PROPOSED COAL REFUSE DISPOSAL PLAN

ENGINEERING REPORT

COAL REFUSE DISPOSAL AREAS
CONCORD PREPARATION PLANT
CLIFFS NATURAL RESOURCES – OAK GROVE MINE
JEFFERSON COUNTY, ALABAMA

EXPANSION EASTWARD TO SITE 3a FOR CCR DISPOSAL

FACILITY ID No. 01-00329
MSHA ID 1211-AL11-00043-02 (Site 2c - CCR Disposal)

ASMC, 3A ONLY
May 2014

Prepared For:
Cliffs Natural Resources
Oak Grove Mine
Jefferson County, Alabama

Prepared By:
Marshall Miller & Associates, Inc.
200 George Street, Suite 6Beckley, WV 25801

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O Dickey III
(Signature)

Date: 5/12/14

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public.
This 12 day of MAY, 2014.
My commission expires 10/17/17.

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

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B	Guideline Technical Specifications
C	Calculation Brief
D	MEC Reference Calculations
E	Almes , 1991 & PERC, 2007Approved Plans (on DVD disc only)

ENGINEERING REPORT

COAL REFUSE DISPOSAL AREAS
CONCORD PREPARATION PLANT
CLIFFS NATURAL RESOURCES – OAK GROVE MINE
JEFFERSON COUNTY, ALABAMA

EXPANSION EASTWARD TO SITE 3a FOR CCR DISPOSAL

1.0 GENERAL INFORMATION

Marshall Miller and Associates (MMA) has prepared this Engineering Report for a proposed plan (Plan) for expansion eastward to Site 3a for coarse coal refuse (CCR) disposal at the Oak Grove Resources LLC (OGR) Concord Preparation Plant in Jefferson County, Alabama. This report encompasses the features of work that are necessary to prepare the sites being modified for coal refuse disposal, including:

- Implementation of local erosion and sedimentation controls (E&SC);
- Development of access and haul roads;
- Storm drainage controls (channels/ditches and culverts);
- Related tasks necessary to prepare the sites for coal refuse disposal.

Refuse disposal requirements, instrumentation, and abandonment capping details and storm water drainage controls are addressed in the existing, previously approved, documents: (1) Report – Proposed Coal Refuse Disposal Area – Expansion Plan, Project No. 90-555-27, September 1991 by Almes and Associates (Almes, 1991) and (2) Oak Grove Resources, LLC – Concord Preparation Plant – Refuse Disposal Area Expansion by PERC Engineering Co., Inc. (PERC, 2007). The requirements of these previously approved plans remain in affect except as modified herein.

1.1 OVERVIEW OF PROPOSED PLAN

The existing conditions are shown on Figure 2 and the overall proposed expansion plan and site designations are shown on the Key Plan, Figure 3 located in Appendix A.

On the east side of Site 2c, a new, larger coarse refuse buttress will be constructed in the area labeled Site 3a (Figure 3). This coarse refuse buttress will enlarge the foot print of the refuse facility to the east and will require a new haul road, additional drainage controls and additional environmental permitting. Others will address the environmental permitting issues associated with the Site 3a expansion with the Alabama Surface Mining Commission (ASMC). McGehee Engineering Company, MEC, has designed the E&SC measures, including two new ponds that will receive the runoff from the Site 3a embankment. The MEC design information is included for reference in Appendix D.

Drainage control for the entire site will be slightly modified with some new diversion ditches and riprapped flumes. Overall these changes will be relatively minor: a new haul road at Site 2b and surface drainage structures and a new haul road at Site 3a. These items are included in this Plan and will comply with current criteria of the Mine Safety and Health Administration (MSHA) and ASMC.

The following companion documents are enclosed in support of the Plan for the proposed expansion of Site 3a (CCR):

- Figures 1-4, 9, 10, 12, 13, 15 (Design Drawings) – Appendix A
- Guideline Technical Specifications – Appendix B
- Calculation Brief – Appendix C
- Geotechnical Data and Laboratory Testing Reports – Section B, Calculation Brief Appendix C
- MEC Calculations– Appendix D

Together these documents comprise the engineering submission for the proposed Plan. Figures 2, 3, and 9, Appendix A, present an existing conditions plan, an overall key plan of the proposed expansion and the final disposal configurations for Site 3a. Several concepts for the final reclamation and abandonment of the sites are proposed, the details of which will be developed and finalized prior to abandonment. Two of the three abandonment options are very similar to what is currently shown in the approved Almes, 1991 and PERC, 2007 plans.

1.2 FACILITY IDENTIFICATION [§ 77.216-2(A) (1)]

Oak Grove Resources, LLC (OGR) is currently operating the Concord Refuse Disposal Facility (Facility) Facility ID No. 01-00329. The MSHA ID Numbers are: 1211-AL11-00043-02 (Site 2c - CCR Disposal). OGR is seeking the approval of MSHA and ASMC for the modification to its currently approved plan as defined by Almes, 1991 and PERC, 2007. The Facility is operated by:

Oak Grove Resources LLC
8800 Oak Grove Mine Road
Adger, AL 35006
Contact: Mr. Ralph Lopez
Telephone: (205) 497-3615

1.3 SITE LOCATION [§ 77.216-2(A) (2)]

The Facility is located in Jefferson County, approximately 0.5 miles North of Hueytown, AL off of Warrior River Road, towards Concord, AL. OGR owns the surface property within the existing and proposed permit boundary. This Facility has been previously operated by other mining companies since the earlier 1950's.

1.4 FACILITY PURPOSE [§ 77.216-2(A) (3)]

The proposed expansion of the Facility is necessary for the continued operation of the Oak Grove Mine and Concord Preparation Plant. After evaluating the proposed coal production from this facility, OGR has requested that its life be extended for continuous operation until early 2020 . Various options were evaluated by MMA to expand the life of the refuse facility. Some options could have added several years in excess of the minimum required life, but those options would have resulted in a much larger footprint than the currently proposed Plan. The larger footprint would require considerable additional acreage. All of these options were evaluated and it was determined that the currently proposed Plan would minimize the impacts associated with all of these variables while satisfying operational needs of the Facility.

1.5 WATERSHED INFORMATION [§ 77.216-2(A) (4)]

The existing refuse facility area is located on the drainage divide between two unnamed tributaries of Lick Creek. A freshwater reservoir (Impoundment 1), used as water supply for the coal preparation plant, is located on the head waters of the unnamed tributary along the west side of the Facility. The Concord coal preparation plant is located on the north side of the Facility and a series of sedimentation ponds, water treatment ponds and associated features are located on the east side. These will be excavated and restored to competent material during the Site 3a buttress construction, as required in the Guideline Technical Specifications, Appendix B.

1.6 EFFECTS OF UNDERGROUND MINE WORKINGS [§ 77.216-2(A) (13 & 14)]

Documentation of previous mining beneath the Facility is included on Figure 2. The abandoned mine works lies approximately 600 feet below natural grade. The impact of mine works under this facility has been previously studied and included with previously approved expansion plans (Almes, 1991). The summary within the Almes report indicates “future subsidence affects are unlikely since the majority of subsidence in this area has probably already occurred.”

The east buttress area at Site 3a will expand the CCR disposal footprint slightly to the east, over abandoned mining areas. Since Site 3a is only being proposed as a coarse refuse disposal area, no impacts due to the underlying mining are anticipated in this area.

2.0 FOUNDATION CHARACTERISTICS

2.1 SITE EXPLORATION [§ 77.216-2(A) (5)]

The exploration program undertaken by MMA in the Spring of 2011 is presented on Figure 4. The previous studies and expansion plan designs (Almes, 1991 and PERC, 2007) already have addressed the existing CCR dams and embankments and downstream stability.

In Site 3a, three (3) conventional test borings (MMA-9 through MMA-11) were performed to explore the existing foundation conditions around the area of proposed expansion. Southern Earth Sciences, Inc. (SESI) performed the drilling and cone penetrometer testing on the project, under the supervision of MMA personnel.

Standard Penetration Testing (SPT), undisturbed piston-tube sampling of FCR and native soil, and selective rock coring (to confirm bedrock) were performed in the conventional borings. Section B – *Geotechnical Properties* of the Calculation Brief, Appendix C includes:

1. Excerpts of previous design information from the Almes,1991 and PERC, 2007 expansion plans;
2. Survey data, exploration information, key elevations, and a report of the SPT-system Energy Transfer for the two drilling rigs employed by SESI (Diedrich B-50 and CME 45-B);
3. Boring logs;
4. SPT data, including raw blow counts (N-values) and corrected N-values from N_1 through $N_{1,60(cs)}$ (overburden, energy transfer, and clean sand corrections);
5. Laboratory Test results, including index and shear strength testing results; and

2.2 REGIONAL GEOLOGY [§ 77.216-2(A) (5)]

The regional geology was previously presented in the Almes,1991 Engineering Report.

