Dike construction beside Pond #2 with inactive landfill in the background.

10/10/83

Work on the south end of Pond #2 and northern slope of inactive landfill.

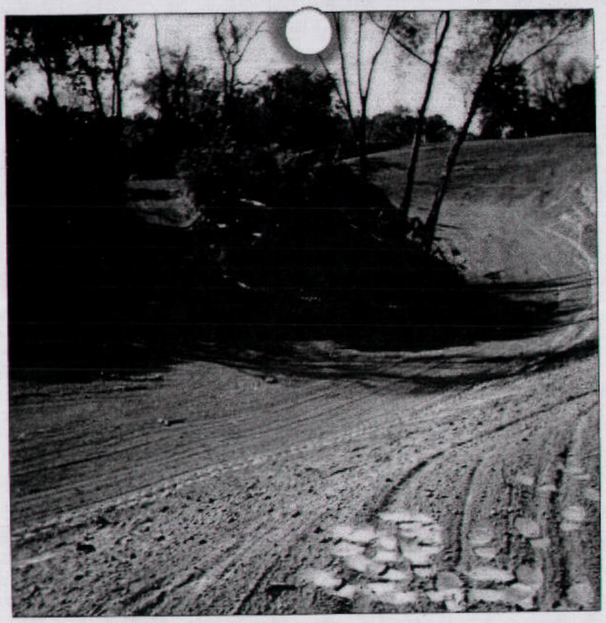
10/10/83

Dike work Along Pond #2
looking from Eastern end of inactive
landfill.
10/10/83

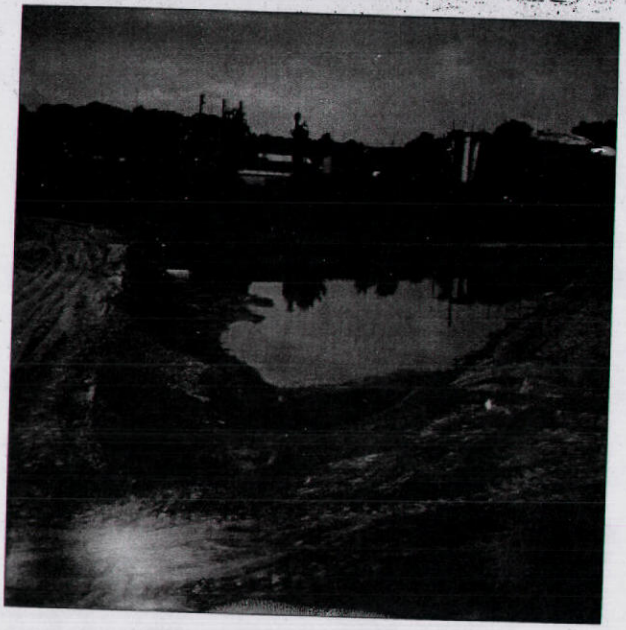
The southern portion of the impoundment and dike.

Looking at the landfill area across the surface impoundment.

Looking west along the northern edge of the landfill. Note the surface impoundment edge on the right.

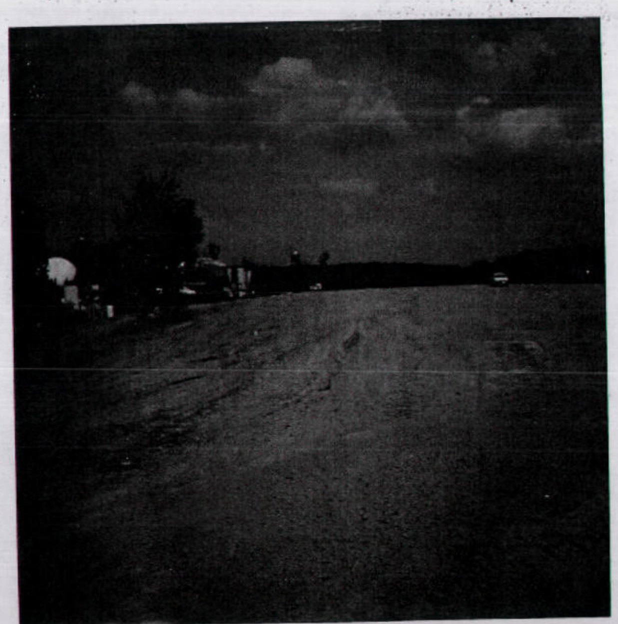


Low area southeast of the impoundment.



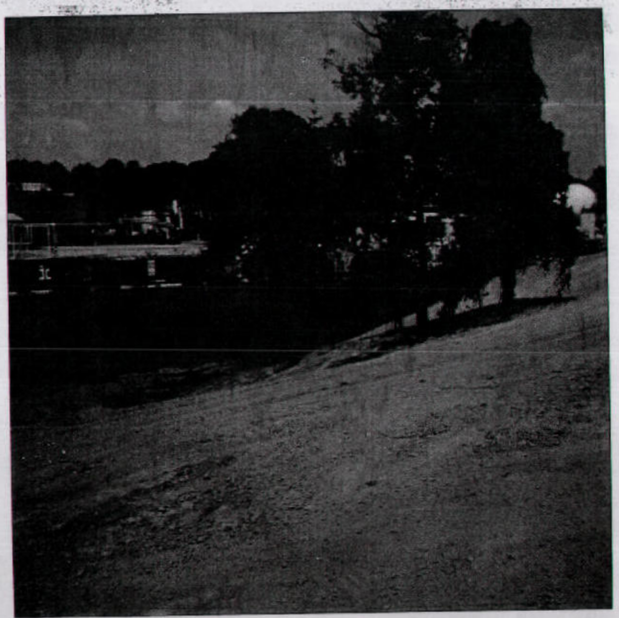
Work on dike around Pond #3

10/10/83



The top of the newly capped inactive landfill looking north from the southwestern end.

10/10/83



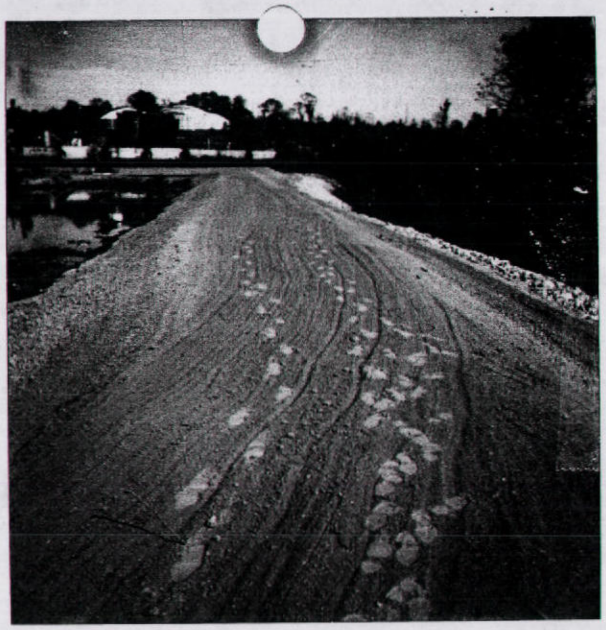
Slope of capped inactive landfill looking northwest. Also the drainage ditch on the west side is in view.

10/10/83

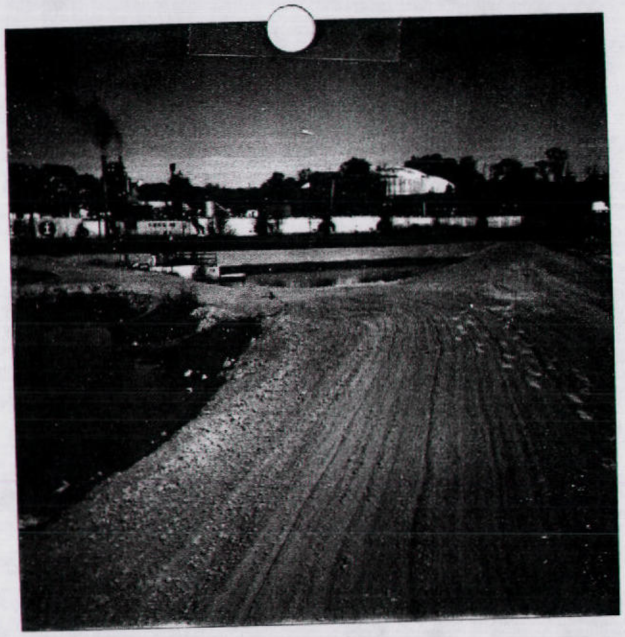
Western side of landfill with ditch in the background.

Vertac Chemical
Landfill (Inactive)
9-28-83

Inactive Landfill
Vertac Chemical
9-28-83



Looking north along the
Newly completed [illegible]



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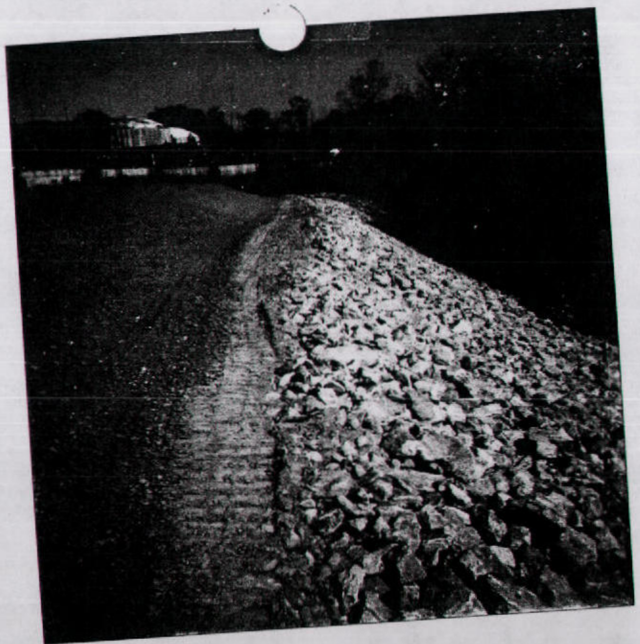
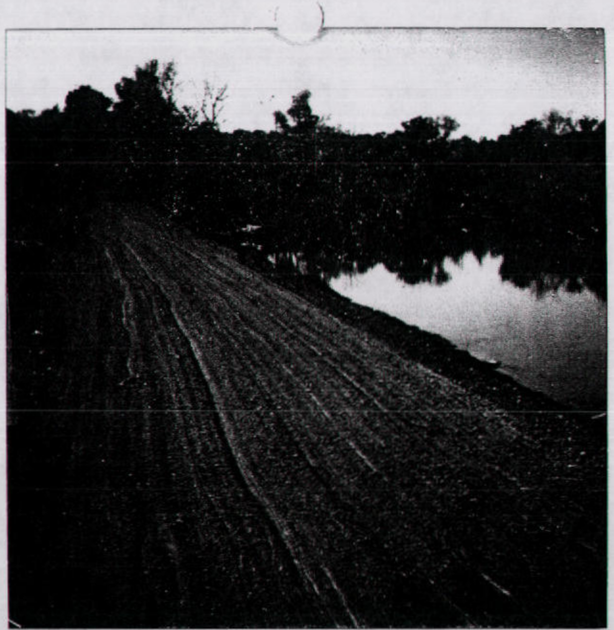
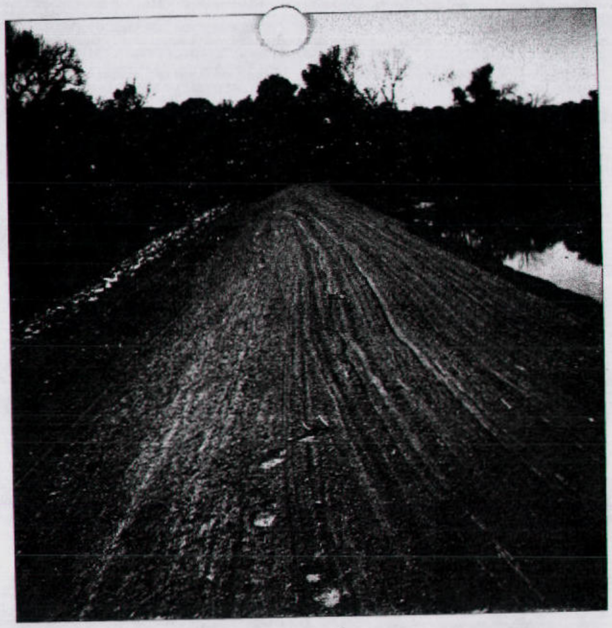
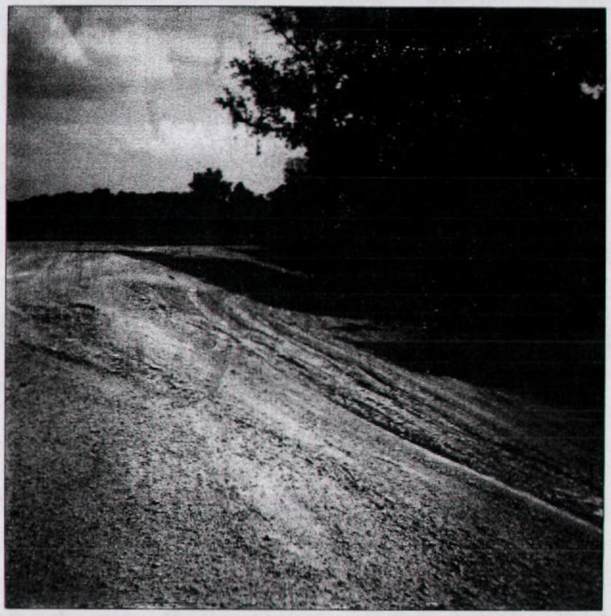


[illegible] the RR



[illegible] the
New [illegible]

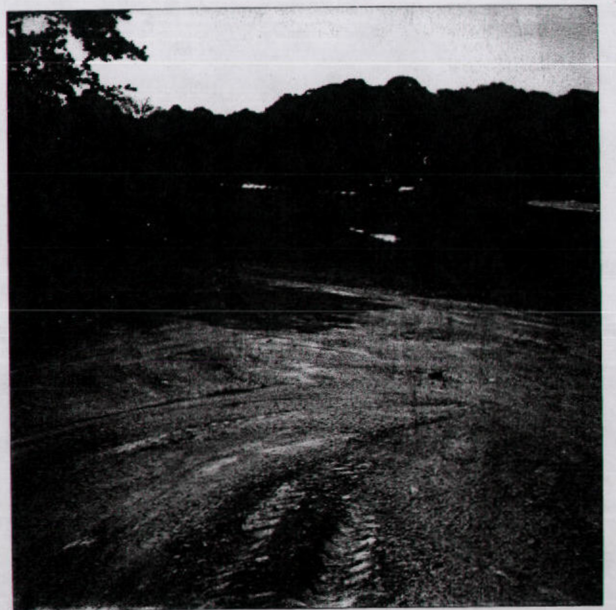




Southern slope of the newly capped inactive landfill looking east from the southwestern end of the landfill. 10/10/83

the [illegible]

newly [illegible]



Backside of inactive landfill looking southwest.

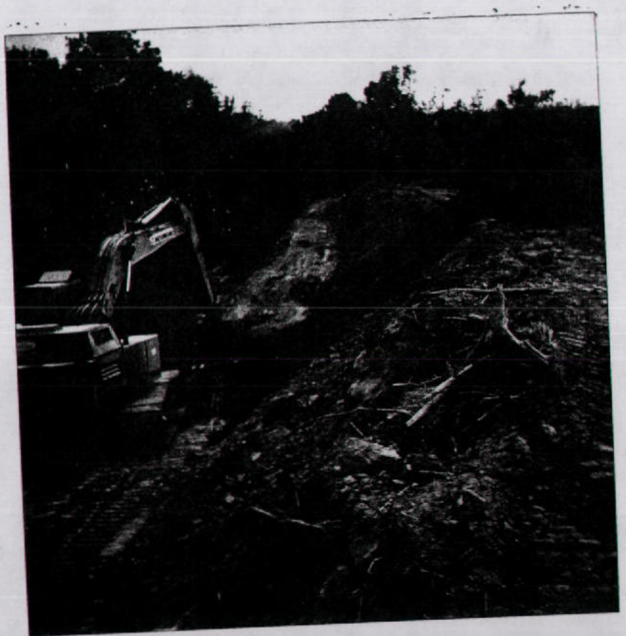
10/10/83

Western side of the newly capped inactive landfill looking east across the railroad tracks in the plant. 10/10/83

The top of the capped inactive landfill looking to the southwest from the northeastern end of landfill. 10/10/83

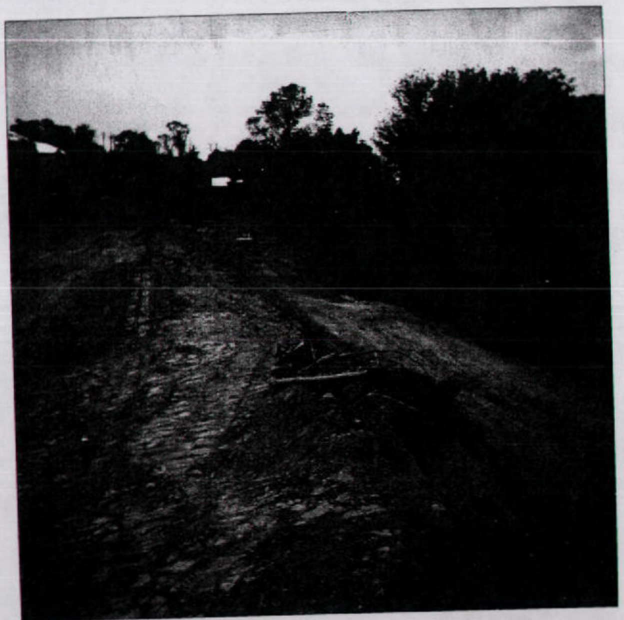
Inactive landfill with new cap in background

10/10/83



Dike construction looking south along Steels Bayou.

10/10/83

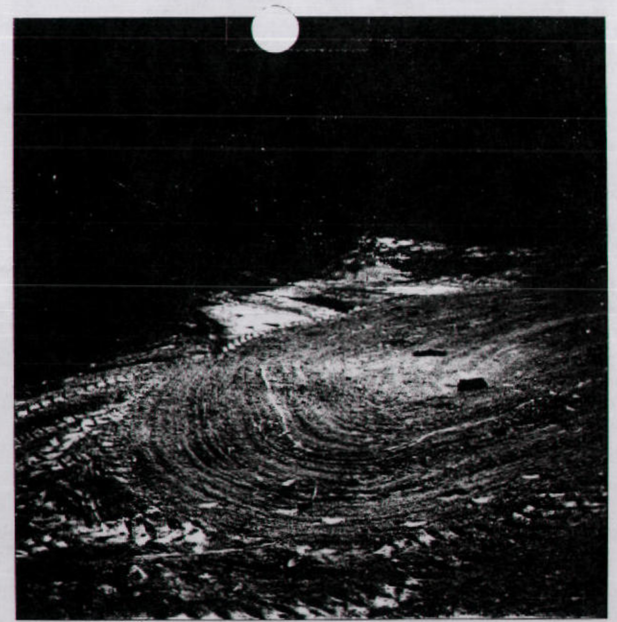


Work on the Northern end of the dike to establish the rock toe

10/10/83

Looking [illegible] eastern side of the [illegible]

Looking southwest to [illegible] across the southern portion of the dike.



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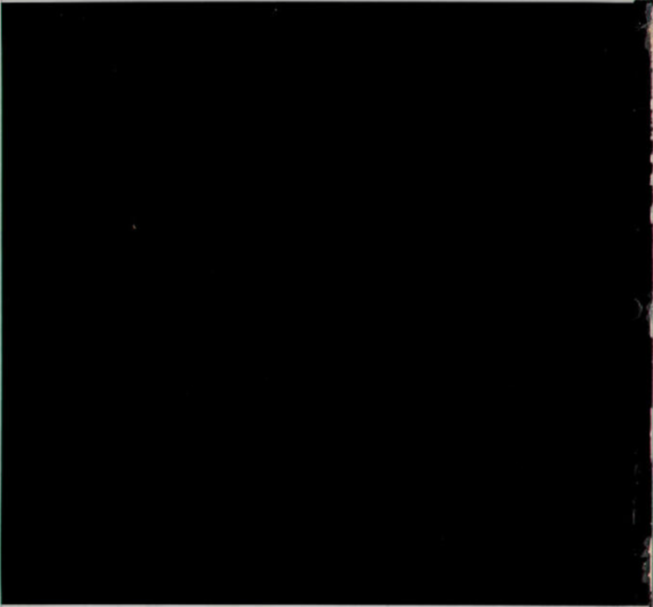
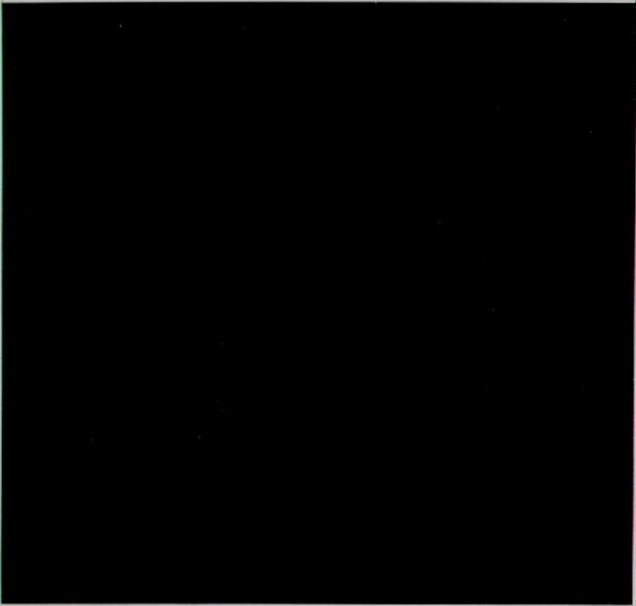


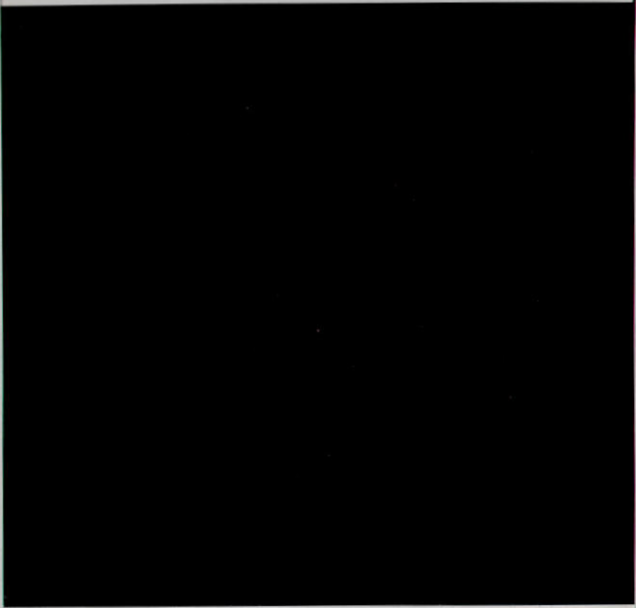
09622225552 POLAROID® 2

Soil Sampling
West of Hazardous Waste Drum Area

B

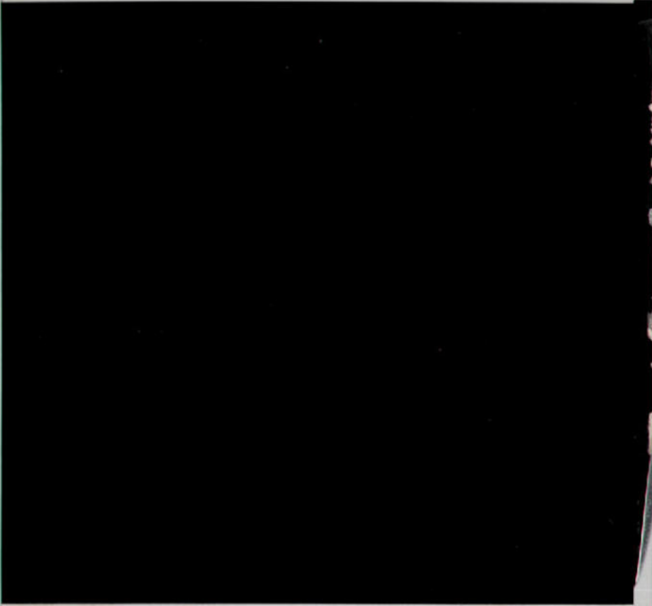


Broken piezometer
PZ-3



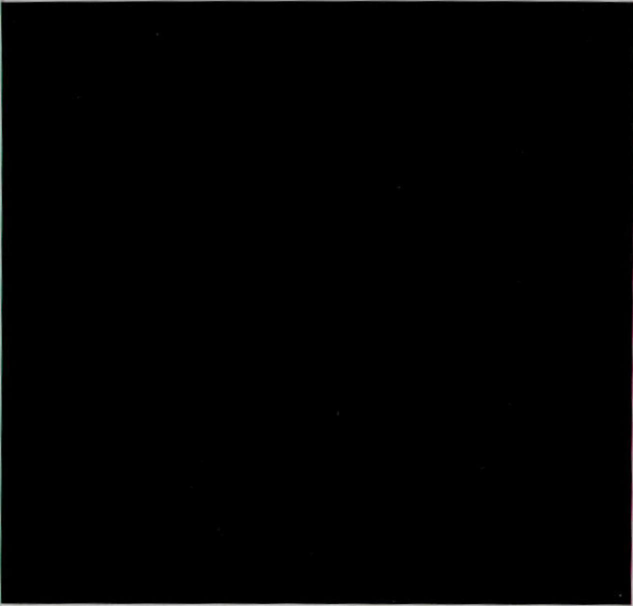
09622225552 POLAROID® 2

Hazardous Waste Drum Storage Area



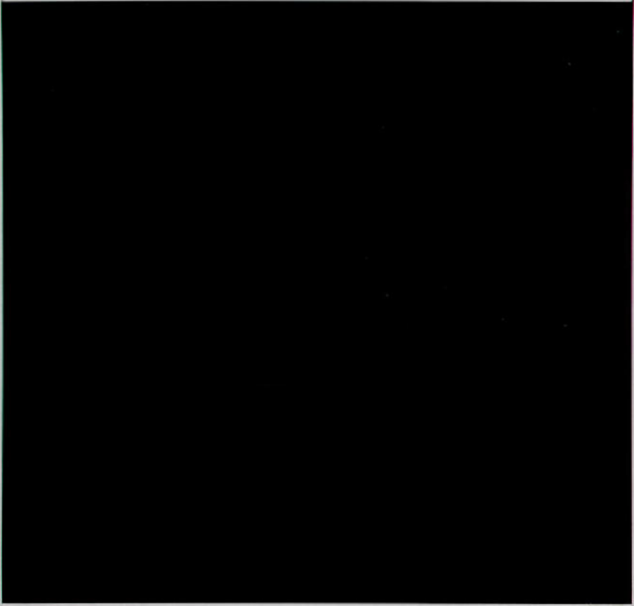
096222255552 POLAROID® 2

Drum Storage Area



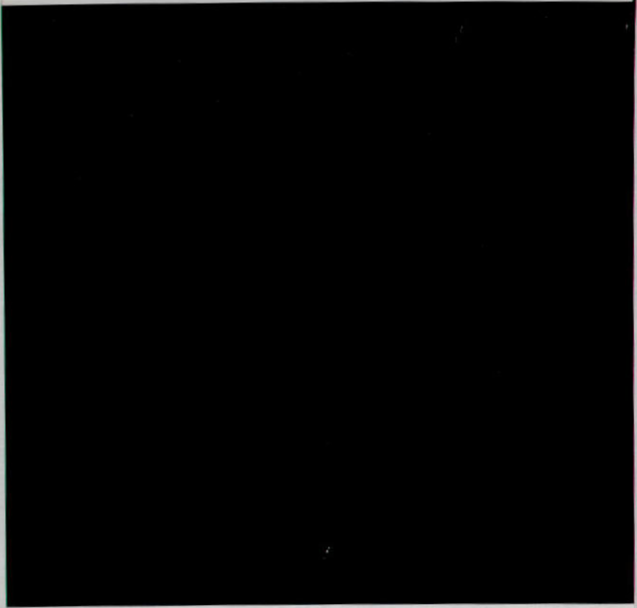
09622225552 POLAROID

Hazardous Waste Drum
Storage Area



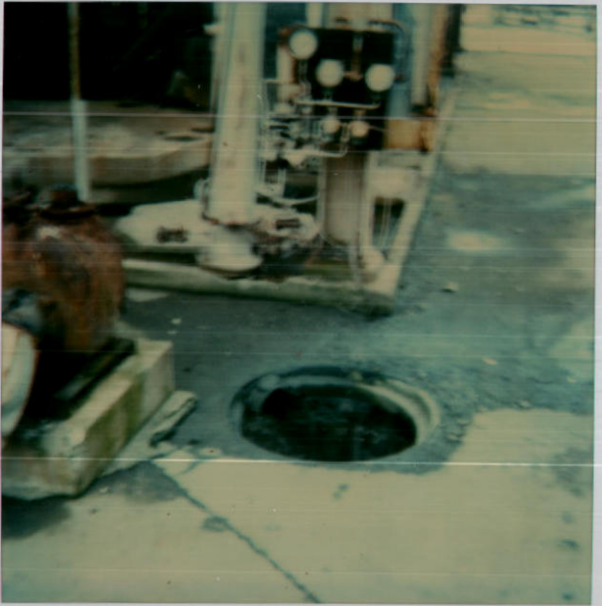
096222225552 POLAROID® 2

Bone yard
Titanium Heat Exchanger Tubes

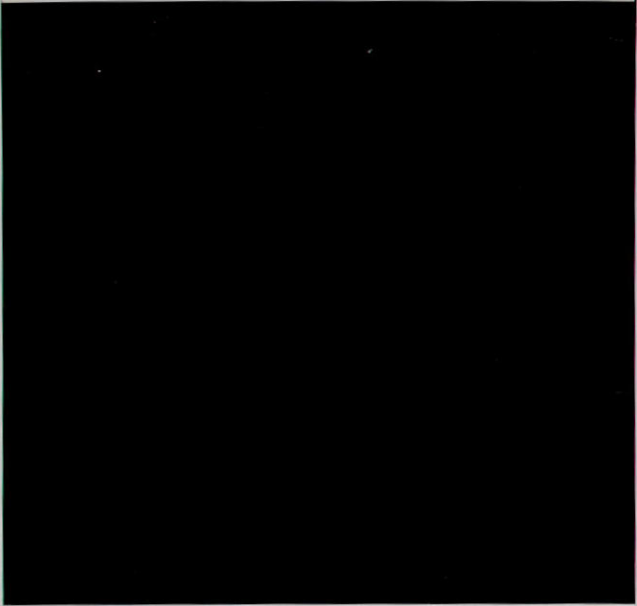


096222255552 POLAROID® 2

View of Surface Impoundments from Landfill South of Impoundment

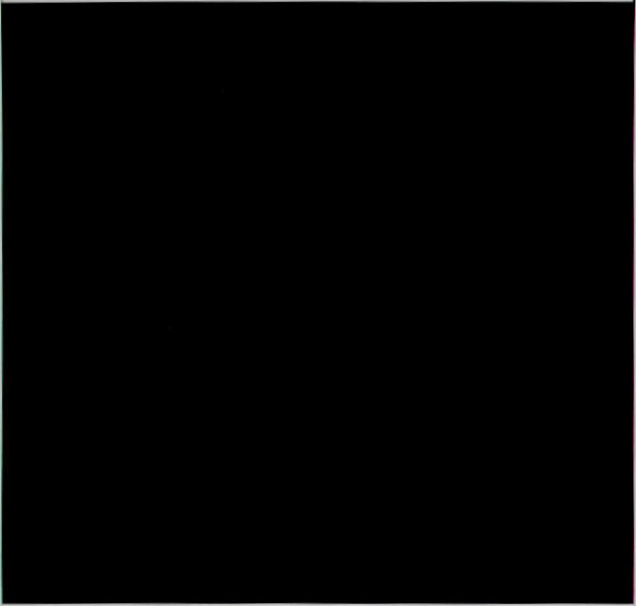


Sump in drum storage area



0962222 5552 POLAROID® 2

Returned Product Drum
Storage Area



09022225552 POLAROID® 2

Repaired Section of Fence

MCI / CONSULTING ENGINEERS, INC.

