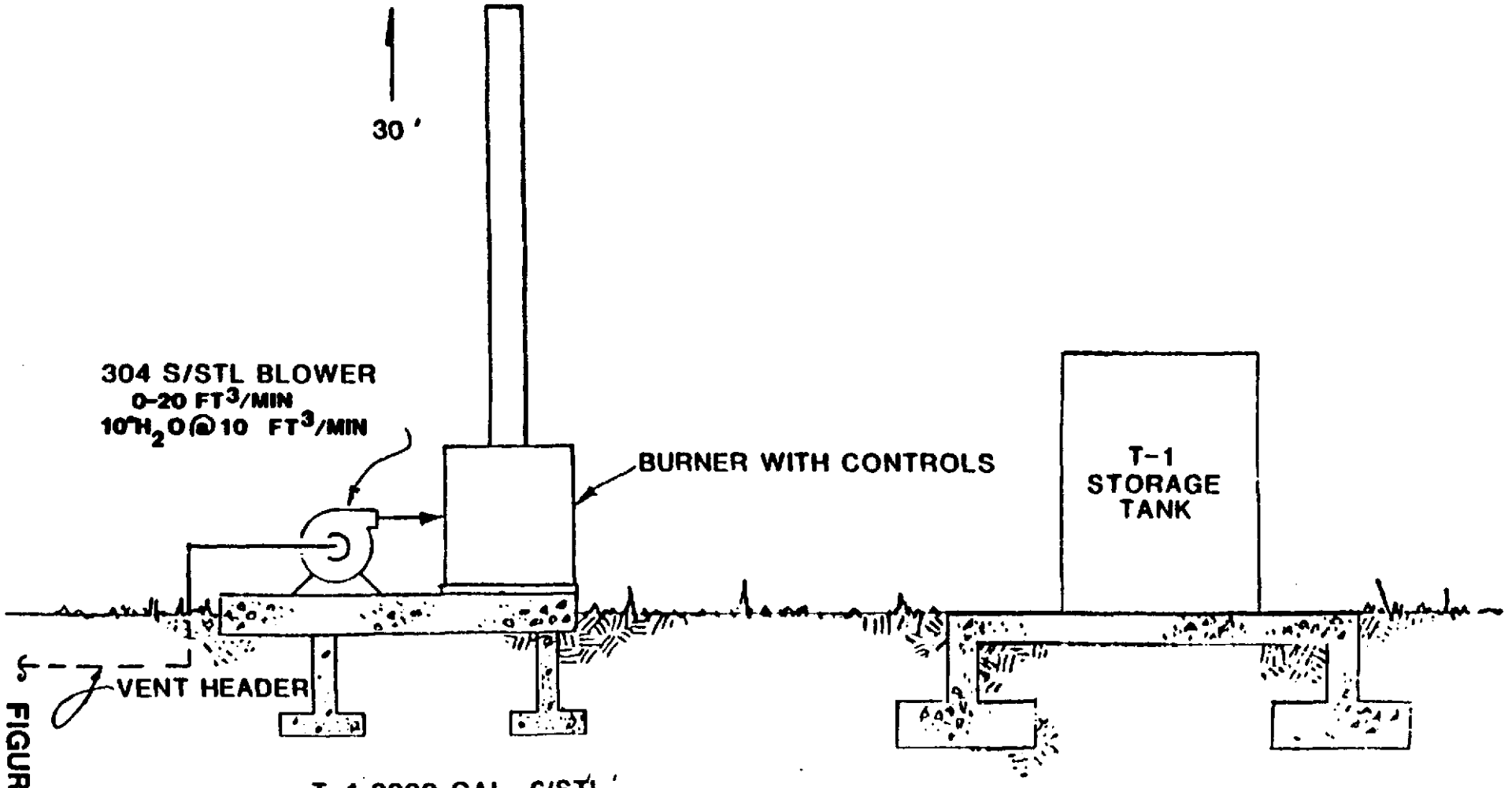
T-1 & T-2 8' DIA. x 6' HIGH 316 S/STL. WITH TOP MANHOLE, SIDE MANHOLE, FLUSH BOTTOM DRAIN, WITH INTERNAL SCREEN TO SUPPORT 6000 LBS. CALGON TYPE IVP CARBON BED

FIGURE 13

STAUFFER CHEMICAL COMPANY
WOBURN, MASS.