2.3 SITE FOUNDATION SOILS [§ 77.216-2(A) (5)]

2.3.1 Description

Site 3a (CCR):

In Site 3a, Borings MMA-9 and MMA-11 encountered native foundation soils consisting of moist, stiff to very stiff clay to sandy clay underlain by dense sand. In MMA-9, medium dense CCR was encountered above the native foundation level. Weathered bedrock, characterized as dense to very dense highly weathered sandstone, was encountered immediately below existing CCR in MMA-10. Similar to Site 2a & 2b, a native soil layer with shear strength lower than the overlaying CCR was not encountered in any of these borings.

2.3.2 Design Parameters

Pertinent geotechnical design parameters are summarized in Table B-1, Calculation Brief Section B, Appendix C. The design parameters for native foundation materials were selected based on the results of the recent subsurface exploration and laboratory geotechnical testing, typical values for similar materials, previously obtained data, and MMA's experience with similar materials. For consistency with the Almes 1991 design (refer to Table B-2 in Section B1.1 of Calculation Brief), MMA presumed the existence of a native foundation soil layer with lower shear strength (effective stress friction angle of 31 degrees), although a lower shear strength native layer was not encountered in MMA-1 through MMA-11. Bedrock/Weathered Rock properties were selected to effectively represent bedrock as a limiting boundary for slope stability analyses. The foundation rock is markedly stronger than the embankment materials, such that the bedrock does not influence slope stability. The critical slope stability failure surfaces are confined to the embankment, and foundation soils (where present).

The design parameters for CCR coal refuse materials are discussed in Section 3.0 Embankment Characteristics.

3.0 EMBANKMENT CHARACTERISTICS

3.1 COAL REFUSE MATERIALS [§ 77.216-2(A) (6)]

3.1.1 Description of Materials

The cross section locations are labeled in plan on Figure 9 and shown on Figures 12 & 13. The cross sections are the same as Almes, 1991 although E has been extended eastward into Site 3a. They identify the foundation materials encountered in the recent site exploration (Spring 2011) and ascertained from the previous Almes,1991 and PERC, 2007 studies SPT, and laboratory test data for materials recovered from Site 3a are summarized in Section B of the Calculation Brief, Appendix C.

3.1.2 Design Properties

The design unit weights, effective stress and total stress shear strength properties, and hydraulic properties for pertinent materials within the 3a site foundation are summarized in Table B-1, Section B of the Calculation Brief (Appendix C) along with supporting data.

The design effective stress shear strength properties for CCR are based on SPT-based correlation, , laboratory testing, and previously reported data. Notably, the present evaluations and data support higher effective stress shear strength properties for CCR than applied in the Almes 1991 design (refer to Table B-2 in Section B1.1 of Calculation Brief). Undrained conditions are typically not applicable to CCR because of its granular, cohesionless nature and drainage characteristics; and therefore, were not characterized.

4.0 FACILITY LAYOUT AND OPERATION

4.1 GENERAL BACKGROUND

Figure 3 provides the overall Key Plan for the proposed expansion of Site 3a. The Plan also discusses a proposed construction sequence for accomplishing the planned development. The proposed Plan primarily involves:

- Implementation of local erosion and sedimentation controls (E&SC);
- Development of modified access and haul road system;
- Construction of the Site 3a CCR disposal area;
- Discussion of the final abandonment cover and storm drainage controls.

4.2 HAUL ROADS AND ACCESS ROADS [§ 77.216-2(A) (7)]

The proposed major access road and haul road are shown on the Site 3a Figures 9 and 10. Haul roads were configured with a maximum grade of 10 percent, transverse slope of 2 to 5 percent, an appropriate traffic width, surface drainage collection ditches and outslope berms. Figure 10 includes plans, profiles, and representative cross sections detailing Haul Roads No. 2.

5.0 IMPOUNDMENT HYDRAULIC & HYDROLOGIC DESIGN [§ 77.216-2(A) (7 & 12)]

5.1 GENERAL CONSTRUCTION SEQUENCE

This general construction sequence is suggested, but many of the tasks may be done concurrently or in different order, depending upon the amount of coarse refuse and fine refuse production from the preparation plant. The construction shall be in accordance with the Guideline Technical Specifications (GTS). The General Construction Sequence, is as follows:

Site 3a

- Excavate and backfill existing five (5) drying ponds.
- Construct Haul Road No. 2
- Construct two new sediment Ponds B and C
- Eliminate existing sediment ponds 3A, 3B and Basin 018E
- Place coarse refuse.
- Install and maintain surface drainage controls as needed.

6.0 EROSION AND SEDIMENT CONTROLS (E&SC)

6.1 EXISTING SEDIMENTATION PONDS

The existing sedimentation ponds will remain in place during the construction of the proposed Plan until the construction of Site 3a is ready to begin. Once the ASMC permit is approved, two new sedimentation ponds (Ponds B & C) will be constructed to the east of the three existing sediment ponds (Ponds 3A, 3B and Basin 018E) currently used to control runoff. The two new sedimentation ponds and associated drainage channels, which were design by McGehee Engineering Corporation (MEC), to conform to the ASMC regulations, are provided for reference in Appendix D.

Runoff from the new Site 3a embankment will be directed to these ponds.

6.2 LOCAL EROSION AND SEDIMENT CONTROLS

Local E&SC measures will be of the same types as currently specified by Almes, 1991 and PERC, 2007. Details of the new ditches and flumes associated with this Plan (Site 3a) are provided on Figure 15. Also, see Section F of the Calculation Brief.

Hydraulic Capacity

Permanent channels are designed to convey the peak runoff rate due to a Type II, 24-hour duration, 100-year recurrence interval design storm, per MSHA guidelines.

Freeboard

The freeboard depth for each channel was determined as recommended by the MSHA Engineering and Design Manual for Coal Refuse Disposal Facilities as follows:

$$\text{Freeboard} = C + 0.025VD^{1/3} \quad \text{(feet) where,}$$

C= 0.25 feet for minor channels or,

C = 1.0 feet for more critical channels

A minimum of one foot of freeboard was provided in all cases.

Channel Linings

All permanent drainage structures have been provided with the appropriate protections to minimize the potential for channel erosion. If velocities exceeded 5.0 feet per second then riprap channel lining protections were used. The two primary types of channel lining prescribed for the project are:

- Vegetated Channel Linings (i.e., grass-lined used on gutter drains)
- Riprap (used on haul road/down drains)

6.3 MISCELLANEOUS BEST MANAGEMENT PRACTICES (BMPS)

Other miscellaneous E&S control structures will be implemented during the initial site development and CRDA construction and operation, as needed. These structures include:

- Coarse aggregate surfacing will be provided on permanent access and haul road corridors, and on construction support and staging areas to stabilize the areas and reduce erosion.
- Rock construction entrances will be constructed/maintained at the main site access points to reduce the transport of sediment away from the permitted work area.
- Fill slopes will be covered with topsoil (where the fill soil is not suitable for direct vegetation) and be vegetated, as soon as practical, to reduce erosion potential.
- Similarly, soil cut slopes will be directly seeded as soon as practical following completion.
- Temporary siltation measures such as siltation fences, straw bales, and/or temporary sumps may be used as necessary for erosion protection.

7.0 GEOTECHNICAL ANALYSES AND DESIGN

7.1 EMBANKMENT SEEPAGE CONTROL [§ 77.216-2(A) (6 & 7)]

7.1.1 Monitoring

Seepage will be monitored by observation of the piezometers, during the MSHA 7-day inspections. The locations and details of the piezometers and weirs are given on Figure 4.

7.2 EMBANKMENT SLOPE STABILITY [§ 77.216-2(A) (13)]

A summary Results of Analysis, Section 7.2.3 is provided below. Detailed results are provided in Section E of the Calculation Brief, Appendix C. The findings reported in this section pertain to the final embankment configurations of Site 3a.