TECHNICAL SPECIFICATIONS
SURFACE IMPOUNDMENT DIKE IMPROVEMENTS
VERTAC CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

Prepared by:

MCI/Consulting Engineers, Inc.
P.O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010

August 8, 1983

TABLE OF CONTENTS

Technical Specifications

Dike Stabilization

Vertac Chemical Company
Vicksburg, Mississippi

SECTION I

1. SCOPE OF WORK

The work concerned by this project includes performing all site work including clearing and grubbing, grading work, and subsurface drainage structures and incidental work as shown by the Drawings and as hereinafter specified.

2. DEFINITIONS

Owner: Vertac Chemical Company

Engineer: MCI/Consulting Engineers, Inc. or designated representative.

3. CONSTRUCTION LAYOUT

The contractor shall be responsible for all surveying and construction layout. The contractor shall set grade stakes, batter boards or other appropriate monuments as required to facilitate construction.

Specifications for Clearing and Grubbing

SECTION II

1. SCOPE OF WORK

   This specification covers the clearing and grubbing associated with site preparation and related works and disposal of all brush, timber and debris and all incidental work related thereto.

2. LIMITS OF THE WORK

   All trees, stumps, vegetation, topsoil and other deleterious materials must be removed from all areas of the site which require excavation, filling or grading. Topsoil shall be removed to the depth necessary to remove all roots and organic matter.

3. DISPOSAL OF MATERIALS

   All timber, brush and other organic materials from clearing operations shall be disposed of on-site. The area for disposal will be adjacent to the project, but not in a drainageway.

Specifications for Grading

SECTION III

1. SCOPE OF WORK

The work covered in this section consists of furnishing all plant, labor and equipment and performing all operations in connection with the required excavation and placing all fills, including compaction, in accordance with the contract drawings and these specifications.

2. CLASSIFICATION

A. Excavation

All excavation shall be considered as unclassified. Subsurface exploratory data are available for review to assist the contractor in assessing the difficulty in achieving all excavations and in evaluating the work in general. However, the contractor is hereby notified that subsurface data furnished by the Owner is for general information only and the contractor is solely responsible for assessing the conditions.

3. DRAINAGE STRUCTURES

Drainage structures including ditches and inlets shall conform to the alignment, grades and details shown by the Plans.

4. GENERAL PROVISIONS

A. Lines and Grades: The fills shall be constructed to the lines and grades indicated on the drawings. Grading shall be finished with a tolerance of 0.1 foot of the grades indicated.

B. Conduct of the Work: The contractor shall maintain the site in a well-drained satisfactory condition at all times until final completion and acceptance of all work under the contract. Any approved fill material which is rendered unsuitable after being placed in the embankment and before final acceptance of the work shall be replaced by the contractor in a satisfactory manner at no additional cost to the Owner.

Throughout construction it is essential that the site be maintained in a well-drained condition. Water should not be allowed to pond or be impounded in any area, and drainage shall be controlled in a manner which will insure the quality of the work.

C. Density Tests: The grading operation will be continuously monitored by the engineer designated by the Owner or their representative hereinafter called the Engineer. During the construction of any fill, density and other tests will be conducted which may cause delays in the contractor's placing and compaction operations. The contractor shall coordinate his work with the operations of the Engineer.

5. MATERIALS

A. General: Fill shall consist of earth or rock. Materials to be stockpiled or wasted are to be specifically designated as such. Materials containing brush, roots, sod, or other deleterious materials will not be considered suitable. The suitability of the materials and their deposition shall be subject to the approval of the Engineer. Considerable drying of materials excavated within the existing dike will probably be required to allow proper compaction.

6. FILL

A. General: The suitability of all materials placed in the fill will be determined by the Engineer.

B. Definitions: The term "Fill" as used in these specifications is defined as the earth to be imported or excavated on the site and deposited in layers and compacted by rolling and/or tamping. Earth fill is considered to be organic-free soil derived from on-site excavations, or approved borrow areas.

7. PREPARATION FOR FILL PLACEMENT

A. General: All areas to have fill placed upon them will be examined by the Engineer after stripping, and any soft or otherwise deleterious materials will be removed prior to placement. No fill material shall be placed until the subgrade has been examined and approved by the Engineer.

B. Proofrolling: After stripping and prior to fill placement those areas which will have fill placed upon them shall be proofrolled with heavy, pneumatic-tired construction equipment. Any soft, unstable or otherwise unacceptable zones detected thereby, as determined by the Engineer, shall be undercut to firm soil, stabilized by compaction or otherwise repaired as deemed necessary by the Engineer. it is the intent of these specifications to provide a uniformly stable surface on which to place fill.

8. PLACEMENT

A. General: No fill shall be placed in any area until such areas have been inspected and approved. The gradation and distribution of materials throughout the compacted fill section shall be such that the fill will be free from lenses, pockets, streaks, layers of material differing substantially in texture or gradation from surrounding material of the same class. Successive loads of materials shall be dumped at locations on the fill as directed or approved by the Engineer. No fill shall be placed upon a frozen surface, nor shall snow, ice, or frozen earth be incorporated in the fill. Unless otherwise directed, all earth fill materials shall be kept crowned with temporary slopes of at least 2% until completed.

B. Compaction: Fill shall be constructed of approved materials and shall be placed in lifts to the lines and grades on the drawings and staked in the field.

Where the fill is predominately earth, it will be placed in uniform layers no greater than eight inches in thickness. Successive layers shall be compacted to at least 95% of its maximum density according to ASTM D 698 (standard Proctor). Compaction shall be accomplished by sheepsfoot rollers, power rollers or other equipment approved by the Engineer.

Rock fill shall be placed in lifts approximately equal in thickness to the maximum particle size contained therein, but in no case greater than twelve inches. This material shall be compacted using heavy rollers or tracked equipment until judged stable by the Engineer.

C. Compaction Equipment: Compaction equipment shall conform to standards of the industry and shall be used as prescribed. The Contractor will furnish and have on the job the various types of compaction and grading equipment which may be required to properly consolidate the various types of materials incorporated in the fill, or which are otherwise required to prepare the site.

D. Spreading: After dumping, the material shall be spread by bulldozer or grader in approximate horizontal layers over the fill areas. Concentration of oversize material will not be permitted. If, in the opinion of the geotechnical engineer, any individual stone or stones interfere with proper and smooth compaction, they shall be removed from the lift. During the dumping and spreading processes, the contractor shall maintain at all times a force of men adequate to remove all roots and debris from all fill materials. The entire surface of any fill under construction shall be maintained in such condition that construction equipment can travel over it. Ruts in the surface of any layer shall be filled satisfactorily before compacting.

9. MOISTURE CONTROL

The materials in each layer of the fill shall contain the amount of moisture necessary to obtain the desired compaction as determined by the Engineer. Material that is too wet when placed in the fill shall be spread over the fill surface and permitted to dry, assisted by discing or harrowing, if applicable, until the moisture content is reduced to an amount within tolerable limits. When the material is too dry, the contractor will be required to sprinkle each layer of fill. Discing, or other approved methods, will be required to work the moisture into the material until a uniform distribution of moisture is obtained. Water applied on a layer of fill shall be accurately controlled in amounts so that free water will not appear on the surface during or subsequent to rolling. Should too much water be added to any part of the fill so that the material is too wet to obtain the desired compaction, the rolling and all work on that section of the fill shall be delayed until the moisture content of the material is reduced to an amount with the specified limits. If, in the opinion of the Engineer, the top or contact surface of a partial fill section becomes too wet or too dry to permit suitable bond between these surfaces and the additional fill to be placed thereon, the contractor shall loosen the wet or dried material by scarifying or discing to such depths as may be directed, shall dampen or dry the loosened material to an acceptable moisture content, and shall then compact this layer in accordance with the applicable requirements to densities comparable to the underlying fill.

Drainage and Rockfill

SECTION IV

1. SCOPE

The work covered by this section consists of furnishing all plant, labor, equipment, and performing all operations in connection with the construction and placing of the subsurface drains and rock toe in accordance with the Drawings and these specifications.

2. TOE DRAIN

Toe drains shall be installed at the base of the slope as shown by the drawing. The rock shall be reasonably well graded with a maximum rock dimension of 12 inches. The rock shall contain no greater than 5% material passing a #200 sieve and shall have at least 50% of the particles (by weight) greater than 6 inches. The rock shall be placed in lifts not to exceed one foot and shall be composed of durable limestone that does not slake in water. Filter fabric (Supac 5-P or equivalent) shall be placed beneath the rock as shown on the drawings.

3. CHIMNEY DRAIN

Chimney drains shall be installed on the appropriately prepared slope as shown on the drawings. The rock shall conform to ASTM D 448, Size Number 357 or an alternate rock approved by MCI/Consulting Engineers, Inc. The rock shall be placed in lifts not exceeding eight inches and shall be composed of durable limestone that does not slake in water, or a washed, clean river gravel approved by MCI/Consulting Engineers, Inc. Filter fabric (Supac 5-P or equivalent) shall be placed around the rock fill as shown on the drawings and shall be overlapped a minimum of two feet at all locations where joints are necessary.

Vegetation

SECTION V

1. Permanent vegetation will be placed on all exposed or bare areas in accordance with the following sections.

   A. Soil Improvement: Evenly apply 150 pounds of agricultural limestone per 1000 square feet. Apply 10 pounds of 10-10-10 analysis fertilizer or equivalent per 1000 square feet.

   B. Seeding: Evenly apply 2 pounds of Rye Grass per 1000 square feet and 1/4 pound Common Bermuda per 1000 square feet. The lime, fertilizer, and seed may be applied separately by hand or with mechanical equipment, or they may be applied simultaneously by using a hydraulic seeder. Other seed as necessary to establish a year-round grass stand shall be applied.

   C. Protective Cover: To provide protective cover and conserve moisture during the establishment of vegetative cover, an erosion control fabric such as Hold-Gro or equivalent will be installed according to manufacturer's recommended procedures.

MCI / CONSULTING ENGINEERS, INC.

ENGINEERING REPORT FOR
SURFACE IMPOUNDMENT DIKE IMPROVEMENTS
VERTAC CHEMICAL CORPORATION
VICKSBURG, MISSISSIPPI

Prepared by:

MCI/Consulting Engineers, Inc.
P.O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010

FELON RAY WILSON
REGISTERED PROFESSIONAL ENGINEER
7772
STATE OF MISSISSIPPI
8/8/83

August 8, 1983

TABLE OF CONTENTS

1.0 INTRODUCTION

Contained herein is the engineering report to support the detailed construction plans for the improvements to the hazardous waste surface impoundment at Vertac Chemical Corporation, Vicksburg, Mississippi. Included with the construction drawings are a set of technical specifications for the dike construction. These specifications and design drawings are presented under separate cover.

This design has been performed by MCI/Consulting Engineers, Inc., utilizing Geologic Associates, Inc. as a geotechnical subcontractor. Vitae for key personnel involved in this project are contained in Appendix I.

2.0 PREVIOUS INVESTIGATIONS

After a failure of the subject dike in early 1983, MCI/Consulting Engineers, Inc. performed an investigation regarding the stability of the subject dike subsequent to the dike repair. This investigation titled "Engineering Analysis of Stability of Surface Impoundment Dike, Vertac Chemical Corporation, Vicksburg, Mississippi" was completed June 11, 1983. This report basically indicated that the mechanism of failure was excessive pore pressure which resulted from the rapid rise and fall of the adjacent creek. Accordingly, a dewatering mechanism was designed, as presented herewith, to relieve the excess pore pressure in the dike and raise the top of the dike to the 100-year flood elevation.

3.0 THRUST OF PROPOSED DESIGN

Based on the findings resulting from the preliminary investigation, the design of the dike improvements sought to relieve excessive pore pressure in the dike. In addition, EPA and State of Mississippi require that the impoundment be protected from the 100-year flood and run-on from the 25-year, 24-hour storm event. The design therefore involved an analysis of both criteria, with a resulting dike elevation to meet these requirements.

4.0 RUN-ON MANAGEMENT

The Vertac surface impoundment receives surface water run-on from much of the manufacturing facility. Based on an aerial and field reconnaissance, an area consisting of approximately 20.7 acres drains to the surface impoundment. Certification of this drainage area by a registered land surveyor is contained in Appendix III. In addition, approximately 3 acres of an inactive landfill located adjacent to the surface impoundment drains into the surface impoundment. Therefore, the total surface area draining to the surface impoundment is 28.3 acres, including the area encompassed by the surface impoundment itself (4.6 acres). Based on site conditions identified and in accordance with SCS hydrologic procedures, the 25 year-24 hour storm will produce a volume of 15.1 acre-feet of run-on into the pond. Utilizing the new dike design as contained in the accompanying construction plans, a storage volume of 17.1 acre-feet is available at elevation 107.0 MSL (allowing 2 feet of freeboard). This does not include the 600 gallons per minute outflow provided by the existing pumping system out of the pond. This volume is based on an average water elevation of 102.0 at the time of the storm. The average water level in the impoundment is based on elevation readings at the time of three different topographic surveys of, or around, the impoundments. Run-on volume calculations for the completed dike are contained in Appendix III.

Run-off management is not a consideration for the facility due to the configuration of the surface impoundment. Any water which comes in contact with the interior of the dike is transmitted to the surface impoundment and is later pumped to the plant for treatment. The proposed dike design contains no overflow structures.

5.0 SUMMARY OF DIKE DESIGN

5.1 100-Year Flood Elevation

As determined by the U.S. Army Corps of Engineers, the 100-year flood elevation at the intersection of Hatcher and Stout's Bayou is 109.00 MSL. The existing top of dike elevation is approximately 105.0 MSL. The 100-year flood elevation is higher than the elevation required for controlling the run-on onto the pond. Accordingly, the top of the new dike is designed to be constructed to elevation 109.0 MSL. A certification by the U.S. Army Corps of Engineers, Vicksburg District, concerning this elevation is contained in Appendix IV. Comments from the Corps of Engineers regarding permitting of the dike improvements are contained in Appendix IV also.

5.2 Hydrodynamic Forces

Based on strength parameters and unit weights from laboratory data, slope stability analyses of the dike, after the subject improvements, were performed. Effective strength parameters of both existing and proposed soil types were used in these analyses. This proposed soil information was determined by utilizing samples of soil collected at a borrow area adjacent to the Vertac facility, as located on Sheet 1 of the design plans. This hill is primarily composed of a loess material and is the closest suitable borrow area to the subject dike. In addition, in-situ data from the dike investigation (discussed in Section 2.0) was used. The stability analysis was performed with the aid of a digital computer using circular arc failure surface. The computer program used is entitled STABL and was developed during the joint highway research project HRP-79-6 by Purdue University and Indiana State Highway Commission. Analysis of the data yielded the following information regarding safety factors:

(1) The Safety Factor for the most critical conditions defined is 1.432. This condition occurs when the impoundment is under a high water (107.0 MSL) condition and a rapid creek drawdown occurs. Deep failure is considered critical under these conditions.

(2) The Safety Factor for normal pond elevation (102.0 MSL) is 1.564. This is for deep failure.

(3) The Safety Factor for maximum pond elevation (107.0 MSL) for a shallow failure is 1.487.

Results of the slope stability analyses including computer plots of the failure surfaces, and laboratory data on the in-situ soil and borrow soil to be used for construction of the new dike are contained in Appendix II. Detailed information on the specifications for the soil compaction and the material to be used for the rock drains are contained in the Technical Specifications for the construction of the dike.

5.3 Hydrostatic Forces

The slope stability analysis of the dike considers both hydrostatic and hydrodynamic forces.

5.4 Seepage Out of Pond ?

The lower portions of the existing dike have an in-situ permeability of 8.1×10^{-6} cm/sec. With a minimum dike width of 18 feet (EL 107.0), seepage through this narrowest portion of the dike would require 2.1 years. This assumes saturation at EL 107.0 for this entire period of time and no decrease in dike permeability as a result of the dike improvements.

5.5 Erosion Protection

Velocity calculations in Stout's Bayou reveal the following velocities along the dike:

Elevation (MSL)	Velocity (feet per second)
95	2.85
100	3.9
above 100	Out of banks opposite side

To protect the dike at lower elevations, large diameter rock will be used for the toe of the rock drain. Above elevation 100.0, velocities should decrease as the creek spills out of its banks.

6.0 CONSTRUCTION

Prior to beginning construction, both ponds of the surface impoundment which border Stout's Bayou will be hydraulically disconnected from the entrance pond either by dewatering the ponds or physically cutting the portion of the pond in contact with the dike off from the remainder of the pond. All liquid in these ponds will be pumped into Pond 3 to be subsequently pumped to the existing wastewater treatment system. Initially, the interior portion of the dike will be constructed first in order to provide safety against failure during the construction of the rock drain. Details for all the construction activities are contained in the project specifications.

EXPERIENCE AND QUALIFICATIONS OF
FELON R. WILSON

Position with MCI/Consulting Engineers, Inc. - Manager of Industrial Operations, Senior Environmental Engineer

EDUCATION:

1975	Mississippi State University Starkville, Mississippi	Bachelor of Science in Civil Engineering
1977	Mississippi State University Starkville, Mississippi	Master of Science in Environmental Engineering
	University of Tennessee Knoxville, Tennessee	Graduate Studies in Industrial Management

EXPERIENCE:

1981 - Present MCI/Consulting Engineers, Inc.
Knoxville, Tennessee

Manager of Industrial Operations
Responsible for technical and managerial services for industrial solid and hazardous waste management. Ground water monitoring, disposal area closure, and hydrogeologic investigations conducted for various facilities. Project Management and Design of landfill operations for industrial clients. Evaluation of ground water contamination data for purposes of secure closure; thorough evaluations of past facility operations for contamination source evaluation.

1980 - 1981 Environmental Systems Corporation
Knoxville, Tennessee

Project Engineer - Group leader for environmental engineering services for industrial hazardous waste management. Regulatory management of hydrogeologic projects relating to buried chemical wastes. Manager of Analytical Laboratory.

1978 - 1979 Union Carbide Corporation
Nuclear Division Y-12 Plant
Oak Ridge, Tennessee
Co-Plant Disposal Coordinator
Management of Solid and Hazardous Wastes from three large Nuclear Facilities. Siting of waste disposal areas and monitoring of buried wastes in Karst terrain. Evaluation of engineered containment and cleanup techniques for leaching wastes. Management of PCB contaminated liquids and coordinator with safety and environmental groups for detoxification and neutralization of reactive and ignitable hazardous wastes. Advisor to Department Head concerning applicable environmental regulations.

1978 University of Southwestern Louisiana
Department of Civil Engineering
Lafayette, Louisiana
Lecturer

1977 - 1978 Domingue, Szabo & Associates
Lafayette, Louisiana
Sanitary Engineer - Industrial wastewater engineering and biological residuals management; Manager of Analytical Laboratory for EPA demonstration Project.

1975 - 1977 E. E. Tumlinson & Associates
West Point, Mississippi
Civil Engineer

PROFESSIONAL QUALIFICATIONS:

Professional Engineer - Tennessee, Virginia, Mississippi, Kentucky Arkansas, and Florida

MEMBERSHIPS:

American Society of Civil Engineers
National Society of Professional Engineers
Water Pollution Control Federation
Tennessee Society of Professional Engineers
National Solid Wastes Management Association

PUBLICATIONS:

1. "Effect of Alum Addition on Aerobic Digestion of Activated Sludge", Water and Sewage Works, July, 1977.

2. "Parametric Studies for Hypochlorite Generation of Undivided Cells", Masters Thesis, Mississippi State University, May, 1977.

3. "Basics of Secondary and Tertiary Wastewater Treatment", Louisiana State University, Proceedings, Annual Conference on Sewage and Industrial Wastes, Baton Rouge, Louisiana, April, 1978.

4. "Dissolved Air Flotation Treatment of Gulf Shrimp Cannery Wastewater", Proceedings, Ninth National Symposium on Food Processing Wastes, Denver, Colorado, March, 1978.

5. "Dissolved Air Flotation Treatment of Gulf Shrimp Cannery Wastewater", EPA Report No. EPA-600/2-79-061, March, 1979.

6. "The Impact of Subtitle C of RCRA Upon Industrial Wastewater Treatment Facilities", Proceedings, 13th Mid Atlantic Industrial Waste Conference, Newark, Delaware, June, 1981.

7. "Saturated Zone vs. Unsaturated Zone Monitoring at Hazardous Waste Land Treatment Storage and Disposal Sites", Proceedings, ASCE Environmental Engineering Division Annual Conference, Atlanta, Georgia, July, 1981.

8. "Sanitary Landfill Site Selection, Design, and Operations to Minimize Impact on Groudwater Resources", 1981 AWRA Annual Conference, Atlanta, Georgia, October, 1981.

9. "Closure of a Baghouse Dust Disposal Site in a Karst Geologic Area," Proceedings, ASCE Environmental Engineering Division Annual Conference, Minneapolis, Minnesota, July, 1982.

ADDITIONAL INFORMATION

* Chapter Secretary, Tennessee Society of Professional Engineers, Knoxville Chapter, 1982-1983.

* Member, ASCE National Subcommittee on Hazardous Waste Management.

MCI/CONSULTING ENGINEERS, INC.
P. O. Box 23010
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010
Telephone (615) 966-9788

Corporate Headquarters:
Nashville, Tennessee

Branch Offices:
Knoxville, Tennessee
Denver, Colorado
Huntsville, Alabama

EXPERIENCE AND QUAILFICATIONS OF MARVIN H. BOWERS

Position with MCI/Consulting Engineers, Inc. - Senior Civil Engineer

EDUCATION

1973	University of Tennessee Knoxville, Tennessee	Bachelor of Science in Civil Engineering
1977	University of Tennessee Knoxville, Tennessee	Master of Science in Environmental Engineering

EXPERIENCE

January, 1983 - Present
MCI/Consulting Engineers Inc.
Knoxville, Tennessee
Senior Civil Engineer

Responsible for site layout of commercial, residential, and industrial developments including design of surface drainage facilities, water and wastewater treatment facilities, water distribution and wastewater collection systems, roads, and earth work.

1980-1982
Environmental Systems Corporation
Knoxville, Tennessee
Manager, Knoxville office of Hydrogeologic Services Division.

Responsible for design of earthwork, drainage, roads, water treatment facilities, revegetation plans, and hydrologic evaluations for numerous projects. Prepared compliance programs for hazardous waste disposal facilities under the Resource Conservation and Recovery Act.

1977-1980
Wayne L. Smith and Associates, Inc.
Knoxville, Tennessee
Project Engineer

Responsible for environmental impact assessment of highway relocation, engineering feasibility studies for several water and wastewater system expansions, hydraulic analysis and design for several water distribution and wastewater collection systems, design of surface coal mines, and engineering evaluation of industrial development sites. Also responsible for preparation of grant and loan applications for municipal clients.

1975-1976 Department of Civil Engineering, University of Tennessee
Knoxville, Tennessee
Graduate Research Assistant

Performed research on the hydrologic impacts of land use changes and assisted in the development of hydrologic models.

1973-1975 Atlantic Division, Naval Facilities Engineering Command
Yorktown, Virginia
Assistant Resident Officer in Charge of Construction at the Naval Weapons Station.

Responsible for the administration and inspection of naval shore facility construction including bid openings, materials approval, progress payment approval, cost estimates, and change order negotiations. Completed courses in contract administration and network analysis systems.