ALTERNATIVE A-4

(THERMAL OXIDATION)
NO SCALE



T-1 3000 GAL. C/STL
PROPANE STORAGE TANK

STAUFFER CHEMICAL COMPANY
WOBURN, MASS.

FIGURE 14

Pre-Design Investigation Tables 7 and 16

TABLE 7

Geotechnical Drilling and Testing

Task S-4, Foundation Design

DRILLING

Hole Number	Depth (ft.)	Number of Disturbed Samples	Number of Undisturbed Samples
Treatment Plant Locations			
T1	15	4	2
T2	15	4	2
T3	15	4	2
T4	35	8	2
Test Pits P1-P10	8 ft. max.	4	
Future Development			
SD1	20	6	2
SD2	40	9	2
SD3	40	9	2
SD4	15	4	2
Test Pits P11-P18	8 ft. max.	4	

LABORATORY TESTING

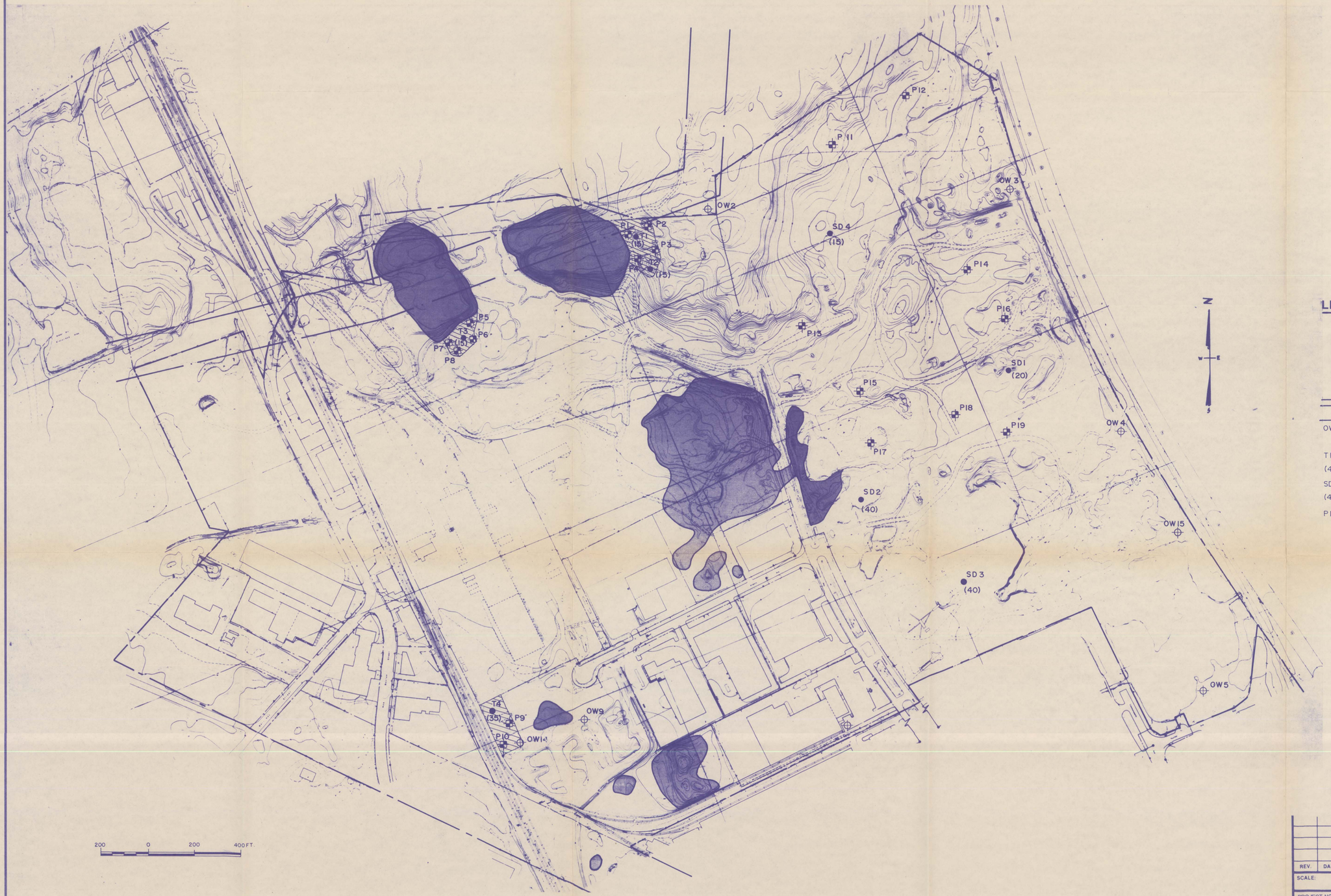
Test	No. Tests
Grain size distribution	15
Atterberg Limits	15
Consolidation Test	4
Triaxial Shear Tests	6
Standard Penetration Tests	48