7.2.1 Methods of Analysis and Assumptions

Slope stability analyses were performed for the outslope of the Site 3a disposal embankment buttress for pertinent conditions using the slope stability module of the computer program SLIDE version 6.0 by Rocscience, Inc. The slope stability analyses evaluated the final embankment configurations.

Only steady-state (static) conditions were analyzed for the Site 3a (CCR) disposal embankment. Where foundations soils were encountered in Site 3a, the soils are predominantly sandy and do not pose a risk of undrained failure during construction or at the end-of-construction.

7.2.2 Conditions Analyzed and Required Factors of Safety

The cases/conditions that were evaluated and the required factors of safety are summarized in the table below.

CASE/CONDITION	REQD SAFETY FACTOR
Static/Steady-State Seepage	1.5
Seismic (or Post-Earthquake)(1)	1.2 also see MSHA Manual Chapter 7

NOTES:

(1) Based on the current MSHA design manual, seismic stability is satisfied via conformance with the static stability design requirements in cases where there are no materials susceptible to earthquake-induced strength loss within the embankments or their foundations.

7.2.3 Results of Analysis

As reflected by the supporting calculations, the proposed embankment configurations satisfy the required minimum slope stability safety factors previously listed for all cases/conditions analyzed.

For the Site 3a (CCR) disposal embankment, the minimum factor of safety calculated for long-term/steady-state (static) conditions for a slip surface that comprises the entire embankment outslope is 1.9 at Cross Section Z-Z.

Refer to Section E of the Calculation Brief in Appendix C for detailed results of the slope stability analyses.

8.0 INSTRUMENTATION [§ 77.216-2(A) (8)]

There are thirteen (13) standpipe piezometers proposed going forward for this facility at the locations shown on Figure 4. All piezometers **were** restored or installed in the **Summer** of 2012.

A graphic display or tabulation of the 7-day MSHA impoundment inspection piezometer readings along with the trigger levels shall be kept file at the mine office for easy access and review.

9.0 MONITORING AND MAINTENANCE [§ 77.216-2(A) (8 & 15)]

Coal Refuse Quantities

Records of coal refuse quantities disposed at the facility shall be maintained by OGR. These records allow for comparison with the quantities used for predicting the CCR and FCR facility disposal life and making modifications to the disposal plan, if necessary. The records shall be reviewed semi-annually.

General Observations

Observations of the embankment, its instrumantation and appurtenant equipment shall be made at intervals not exceeding 7 days and immediately following any unusual events such as floods, heavy rainfalls, heavy frost periods, abnormal structural behavior, etc. in accordance with MSHA impoundment inspection requirements. Reports or records from field observations and testing results shall be maintained at the mine office. A report of the observations shall be reviewed at least semi-annually. Any unusual features shall be reported immediately to the Certifying Engineer. Items to be recorded by OGR and the Certifying Engineer include the following:

- Embankment Slopes - Any irregularities such as tension cracks, scarps, slumps, wet areas or vegetation disturbance shall be recorded.
- Working Disposal Surface - Irregularities shall be recorded.
- Bench and Perimeter Sediment Ditches - General condition of channels, soil erosion adjacent to or beneath riprap and seeded slopes, blockage by debris, etc., shall be recorded.
- Vicinity of the Embankment - General conditions throughout the area of the embankment shall be observed to note any changes, which could be associated with the behavior of the embankment and its foundation.
- Piezometer Readings and Impoundment Level - Piezometer readings and the impoundment level shall be recorded at intervals not exceeding seven days. Should the piezometers become damaged during operations they

shall be replaced. To evaluate sensitivity of the piezometers pumping or bailing of water may be performed to determine the time to recharge/refill the piezometer. Adding water to the piezometers shall not be permitted.

- Graphs- Graphs of the 7-day inspection results of the flows from each internal drain outlet and levels of each piezometer shall be prepared. The graphs will assist in identifying abnormal readings and dievations from trends. These graphs shall be kept with the 7-day inspection report information at the mine office.

Maintenance

The following maintenance activities shall be performed regularly:

- Routine Maintenance - Continuous maintenance, including replacement or patching of grouted riprap, reseeding of gutters, removal of debris from the ditches at the site, etc.
- Maintenance After Unusual Meteorological Events (Heavy Rainfall, Extreme Frost Periods, Severe Droughts, Floods, High Winds, Etc.) - The most important maintenance tasks, at these times, are the immediate backfilling of all scarps or slumps, repair of erosion rills or gullies and the repair and improvement of drainage systems and riprap lined ditches.
- Maintenance After Abnormal Changes in the Behavior of the Structure - If abnormal behavior of any portion of the embankment is observed, qualified persons knowledgeable of the facility design characteristics shall be advised immediately by the Certifying Engineer and any recommended maintenance measures undertaken.

Data Review

All facility performance data and maintenance data obtained during periodic inspections shall be reviewed by qualified persons knowledgeable of the facility construction. All performance data such as the relative compaction (or in-place dry density) of embankment fill materials, fill placement moisture content, filter fabric, underdrain stone, etc, must meet the requirements described within the Guideline Technical Specifications (Appendix B), the design recommendations presented in this Plan and the Almes, 1991

and PERC 2007 approved plans. If the required CCR fill material properties do not meet these specifications during construction of the refuse facility, the Certifying Engineer will determine if changes need to be made to the placement procedures or shall re-evaluate the stability of the upstream and downstream slopes and/or intermediate benches.

10.0 ABANDONMENT PLAN [§ 77.216-2(A) (16)]

The final reclamation of this facility will consist of the placement of the final soil cover material and applying the appropriate seed mixture according to the currently approved plans, Almes, 1991 and PERC, 2007.

A tentative abandonment plan for capping and covering the slurry impoundment was included in the Almes, 1991 and PERC, 20007 plan approvals. However, other options may be implemented at the actual time of abandonment and a Final Abandonment Plan will be submitted to MSHA for approval prior to initiation of abandonment of the Facility. The Final Abandonment Plan for the slurry impoundments must eliminate any potential to impound water at the Facility. Options to eliminate the potential for impounding water at this Facility may include, but are not limited to, the following:

- Filling in the fine slurry area with coarse refuse generated from the plant while operating towards the closure date.
- Breaching one side of the embankment and placing cover material over the fine slurry area to create a positive drain towards the breach area.
- Lowering the entire embankment crest and placing this coarse refuse material over the fine slurry area to create a positive drainage area.
- Once the final abandonment of the slurry impoundment has started the impounding potential will be eliminated within two years.

The final reclamation surface will be graded such that a minimum 2-percent grade is provided to promote positive drainage toward the appropriate surface drainage control structures.

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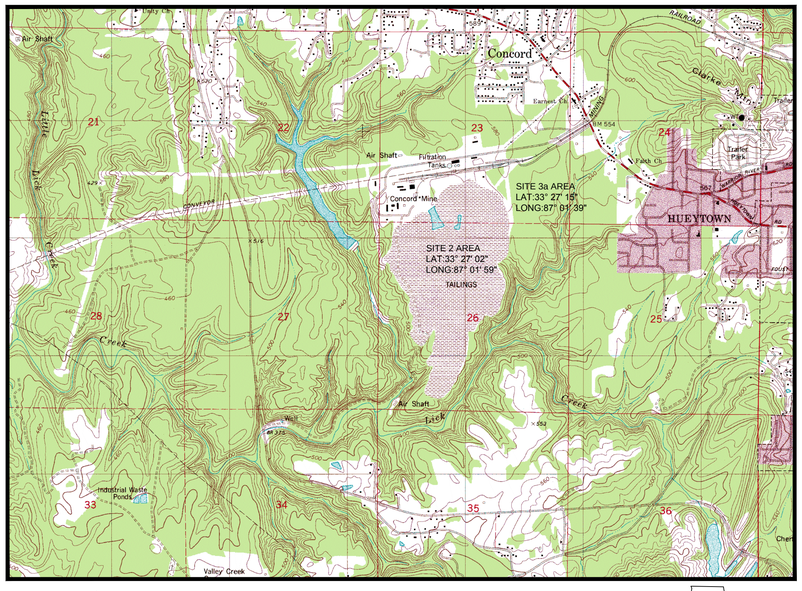
JEFFERSON COUNTY, ALABAMA