PERSONAL QUALIFICATIONS

Professional Engineer - Tennessee, Kentucky, Alabama and Virginia

ADDITIONAL INFORMATION

Project Manager or Principal Engineer for the following projects:

- Wastewater System Expansion, Crossville, Tennessee
- Waste System Expansion, Rockwood, Tennessee
- Water System Expansion, Pleasant Valley Utility District, Johnson County, Tennessee
- Hydraulic Analysis, Glen Hills Utility District, Green County, Tennessee
- Water System Development, Clearfork Utility District, Caliborne and Campbell Counties, Tennessee
- Industrial Park Feasibility Study, Oliver Springs, Tennessee
- Environmental Impact Assessment, Relocation of State Route 32, Tennessee Department of Transportation
- R.C.R.A. Compliance Program, Ashland Petroleum Co., Ashland, Kentucky

EXPERIENCE AND QUALIFICATIONS OF
KENNETH E. DARNELL

Geologic Associates, Inc., Assignment: Principal Engineer
East Tennessee Manager,
Knoxville, Tennessee

EDUCATION

1974 -	University of Alabama Tuscaloosa, Alabama	Bachelor of Science in Civil Engineering

REGISTRATION

Professional Engineer - Tennessee, Kentucky, Florida, California, Nevada

EXPERIENCE

1970 - 1974	Co-operative Education work with Tennessee Department of Transportation and Design Draftsman for McGiffert and Associates.
1974 - 1976	Project Soils and Materials Engineer Law Engineering Testing Company, Birmingham, Alabama
1976 - 1977	Metals Testing and Inspection Department Manager, Law Engineering Testing Company, Nashville, Tennessee
1977 - 1979	Senior Geotechnical and Materials Engineer with Geologic Associates, Inc. Principal duties include: Engineer in charge of various geotechnical studies and geotechnical and materials construction projects, and pollution abatement and hydrological designs for the mining industry.
1979 - Present	East Tennessee Manager, Principal Engineer in charge of East Tennessee operations.

REPRESENTATIVE MAJOR PROJECT RESPONSIBILITIES

Principal Geotechnical Engineer for 1982 World's Fair, Knoxville, Tennessee

Project geotechnical and materials engineer for two major hospitals of the University of Alabama in Birmingham, Medical Complex.

Principal Engineer for numerous landslide repairs in Blue Ridge Mountains for Clinchfield Railroad Company.

Project metals engineer for Union Carbide Graphite Plant, Clarksville, Tennessee.

Project engineer for geotechnical study and design of Deadhead Route for Marion 5761 Shovel, Amax Coal Company, Ayregem Mine, Central City, Kentucky.

Project engineer for pollution abatement design for Kelley's Creek Mines of Tennessee Consolidated Coal Company.

Foundation and Materials Consultant for the U.S. Tobacco Company.

Designer for two major refuse dams for Eastover Coal Company.

MEMBERSHIPS

American Society of Civil Engineers
National Society of Professional Engineers
International Society of Soil Mechanics and Foundation Engineers

PUBLICATIONS AND TECHNICAL PAPERS

"Highway Landslides Along Cumberland Plateau", presented to joint meeting of Alabama-Mississippi sections of ASCE in 1974.

"Geotechnical Considerations for Deadheading a Marion 5761 Shovel", presented to and published by Ohio River Valley Soils Seminar, 1979.

"Considerations Leading to the Selection of Drilled Pier Foundations", presented to Drilled Pier Seminar conducted by Tennessee Valley Section of ASCE, 1981.

"Design and Construction of the Abner Fork Slurry Impoundment: A Case of History", presented at the 8th Annual Kentucky Coal Seminar, Pineville, Kentucky, May 4, 1982.

"Multi-Layer, Impervious, Stable Liner as Used for the Decorative Lakes, 1982 World's Fair", presented to the American Society of Civil Engineers Geotechnical Conference, Las Vegas, Nevada, April, 1982.

Biographical Sketch - KENNETH E. DARNELL, P.E.

Mr. Darnell, a native of Bowling Green, Kentucky, attended the University of Alabama from 1969 to 1974, where he received a Bachelor of Science degree in Civil Engineering in 1974. While at the University, Mr. Darnell received work experience in many phases of Civil Engineering through a Co-operative Education program with the Tennessee Highway Department and part-time work with a Tuscaloosa, Alabama, Civil Engineering firm. Upon graduation Mr. Darnell joined a geotechnical and materials engineering firm in Birminghtm, Alabama, and in 1977 he joined Geologic Associates, Inc., in Franklin, Tennessee. In 1979, Mr. Darnell was appointed principal engineer and manager of Geologic Associates East Tennessee operations, and he continues to serve in that capacity.

Mr. Darnell has acted as a geotechnical engineer for numerous projects of substantial scope throughout the United States. These projects include the 1982 World's Fair, major earth dams, landslides, remedial treatment of sinkholes, and foundation designs. Further, he has published papers on several of the subjects listed above.

He is a registered engineer in Tennessee, Kentucky, Florida, California, and Nevada and is a member of the American Society of Civil Engineers and the National Society of Professional Engineers.

EXPERIENCE AND QUALIFICATIONS OF
WILLIAM J. ROSEN

Position with Geologic Associates, Inc. - Senior Engineer
Knoxville, Tennessee

EDUCATION

B. S. C. E., 1973, University of Tennessee, Knoxville, Tennessee
Major Area of Specialization: Construction

M. S., 1974, University of Tennessee, Knoxville, Tennessee
Major Area of Specialization: Soil Mechanics and Foundation
Minor Area of Specialization: Materials
Thesis Title: "Development of Design Criteria for Filter Fabrics"

CONTINUING EDUCATION

Hydrology and Sedimentation, Surface Mining Control and Reclamation Law, Ohio River Valley Soils Seminars VI, VII, VIII, Surface Mining Control and Reclamation Act of 1977, Stability Analysis of Mine Refuse

EXPERIENCE

1981 - Present	Senior Engineer Geologic Associates, Inc. Knoxville, Tennessee
1980 - 1981	Branch Manager Soil and Material Engineers, Inc. Knoxville, Tennessee
1974 - 1980	Part-owner, President Marks-Rosen, Inc. Knoxville, Tennessee
1978 - 1980	Chief Engineer Conrich-Tennessee, Inc.

1976 - 1980	Part-time instructor in Civil Engineering University of Tennessee Knoxville, Tennessee
1976 - 1978	Part-time instructor in Civil Engineering Roane State Community College Harriman, Tennessee

REGISTRATION

Professional Engineer - Tennessee and Kentucky
Registered Land Surveyor - Tennessee

AFFILIATIONS

Tennessee Society of Professional Engineers
National Society of Professional Engineers
American Society of Civil Engineers

PUBLICATIONS AND TECHNICAL PAPERS

Co-author, "Geological Studies of Selected or Marginal Sites for Sanitary Landfills", Report 73-7, submitted to Tennessee Department of Public Health, September 1973.

Co-author, "Cold Weather Lime Stabilization", presented at 53rd Annual Meeting, Highway Research Board, National Academy of Science, January, 1974.

Author, "Geotechnical Oversight Nullifies Proper Procedures", Proceedings of the Seventh Ohio River Valley Soils Seminar, Lexington, Kentucky, October, 1976.

Co-author, "Design and Construction of the Abner Fork Slurry Impoundment: A Case History", presented at the 8th Annual Kentucky Coal Seminar, Pineville, Kentucky, May 4, 1982.

REPRESENTATIVE PROJECTS

Project Engineer for comprehensive field study of the use of a geotextile for erosion control and filter applications.

Project Geotechnical Engineer for extensive embankment fills associated with airport construction in mountainous western North Carolina.

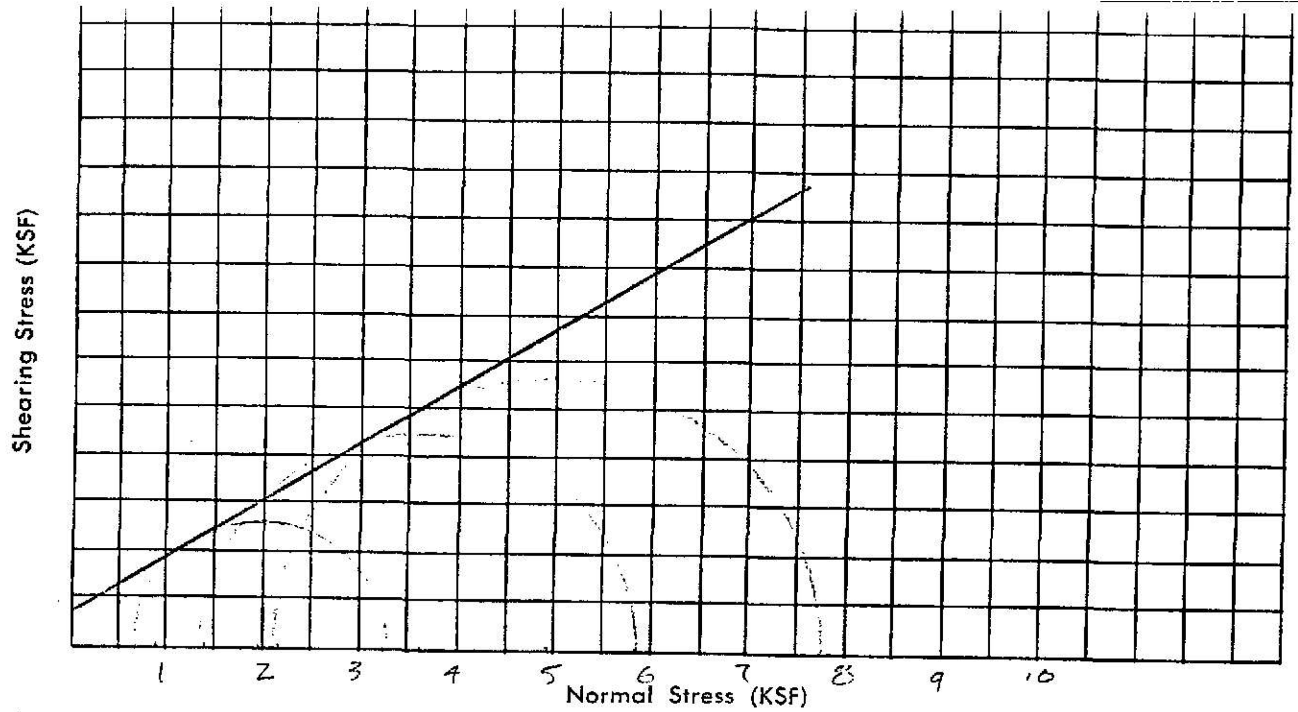
Project Engineer for coal reserve evaluation of 1100 acre tract in southeastern Ohio and 45,000 acre tract in eastern Tennessee.

Project Engineer for corrective procedures involving massive slope stability problems for condominium development in Knoxville.

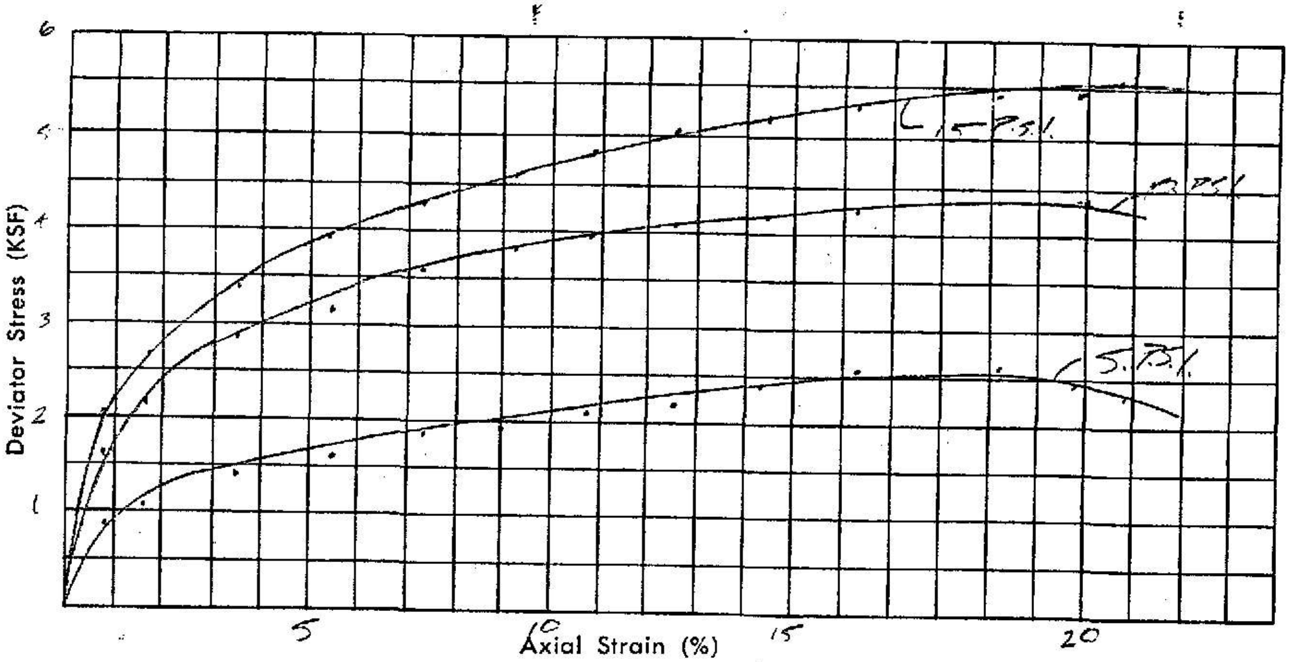
Project Geotechnical Engineer for Nissan Motor Manufacturing Plant, Smyrna, Tennessee.

Project Engineer for construction services for the A. E. Staley Plant, Loudon, Tennessee.

LABORATORY DATA
BORROW MATERIAL



MOHR DIAGRAMS — φ



STRESS — STRAIN CURVES

TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silty, sl sandy, DK Brown Proposed Fill material

COHESION (c) 900 PSF

ANGLE OF INTERNAL FRICTION (φ) 35.2°

UNIT WEIGHT, PCF 115.5

WATER CONTENT, % 20.2

SPECIFIC GRAVITY 2.6

VOID RATIO 0.689

CLIENT MCI, Inc

PROJECT Vertac Chemical Corp.

PROJECT NO.: 83-169K

BORING NO.: 2, 4, 5

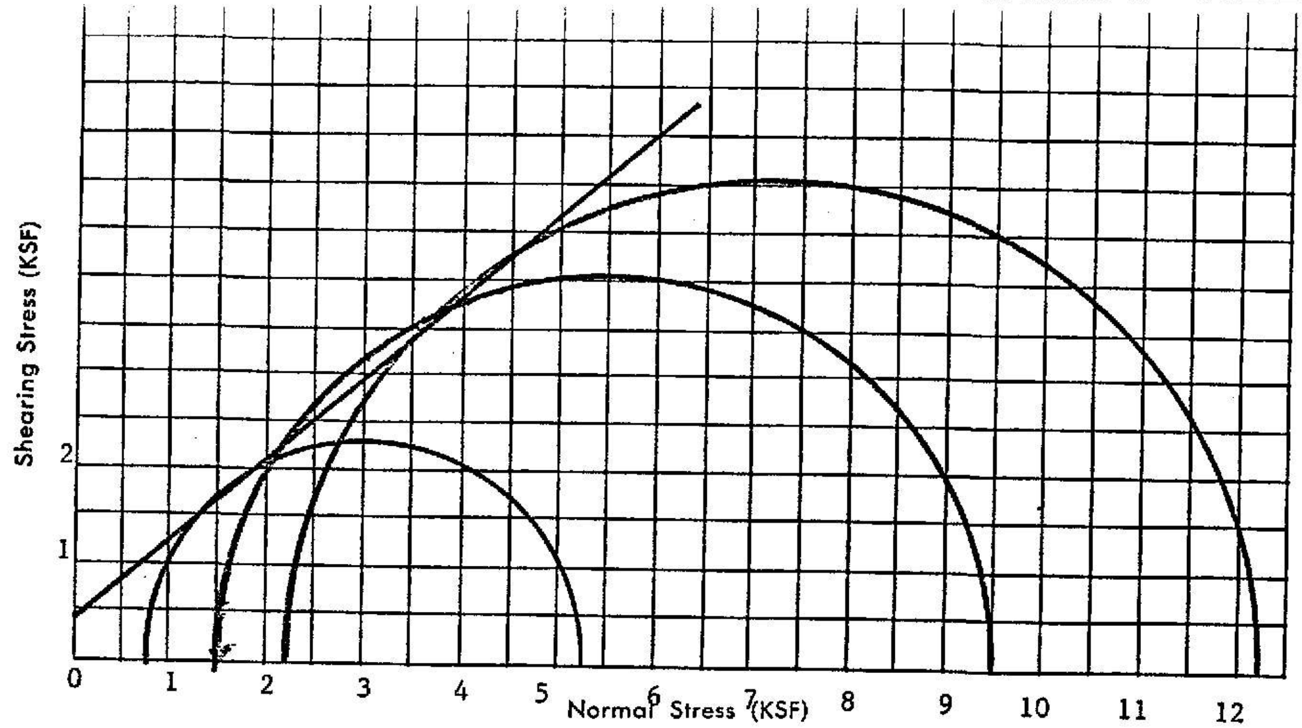
SAMPLE NO.: St-2, St-3, St-5

ELEV. OR DEPTH 3.0-5.0' 8.0-10.0' [illegible]

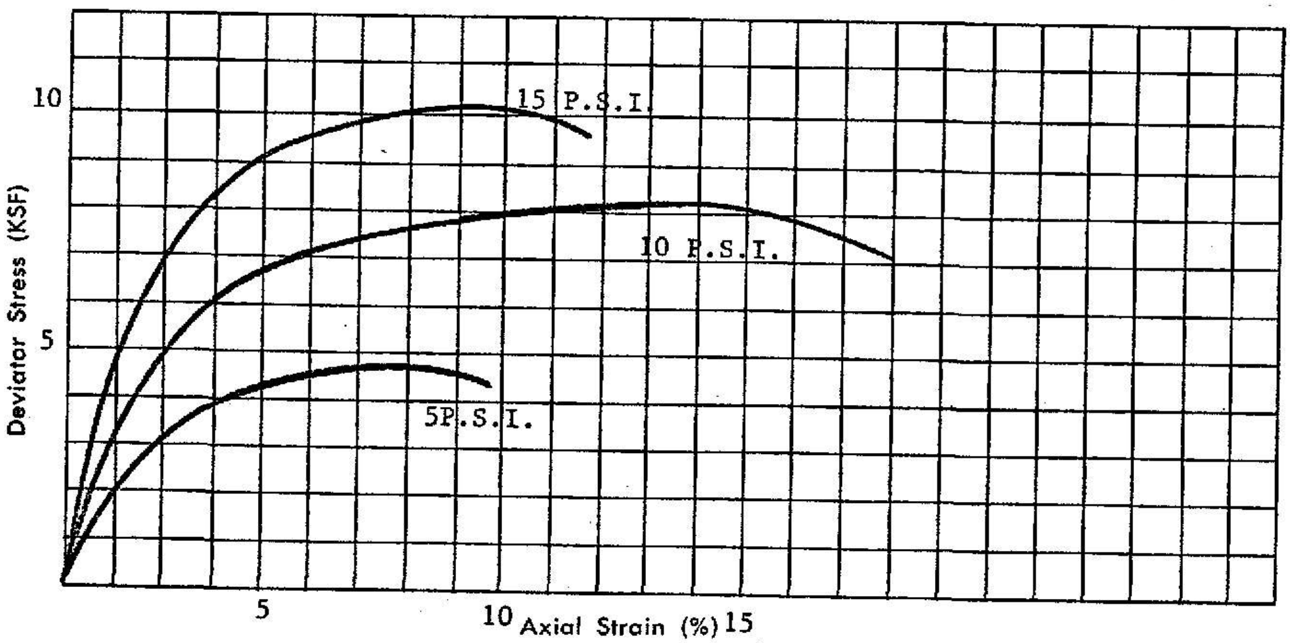
DATE: June, 1985

GEOLOGIC ASSOCIATES, INC.

LABORATORY DATA
IN-SITU SOIL



MOHR DIAGRAMS — ϕ



STRESS — STRAIN CURVES

TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silt, Very Slightly Clayey, Dark Brown

COHESION (c) 400 PSF

ANGLE OF INTERNAL FRICTION (ϕ) 39°

UNIT WEIGHT, PCF 123.8 (γ_d=100.9)

WATER CONTENT, % 22.7

SPECIFIC GRAVITY 2.60

VOID RATIO 0.61

CLIENT MCI, Inc.

PROJECT Vertac Chemical Corporation

PROJECT NO.: 83-169K

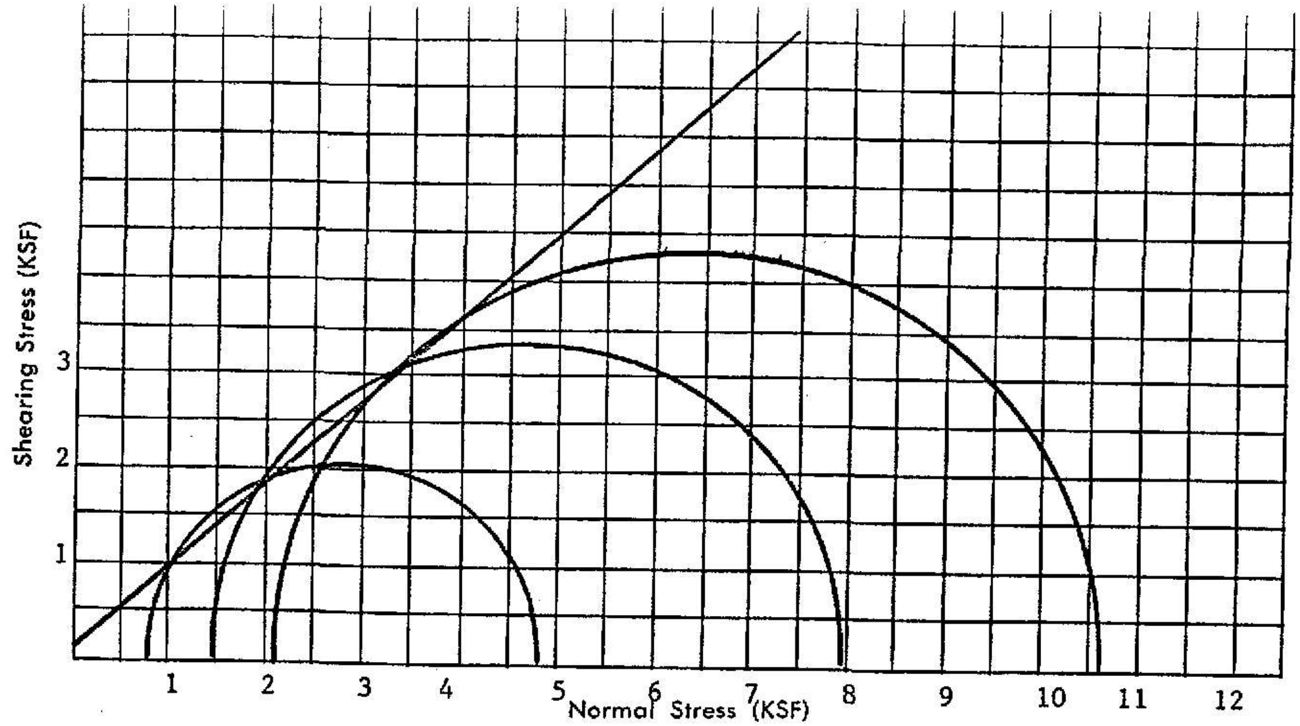
BORING NO.: 3

SAMPLE NO.: St-3

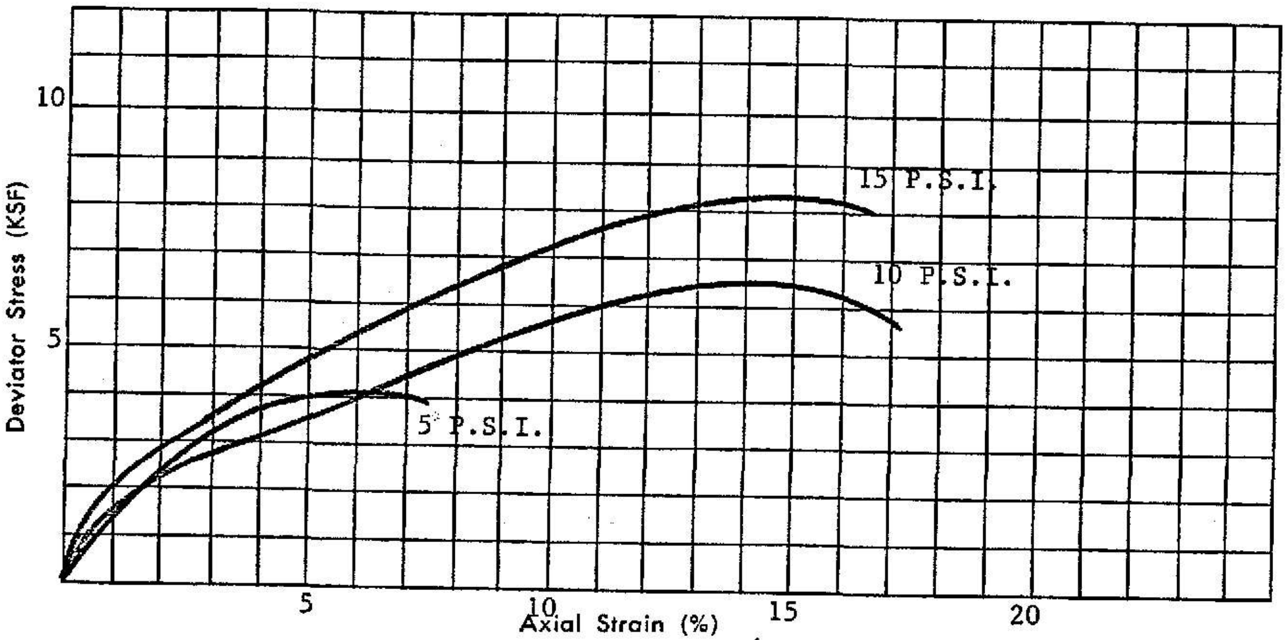
ELEV. OR DEPTH 8.0 - 10.0

DATE: May, 1983

GEOLOGIC ASSOCIATES, INC.