Actual testing will depend on soil types.

TABLE 16 (Cont.)
DATA QUALITY OBJECTIVE SUMMARY

MEDIA	CONSENT DECREE OBJECTIVE	DATA NEEDS	ANALYSES	NUMBER OF SAMPLES	ANALYTICAL LEVEL	ANALYTICAL METHOD	RATIONALE
Soil		East Hide Pile cover drainage layer sand	Grain size distribution	3	N/A	ASTM-D422	Samples from each potential borrow source will be tested to determine USDA classification and flow capacity.
			Permeability	3	N/A	COE EM 1110-2-1906	
		East Hide Pile cover gas collection gravel	Grain size distribution	3	N/A	ASTM-D422	Samples from each potential borrow source will be tested to determine USDA classification and flow capacity.
			Permeability	3	N/A	COE EM 1110-2-1906	
		Permeable cover filter fabric	Aperture Size	3	N/A	ASTM-D4751	To ensure compliance with design specification for weight and aperture
			Weight	3	N/A	ASTM-D3776	
		East Hide Pile cover Flexible Memebrane Liner	Strength	3	N/A	ASTM-D4632	To insure that the FML will meet the design specifications against tearing, puncture or degradation.
			Puncture resistance	3	N/A	ASTM-D4833	
			Thickness	3	N/A	ASTM-D1777	
			Environmental compatibility	3	N/A	Literature Review	
	An additional task has been added to perform a preliminary foundation assessment for potential treatment plant sites (Task S-4)	Bearing capacity	Standard penetration tests	48	N/A	ASTM-1586	Soils investigation is required to locate potentially suitable sites for construction of water and gas treatment facilities.
			Grain size distribution	15	N/A	ASTM-D422	
			Atterberg limit	15	N/A	ASTM-D4318	
			Shear strength	6	N/A	COE EM 1110-2-1906	
			Consolidation	4	N/A	ASTM-D2974	

Pre-Design Investigation Figure 23



LEGEND

- EXTENT OF HIDE PILES
- POSSIBLE AREA FOR TREATMENT PLANT LOCATION
- APPROXIMATE BOUNDARY OF THE BOSTON EDISON COMPANY EASEMENT
- APPROXIMATE SITE BOUNDARY
- OW5 — APPROXIMATE LOCATION OF EXISTING MONITORING WELL
- T1 (40) — TREATMENT PLANT BOREHOLE, WITH DEPTH IN BRACKETS
- SD1 (40) — SITE DEVELOPMENT HOLE, WITH DEPTH IN BRACKETS
- P10 — TEST PIT

400 0 400 800
scale feet

SEP 26 1990

REV.	DATE	DESCRIPTION	DR BY	APP BY

SCALE: 1"=400'