PREPARED FOR
CLIFFS NATURAL RESOURCES
OAK GROVE MINE
JEFFERSON COUNTY, ALABAMA



LOCATION MAP

SITE LOCATED ON PORTIONS OF USGS 7.5' CONCORD, ALABAMA QUADRANGLE

ALABAMA QUADRANGLE LOCATION

DRAWING LIST

FIGURE NO.	DESCRIPTION
1 ⚠	TITLE SHEET, SITE LOCATION MAP, & DRAWING INDEX
2 ⚠	EXISTING CONDITIONS - PLAN
3 ⚠	KEY PLAN - REFUSE DISPOSAL AREAS
4 ⚠	SUBSURFACE EXPLORATION & PIEZOMETER - PLAN
5	FIGURE NOT USED
6	FIGURE NOT USED
7	FIGURE NOT USED
8	FIGURE NOT USED
9 ⚠	SITE 3a - PLAN - CCR EXPANSION TO THE EAST
10 ⚠	TRAVEL WAY NO. 2 - PLAN, PROFILE, DETAILS
11	FIGURE NOT USED
12 ⚠	CROSS SECTION E-E
13 ⚠	CROSS SECTIONS N-N, Z-Z
14	FIGURE NOT USED
15 ⚠	TYPICAL DITCH - SECTIONS AND DETAILS

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Dickey Jr (Signature)

Date: 12/7/2015

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public
This 7 day of December, 2015
My commission expires 10/17/17

NOTARY PUBLIC STATE OF WEST VIRGINIA STEPHANIE D. HILL 357 OAK GROVE ROAD BECKLEY, WV 25801 My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	12/15	CHANGED FIG 10 TITLE	WOD
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD

Prepared By:

Marshall Miller and Associates

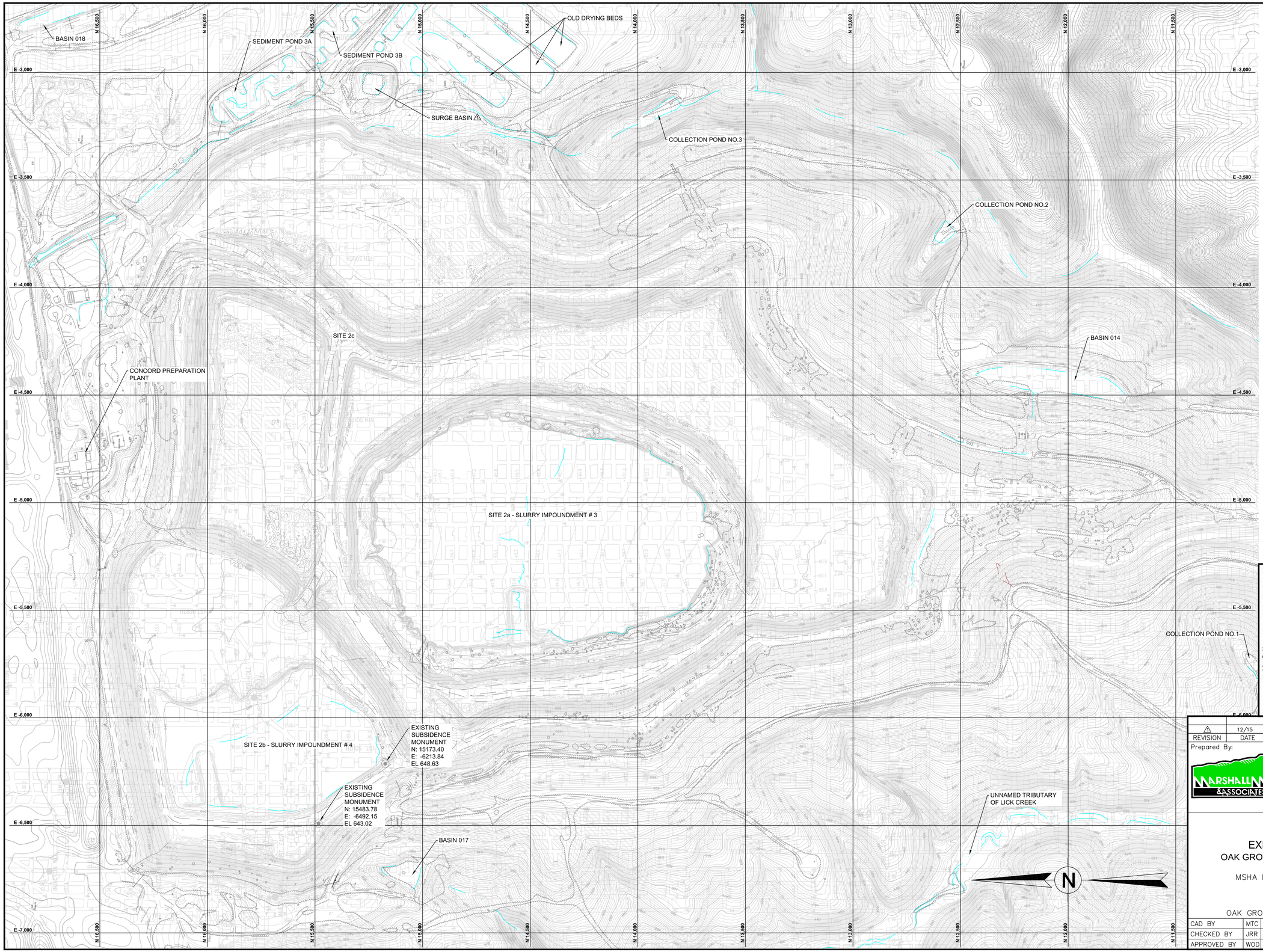
Geology, Environmental Sciences & Engineering, Geophysics

☐Bluefield, VA • ☐Lexington, KY • ☐Raleigh, NC
☐Ashland, VA • ☐Charleston, WV • ☐Camp Hill, PA
☐Kingsport, TN • ☐Lenexa, KS • ☐Bossier City, LA
☐Cincinnati, OH • ■Beckley, WV • ☐Evansville, IN

FIGURE 1
TITLE SHEET, SITE LOCATION MAP, & DRAWING INDEX
OAK GROVE RESOURCES, LLC REFUSE FACILITY
CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

Scale in Feet
2000 0 2000 4000



LEGEND

CONTOURS
- INDEX — 160
- INTERMEDIATE — 161
- DEPRESSION — 160 / 161

DRAINAGE
- CULVERT
- DROP INLET
- BRIDGE
- MARSH

ROADS
- PRIMARY
- SECONDARY
- TRAIL
- RAILROAD

OTHER FEATURES
- BUILDING
- VEGETATION
- PROPERTY LINE — P.L. — P.L.
- PROPERTY CORNER
- FENCE — X — X — X
- WALL — W
- UTILITY POLE
- LIGHT POLE
- EXISTING UNDERGROUND MINEWORKS
- EXISTING SUBSIDENCE MONUMENT

SOUTHERN RESOURCES MAPPING CORPORATION
2808-4 McFARLAND BOULEVARD
NORTHPORT, ALABAMA 35476
PHONE: (205) 333-9900
FAX: (205) 333-9915
Email: srmc@srmcmaps.com
Web Site: srmcmaps.com

N 33° 14' 31.41", W 87° 35' 11.85"

PHOTOGRAPHED: DECEMBER 23, 2010

COMPILED: FEBRUARY, 2011

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Dickey (Signature)

Date: 12/7/2015

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public
This 7 day of December, 2015
My commission expires 10/17/17

Stephanie D. Hill

NOTARY PUBLIC STATE OF WEST VIRGINIA STEPHANIE D. HILL 307 OAK GROVE ROAD BECKLEY, WV 25801 My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
1	12/15	ADDED SURGE BASIN LABEL	WOD

Prepared By:

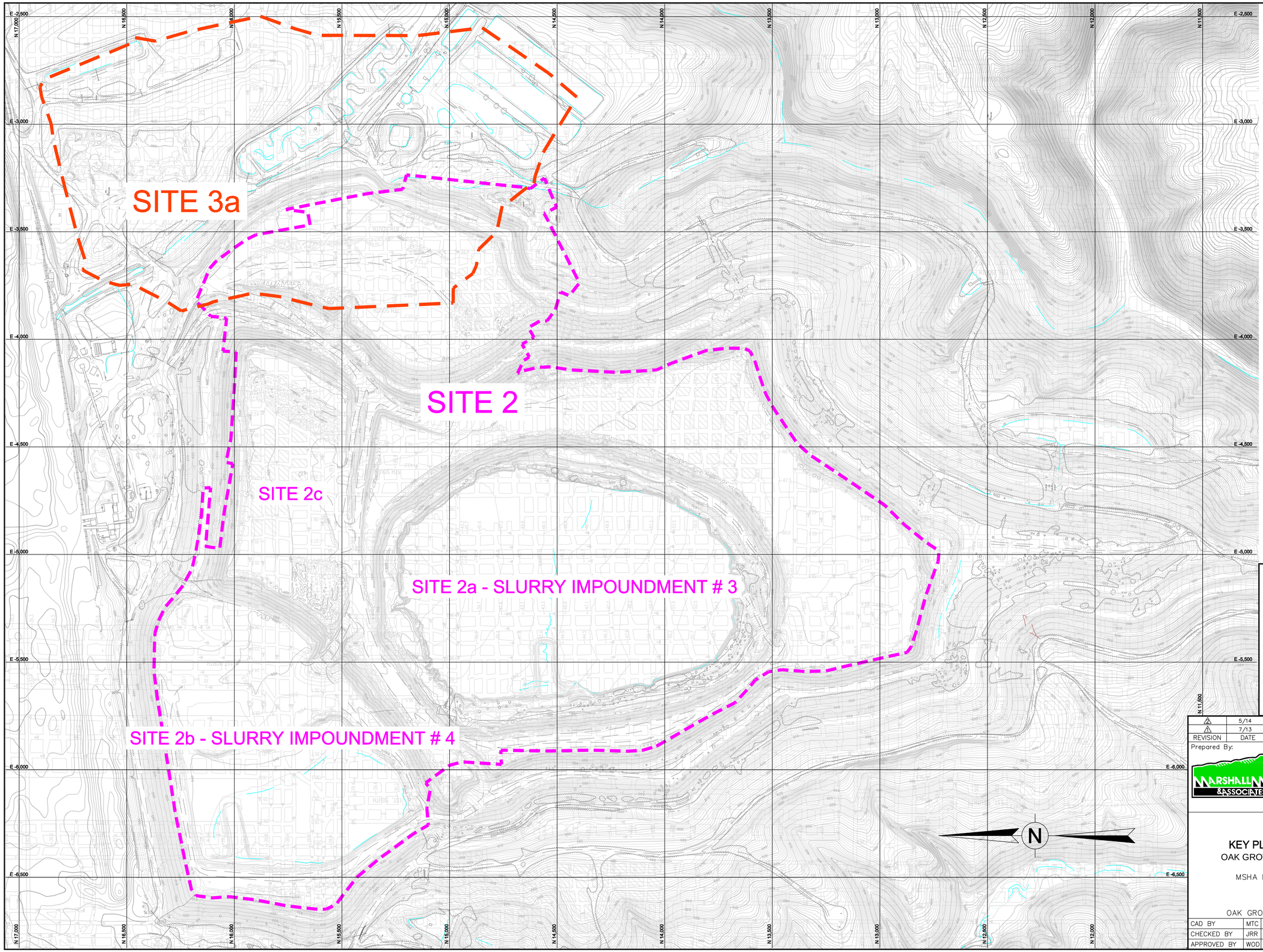
Marshall Miller and Associates
Geology, Environmental Sciences & Engineering, Geophysics
☐ Bluefield, VA • ☐ Lexington, KY • ☐ Raleigh, NC
☐ Ashland, VA • ☐ Charleston, WV • ☐ Camp Hill, PA
☐ Kingsport, TN • ☐ Lenexa, KS • ☐ Bossier City, LA
☐ Cincinnati, OH • ■ Beckley, WV • ☐ Evansville, IN

FIGURE 2
EXISTING CONDITIONS - PLAN
OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

Scale in Feet: 200 0 200 400



LEGEND

SITE 3a BOUNDARY - (PROPOSED EXPANSION TO EAST - CCR)

⚠ SITE 2 BOUNDARY - (EXISTING PERMIT)

EXISTING - UNDERGROUND MINEWORKS

NOTES:

⚠1. **REFUSE IMPOUNDMENT IS CLASSIFIED AS A HIGH HAZARD POTENTIAL STRUCTURE.**

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

(Signature) Date: 5/12/14

ALABAMA LICENSED No. 31771 PROFESSIONAL WILLIAM O. RICKETT

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public,
This 12 day of May, 2014
My commission expires 10/17/17

NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD
⚠	7/13	RESPONSE TO MSHA COMMENTS.	WOD

Prepared By:

Marshall Miller and Associates

Geology, Environmental Sciences & Engineering, Geophysics

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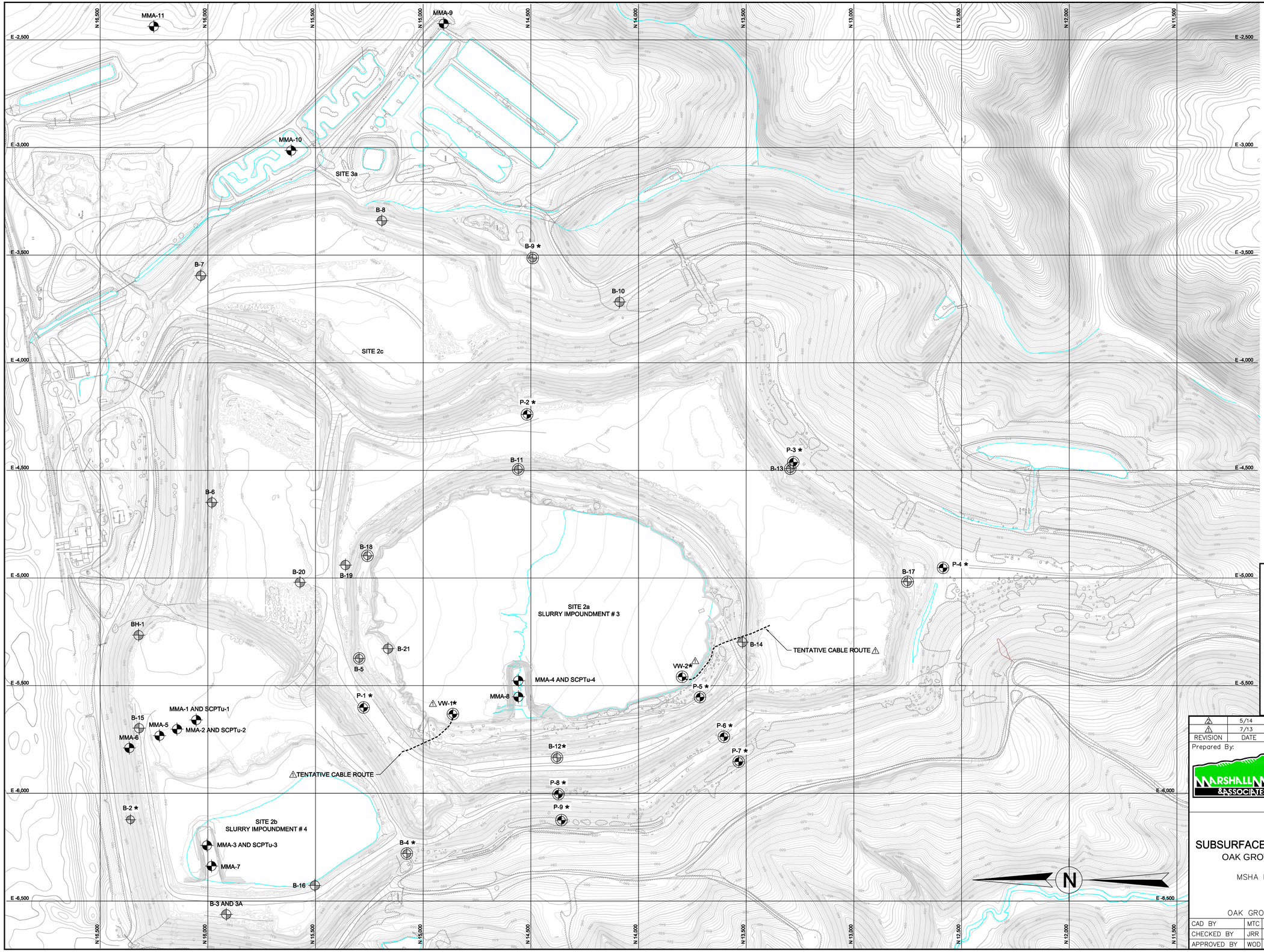
☐ Kingsport, TN · ☐ Lenexa, KS · ☐ Bossier City, LA
☐ Cincinnati, OH · ■ Beckley, WV · ☐ Evansville, IN

FIGURE 3
KEY PLAN - REFUSE DISPOSAL AREAS
OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