MOHR DIAGRAMS — φ

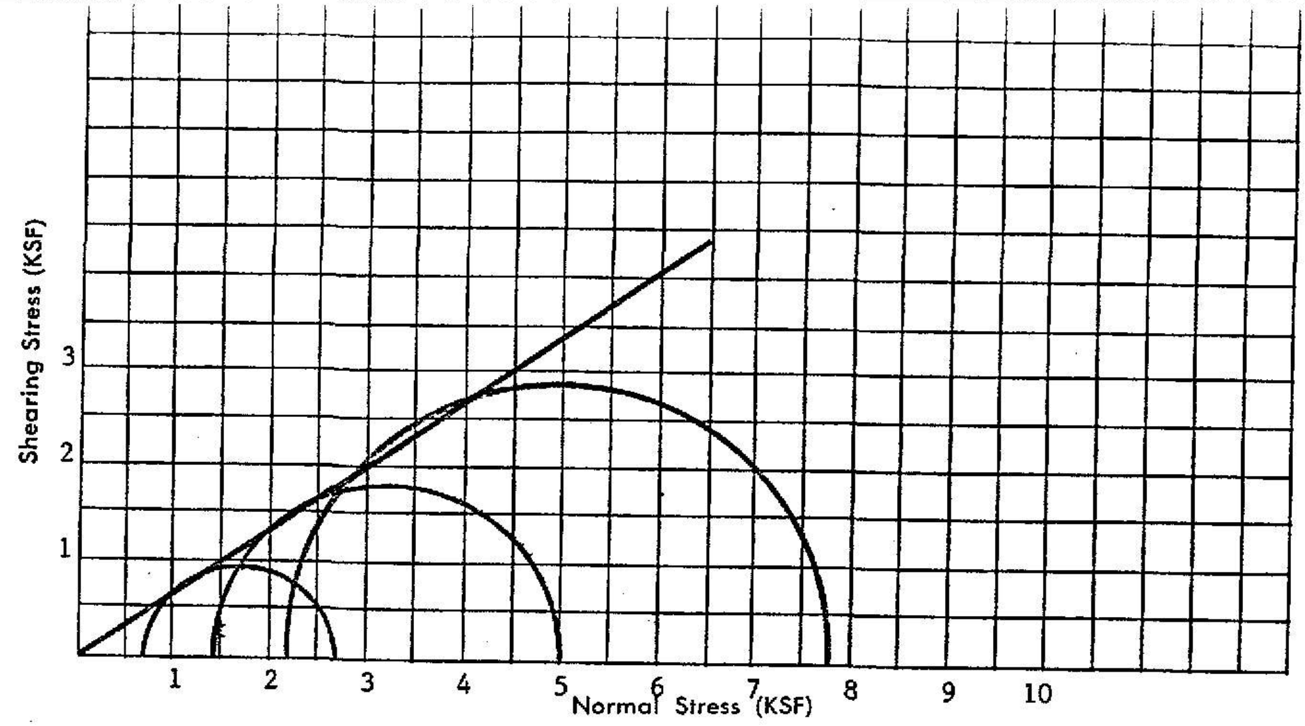


STRESS — STRAIN CURVES

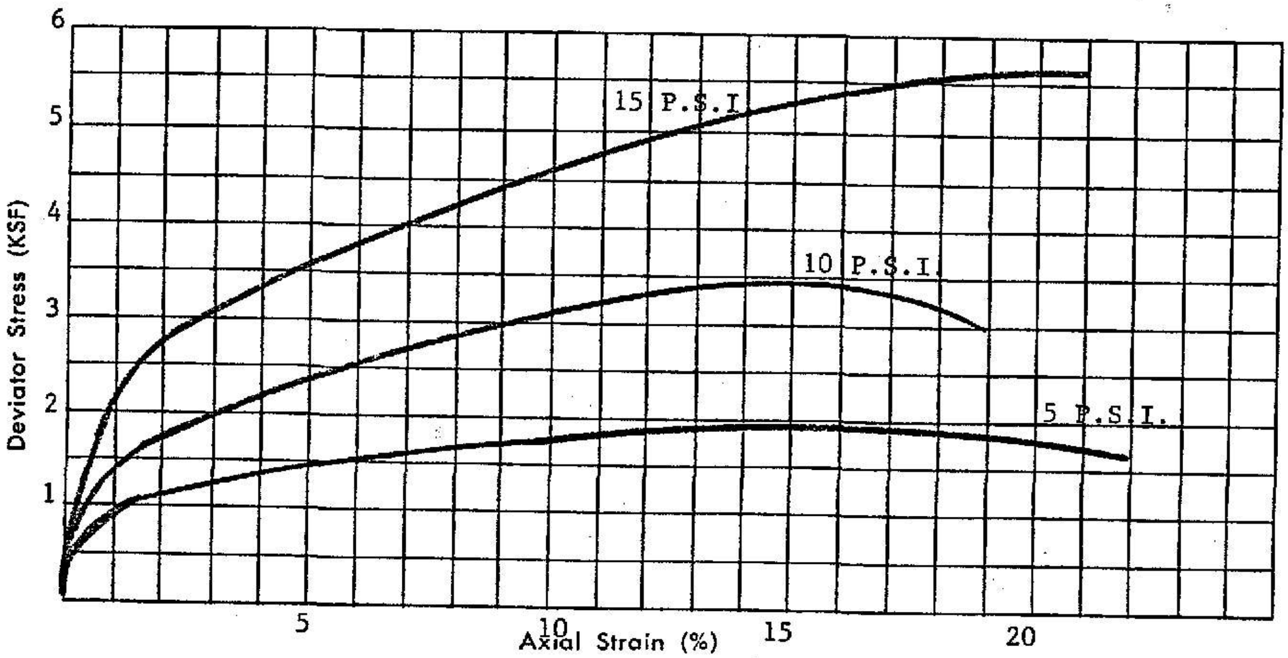
TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silt Dark Brown	CLIENT MCI, Inc.
	PROJECT Vertac Chemical Corporation
COHESION (c) 30 PSF	PROJECT NO.: 83-169K
ANGLE OF INTERNAL FRICTION (φ) 40°	BORING NO.: 1
UNIT WEIGHT, PCF 128.3 (γ_d=106.5)	SAMPLE NO.: St-2
WATER CONTENT, % 20.5	ELEV. OR DEPTH 3.0 - 5.0
SPECIFIC GRAVITY 2.60	DATE: May, 1983
VOID RATIO 0.52	

GEOLOGIC ASSOCIATES, INC.



MOHR DIAGRAMS — φ



STRESS — STRAIN CURVES

TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silt Dark Brown	CLIENT MCI, Inc.
	PROJECT Vertac Chemicals
COHESION (c) OPSF	PROJECT NO.: 83-169K
ANGLE OF INTERNAL FRICTION (φ) 34°	BORING NO.: 4
UNIT WEIGHT, PCF 117.4 (γd 87.0)	SAMPLE NO.: St-4
WATER CONTENT, % 35.0	ELEV. OR DEPTH 13.0 - 15.0
SPECIFIC GRAVITY 2.60	DATE: May 1983
VOID RATIO 0.87	

GEOLOGIC ASSOCIATES, INC.

SUMMARY OF LABORATORY TEST RESULTS

Project Vertac Chemical Company
Project No. 83-169K
Date June 6, 1983

Hole No.	Sample No.	SAMPLE TYPE *	Depth	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, ϕ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
1	1		0.0-2.0	17	131.8	112.6							Silt, brown, loess
	2		3.0-5.0	20.5	128.3	106.5							Silt, brown, loess
	3		8.0-10.0	28.1	123.9	96.7							Silt, brown, loess
	4		13.0-15.0	32.8	117.4	88.4							Silt, brown, loess
	5		18.0-20.0	33.6	115.3	86.3							Silt, brown, loess
2	1		0.0-2.0	19.5	120.4	100.8							Silt, brown, loess
	2		3.0-5.0	25.8	120.4	95.7							Silt, brown, loess
	3		8.0-10.0	23.8	117.6	95.0							Silt, brown, loess
	4		13.0-15.0	32.8	113.9	85.8							Silt, brown, loess
	5		18.0-20.0	29.8	119.5	92.1							Silt, brown, loess
3	1		0.0-2.0	18.0	128.3	108.7							Silt, brown, loess
	2		3.0-5.0		NO SAMPLE RECOVERY								Silt, brown, loess

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE
** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

Data checked by: BR

GEOLOGIC ASSOCIATES, INC.

SUMMARY OF LABORATORY TEST RESULTS

Project Vertac Chemical Company
Project No. 83-169K
Date Juen 6, 1983

Hole No.	Sample No.	SAMPLE TYPE *	Depth	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, φ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
3	3		8.0-10.0	22.3	121.9	99.7							Silt, brown, loess
	4		13.0-15.0	36.1	110.7	81.3							Silt, brown, loess
	5		18.0-20.0	33.4	116.6	87.4							Silt, brown, loess
4	1		0.0-2.0	25.6	120.4	95.9							Silt, brown, loess
	2		3.0-5.0	27.0	109.1	85.9							Silt, brown, loess
	3		8.0-10.0	29.4	116.4	90.0							Silt, brown, loess
	4		13.0-15.0	35.0	117.4	87.0							Silt, brown, loess
	5		18.0-20.0	34.0	109.5	81.7							Silt, brown, loess
5	1		0.0-2.0	23.5	120.2	97.3							Silt, brown, loess
	2		3.0-5.0	25.5	124.1	98.9							Silt, brown, loess
	3		NO SAMPLE RECOVERY										
	4		13.0-15.0	27.1	120.1	94.5							Silt, brown, loess

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE
** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

Data checked by: BR

GEOLOGIC ASSOCIATES, INC.

SUMMARY OF LABORATORY TEST RESULTS

Project Vertac Chemical Company

Project No. 83-169K

Date June 6, 1983

Hole No.	Sample No.	SAMPLE TYPE *	Depth	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, ϕ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
5	5		18.0-20.0	31.2	114.5	87.3							Silt, brown, loess
6	1		0.0-2.0	20.8	128.2	106.1							Silt, brown, loess
	2		3.0-5.0	24.5	116.5	93.6							Silt, brown, loess
	3		8.0-10.0	22.3	122.2	99.9							Silt, brown, loess
	4		13.0-15.0	29.8	117.2	90.3							Silt, brown, loess
	5		18.0-20.0	32.1	114.2	86.4							Silt, brown, loess

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE

** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

Data checked by: BR

GEOLOGIC ASSOCIATES, INC.

LABORATORY TEST — MOISTURE DENSITY RELATIONSHIP

CLIENT M.C.I. Consulting Engineers

DATE December 15, 1982

PROJECT Vertac Chemical Corporation

SOIL PROPERTIES:

PROJECT NO. 82-824

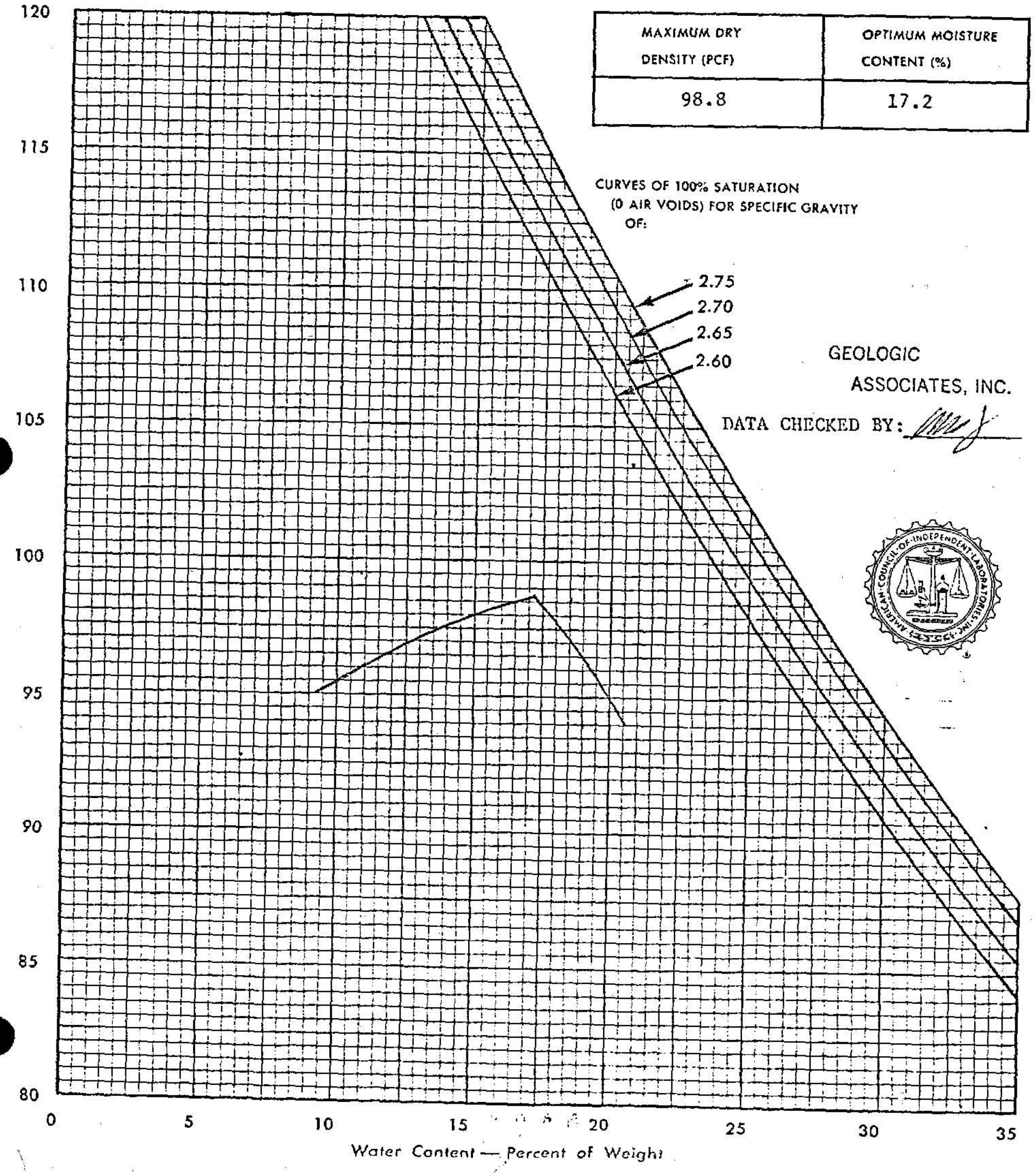
NATURAL MOISTURE (%) 22.8

SAMPLE LOCATION Delivered by Client

SOIL DESCRIPTION Silt, (loess) Brown

TEST METHOD: ASTM D-698, Method A

MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
98.8	17.2



GEOLOGIC ASSOCIATES, INC.

DATA CHECKED BY: [signature]

Remolded Permeabilities:

1.23×10^{-7}

1.85×10^{-6} Avg. = 9.86×10^{-7} cm/sec

In-Situ Permeabilities

3.84×10^{-7}

1.18×10^{-6}

3.25×10^{-5} Ave = 8.1×10^{-6} cm/sec

4.8×10^{-6}

1.35×10^{-6}

Top of dike = 109.0; width = 10'
At 2:1 slopes, width at 107.0 = 10' + (2)(2)(2) = 18'

$$\frac{8.1 \times 10^{-6}\ \text{cm}}{\text{sec}} \quad \frac{1\ \text{inch}}{2.54\ \text{cm.}} \quad \frac{1\ \text{ft.}}{12\ \text{in.}} \quad \frac{1}{18\ \text{ft.}} \quad \frac{60\ \text{sec.}}{1\ \text{min.}}$$

$$\frac{1440\ \text{min.}}{1\ \text{day}} = .0013\ \text{day}^{-1} = 784\ \text{days} = 2.14\ \text{years}$$

Using 9.86×10^{-7} cm/sec., time required = 17.6 years ?

SLOPE STABILITY ANALYSES

S[illegible]T STABL.LST

--SLOPE STABILITY ANALYSIS--
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION   VERTAC   DEEP FAILURE

BOUNDARY COORDINATES

7 TOP BOUNDARIES
16 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (FT)	Y-LEFT (FT)	X-RIGHT (FT)	Y-RIGHT (FT)	SOIL TYPE BELOW BND
1	2.50	12.50	15.00	12.50	1
2	15.00	12.50	28.50	19.00	2
3	28.50	19.00	42.50	26.00	1
4	42.50	26.00	47.00	26.00	1
5	47.00	26.00	61.50	33.00	1
6	61.50	33.00	71.50	33.00	1
7	71.50	33.00	89.00	24.00	1
8	47.00	26.00	53.50	26.00	1
9	53.50	26.00	58.00	26.00	2
10	28.50	19.00	38.00	19.00	2
11	38.00	19.00	39.50	20.00	2
12	39.50	20.00	41.50	20.00	2
13	41.50	20.00	53.50	26.00	2
14	15.00	12.50	20.00	12.50	1
15	20.00	12.50	44.00	19.00	1
16	44.00	19.00	58.00	26.00	1

ISOTROPIC SOIL PARAMETERS

2 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (PCF)	SATURATED UNIT WT. (PCF)	COHESION INTERCEPT (PSF)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (PSF)	PIEZOMETRIC SURFACE NO.
1	115.0	120.0	0.0	34.0	0.00	0.0	1
2	130.0	140.0	0.0	40.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER = 62.40

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 10 COORDINATE POINTS

POINT NO.	X-WATER (FT)	Y-WATER (FT)
1	2.50	12.50
2	15.00	12.50
3	20.00	12.50
4	44.00	19.00
5	51.50	20.50
6	60.00	22.00
7	66.00	23.00
8	70.50	23.50
9	80.00	24.50
10	88.00	24.50

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

50 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 5 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 5.00 FT.
AND X = 45.00 FT.

EACH SURFACE TERMINATES BETWEEN X = 46.00 FT.
AND X = 70.00 FT.

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = 0.00 FT.

30.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE 5 MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.56	7.38
3	60.65	22.20
4	64.79	33.00

*** 1.564 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.44	6.72
3	60.04	22.37
4	63.09	33.00

*** 1.570 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.17	5.48
3	60.98	18.94
4	67.00	33.00

*** 1.590 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

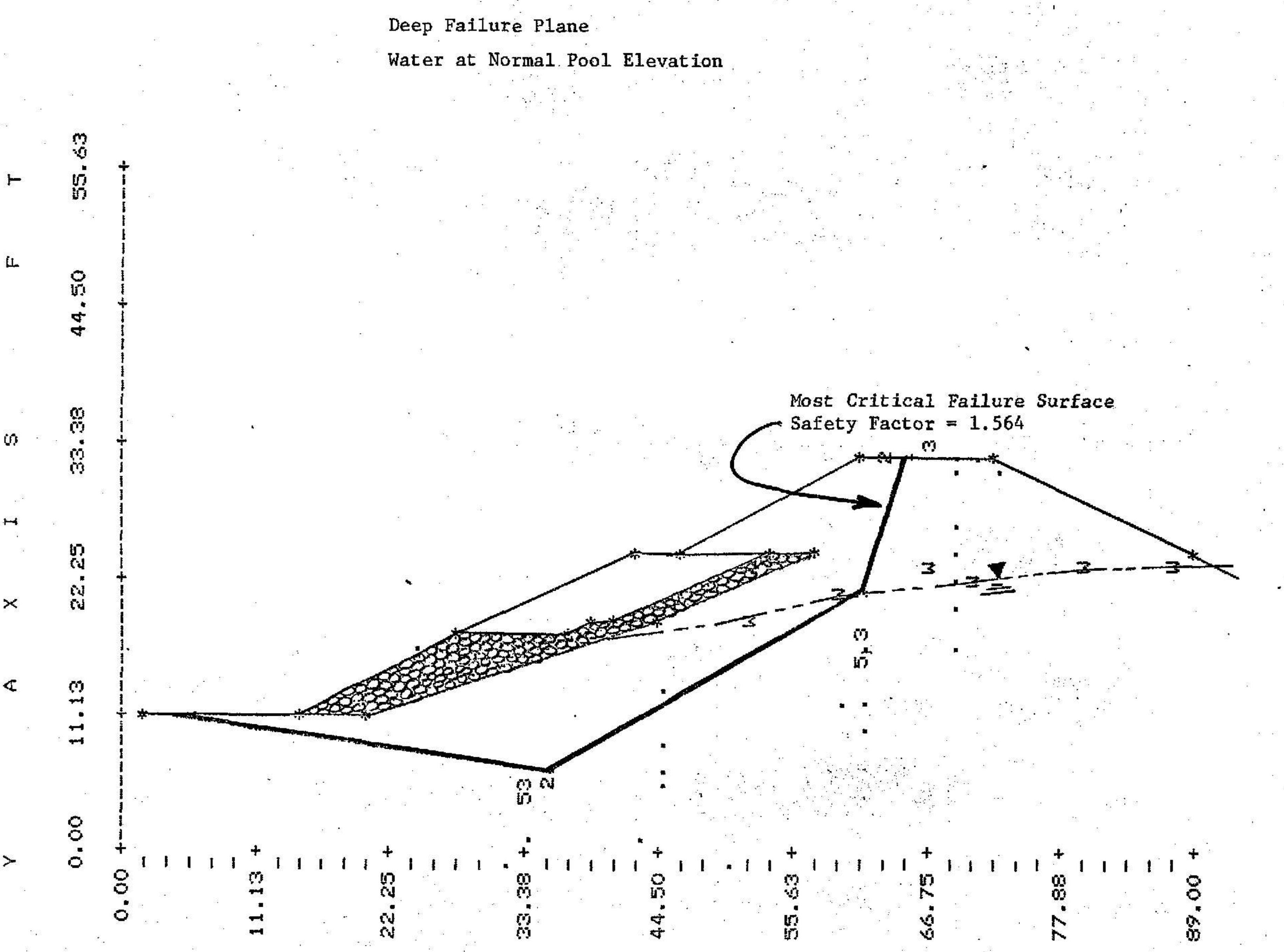
POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.29	6.02
3	59.61	22.12
4	62.05	33.00

*** 1.590 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	33.78	4.01
3	60.76	17.13
4	67.09	33.00

*** 1.614 ***



Deep Failure Plane
Water at Normal Pool Elevation
Most Critical Failure Surface
Safety Factor = 1.564
Y AXIS FT
0.00
11.13
22.25
33.38
44.50
55.63
X AXIS FT
0.00
11.13
22.25
33.38
44.50
55.63
66.75
77.88
89.00

```
>44. 19.
>[illegible]8. 26.
>[illegible]2. 27.5
>65.5 28.5
>70.5 29.5
>[illegible]7. 30.
ENTER COMMAND >CIRCLE
>5[illegible] 25. 36. 42. 50. 0. 5. 0. 0.
E[illegible]R COMMAND >END
0.
End of file. Cominput. (Input from terminal.)
$LIST STABL.LST
```

--SLOPE STABILITY ANALYSIS--
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION VERTAC SHALLOW FAILURE

BOUNDARY COORDINATES

7 TOP BOUNDARIES
16 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (FT)	Y-LEFT (FT)	X-RIGHT (FT)	Y-RIGHT (FT)	SOIL TYPE BELOW BND
1	2.50	12.50	15.00	12.50	1
2	15.00	12.50	28.50	19.00	2
3	28.50	19.00	42.50	26.00	1
4	42.50	26.00	47.00	26.00	1
5	47.00	26.00	61.50	33.00	1
6	61.50	33.00	71.50	33.00	1
7	71.50	33.00	89.00	24.00	1
8	47.00	26.00	53.50	26.00	1
9	53.50	26.00	58.00	26.00	2
10	28.50	19.00	38.00	19.00	2
11	38.00	19.00	39.50	20.00	2
12	39.50	20.00	41.50	20.00	2
13	41.50	20.00	53.50	26.00	2
14	15.00	12.50	20.00	12.50	1
15	20.00	12.50	44.00	19.00	1
16	44.00	19.00	58.00	26.00	1

ISOTROPIC SOIL PARAMETERS

2 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (PCF)	SATURATED UNIT WT. (PCF)	COHESION INTERCEPT (PSF)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (PSF)	PIEZOMETRIC SURFACE NO.
1	115.0	120.0	0.0	34.0	0.00	0.0	1
2	130.0	140.0	0.0	40.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER = 62.40

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 9 COORDINATE POINTS

POINT NO.	X-WATER (FT)	Y-WATER (FT)
1	2.50	12.50
2	15.00	12.50
3	20.00	12.50
4	44.00	19.00
5	58.00	26.00
6	62.00	27.50
7	65.50	28.50
8	70.50	29.50
9	77.00	30.00

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

50 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 5 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 25.00 FT.
AND X = 36.00 FT.

EACH SURFACE TERMINATES BETWEEN X = 42.00 FT.
AND X = 50.00 FT.

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = 0.00 FT.

5.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE 5 MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	33.25	21.38
2	38.17	22.26
3	42.42	24.90
4	43.22	26.00

FAILURE SURFACE SPECIFIED BY 6 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	25.00	17.32
2	29.86	18.49
3	34.54	20.25
4	38.96	22.58
5	43.07	25.44
6	43.69	26.00

*** 1.501 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	33.25	21.38
2	38.20	22.11
3	42.57	24.53
4	43.84	26.00

*** 1.562 ***

FAILURE SURFACE SPECIFIED BY 6 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	25.00	17.32
2	29.70	19.02
3	34.35	20.86
4	38.95	22.81
5	43.50	24.88
6	45.79	26.00

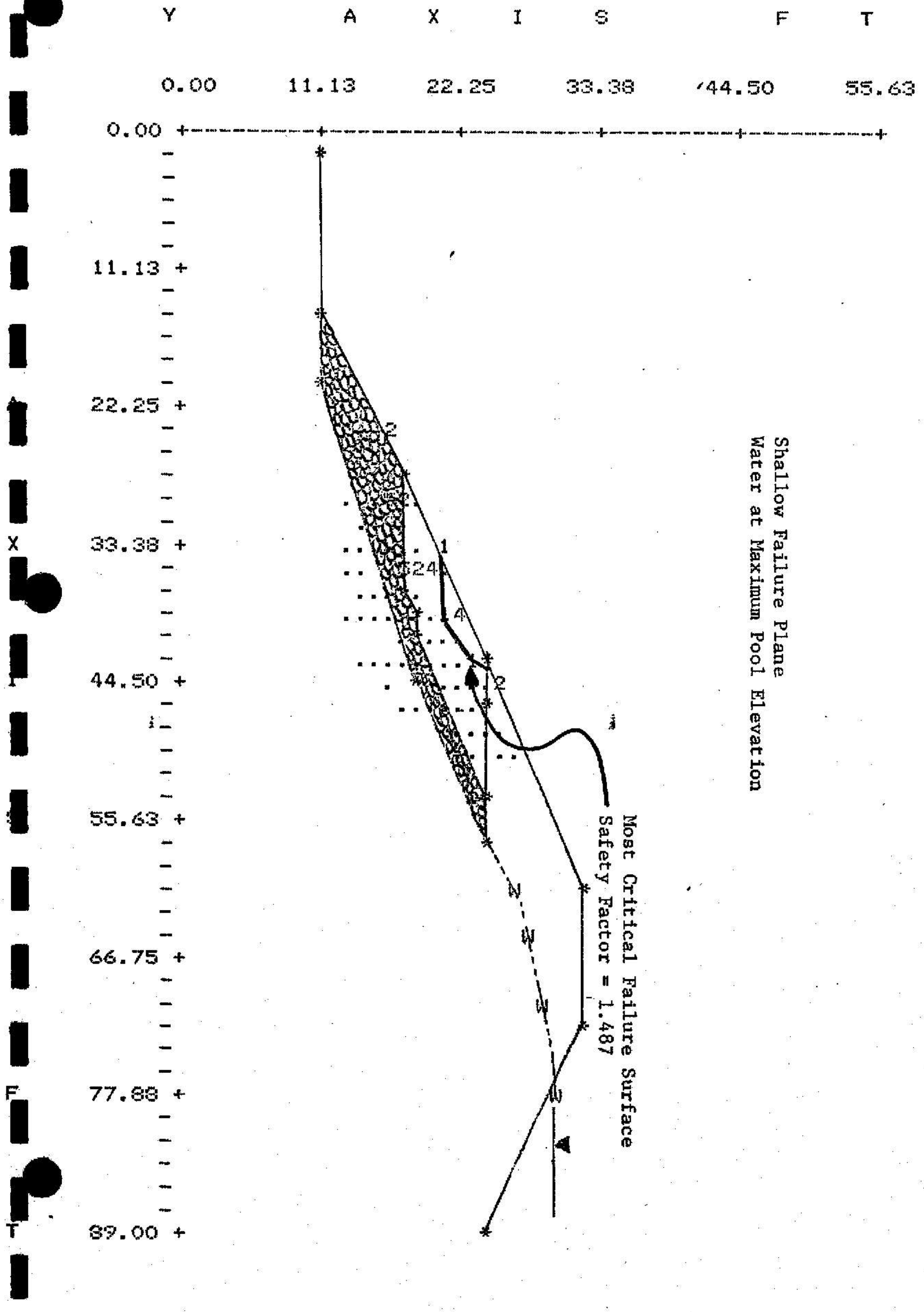
*** 1.602 ***

FAILURE SURFACE SPECIFIED BY 6 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	25.00	17.32
2	29.98	17.78
3	34.75	19.26
4	39.12	21.70

5	42.89	24.98
6	43.66	26.00

*** 1.632 ***



LIST STABL.LST

--SLOPE STABILITY ANALYSIS--
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION VERTAC DEEP FAILURE

BOUNDARY COORDINATES

7 TOP BOUNDARIES
16 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (FT)	Y-LEFT (FT)	X-RIGHT (FT)	Y-RIGHT (FT)	SOIL TYPE BELOW BND
1	2.50	12.50	15.00	12.50	1
2	15.00	12.50	28.50	19.00	2
3	28.50	19.00	42.50	26.00	1
4	42.50	26.00	47.00	26.00	1
5	47.00	26.00	61.50	33.00	1
6	61.50	33.00	71.50	33.00	1
7	71.50	33.00	89.00	24.00	1
8	47.00	26.00	53.50	26.00	1
9	53.50	26.00	58.00	26.00	2
10	28.50	19.00	38.00	19.00	2
11	38.00	19.00	39.50	20.00	2
12	39.50	20.00	41.50	20.00	2
13	41.50	20.00	53.50	26.00	2
14	15.00	12.50	20.00	12.50	1
15	20.00	12.50	44.00	19.00	1
16	44.00	19.00	58.00	26.00	1

ISOTROPIC SOIL PARAMETERS

2 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (PCF)	SATURATED UNIT WT. (PCF)	COHESION INTERCEPT (PSF)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (PSF)	PIEZOMETRIC SURFACE NO.
1	115.0	120.0	0.0	34.0	0.00	0.0	1
2	130.0	140.0	0.0	40.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER = 62.40

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 9 COORDINATE POINTS

POINT NO.	X-WATER (FT)	Y-WATER (FT)
1	2.50	12.50
2	15.00	12.50
3	20.00	12.50
4	44.00	19.00
5	58.00	26.00
6	62.00	27.50
7	65.50	28.50
8	70.50	29.50
9	77.00	30.00

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

50 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 5 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 5.00 FT.
AND X = 45.00 FT.