PROJECT NO. 893-6255

DES BY	MSL	11/17/89
DR BY	EAM	11/17/89
CHK BY	RMG	12/15/89
REV BY	JEB	12/15/89

PROJECT:
INDUSTRI-PLEX SITE REMEDIAL TRUST
WOBURN, MASSACHUSETTS

SHEET TITLE:
BOREHOLES FOR TREATMENT PLANT AND FUTURE DEVELOPMENT

Golder Associates
Mt. Laurel, New Jersey

SHEET _____ OF _____
DRAWING NO. MA01-066

FIGURE 23

TITLE

LOCATIONS OF
GEOLOGIC
CROSS SECTIONS

PREPARED FOR

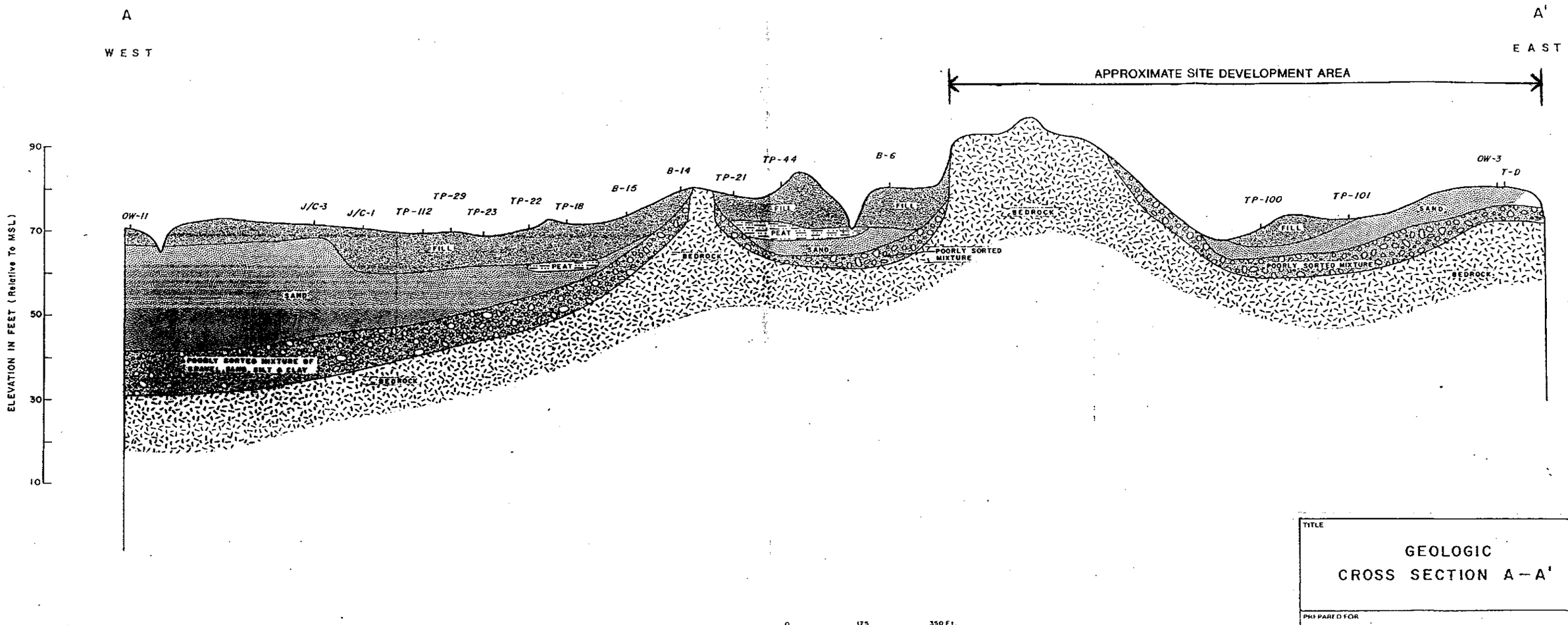
Stauffer Chemical Company

Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE: SHOWN

DATE: MAR. 1984

FIGURE 7



TITLE

GEOLOGIC CROSS SECTION A–A'