Scale in Feet
200 0 200 400



LEGEND

BOREHOLE / PIEZOMETER - APPOXIMATE LOCATIONS ALMES FEBRUARY, 1991 — B-11

EXISTING BOREHOLE - APPOXIMATE LOCATIONS ALMES FEBRUARY, 1991 — B-5

MMA BOREHOLE AND SCPTu - LOCATIONS — MMA-1

⚠PIEZOMETER INSTALLED - JULY-AUGUST 2012 AS-BUILT LOCATIONS — P-5

⚠ PROPOSED VIRBRATING - WIRE PIEZOMETERS APPROXIMATE LOCATIONS — VW-1

ACTIVE PIEZOMETERS - GOING FORWARD — *

⚠REMOVED PIEZOMETER DETAIL NOTES

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Buckley III
(Signature)

Date: 5/12/14

WILLIAM O. BUCKLEY III — LICENSED — No. 31771 PROFESSIONAL — MINING ENGINEER

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public,
This 12 day of May, 2014
My commission expires 10/17/17

Stephanie D. Hill
OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
327 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD
⚠	7/13	RESPONSE TO MSHA COMMENTS.	WOD

Prepared By:

Marshall Miller and Associates

Geology, Environmental Sciences & Engineering, Geophysics

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☐Kingsport, TN · ☐Lenexa, KS · ☐Bossier City, LA
☐Cincinnati, OH · ■Beckley, WV · ☐Evansville, IN

FIGURE 4
SUBSURFACE EXPLORATION & PIEZOMETER - PLAN
OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

Scale in Feet
200 0 200 400

SEDIMENT BASIN 050 ⚠
BY OTHERS
SEE REFERENCE DRAWINGS

SEDIMENT BASIN 051 ⚠
BY OTHERS
SEE REFERENCE DRAWINGS

CLEARING AND GRUBBING LIMITS

BY OTHERS
SEE REFERENCE DRAWINGS

DOWN DRAIN NO.2
SEE DETAIL 1, FIGURE 15

SITE 3a

SECTION Z-Z

EL 700 SLOPE TO DRAIN

EL 730 SLOPE TO DRAIN

CLEARING AND GRUBBING LIMITS

PREVIOUS DOWNDRAIN TO BE REMOVED

B-9 ✱

1 - 60 IN. CMP CULVERT

DOWN DRAIN NO.1 ⚠
SEE DETAIL 1, FIGURE 15

⚠ TRAVEL WAY NO. 2
SEE FIGURE 10

EXTEND EXISTING CULVERT

SITE 2c

SECTION N-N

P-2✱

P-3 ✱

N

SITE 2a
SLURRY IMPOUNDMENT # 3

SECTION E-E

SECTION D-D

LEGEND

CONTOURS

PREVIOUS PERMIT - (INDEX CONTOURS) — 160

PREVIOUS PERMIT - (INTERMEDIATE CONTOURS)

PROPOSED INDEX CONTOURS - 160

PROPOSED INTERMEDIATE - CONTOURS

DRAINS

PREVIOUS PERMIT - (DOWN DRAINS)

PREVIOUS PERMIT - (DOWN DRAINS TO BE REMOVED)

PREVIOUS PERMIT - (SLOPE BENCH DRAINS)

PROPOSED ROAD DITCH -

PROPOSED SLOPE BENCH DRAIN -

PROPOSED DOWN DRAINS -

CLEARING AND GRUBBING LIMITS -

PIEZOMETERS

BOREHOLE / PIEZOMETER - APPOXIMATE LOCATIONS ALMES FEBRUARY, 1991 — B-11

PROPOSED PIEZOMETER - APPOXIMATE LOCATIONS — P-5

ACTIVE PIEZOMETERS - GOING FORWARD — ✱

⚠ REMOVED SECTIONS A, B, C, D, AND M

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Dickey Jr
(Signature)

Date: 12/7/2015

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public
This 7 day of December, 2015
My commission expires 10/11/17

Stephanie D. Hill

NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 11, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	12/15	CHANGED HAULROAD TO TRAVEL WAY	WOD
⚠	10/15	REVISED BASIN 050 AND 051	WOD
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD

Prepared By:

MARSHALL MILLER & ASSOCIATES

Marshall Miller and Associates
Geology, Environmental Sciences & Engineering, Geophysics

☐ Bluefield, VA • ☐ Lexington, KY • ☐ Raleigh, NC
☐ Ashland, VA • ☐ Charleston, WV • ☐ Camp Hill, PA
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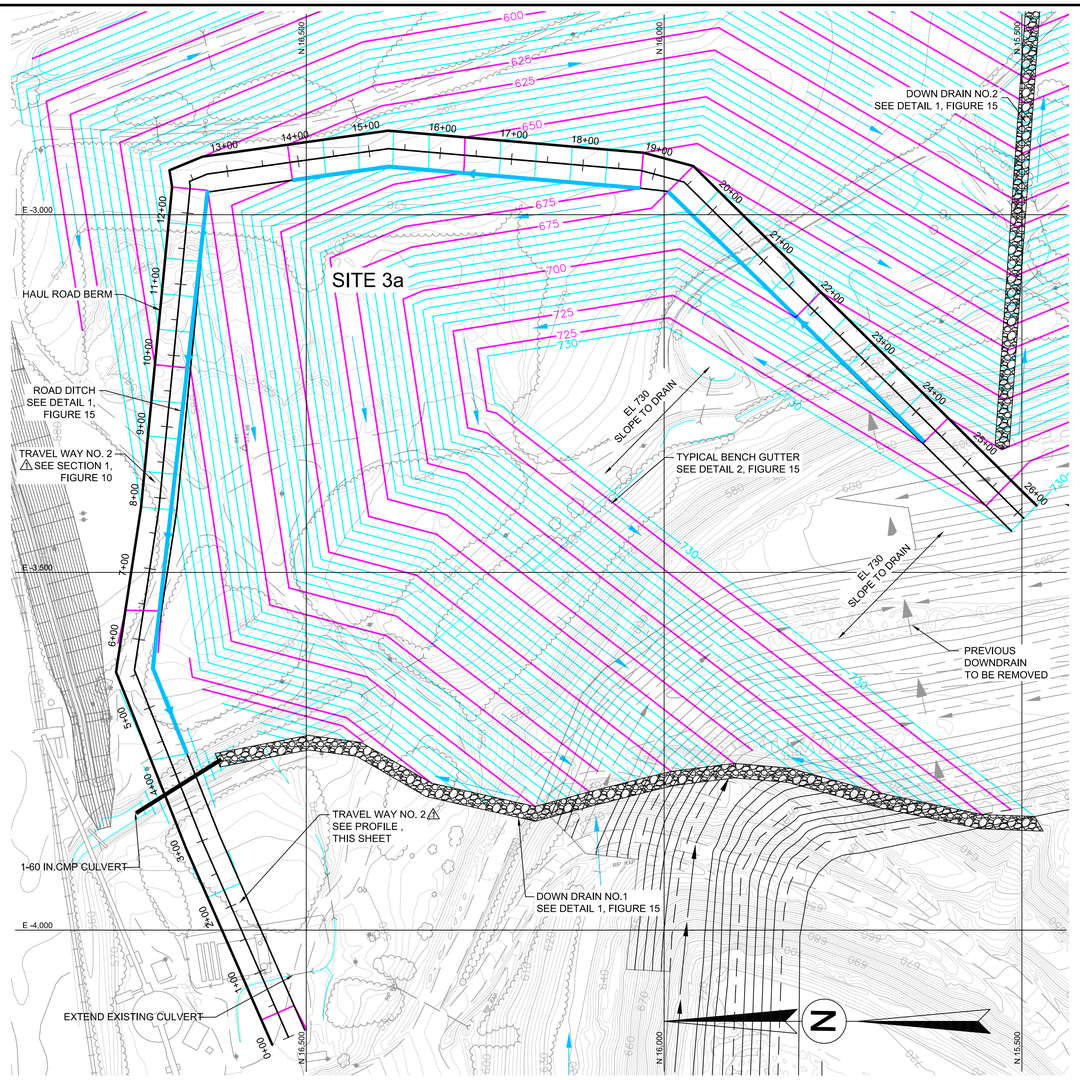
☐ Cincinnati, OH • ■ Beckley, WV • ☐ Evansville, IN

FIGURE 9
SITE 3a - PLAN
CCR EXPANSION TO THE EAST
OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