EACH SURFACE TERMINATES BETWEEN X = 46.00 FT.
AND X = 70.00 FT.

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = 0.00 FT.

30.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE 5 MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.56	7.38
3	60.65	22.20
4	64.79	33.00

*** 1.432 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.17	5.48
3	60.98	18.94
4	67.00	33.00

*** 1.433 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	34.44	6.72
3	60.04	22.37
4	63.09	33.00

*** 1.449 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

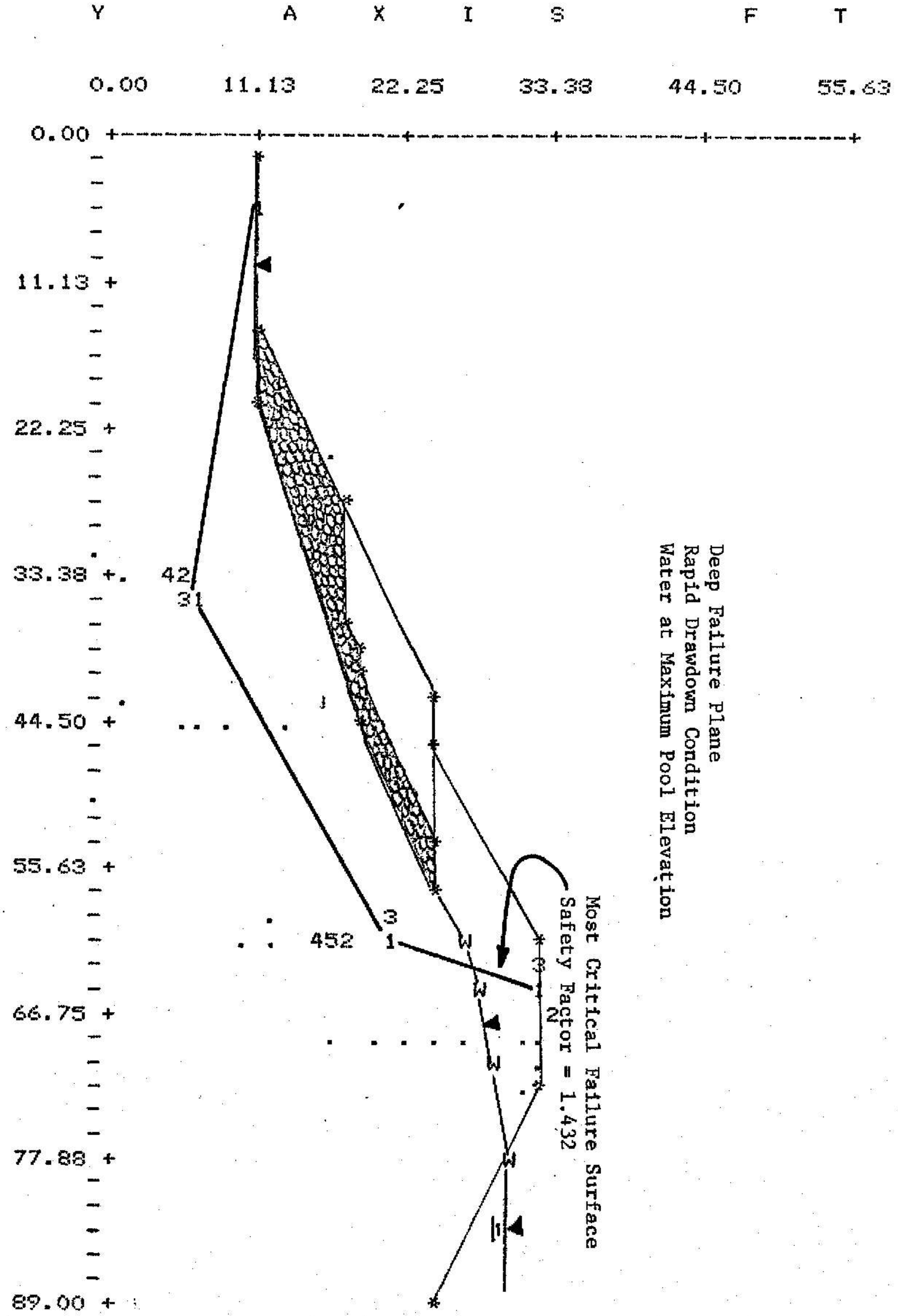
POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	5.00	12.50
2	33.78	4.01
3	60.76	17.13
4	67.09	33.00

*** 1.451 ***

FAILURE SURFACE SPECIFIED BY 4 COORDINATE POINTS

1	5.00	12.50
2	33.75	3.93
3	60.29	17.91
4	65.16	33.00

** 1.463 ***



MAPTECH, INC. SURVEYING • MAPPING

P.O BOX 5300A • JACKSON, MISSISSIPPI 39216 • (601) 969-6673

July 1, 1983

MCI/Consulting Engineers, Inc.
Post Office Box 23154
McBride Lane
Knoxville, Tennessee 37922

Attention: Mr. Felon R. Wilson, P. E.

RE: Vertac Chemical Corporation
(Our Ref. 8378)

Dear Mr. Wilson:

In accordance with your request, we determined the drainage area for the ponds at the subject plant. We used photography obtained in 1982 plus some on site investigation to determine the limits. The site investigation involved looking at drop inlets, direction of drainage pipes and direction of flow in ditches. The acreage was calculated by use of a planimeter. The drainage area equals 20.7 acres.

Should you have any questions, please call.

Yours very truly,

MAPTECH, INC.

S.G. Posey

Sam G. Posey
Registered Land Surveyor

SGP:tz

[redacted]

25-Year, 24-Hour Storm Volume Calculations

Bottomland - Adler Soil - C

Composite Curve Number:

	Area	CN
Inactive Disposal Area	3.0	87
Plant Site	20.7	87 ? (Isn't most of this concreted area? If so runoff should approach 100%)
Pond Area	4.6	100
	28.3	89

761
460
1801

$$CN = \frac{1000}{10+S}$$

$$89 = \frac{1000}{10+S}$$

$$10+S = \frac{1000}{89}$$

$$S = 1.24$$

25 Yr. - 24 Hr. Precip. = 7.74 in.

$$Q = \frac{(p-0.2S)^2}{p+0.8S}$$

$$Q = \frac{(7.74-(0.2)1.23)^2}{7.74+(0.8)(1.24)} = 6.42"$$

Storage Volume Required

$$V = (6.42") \frac{1\ ft}{12"} (28.3\ acres)(43560\ ft^2/ac)$$

$$= 659{,}520\ ft^3 = 15.1\ ac.\ ft.$$

SURFACE IMPOUNDMENT STORAGE CALCULATIONS

Pond 1 (Northwestern)

El	in^2	Avg in^2	Avg ft^2			ft^3
99.5	0					
		2.71	4336	x	0.5	2168
100	5.42					
		9.70	15520	x	1.0	15520
101	13.98					
		22.39	35824	x	1.0	35824
102	30.8					
		35.18	56288	x	1.0	56288
103	39.56					
		40.35	64560	x	1.0	64560
104	41.14					
		41.47	66352	x	1.0	66352
105	41.8					

Pond 2 (Southeastern)

El	in^2	Avg in^2	Avg ft^2			ft^3
97.3	0					
		3.70	5920	x	0.7	4144
98	7.4					
		10.85	17360	x	1.0	17360
99	14.3					
		17.30	27680	x	1.0	27680
100	20.3					
		23.47	37544	x	1.0	37544
101	26.63					
		30.7	49064	x	2.0	98128
103	34.7					
		36.2	57920	x	2.0	115840
105	37.7					

Pond 3 (Northeastern)

El	in^2	Avg in^2	Avg ft^2			ft^3
97.6	0					
		1.90	3040	x	0.4	1216
98	3.8					
		4.72	7552	x	1.0	7552
99	5.64					
		7.17	11472	x	1.0	11472
100	8.7					
		8.35	13360	x	1.0	13360
101	8.0					
		9.35	14960	x	2.0	29920
103	10.7					
		14.45	23120	x	2.0	46240
105	18.2					

Composite Ponds

105	97.7					
		107.35	171760	x	4.0	687040
109	117.0					

Composite Volumes

El	ft^3	Cumulative ft^3	Ac-ft
98	5360	5360	0.12
99	24912	30272	0.69
100	41320	71592	1.64
101	66424	138016	3.17
102			5.69
103	220160	358176	8.2
105	292992	651168	14.9
107			22.8
109	687040	1,338,208	30.7

Water Elevation:

January 5, 1983	101.68
May 9, 1983	101.67
June 15, 1983	102.5
Average =	101.95

Assume water surface at EL 102.0 MSL

Available volume at EL 107 = 22.8 Ac-ft - 5.69 = 17.1 Ac-ft
25 yr-24 hr storm volume = 15.1 Ac-ft

Assuming an outflow of 600 gpm, available volume at EL 107 = 19.75 Ac-ft

DEPARTMENT OF THE ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60
VICKSBURG, MISSISSIPPI 39180

REPLY TO ATTENTION OF:

July 18, 1983

Operations Division
Regulatory

Mr. Felon R. Wilson, P.E.
Manager of Industrial Operations
MCI/Consulting Engineers, Inc.
10628 Dutchtown Road
Knoxville, Tennessee 37933-1010

Dear Mr. Wilson:

I refer to your letter of July 6, 1983, concerning remedial construction of the Vertac Chemical Corporation surface impoundment dike on Stouts Bayou in Vicksburg, Mississippi.

Based upon the information submitted, and your subsequent telephone conversation of July 14, 1983, with Charles Curcio of my staff, we have determined that the proposed work will not require a Department of the Army permit, provided there is no dredged or fill material deposited into wetlands or other waters of the United States. Waters of the United States near the project site include Hatcher Bayou and Stouts Bayou and any adjacent wetlands.

Please note that if the location or plans for the proposed work change, our office should be notified to determine permit requirements. If we can be of further assistance, please contact Mr. Charles Curcio of my staff, telephone number (601) 634-5297.

Sincerely,

Kenneth P. Mosley
for Charles M. Hargett
Chief, Regulatory Branch

DEPARTMENT OF THE ARMY
VICKSBURG DISTRICT, CORPS OF ENGINEERS
P. O. BOX 60
VICKSBURG, MISSISSIPPI 39180

REPLY TO
ATTENTION OF:

July 8, 1983

Engineering Division
Hydraulics

Mr. Felon Wilson
MCI Consulting Engineers
Post Office Box 23010
Knoxville, Tennessee 37933

Dear Mr. Wilson:

I refer to your telephone conversation of July 6, 1983, with Charles McKinnie of Hydraulics Branch, requesting the 100-year elevation at the confluence of Stouts Bayou and Hatcher Bayou near Vicksburg, Mississippi. The 100-year elevation for this site is approximately 109.0 feet NGVD.

If we can be of further assistance, please contact this office.

Sincerely,

John E. Henley
Chief, Engineering Division

RECEIVED
JUL 15 1983
M. C. I.

MCI / CONSULTING ENGINEERS, INC.

ENGINEERING ANALYSIS OF STABILITY OF
SURFACE IMPOUNDMENT DIKE
VERTAC CHEMICAL CORP.
VICKSBURG, MISSISSIPPI

Prepared by:

MCI/CONSULTING ENGINEERS, INC.
P. O. Box 23010
Knoxville, Tennessee 37933-1010

June 11, 1983

ELDON RAY WILSON
REGISTERED PROFESSIONAL ENGINEER
11712
STATE OF MISSISSIPPI
6/11/83

MCI/CONSULTING ENGINEERS, INC.
P. O. Box 23154
McBride Lane
Knoxville, Tennessee 37922
Telephone (615) 966-9788

June 10, 1983

Mr. R. D. Karkkainen
Vertac Chemical Corporation
5100 Poplar, Suite 2414
Memphis, TN 38137

RE: Vicksburg, Mississippi;
Surface Impoundment; Dike
Stability; MCI-83-562

Dear Dick:

In accordance with your request we have evaluated the stability of the subject dike and herewith present our conclusions and recommendations.

Laboratory samples were obtained at the subject dike in May 1983 and were transported to the Geologic Associates laboratory in Knoxville, Tennessee for analysis. Laboratory testing consisted of determining the insitu moisture content and unit weight of selected samples obtained from the dike. A series of consolidated drained triaxial tests were performed on undisturbed samples to obtain soil strength parameters. In addition, six piezometers were installed within the dike and water level subsequently monitored by personnel at the Vicksburg facility. A limited amount of topographic data was obtained while on-site, which is contained in Appendix I. Laboratory results are contained in Appendix II.

Slope stability analysis of the dike using the strength parameters and unit weights from the laboratory data was performed. Effective strength parameters of $C' = 0$ psf (cohesion) and $\phi = 34°$ (angle of internal friction) were used in this analysis. The stability analysis was performed with the aid of a digital computer using circular arc failure surface. The computer program used is entitled "STABL" and was developed during the joint highway research project HRP-79-6 by Purdue University and Indiana State Highway Commission.

Analysis of the data indicates that the lower portion of the soil embankment is completely saturated. This factor combined with the nature of the silty embankment material offer very low strength characteristics. Analysis of the critical failure surface for the embankment indicates the embankment has a safety factor of less than one. This means that the forces resisting movement are exceeded by the forces causing movement. In other words, an incipient failure condition exists whereby any slight change in conditions could create immediate failure of the embankment.

Using standard SCS Drainage Analysis methods, the volume of water which would enter the impoundment from the 25YR - 24HR storm was estimated. A detailed topographic map of the plant property was not available. It was assumed all manufacturing areas of the south plant were within the drainage shed which would enter the surface impoundment. Utilizing this area it was determined that 7.1×10^6 gallons of water would enter the impoundment during the storm and a peak flow of 100 cfs (45,000 gallons per minute) would enter during the storm. Since a detailed topographic map of the surface impoundment was not available, an estimate of the size of the impoundment yielded a total water depth in the impoundment due to the storm of 7.5 feet. This assumes the impoundment is empty at the time of the storm and it also assumes that no water would be pumped from the impoundment during a storm. Based on these conditions the total depth of the surface of the impoundment with a two foot free-board would have to be 9.5 deep (109.5 MSL), assuming an average bottom elevation of 100.00' MSL. Assuming an outflow of 600 gpm, the required top elevation would be 108.6 MSL.

The 100YR flood elevation at the intersection of Stouts Bayou and Hatcher Bayou at the beginning of Hennessee Bayou is 109.00 feet mean sea level. The current top of the dike is approximately 105.5 feet mean sea level. In order to be at the 100YR flood elevation the top of the dike would thus have to be elevated an additional 3.5 feet.

Conclusions

(1) The dike is unstable and is likely to fail again due primarily to the degree of moisture in the dike which results from flooding in the creek.

(2) The top of the dike will have to be elevated approximately 3.1 feet in order to compensate for the 24 Hr. - 25 Yr. storm flow, assuming an outflow of 600 gpm.

(3) The dike will have to be elevated 3.5 feet in order to be above the 100YR flood elevation (109.00').

Recommendations

Short-term stability of the dike could be enhanced by the installation of horizontal drains in the toe of the dike on the creek side. This would be a trial mechanism and it could not be assured that these drains would prevent failure of the dike.

For the long-term stability of the dike some degree of remedial action is necessary. Three possible alternatives exist as shown on the drawings in Appendix III. The first would be to install a rock drain at the toe of the dike on the creek side with a bench constructed on the outslope for stability. This is in addition to the fact that top of the dike would have to be raised in order to compensate for the design flood and the 100 year flood elevation. The second alternative would be to install a rock drain upon re-shaping of the dike to provide stability. This option would also require the raising of the top of the dike to meet the 100 year flood elevation requirement. The third option would be to completely rebuild the dike with either highly plastic soil, which would have to be imported or the use of local soils with a bentonite mixture. The total rebuilding of the dike would still require a small toe drain installed on the creek side of the dike. Schematics of these possible alternatives are illustrated in Appendix II. Each alternative considered is a reliable mechanism for the rebuilding of the dike. Any rebuilding in the creek may require a permit from the Corp of Engineers. The raising of the dike would lower the capacity of the pond and thus may present difficulties with containment of the 25-year flood. It is our opinion that any of these three methods are adequate to satisfy the stability requirements in order to obtain a Part B permit. We recommend that the use of any of these three methods be decided in the initial design phase after acquiring the detailed topographic map and information on local soils that are available near the Vertac plant.

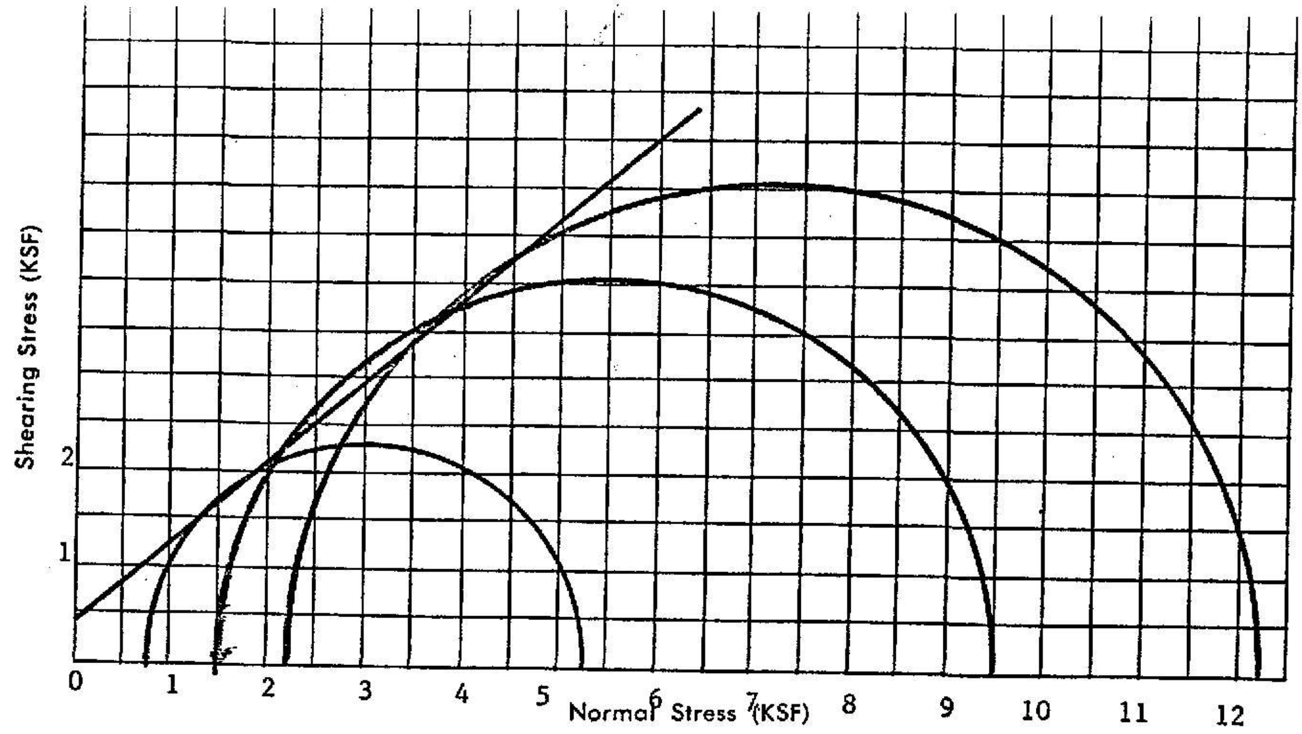
We will proceed with the detailed design of the remedial action on the dike at your direction.

Yours truly,

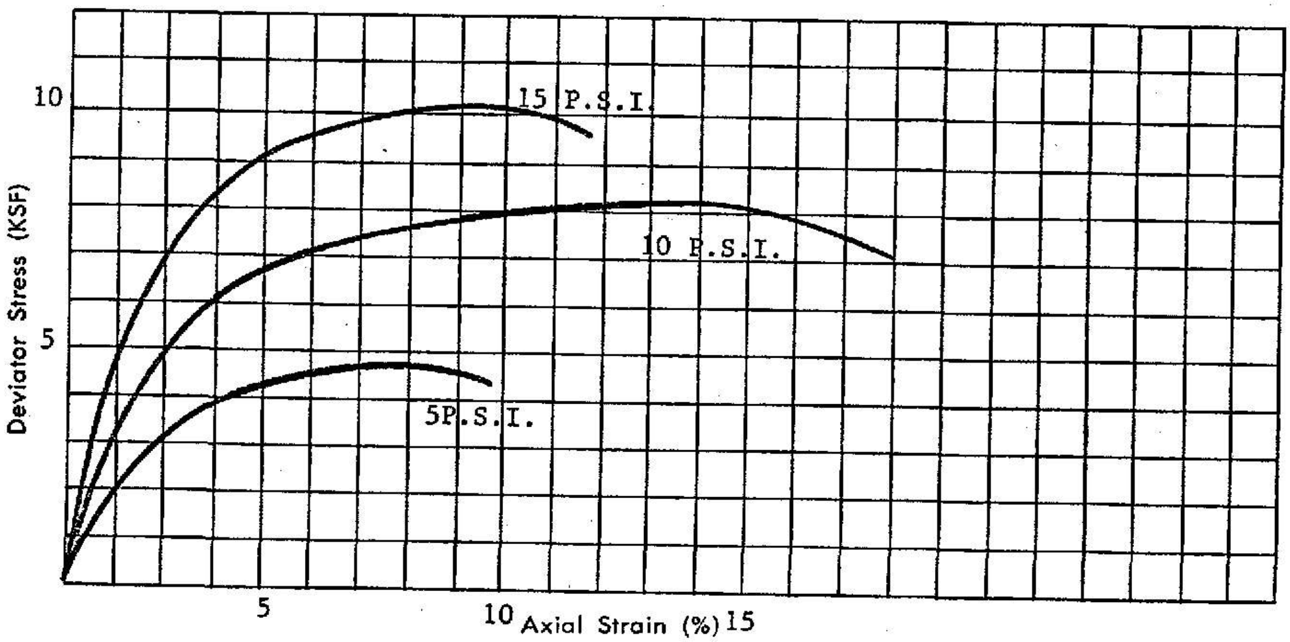
MCI/CONSULTING ENGINEERS, INC.

Felon R. Wilson, P.E.
Manager of Industrial Operations

FRW:kd



MOHR DIAGRAMS — φ



STRESS — STRAIN CURVES

TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silt, Very Slightly Clayey, Dark Brown

COHESION (c) 400 PSF

ANGLE OF INTERNAL FRICTION (φ) 39°

UNIT WEIGHT, PCF 123.8 (γd=100.9)

WATER CONTENT, % 22.7

SPECIFIC GRAVITY 2.60

VOID RATIO 0.61

CLIENT MCI, Inc.

PROJECT Vertac Chemical Corporation

PROJECT NO.: 83-169K

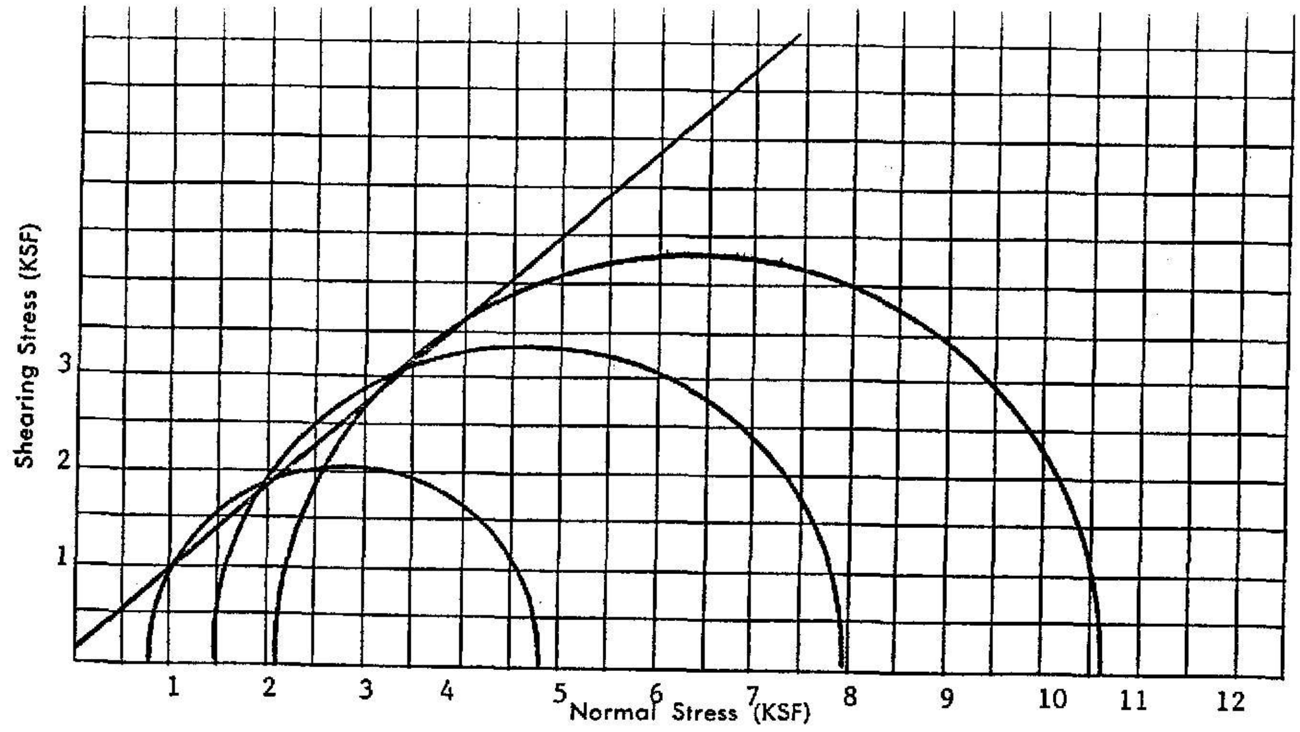
BORING NO.: 3

SAMPLE NO.: St-3

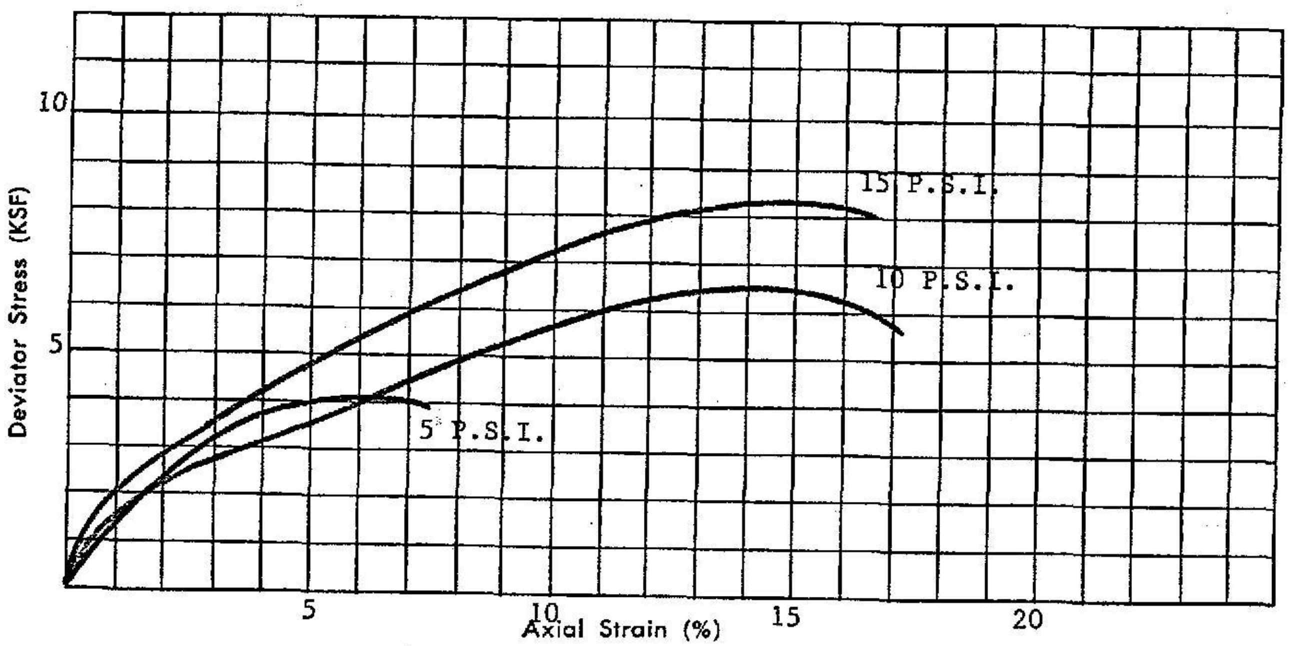
ELEV. OR DEPTH 8.0 - 10.0

DATE: May, 1983

GEOLOGIC ASSOCIATES, INC.