PREPARED FOR

Stauffer Chemical Company

Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE SHOWN

DATE MAR. 1984

FIGURE 8

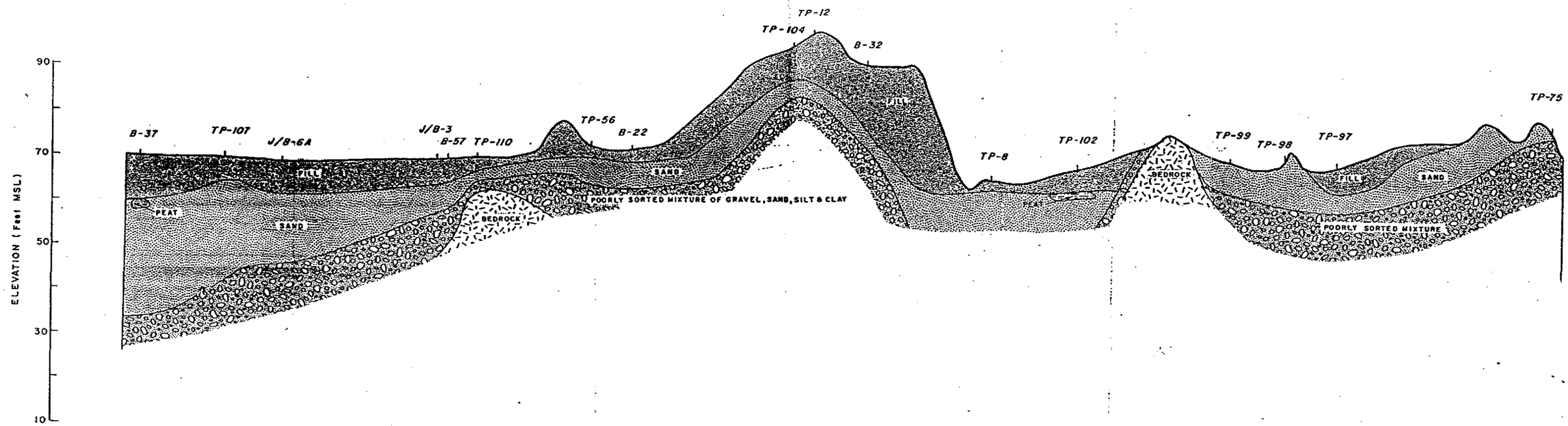
B

WEST

B'

EAST

APPROXIMATE SITE DEVELOPMENT AREA



0 175 350 Ft.

TITLE

GEOLOGIC
CROSS SECTION B – B'

PREPARED FOR

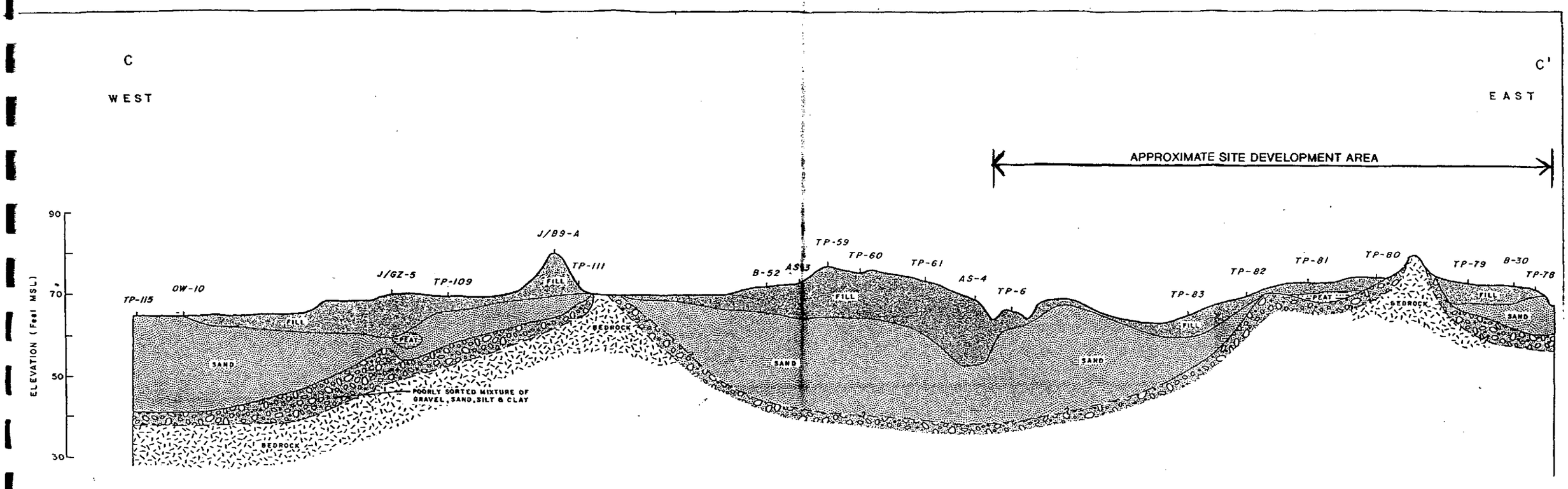
Stauffer Chemical Company

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE SHOWN

DATE MAR. 1984

FIGURE 9



0 175 350 Ft.