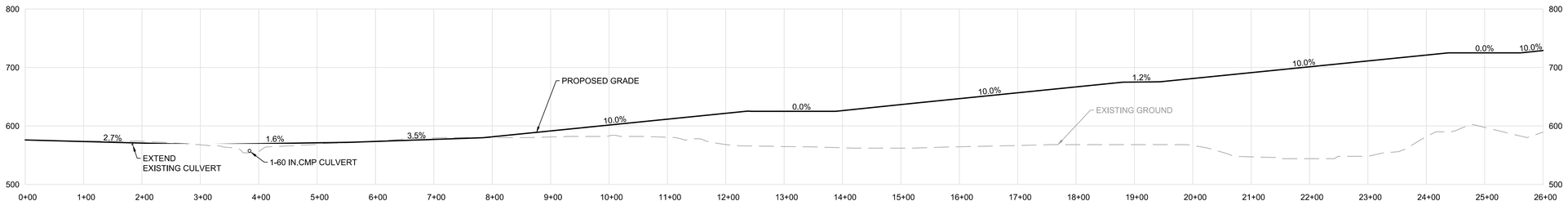
CAD BY	MTC	2/12	Scale in Feet
CHECKED BY	JRR	2/12	200 0 200 400
APPROVED BY	WOD	2/12	



⚠ TRAVEL WAY NO.2 PLAN

SCALE: 1" = 100'

100 0 100 200



⚠TRAVEL WAY NO.2 PROFILE

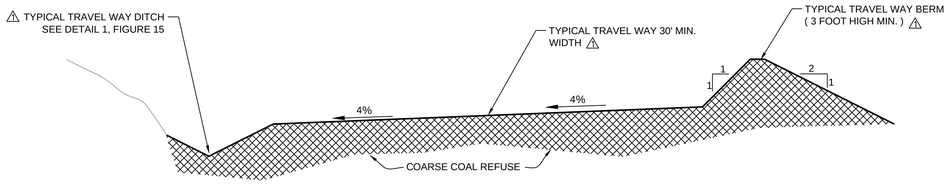
SCALE: 1" = 100'

100 0 100 200

⚠ TYPICAL TRAVEL WAY DITCH
SEE DETAIL 1, FIGURE 15

TYPICAL TRAVEL WAY 30' MIN.
WIDTH ⚠

TYPICAL TRAVEL WAY BERM
(3 FOOT HIGH MIN.) ⚠



1/10 TYPICAL TRAVEL WAY SECTION LOOKING DOWN GRADE ⚠

N.T.S.

LEGEND

CONTOURS

PREVIOUS PERMIT - (INDEX CONTOURS) — 160

PREVIOUS PERMIT - (INTERMEDIATE CONTOURS)

PROPOSED INDEX CONTOURS - 160

PROPOSED INTERMEDIATE - CONTOURS

DRAINS

PREVIOUS PERMIT - (DOWN DRAINS)

PREVIOUS PERMIT - (DOWN DRAINS TO BE REMOVED)

PREVIOUS PERMIT - (SLOPE BENCH DRAINS)

PROPOSED ROAD DITCH -

PROPOSED SLOPE BENCH DRAIN -

PROPOSED DOWN DRAINS -

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Dickey Jr
(Signature)

Date: 12/7/2015

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public,
This 7 day of December, 2015
My commission expires 10/17/17

NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	12/15	CHANGED HAULROAD TO TRAVEL WAY	WOD

Prepared By:

Marshall Miller and Associates

Geology, Environmental Sciences & Engineering, Geophysics

☐Bluefield, VA • ☐Lexington, KY • ☐Raleigh, NC
☐Ashland, VA • ☐Charleston, WV • ☐Camp Hill, PA
☐Kingsport, TN • ☐Lenexa, KS • ☐Bossier City, LA
☐Cincinnati, OH • ■Beckley, WV • ☐Evansville, IN

FIGURE 10
⚠ TRAVEL WAY NO. 2 - PLAN, PROFILES, DETAILS

OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA

Prepared For:

CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

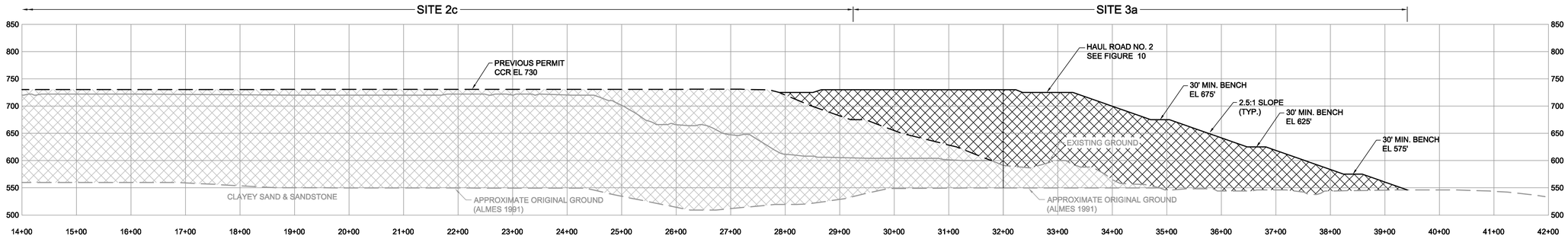
Scale As Noted

⚠ LEGEND

COAL REFUSE

PREVIOUS PERMIT CCR -

PROPOSED CCR -



⚠ SECTION E-E

SCALE: 1" = 100'

⚠ REMOVED SECTIONS D-D, K-K, L-L, AND SECTION E-E FROM STATION 0+00 TO 13+99

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O'Dell III
(Signature)

Date: 5/12/14

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DELL III

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public
This 12 day of May, 2014
My commission expires 10/17/17

Official Seal
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD
⚠	7/13	RESPONSE TO MSHA COMMENTS.	WOD

Prepared By:

Marshall Miller and Associates

Geology, Environmental Sciences & Engineering, Geophysics

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☐ Ashland, VA · ☐ Charleston, WV · ☐ Camp Hill, PA
☐ Kingsport, TN · ☐ Lenexa, KS · ☐ Bossier City, LA
☐ Cincinnati, OH · ■ Beckley, WV · ☐ Evansville, IN

FIGURE 12
⚠ CROSS SECTION E-E
OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

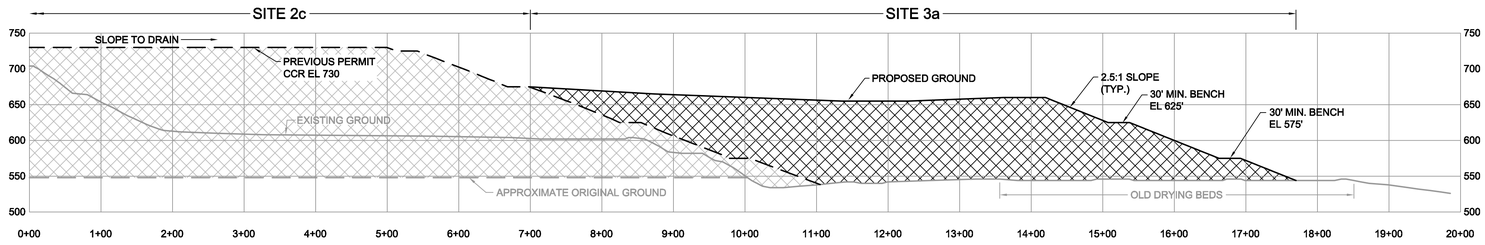
Scale in Feet
100 0 100 200

⚠ LEGEND

COAL REFUSE

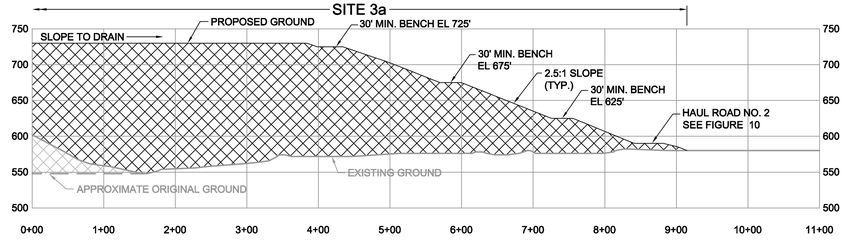
PREVIOUS PERMIT CCR -

PROPOSED CCR -



SECTION N-N

SCALE: 1" = 100'



SECTION Z-Z

SCALE: 1" = 100'