MOHR DIAGRAMS — φ



STRESS — STRAIN CURVES

TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silt Dark Brown

COHESION (c) 30 PSF

ANGLE OF INTERNAL FRICTION (φ) 40°

UNIT WEIGHT, PCF 128.3 (γd=106.5)

WATER CONTENT, % 20.5

SPECIFIC GRAVITY 2.60

VOID RATIO 0.52

CLIENT MCI, Inc.

PROJECT Vertac Chemical Corporation

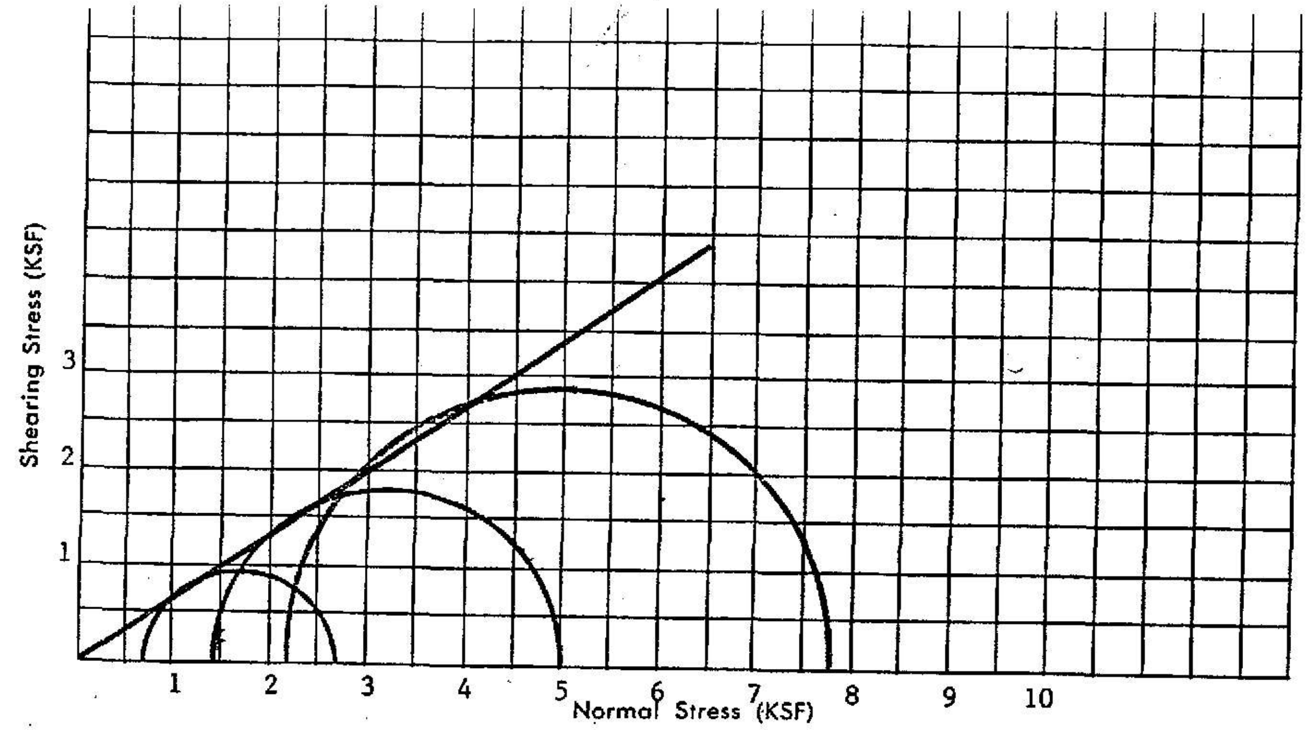
PROJECT NO.: 83-169K

BORING NO.: 1

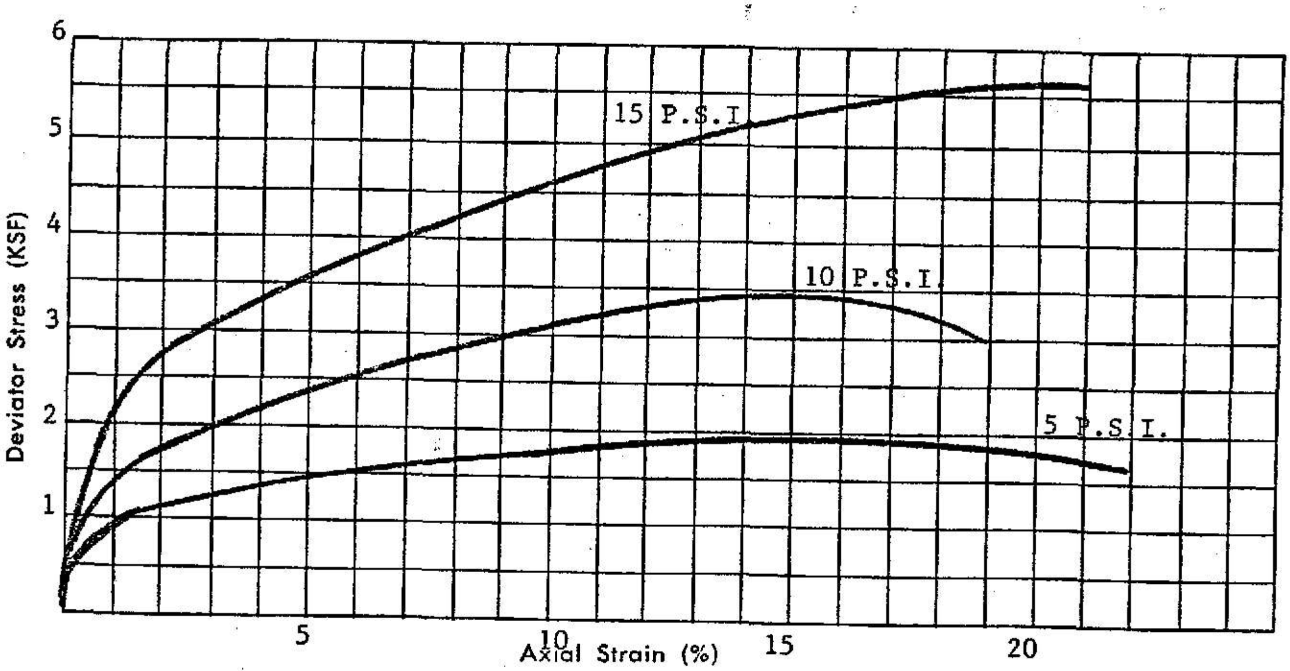
SAMPLE NO.: St-2

ELEV. OR DEPTH 3.0 - 5.0

DATE: May, 1983



MOHR DIAGRAMS — φ



STRESS — STRAIN CURVES

TRIAXIAL SHEAR TEST

SOIL DESCRIPTION Silt Dark Brown	CLIENT MCI, Inc.
	PROJECT Vertac Chemicals
COHESION (c) OPSF	PROJECT NO.: 83-169K
ANGLE OF INTERNAL FRICTION (φ) 34°	BORING NO.: 4
UNIT WEIGHT, PCF 117.4 (γd 87.0)	SAMPLE NO.: St-4
WATER CONTENT, % 35.0	ELEV. OR DEPTH 13.0 - 15.0
SPECIFIC GRAVITY 2.60	DATE: May 1983
VOID RATIO 0.87	

GEOLOGIC ASSOCIATES, INC.

SUMMARY OF LABORATORY TEST RESULTS

Project: Vertac Chemical Company
Project No. 83-169K
Date: June 6, 1983

Hole No.	Sample No.	SAMPLE TYPE *	Depth	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, φ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
1	1		0.0-2.0	17	131.8	112.6							Silt, brown, loess
	2		3.0-5.0	20.5	128.3	106.5							Silt, brown, loess
	3		8.0-10.0	28.1	123.9	96.7							Silt, brown, loess
	4		13.0-15.0	32.8	117.4	88.4							Silt, brown, loess
	5		18.0-20.0	33.6	115.3	86.3							Silt, brown, loess
2	1		0.0-2.0	19.5	120.4	100.8							Silt, brown, loess
	2		3.0-5.0	25.8	120.4	95.7							Silt, brown, loess
	3		8.0-10.0	23.8	117.6	95.0							Silt, brown, loess
	4		13.0-15.0	32.8	113.9	85.8							Silt, brown, loess
	5		18.0-20.0	29.8	119.5	92.1							Silt, brown, loess
3	1		0.0-2.0	18.0	128.3	108.7							Silt, brown, loess
	2		3.0-5.0		NO SAMPLE RECOVERY								Silt, brown, loess

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE
** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

Data checked by: BR

GEOLOGIC ASSOCIATES, INC.

SUMMARY OF LABORATORY TEST RESULTS

Project Vertac Chemical Company
Project No. 83-169K
Date Juen 6, 1983

Hole No.	Sample No.	SAMPLE TYPE *	Depth	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, ϕ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
3	3		8.0-10.0	22.3	121.9	99.7							Silt, brown, loess
	4		13.0-15.0	36.1	110.7	81.3							Silt, brown, loess
	5		18.0-20.0	33.4	116.6	87.4							Silt, brown, loess
4	1		0.0-2.0	25.6	120.4	95.9							Silt, brown, loess
	2		3.0-5.0	27.0	109.1	85.9							Silt, brown, loess
	3		8.0-10.0	29.4	116.4	90.0							Silt, brown, loess
	4		13.0-15.0	35.0	117.4	87.0							Silt, brown, loess
	5		18.0-20.0	34.0	109.5	81.7							Silt, brown, loess
5	1		0.0-2.0	23.5	120.2	97.3							Silt, brown, loess
	2		3.0-5.0	25.5	124.1	98.9							Silt, brown, loess
	3		NO SAMPLE RECOVERY										
	4		13.0-15.0	27.1	120.1	94.5							Silt, brown, loess

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE
** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

Data checked by: BR

GEOLOGIC ASSOCIATES, INC.

SUMMARY OF LABORATORY TEST RESULTS

Project Vertac Chemical Company
Project No. 83-169K
Date June 6, 1983

Hole No.	Sample No.	SAMPLE TYPE *	Depth	Natural Moisture (%)	UNIT WEIGHT (PCF) WET	UNIT WEIGHT (PCF) DRY	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Index (%)	UNIFIED SOIL CLASSIFICATION	TRIAXIAL SHEAR TEST ANGLE OF INTERNAL FRICTION, φ	TRIAXIAL SHEAR TEST COHESION C (PSF)	OTHER TESTS **	Soil Description
5	5		18.0-20.0	31.2	114.5	87.3							Silt, brown, loess
6	1		0.0-2.0	20.8	128.2	106.1							Silt, brown, loess
	2		3.0-5.0	24.5	116.5	93.6							Silt, brown, loess
	3		8.0-10.0	22.3	122.2	99.9							Silt, brown, loess
	4		13.0-15.0	29.8	117.2	90.3							Silt, brown, loess
	5		18.0-20.0	32.1	114.2	86.4							Silt, brown, loess

* ST—SHELBY TUBE SAMPLE, SS—SPLIT SPOON SAMPLE, B—BAG SAMPLE
** TEST RESULTS REPORTED ON OTHER SHEETS:
C—CONSOLIDATION
S—SIEVE OR GRAIN SIZE ANALYSIS
U—UNCONFINED COMPRESSION TEST
D—DIRECT SHEAR TEST
T—TRIAXIAL TEST

Data checked by: BL

GEOLOGIC ASSOCIATES, INC.

LABORATORY TEST — MOISTURE DENSITY RELATIONSHIP

CLIENT: M.C.I. Consulting Engineers

PROJECT: Vertac Chemical Corporation

PROJECT NO.: 82-824

SAMPLE LOCATION: Delivered by Client

TEST METHOD: ASTM D-698, Method A

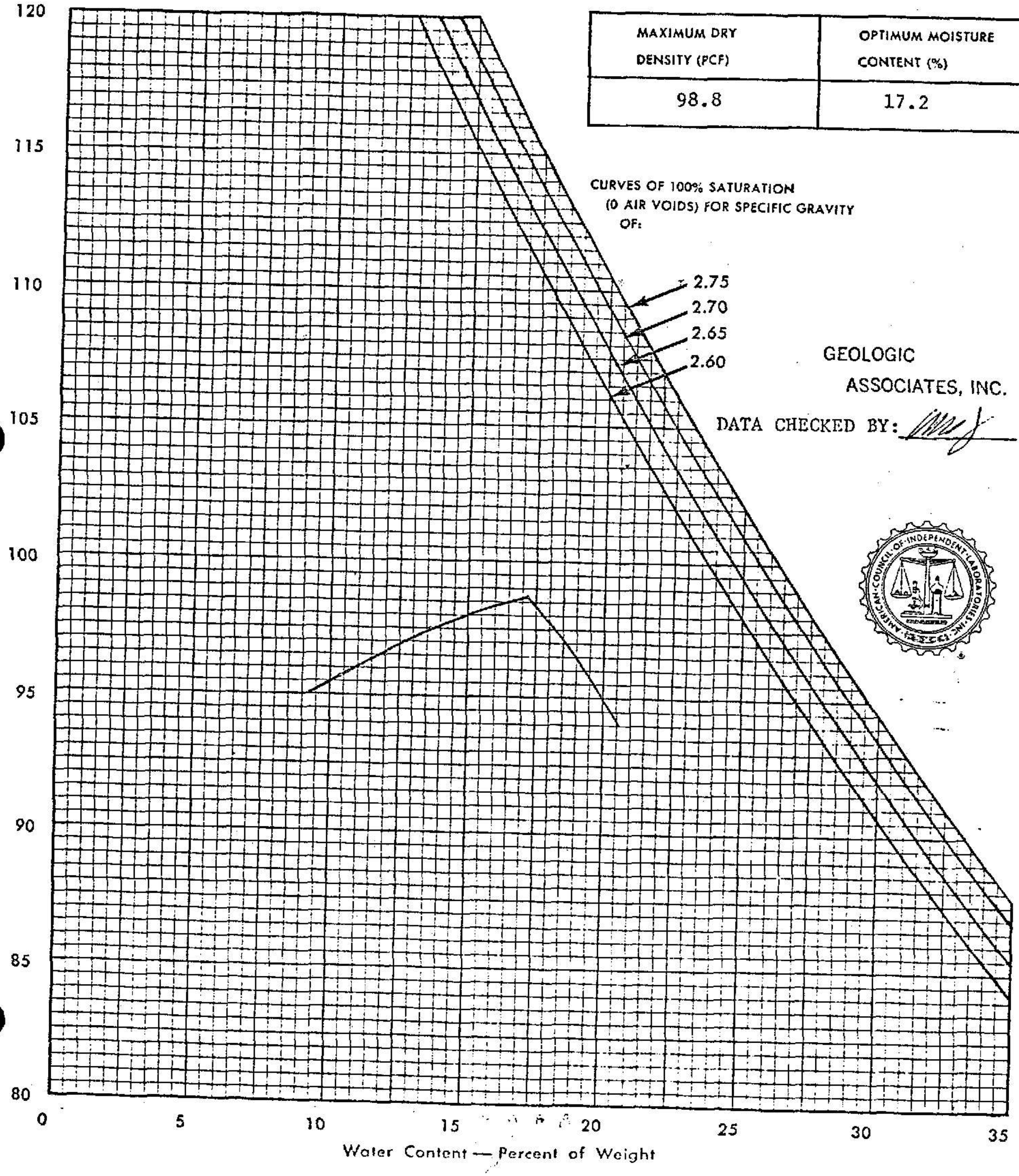
DATE: December 15, 1982

SOIL PROPERTIES:

NATURAL MOISTURE (%): 22.8

SOIL DESCRIPTION: Silt, (loess) Brown

MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE CONTENT (%)
98.8	17.2



GEOLOGIC ASSOCIATES, INC.

DATA CHECKED BY: [signature]

--SLOPE STABILITY ANALYSIS--
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION 83-169K VERTAC-MISSISSIPPI
FOR: MCI CONSULTING ENGINEERS

HIGH WATER CONDITION

BOUNDARY COORDINATES

7 TOP BOUNDARIES
7 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (FT)	Y-LEFT (FT)	X-RIGHT (FT)	Y-RIGHT (FT)	SOIL TYPE BELOW BND
1	0.00	14.00	16.00	6.00	1
2	16.00	6.00	42.00	17.00	1
3	42.00	17.00	54.00	26.00	1
4	54.00	26.00	62.00	26.00	1
5	62.00	26.00	68.00	25.00	1
6	68.00	25.00	79.00	22.00	1
7	79.00	22.00	100.00	20.00	1

ISOTROPIC SOIL PARAMETERS

1 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (PCF)	SATURATED UNIT WT. (PCF)	COHESION INTERCEPT (PSF)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (PSF)	PIEZOMETRIC SURFACE NO.
1	115.0	120.0	0.0	34.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER = 62.40

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 8 COORDINATE POINTS

POINT NO.	X-WATER (FT)	Y-WATER (FT)
1	0.00	11.00
2	12.00	8.00
3	20.00	8.00
4	30.00	10.00
5	51.00	18.00
6	62.00	21.00
7	71.00	22.00
8	100.00	22.00

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

80 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 8 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 0.00 FT.
AND X = 25.00 FT.

EACH SURFACE TERMINATES BETWEEN X = 50.00 FT.
AND X = 65.00 FT.

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = 0.00 FT.

5.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE 5 MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	10.71	8.64
2	14.81	5.78
3	19.37	3.71
4	24.22	2.51
5	29.21	2.22
6	34.17	2.85
7	38.94	4.37
8	43.34	6.74
9	47.24	9.87
10	50.50	13.66
11	53.01	17.98
12	54.69	22.69
13	55.22	26.00

*** 0.949 ***

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

80 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 8 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 0.00 FT.
AND X = 25.00 FT.

EACH SURFACE TERMINATES BETWEEN X = 50.00 FT.
AND X = 65.00 FT.

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = 0.00 FT.

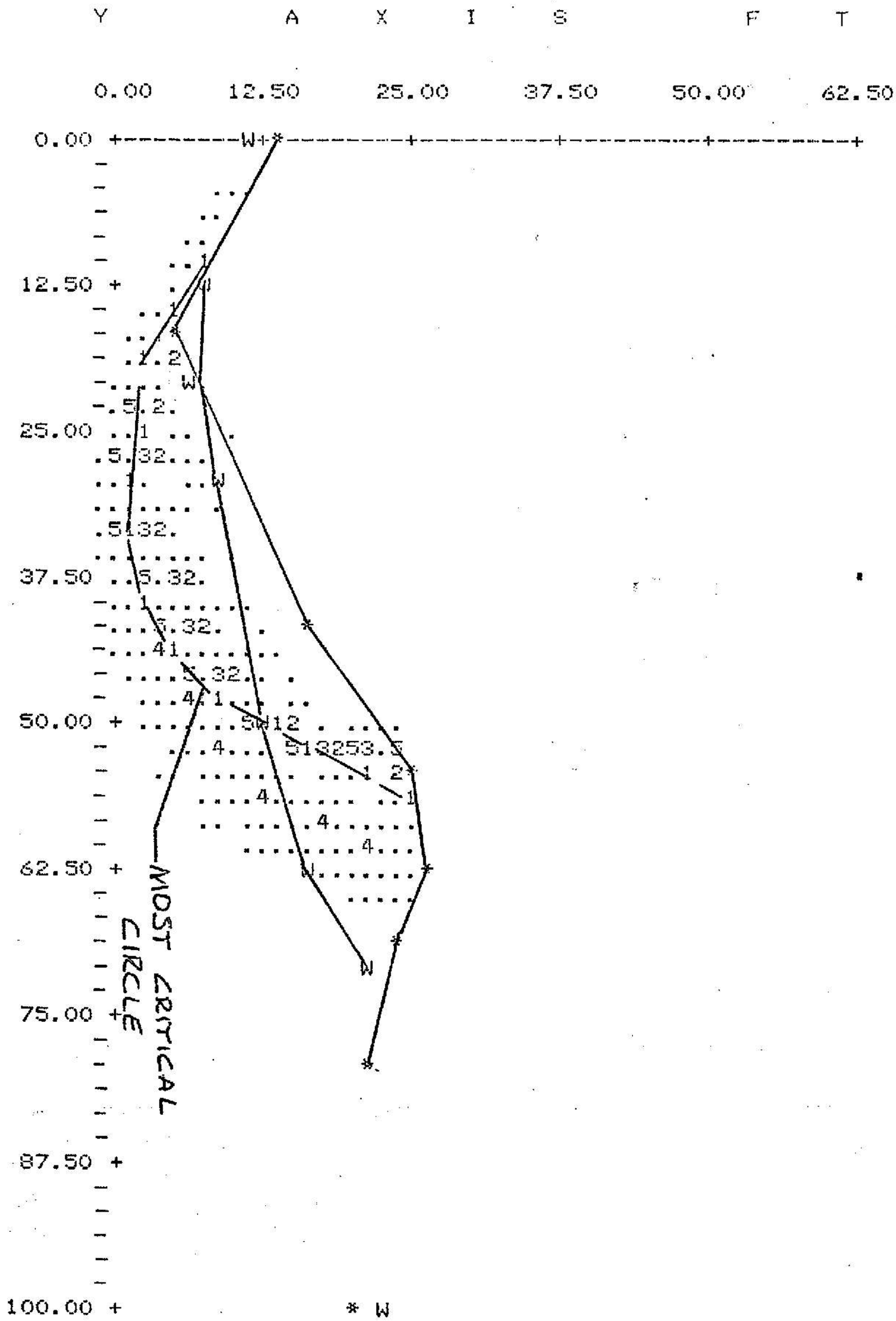
[illegible].00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE 5 MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	10.71	8.64
2	14.81	5.78
3	19.37	3.71
4	24.22	2.51
5	29.21	2.22
6	34.17	2.85
7	38.94	4.37
8	43.34	6.74
9	47.24	9.87
10	50.50	13.66
11	53.01	17.98
12	54.69	22.69
13	55.22	26.00

*** 1.141 ***



Y AXIS FT
0.00
12.50
25.00
37.50
50.00
62.50
75.00
87.50
100.00
MOST CRITICAL CIRCLE
* W

OK, SLIST STABL.LST

--SLOPE STABILITY ANALYSIS--
SIMPLIFIED JANBU METHOD OF SLICES
IRREGULAR FAILURE SURFACES

PROBLEM DESCRIPTION 83-169K VERTAC-MISSISSIPPI
FOR: MCI CONSULTING ENGINEERS

NORMAL CONDITION
June 11, 1983

BOUNDARY COORDINATES

7 TOP BOUNDARIES
7 TOTAL BOUNDARIES

BOUNDARY NO.	X-LEFT (FT)	Y-LEFT (FT)	X-RIGHT (FT)	Y-RIGHT (FT)	SOIL TYPE BELOW BND
1	0.00	14.00	16.00	6.00	1
2	16.00	6.00	42.00	17.00	1
3	42.00	17.00	54.00	26.00	1
4	54.00	26.00	62.00	26.00	1
5	62.00	26.00	68.00	25.00	1
6	68.00	25.00	79.00	22.00	1
7	79.00	22.00	100.00	20.00	1

ISOTROPIC SOIL PARAMETERS

1 TYPE(S) OF SOIL

SOIL TYPE NO.	TOTAL UNIT WT. (PCF)	SATURATED UNIT WT. (PCF)	COHESION INTERCEPT (PSF)	FRICTION ANGLE (DEG)	PORE PRESSURE PARAMETER	PRESSURE CONSTANT (PSF)	PIEZOMETRIC SURFACE NO.
1	115.0	120.0	0.0	34.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

UNITWEIGHT OF WATER = 62.40

PIEZOMETRIC SURFACE NO. 1 SPECIFIED BY 8 COORDINATE POINTS

POINT NO.	X-WATER (FT)	Y-WATER (FT)
1	0.00	11.00
2	12.00	8.00
3	20.00	8.00
4	30.00	10.00
5	51.00	13.00
6	62.00	16.00
7	71.00	22.00
8	100.00	[illegible]

A CRITICAL FAILURE SURFACE SEARCHING METHOD, USING A RANDOM TECHNIQUE FOR GENERATING CIRCULAR SURFACES, HAS BEEN SPECIFIED.

80 TRIAL SURFACES HAVE BEEN GENERATED.

10 SURFACES INITIATE FROM EACH OF 8 POINTS EQUALLY SPACED ALONG THE GROUND SURFACE BETWEEN X = 0.00 FT.
AND X = 25.00 FT.

EACH SURFACE TERMINATES BETWEEN X = 50.00 FT.
AND X = 65.00 FT.

UNLESS FURTHER LIMITATIONS WERE IMPOSED, THE MINIMUM ELEVATION AT WHICH A SURFACE EXTENDS IS Y = 0.00 FT.

5.00 FT. LINE SEGMENTS DEFINE EACH TRIAL FAILURE SURFACE.

FOLLOWING ARE DISPLAYED THE 5 MOST CRITICAL OF THE TRIAL FAILURE SURFACES EXAMINED. THEY ARE ORDERED - MOST CRITICAL FIRST.