TITLE

GEOLOGIC
CROSS SECTION C – C'

PREPARED FOR
Stauffer Chemical Company

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE SHOWN

DATE MAR. 1984

FIGURE 10

D

WEST

D'

EAST

APPROXIMATE SITE DEVELOPMENT AREA

ELEVATION IN FEET (Relative To MSL)

100
80
60
40
20

TP-113
OW-14
B-25
TP-89
OW-9
AS-5
TP-91
AS-6
B-53
OW-13

FILL
PEAT
POORLY SORTED MIXTURE OF GRAVEL, SAND, SILT & CLAY
BEDROCK
FILL
SAND
BEDROCK

0 175 350Ft.

TITLE

GEOLOGIC
CROSS SECTION D – D'

PREPARED FOR
Stauffer Chemical Company

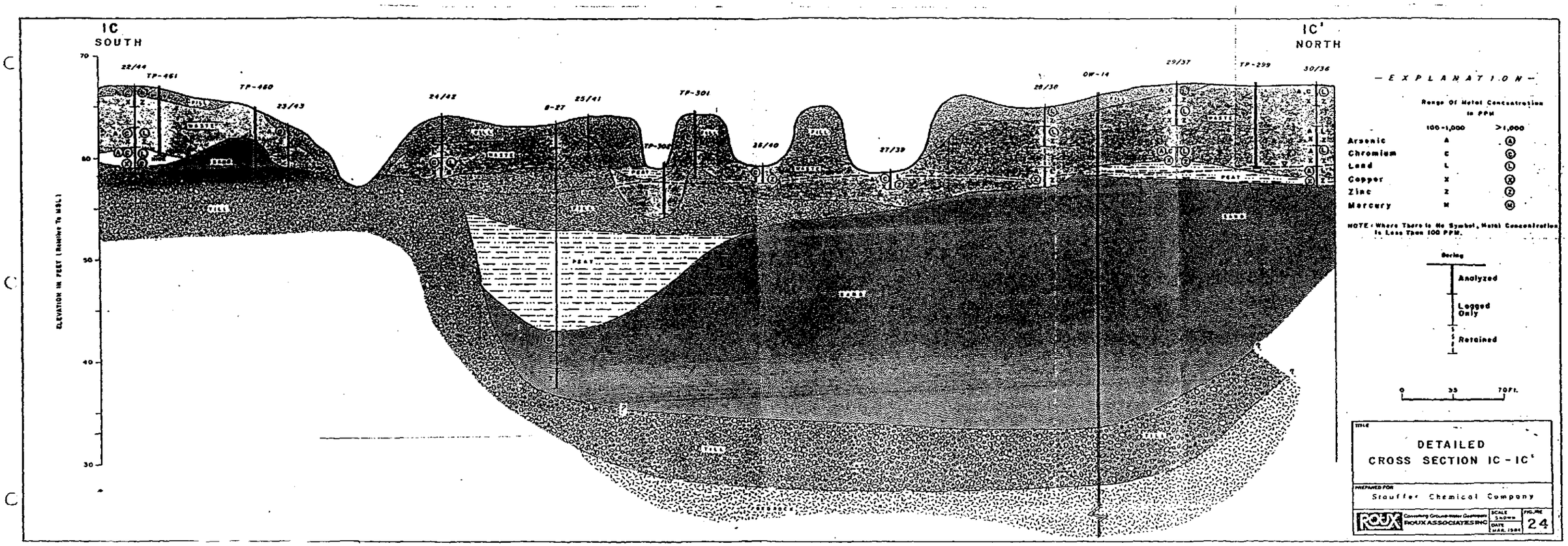
Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE SHOWN

DATE MAR. 1984

FIGURE 11

POTENTIAL TREATMENT PLANT LOCATION
ADJACENT TO CHROMIUM LAGOONS



— E X P L A N A T I O N —

Range Of Metal Concentrations in PPM	100 - 1,000	> 1,000
Arsenic	A	Ⓐ
Chromium	C	Ⓒ
Lead	L	Ⓛ
Copper	X	Ⓧ
Zinc	Z	Ⓩ
Mercury	M	Ⓜ

NOTE : Where There Is No Symbol, Metal Concentration Is Less Than 100 PPM.