FAILURE SURFACE SPECIFIED BY 13 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	10.71	8.64
2	14.81	5.78
3	19.37	3.71
4	24.22	2.51
5	29.21	2.22
6	34.17	2.85
7	38.94	4.37
8	43.34	6.74
9	47.24	9.87
10	50.50	13.66
11	53.01	17.98
12	54.69	22.69
13	55.22	26.00

*** 1.141 ***

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	17.86	6.79
2	22.63	5.28
3	27.59	4.71

4	32.58	5.09
5	37.40	6.41
6	41.88	8.63
7	45.86	11.66
8	49.19	15.39
9	51.75	19.68
10	53.45	24.38
11	53.66	25.75

*** 1.168 ***

FAILURE SURFACE SPECIFIED BY 11 COORDINATE POINTS

POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	17.86	6.79
2	22.47	4.85
3	27.38	3.90
4	32.38	3.99
5	37.25	5.11
6	41.79	7.21
7	45.80	10.19
8	49.10	13.94
9	51.57	18.30
10	53.08	23.06
11	53.32	25.49

1.197 ***

FAILURE SURFACE SPECIFIED BY 14 COORDINATE POINTS

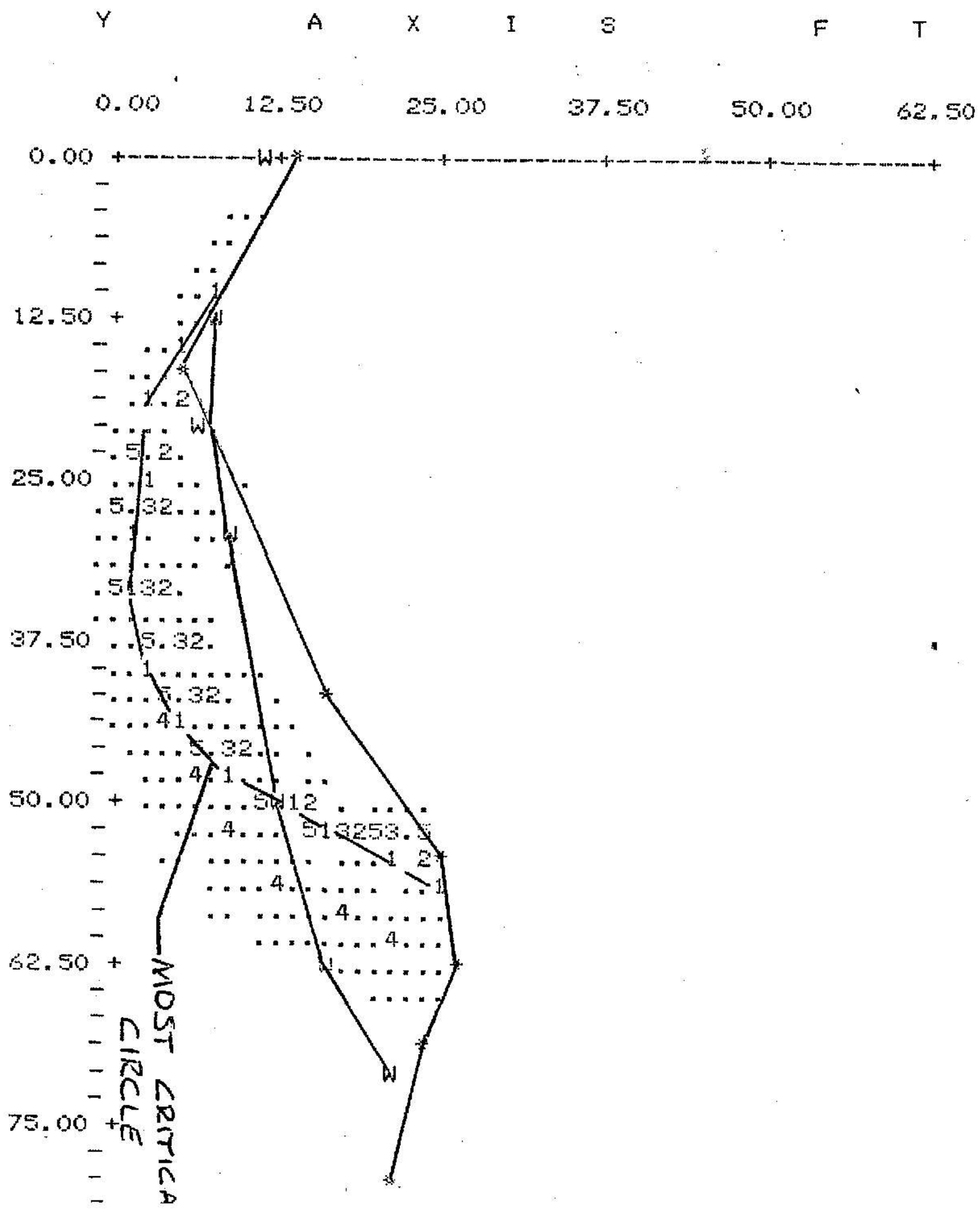
POINT NO.	X-SURF (FT)	Y-SURF (FT)
1	10.71	8.64
2	14.93	5.95
3	19.50	3.93
4	24.33	2.63
5	29.30	2.09
6	34.29	2.32
7	39.20	3.30
8	43.89	5.03
9	48.26	7.45
10	52.21	10.52
11	55.65	14.15
12	58.49	18.26
13	60.66	22.77
14	61.65	26.00

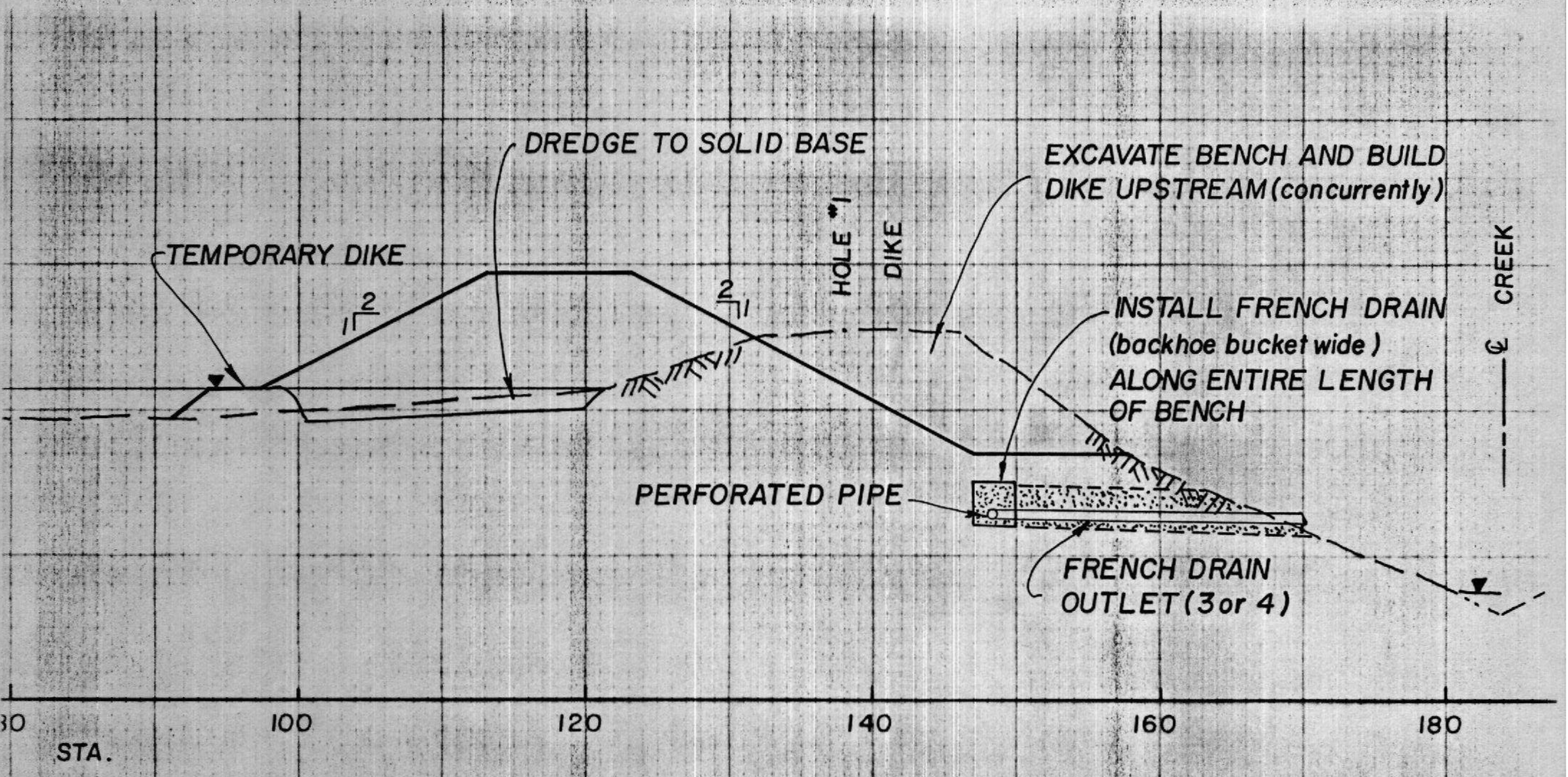
*** 1.210 ***

FAILURE SURFACE SPECIFIED BY 12 COORDINATE POINTS

NO.	(FT)	(FT)
1	14.29	6.86
2	18.33	3.92
3	22.92	1.92
4	27.82	0.96
5	32.82	1.07
6	37.68	2.25
7	42.17	4.46
8	46.08	7.57
9	49.22	11.46
10	51.46	15.93
11	52.68	20.78
12	52.81	25.11

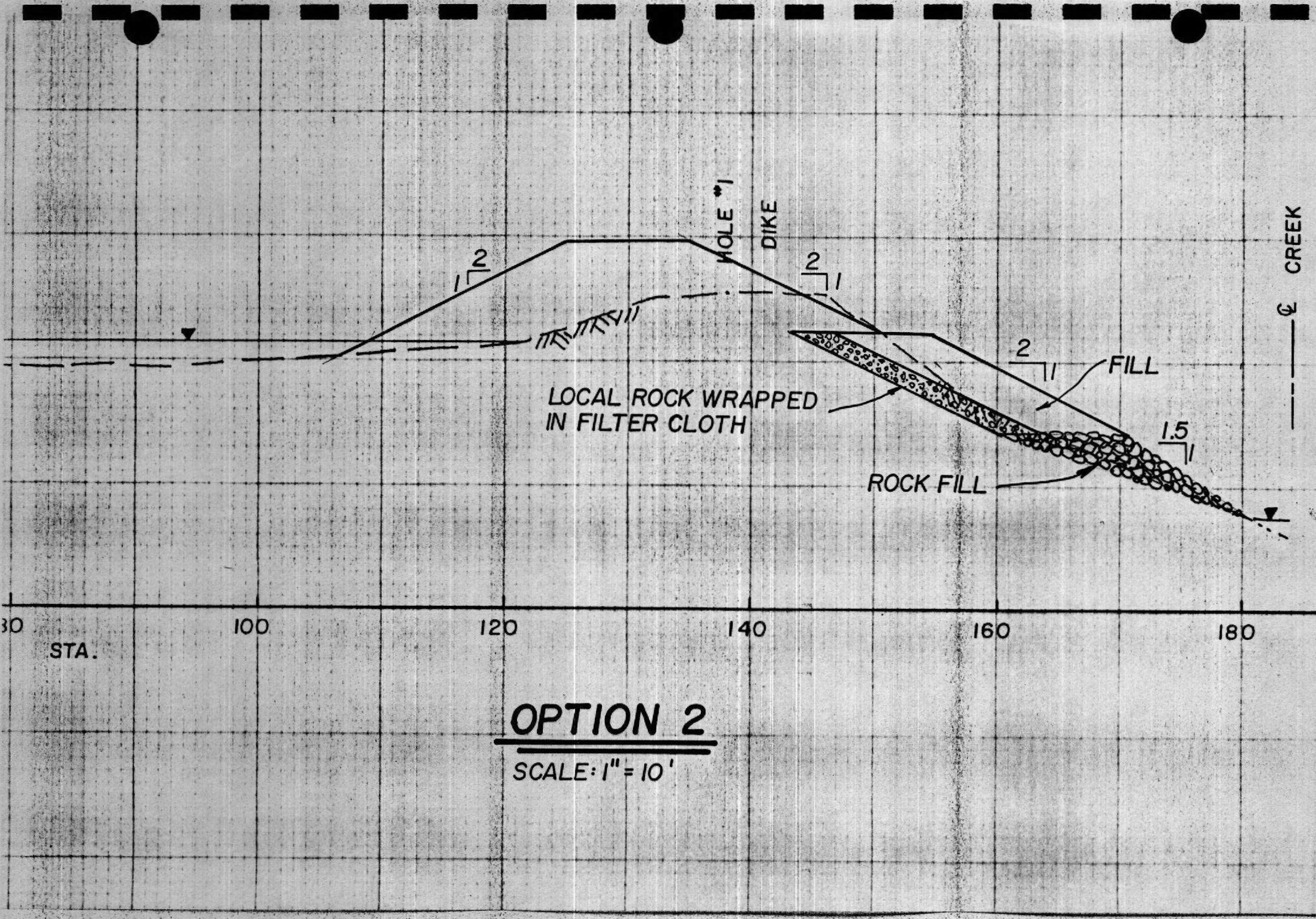
** 1.212 ***





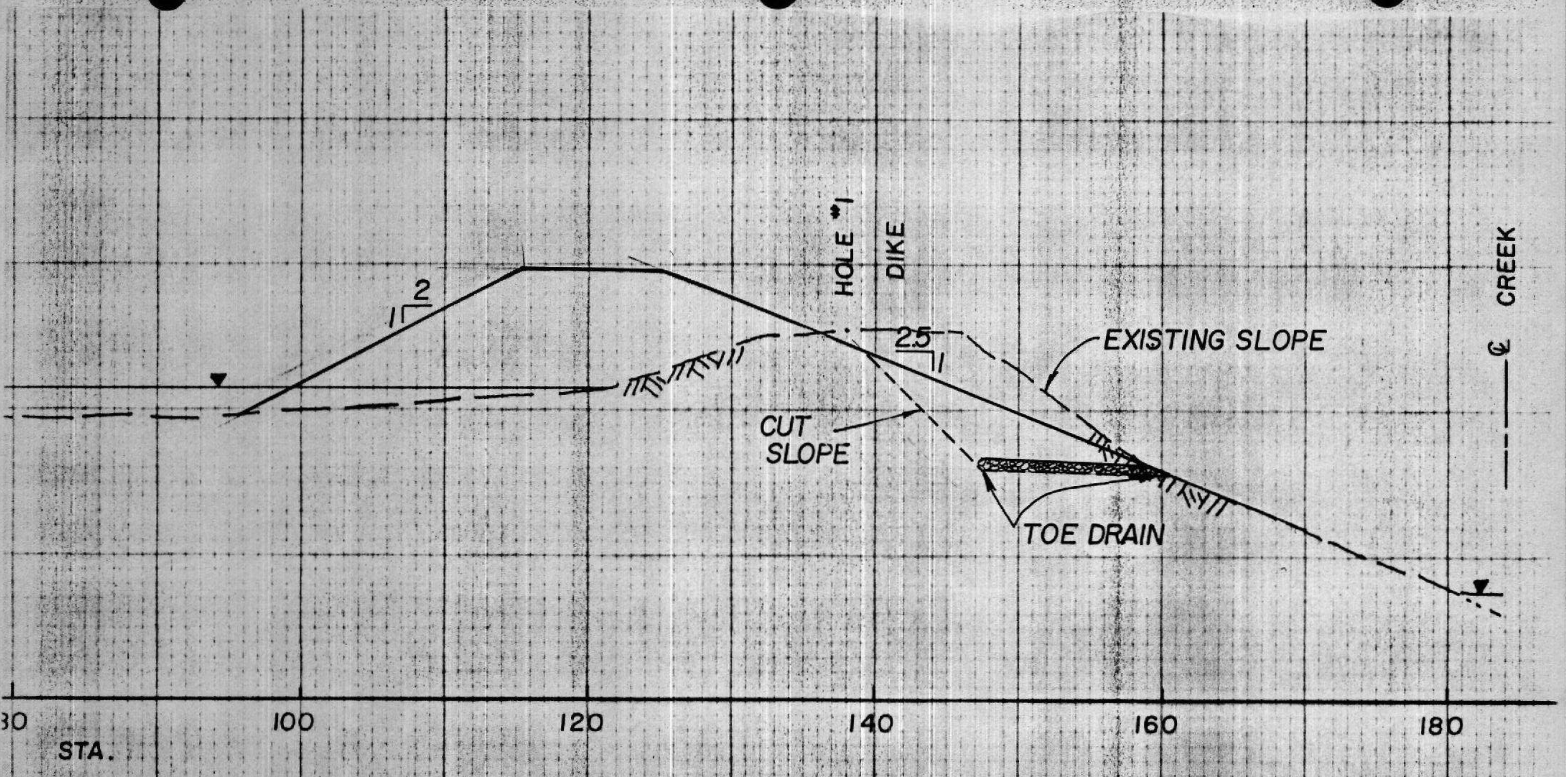
OPTION 1

SCALE: 1" = 10'



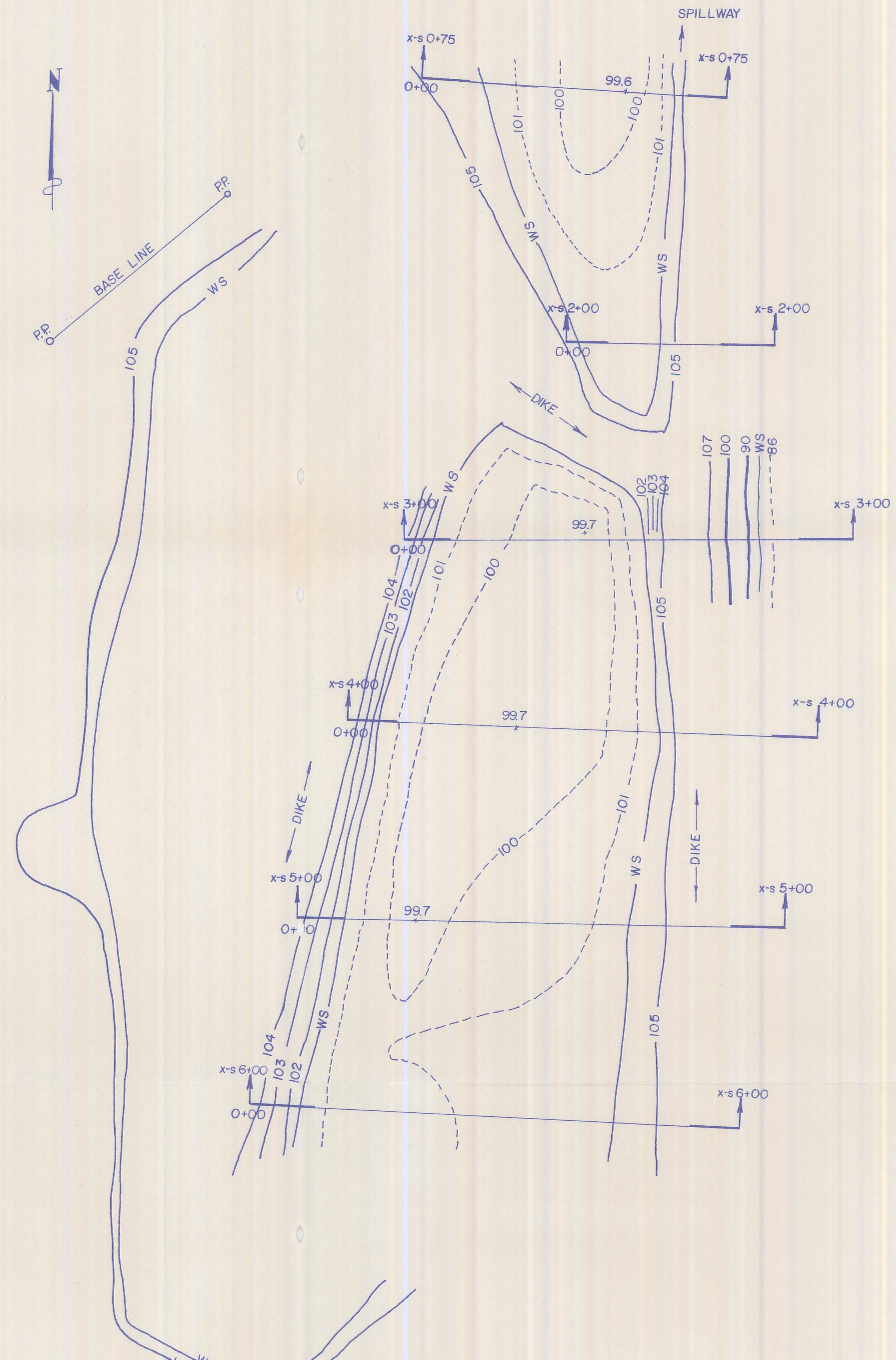
OPTION 2

SCALE: 1" = 10'



OPTION 3

SCALE: 1" = 10'



DATA FROM MAP TECH TOPO (JAN. 1983)

NOTES:

1.) W S ELEV. 101.67

2.) ELEV'S MSL; BM CONCRETE PAD 114.43

3.) POND SPILLWAY ELEV. 103.63

4.) 100YR. FLOOD EL. 109.0 AT INTERSECTION OF STOUTS & HATCHER BAYOU.

DATE	REVISIONS	BY

VERTAC CHEMICAL CORPORATION

VICKSBURG, MS.

SURFACE IMPOUNDMENT

TOPOGRAPHIC MAP

SCALE: 1" = 40'

PREPARED FOR:

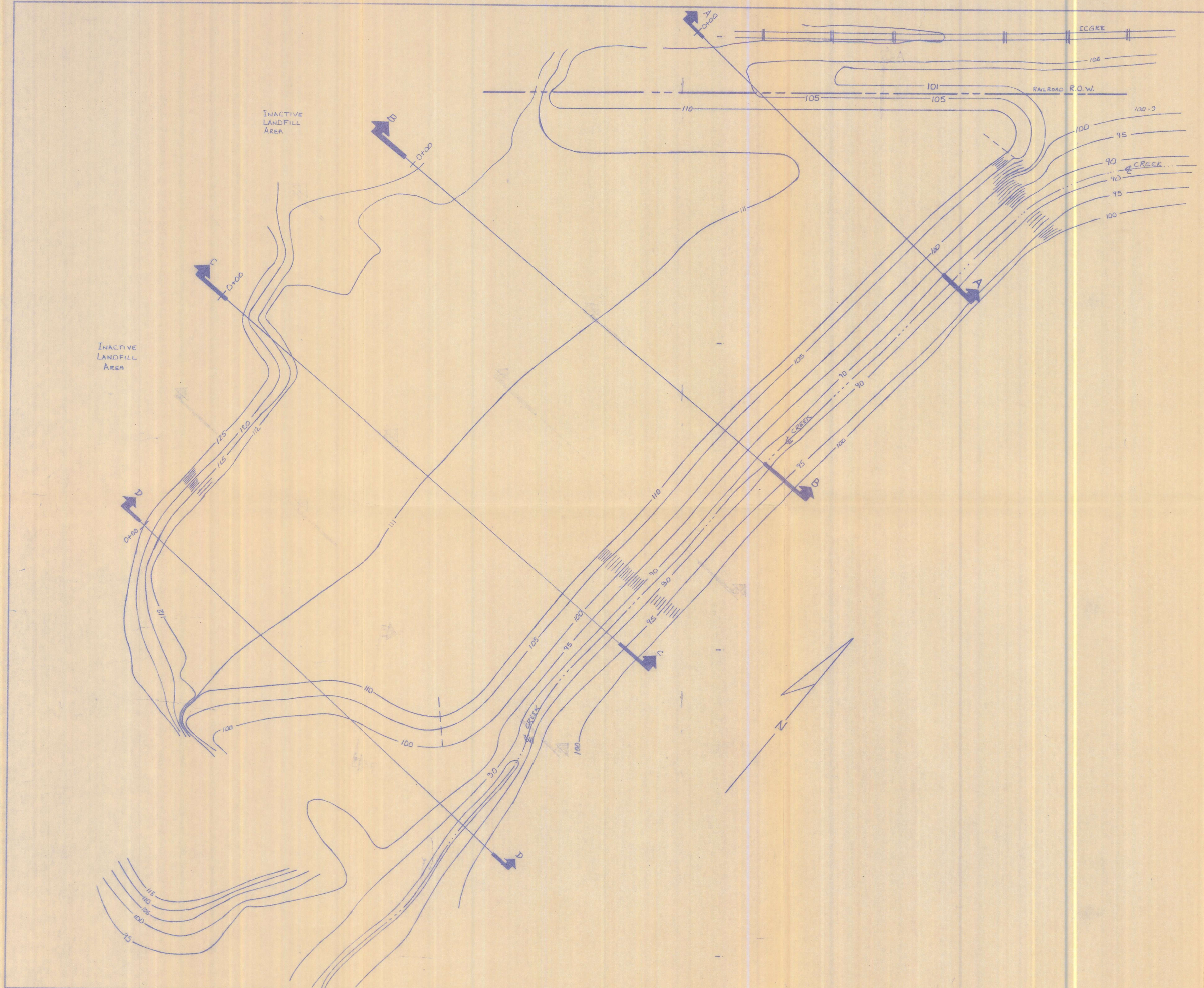
VERTAC CHEMICAL CORPORATION

MCI/CONSULTING ENGINEERS, INC.

FRANKLIN & KNOXVILLE, TENNESSEE

PROJ. 83-560 | DATE 6-11-83 | SHEET 1 OF 2

BRUNING 44-142 26653



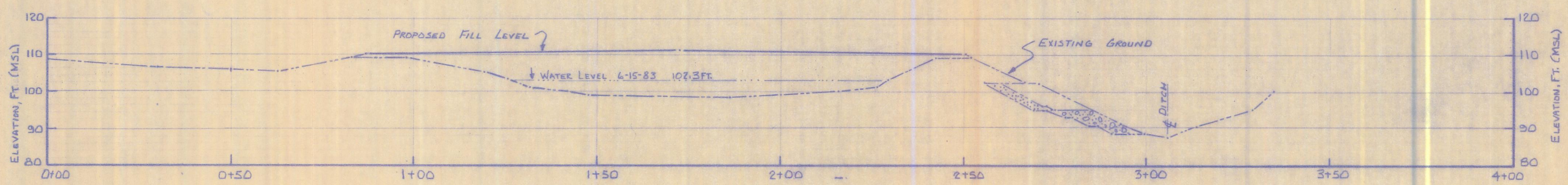
NOTES

SEE SHEETS 2 & 3 FOR DETAILED CROSS-SECTIONS "A-A" THROUGH "D-D".

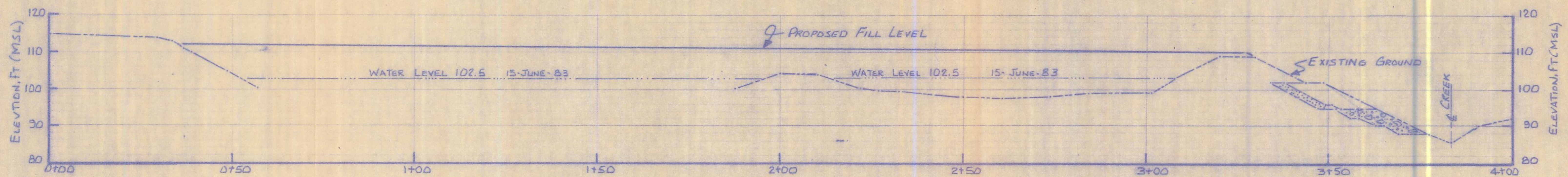
VERTAC CHEMICAL CORP.
P. O. BOX 3
VICKSBURG, MISSISSIPPI 39180
TELEPHONE (601) 636-1231

SURFACE IMPOUNDMENT
CLOSURE PLAN

SCALE 1" = 40'	APPROVAL— TECHNICAL
DWN Glen Hicks	APPROVAL— PRODUCTION
CKD	APPROVAL— SAFETY
DATE AUG. 1984	NO. SHT 1 OF 3



Section "A-A"
Scale: 1" = 20'

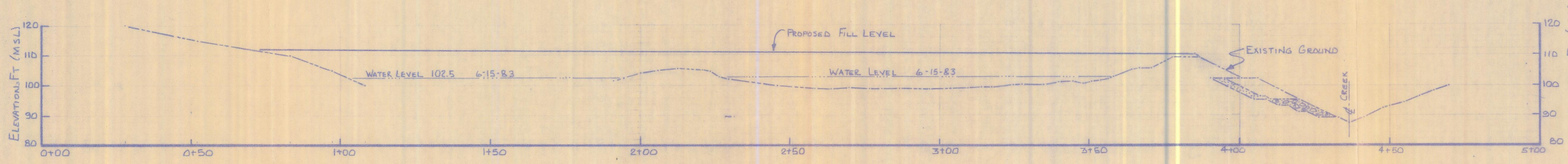


Section "B-B"
Scale: 1" = 20'

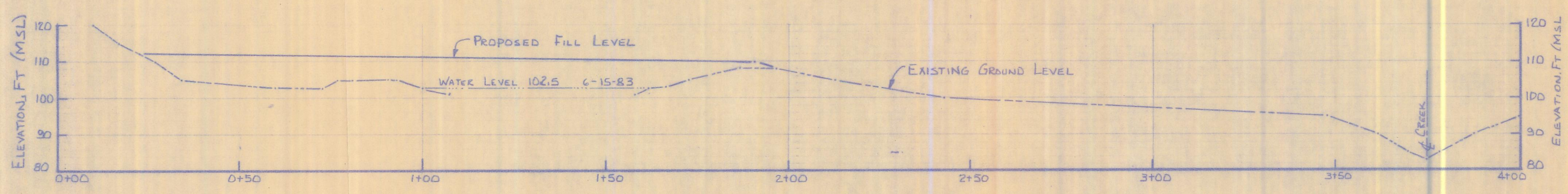
VERTAC CHEMICAL CORP.
P.O. BOX 3
VICKSBURG, MISSISSIPPI 39180
TELEPHONE (601) 636-1231

CROSS SECTIONS "A-A" & "B-B"
SURFACE IMPOUNDMENT
CLOSURE PLAN

SCALE As Noted	APPROVAL—TECHNICAL
DWN Glen Hicks	APPROVAL—PRODUCTION
CKD	APPROVAL—SAFETY
DATE 8-31-84	NO. SHT 2 OF 3



Section "C-C"
Scale: 1" = 20'

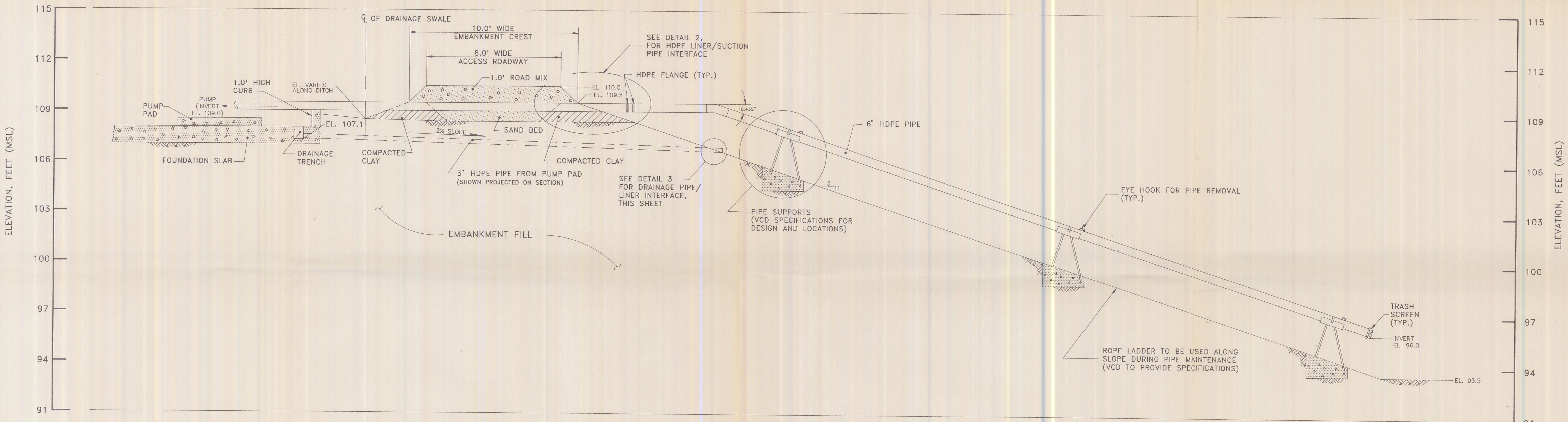


Section "D-D"
Scale: 1" = 20'

VERTAC CHEMICAL CORP.
P. O. BOX 3
VICKSBURG, MISSISSIPPI 39180
TELEPHONE (601) 636-1231

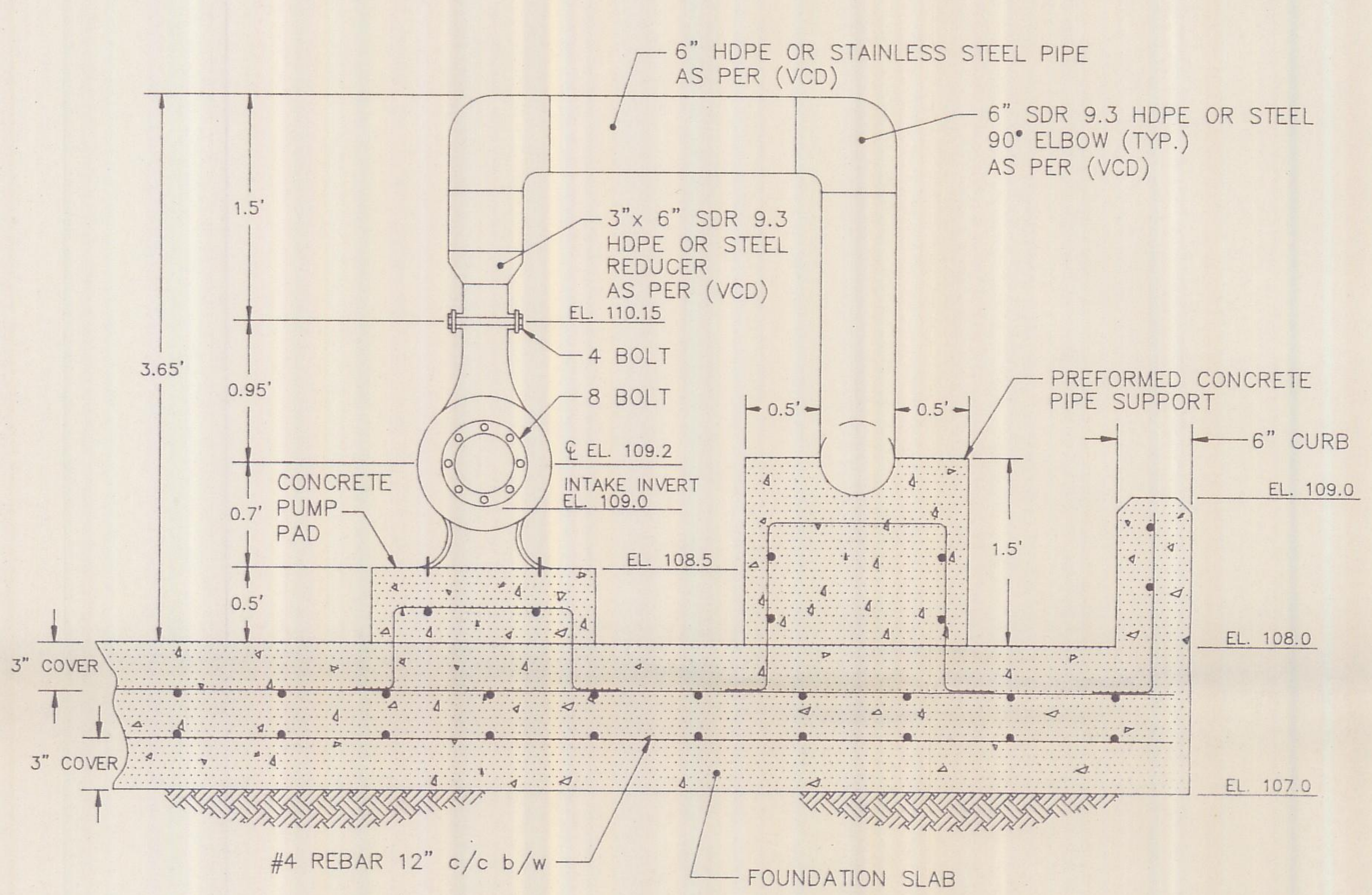
CROSS SECTIONS "C-C" & "B-B"
SURFACE IMPOUNDMENT
CLOSURE PLAN

SCALE As Noted	APPROVAL— TECHNICAL
DWN Glen Hicks	APPROVAL— PRODUCTION
CKD	APPROVAL— SAFETY
DATE 9-4-84	NO. Sht 3 of 3



TYPICAL PROFILE OF DISCHARGE PIPING IMPOUNDMENT A

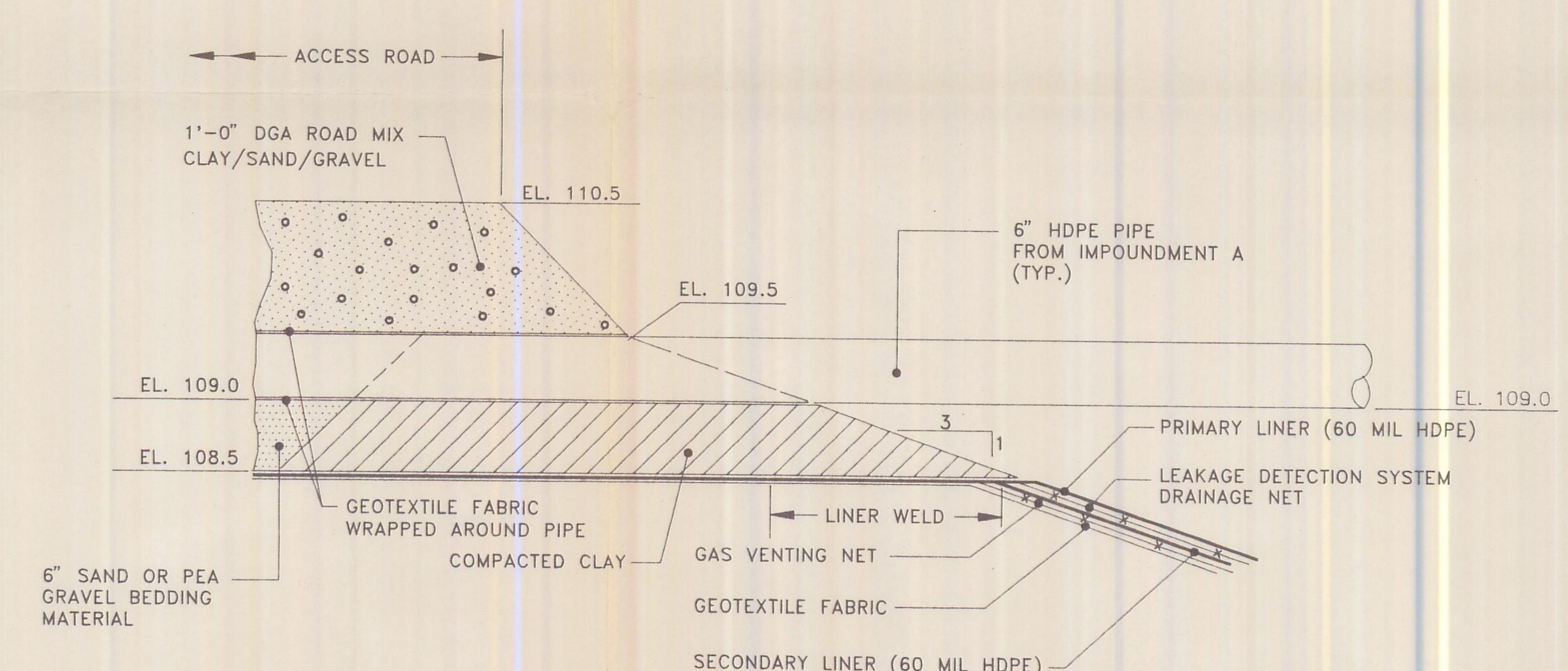
SCALE 0 3 6 FEET



TYPICAL PUMP DETAIL/DISCHARGE INTERFACE

SCALE 0 1 2 FEET

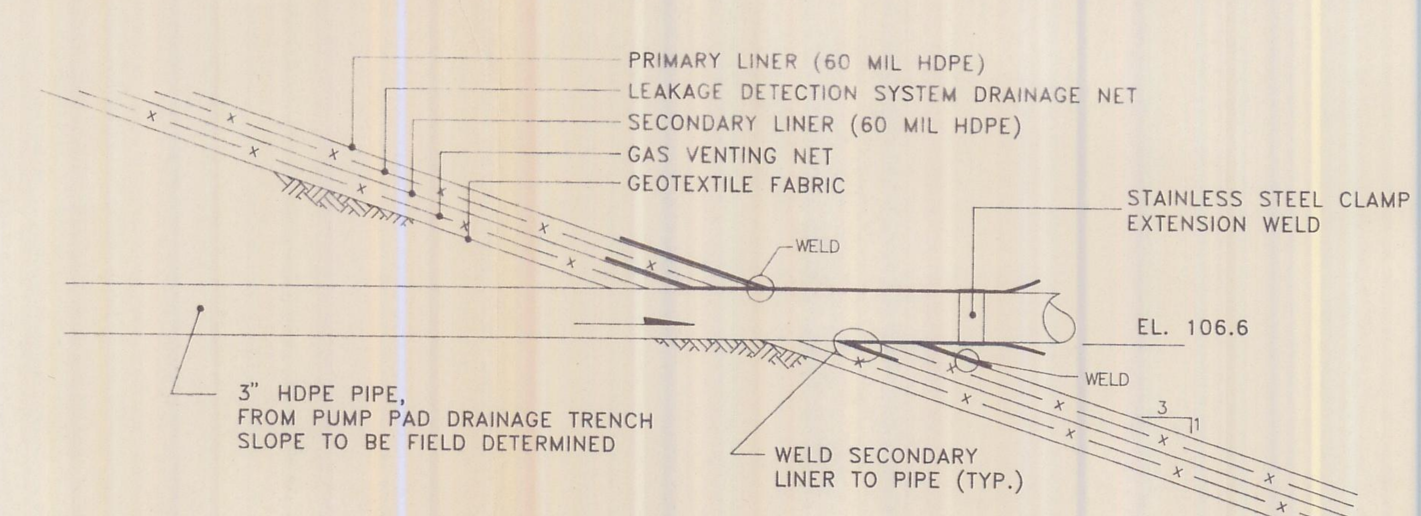
DETAIL 1



HDPE LINER/SUCTION PIPE INTERFACE

SCALE 0 1 2 FEET

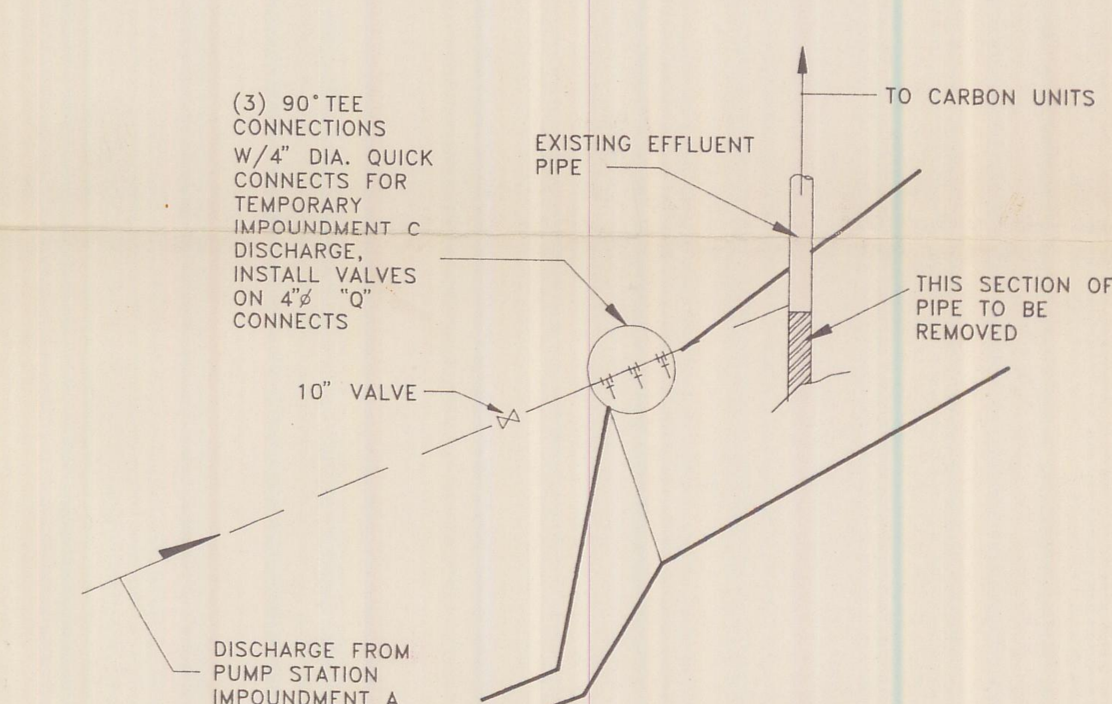
DETAIL 2



DRAINAGE PIPE/LINER INTERFACE

NOT TO SCALE

DETAIL 3



IMPOUNDMENT C DISCHARGE INTERFACE

NOT TO SCALE

DETAIL 4

FIGURE 2

PUMP STATION PIPING DESIGN SHEET 2 OF 2

SURFACE IMPOUNDMENTS

PREPARED FOR

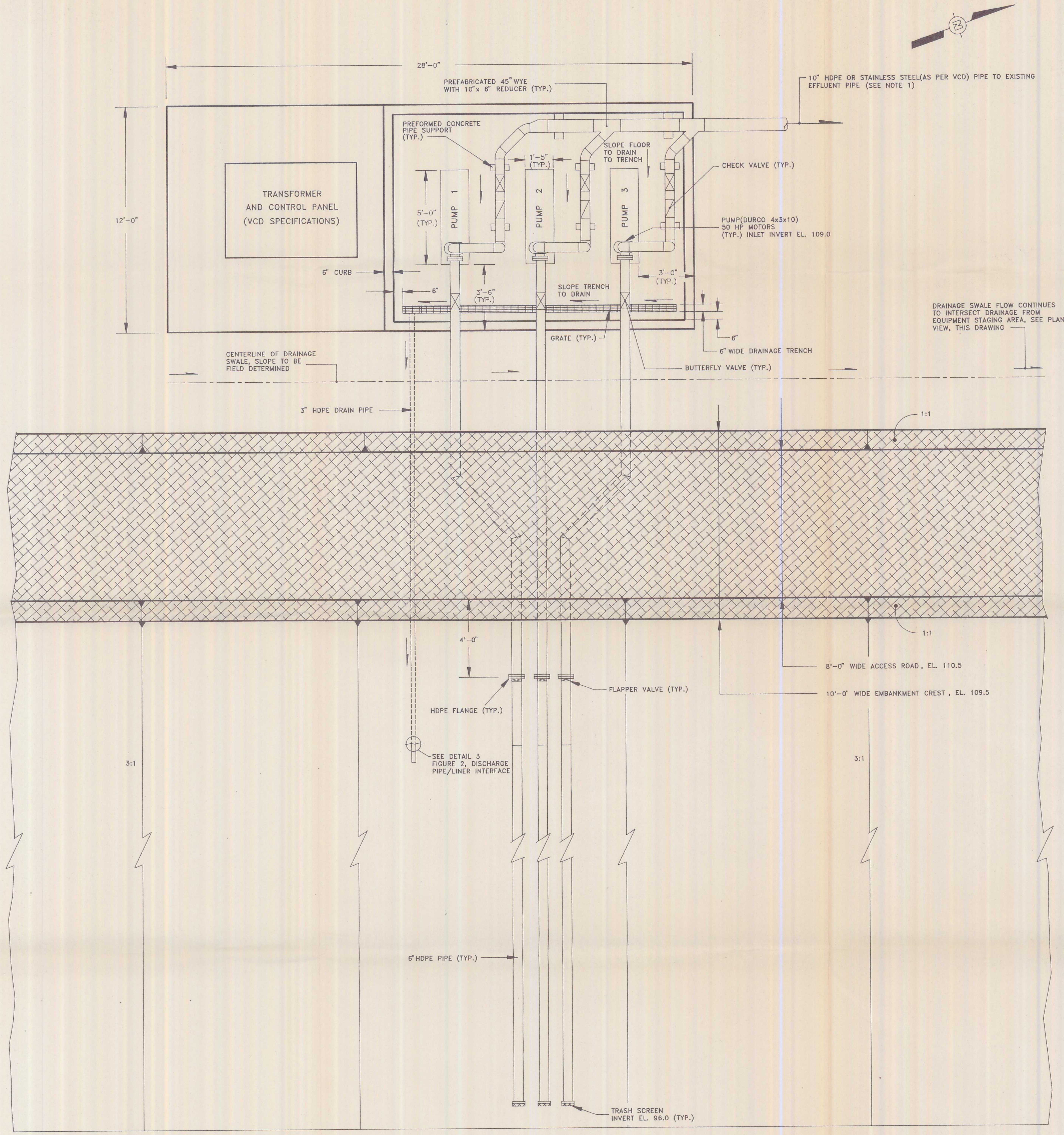
VICKSBURG CHEMICAL DIVISION VICKSBURG, MISSISSIPPI

IT ... Creating a Safer Tomorrow

DRAWN BY	T.BURNS	4/14/89
CHECKED BY		
APPROVED BY		
DRAWING NUMBER	435425-E4	

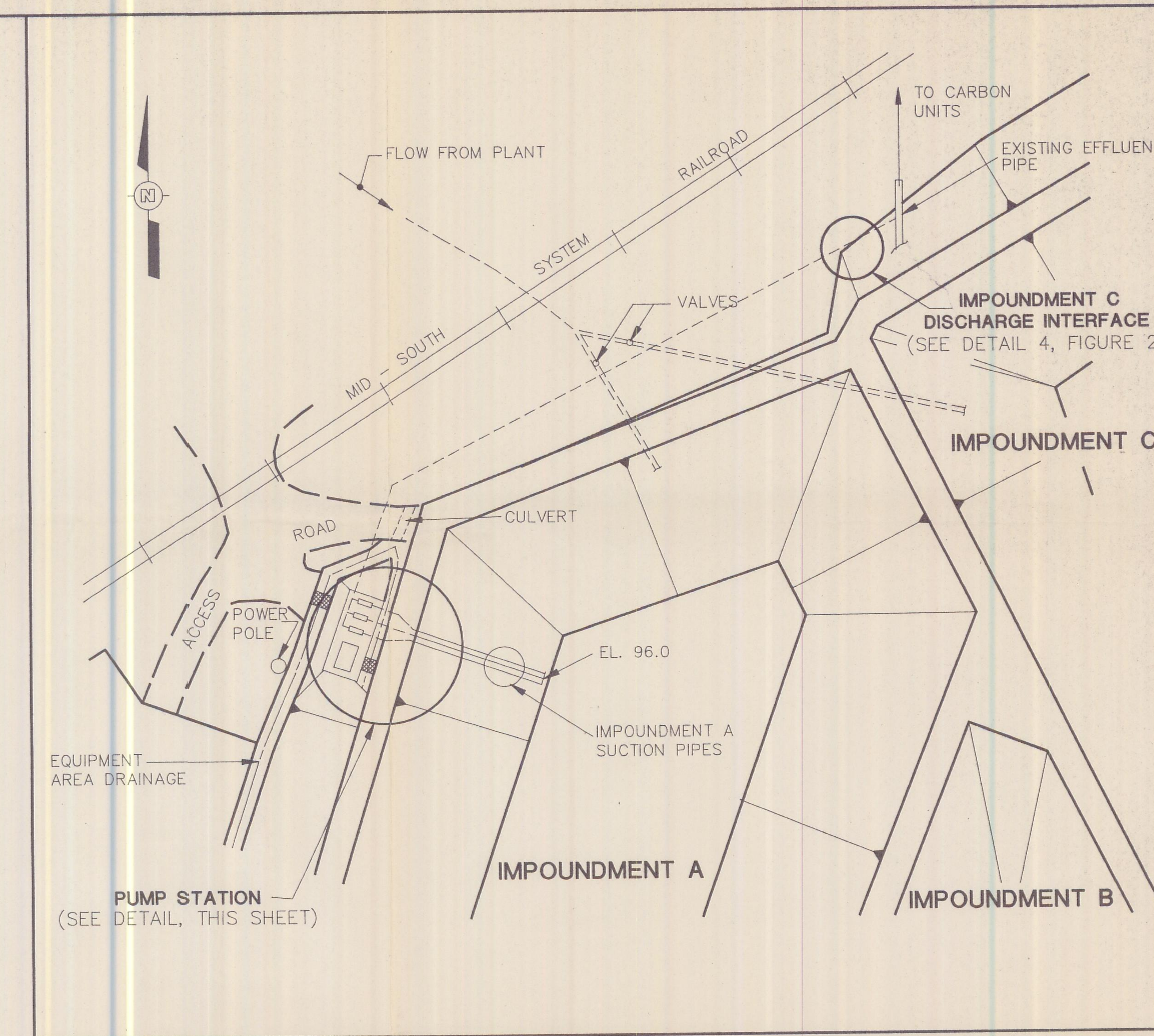
"Do Not Scale This Drawing"

DRAWN BY | C. BENTZ | 4-14-89
CHECKED BY | APPROVED BY
DRAWING NUMBER 435425-E3



PLAN VIEW - PUMP STATION DETAIL

SCALE 0 3 6 FEET



PLAN VIEW

SCALE 0 30 60 FEET

NOTES:
1. DISCHARGE FROM PUMPS TO FLOW TO EXISTING EFFLUENT PIPE. LENGTH OF PIPES TO EFFLUENT PIPE WILL BE FIELD VERIFIED BY VCD.
2. ALL PIPE LENGTHS WILL BE FIELD VERIFIED BY VCD.
3. ALL CONTROL ELEVATIONS ARE APPROXIMATE AND MAY VARY.
4. SEE FIGURE 2 FOR TYPICAL PROFILE OF DISCHARGE PIPING.

FIGURE 1

PUMP STATION PIPING DESIGN
SHEET 1 OF 2
SURFACE IMPOUNDMENTS

PREPARED FOR

VICKSBURG CHEMICAL DIVISION
VICKSBURG, MISSISSIPPI

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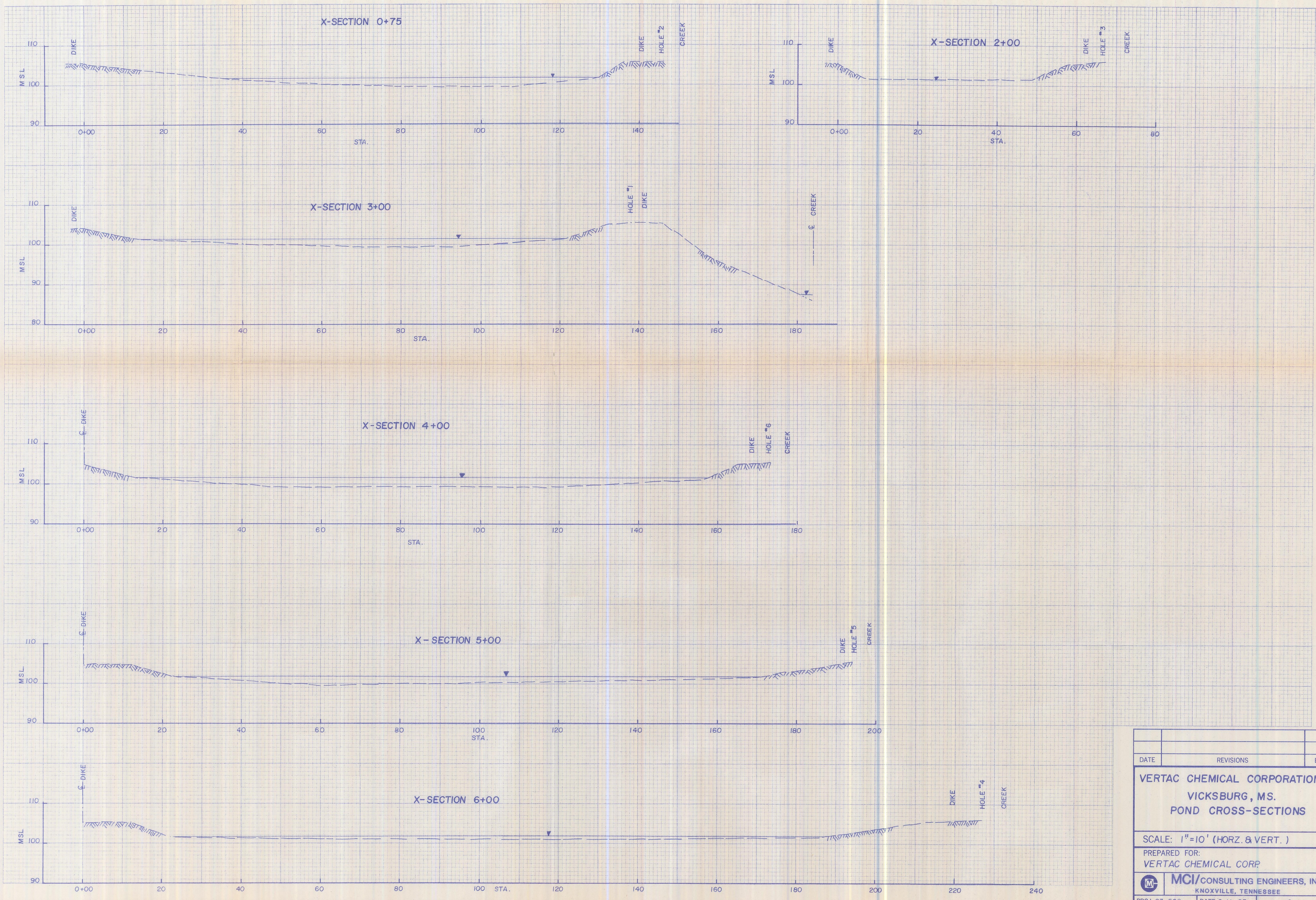

DATE	REVISIONS	BY

VERTAC CHEMICAL CORPORATION
VICKSBURG, MS.
POND CROSS-SECTIONS

SCALE: 1"=10' (HORZ. & VERT.)

PREPARED FOR:
VERTAC CHEMICAL CORP.

MCI/CONSULTING ENGINEERS, INC.
KNOXVILLE, TENNESSEE

PROJ. 83-560 | DATE 6-11-83 | SHEET 2 OF 2