Boring
Analyzed
Logged Only
Retained

0 35 70Ft.

TITLE
DETAILED
CROSS SECTION IC - IC'

PREPARED FOR
Stauffer Chemical Company

Consulting Ground-Water Geologists
ROUX ASSOCIATES INC
SCALE As Shown
DATE MAR. 1984
FIGURE 24

5B
SOUTH

5B'
NORTH

ELEVATION IN FEET (RELATIVE TO MSL)

95
85
75
65
55

— E X P L A N A T I O N —

Range Of Metal Concentration In PPM

	100-1,000	>1,000
Arsenic	A	Ⓐ
Chromium	C	Ⓒ
Lead	L	Ⓛ
Copper	K	Ⓚ
Zinc	Z	Ⓩ
Mercury	M	Ⓜ

Boring
Analyzed
Logged Only
Retained

NOTE: Where There Is No Symbol, Metal Concentration Is Less Than 100 PPM.

POTENTIAL TREATMENT PLANT LOCATION ADJACENT TO THE WEST HIDE PILE

44/36 TP-16 TP-256 45/37 48/34 49/33 50/32 TP-422 51/31 BH-19 52/30 TP-247 TP-419 TP-238 TP-239

MIXED WASTE

PEAT

FORMATION

0 35 70 Ft.

TITLE
DETAILED
CROSS SECTION 5B - 5B'

PREPARED FOR
Stauffer Chemical Company

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE SHOWN
DATE MAR. 1984

FIGURE 44

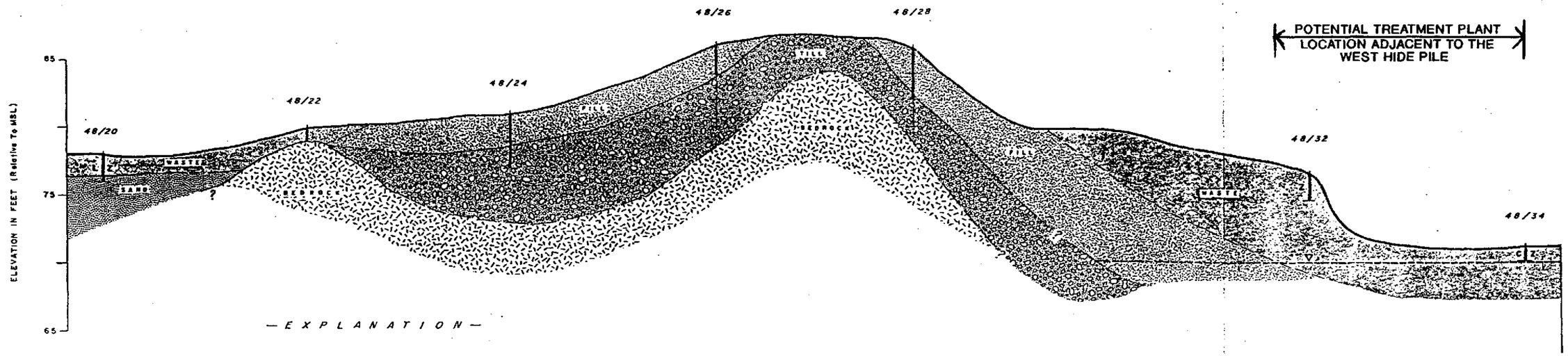
5 E

WEST

5 E'

EAST

POTENTIAL TREATMENT PLANT
LOCATION ADJACENT TO THE
WEST HIDE PILE



—EXPLANATION—

	Range Of Metal Concentration in PPM	
	100 - 1,000	>1,000
Arsenic	A	Ⓐ
Chromium	C	Ⓒ
Lead	L	Ⓛ
Copper	X	Ⓧ
Zinc	Z	Ⓩ
Mercury	M	Ⓜ

Boring
- Analyzed
- Logged Only
- Retained

NOTE : Where There Is No Symbol, Metal Concentration Is Less Than 100 PPM.

0 35 70 Ft.

TITLE
DETAILED
CROSS SECTION 5E - 5E'

PREPARED FOR
Stauffer Chemical Company

ROUX Consulting Ground-Water Geologists
ROUX ASSOCIATES INC

SCALE SHOWN
DATE MAR. 1984

FIGURE 47