⚠ REMOVED SECTION M-M

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Daly III
(Signature)

Date: 5/12/14

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DALY III

State of West Virginia
County of Raleigh

Acknowledged before me, a Notary Public,
This 12 day of May, 2014
My commission expires 10/17/17

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD
⚠	7/13	RESPONSE TO MSHA COMMENTS.	WOD

Prepared By:

Marshall Miller and Associates

Geology, Environmental Sciences & Engineering, Geophysics

☐ Bluefield, VA · ☐ Lexington, KY · ☐ Raleigh, NC
☐ Ashland, VA · ☐ Charleston, WV · ☐ Camp Hill, PA
☐ Kingsport, TN · ☐ Lenexa, KS · ☐ Bossier City, LA
☐ Cincinnati, OH · ■ Beckley, WV · ☐ Evansville, IN

FIGURE 13
CROSS SECTIONS M-M, N-N, Z-Z

OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA

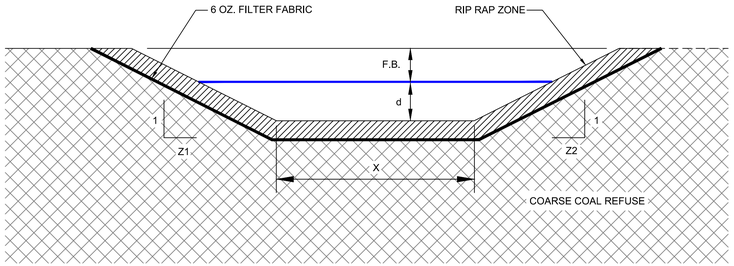
Prepared For:

CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

Scale in Feet

100 0 100 200



⚠ REMOVED 2B CHART

NOTES: DITCH SUMMARY

1) ALL DITCH DIMENSIONS WERE BASED ON THE WORST CASE FLOW CALCULATION FOR EACH STRUCTURE.

2) ROAD DITCHES AT SITE 3a ARE DESIGNED TO ROUTE STORMWATER FLOW TO THE ADJOINING BENCH DISCHARGE. THERE ARE NO ROAD CULVERTS DESIGNED ALONG THE PROPOSED ROAD ALIGNMENTS.

3) D50 ROCK SIZING CALCULATIONS AND CHANNEL SIZING WERE PERFORMED USING THE SEDCAD 4.0 SOFTWARE CHANNEL DESIGN FUNCTION.

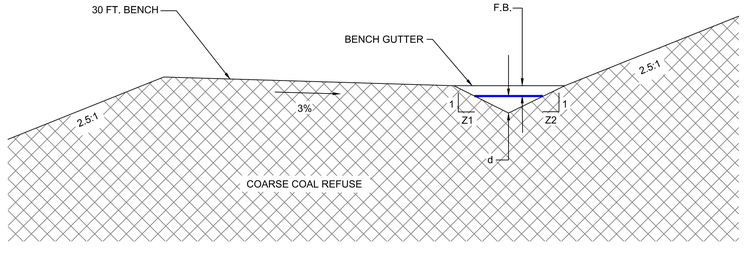
4) THE ROCK RIP SHALL HAVE A MINIMUM OF 75 - PERCENT OF THE MATERIAL GREATER THAN OR EQUAL TO 18 INCHES IN DIAMETER AND 25 - PERCENT OF MATERIAL OF SUFFICIENT SIZE TO FILL THE VOIDS.

5) THE RIP RAP ZONE SHALL BE 2 FT. THICK.

SITE 3a		Z1	Z2		X			d		F.B.	
Structure Name	Slope (%)			Channel Lining	Bottom Width (ft.)	Design Flow (cfs)	Calculated Velocity (ft/sec)	Flow Depth (ft)	Design Depth (ft)	$Fb=1+0.025v(d)^{0.5}$ (ft)	D50 dia. stone (inches)
DOWN DRAINS 1 AND 2 (TYPICAL CONFIGURATION)											
MINIMUM SLOPE (BENCH CROSSING)	5	2	2	Rip Rap	8.00	150.57	9.05	1.81	**3.09**	1.29	18
MAXIMUM SLOPE	40	2	2	Rip Rap	8.00	150.57	13.30	1.34	**2.74**	1.40	18
WORST CASE BENCH GUTTER (TYPICAL CONFIGURATION)											
Bench Gutter (based on subshed 1g)	1	2	2	Vegetated	0.00	47.85	2.36	3.18	**4.27**	1.09	N/A
WORST CASE ROAD DITCH (TYPICAL CONFIGURATION)											
⚠ TRAVEL WAY NO. 2 DITCH											
Road Ditch (based on subshed 1e)	1	2	2	Rip Rap	0.00	12.41	3.51	1.33	**2.43**	1.10	18
Road Ditch (based on subshed 1e)	10	2	2	Rip Rap	0.00	12.41	6.59	0.97	**2.14**	1.17	18
	The highlighted dimensions are recommended for construction.										

1/15 ⚠ TYPICAL TRAVEL WAY DITCH DETAIL

N.T.S.



2/15 TYPICAL BENCH GUTTER DETAIL - SITE 3a

N.T.S.

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O. Dickey Jr
(Signature)

Date: 12/7/2015

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public,
This 7 day of December, 2015
My commission expires 10/17/17

NOTARY PUBLIC STATE OF WEST VIRGINIA STEPHANIE D. HILL 357 OAK GROVE ROAD BECKLEY, WV 25801 My commission expires October 17, 2017

REVISION	DATE	DESCRIPTION	P.M.
⚠	12/15	CHANGED HAULROAD TO TRAVEL WAY	WOD
⚠	5/14	SITE 3A ASMC SUBMISSION	WOD

Prepared By:

Marshall Miller and Associates

Geology, Environmental Sciences & Engineering, Geophysics

☐ Bluefield, VA • ☐ Lexington, KY • ☐ Raleigh, NC
☐ Ashland, VA • ☐ Charleston, WV • ☐ Camp Hill, PA
☐ Kingsport, TN • ☐ Lenexa, KS • ☐ Bossier City, LA
☐ Cincinnati, OH • ■ Beckley, WV • ☐ Evansville, IN

FIGURE 15
TYPICAL DITCH - SECTIONS AND DETAILS
OAK GROVE RESOURCES, LLC REFUSE FACILITY

CONCORD QUADRANGLE
MSHA DISTRICT 11 – BIRMINGHAM, ALABAMA
JEFFERSON COUNTY, ALABAMA
Prepared For:
CLIFFS NATURAL RESOURCES
OAK GROVE MINE, JEFFERSON COUNTY, ALABAMA

CAD BY	MTC	2/12
CHECKED BY	JRR	2/12
APPROVED BY	WOD	2/12

Scale as Noted

APPENDIX B - GUIDELINE TECHNICAL SPECIFICATIONS

PROPOSED COAL REFUSE DISPOSAL PLAN

COAL REFUSE DISPOSAL AREAS
CONCORD PREPARATION PLANT
CLIFFS NATURAL RESOURCES – OAK GROVE MINE
JEFFERSON COUNTY, ALABAMA

EXPANSION EASTWARD TO SITE 3a FOR CCR DISPOSAL

FACILITY ID No. 01-00329
MSHA ID 1211-AL11-00043-02 (Site 2c - CCR Disposal)

ASMC 3A ONLY
MAY 2014

I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O Dickey Jr
(Signature)

Date: 5/12/14

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public.
This 12 day of MAY, 2014.
My commission expires 10/17/17.

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

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1.0 INTRODUCTION

THIS SPECIFICATION CONTAINS ONLY INFORMATION PERTINENT TO THE EXPANSION OF A CCR DISPOSAL BUTTRESS EMBANKMENT, SITE 3A. Marshall Miller and Associates (MMA) has prepared a proposed plan (Plan) for expansion eastward to Site 3a for coal refuse disposal at the Oak Grove Resources LLC (OGR) Concord Preparation Plant in Jefferson County, Alabama. These Guideline Technical Specifications (GTS) are part of that Plan. Unless modified herein, all conditions and requirements of the existing permits, Almes, 1991 and PERC, 2007 are still valid. A specific modification is provided as needed for excavation to competent material and special placement of back fill at the proposed toe of the Site 3a buttress toe.

The Engineering Report, of which this GTS is Appendix A, provides other important information on the Facility and the Plan. MMA is responsible for the design of the proposed Plan and OGR is responsible for placing CCR and for construction of the Facility to the requirements of the Plan including these Guideline Technical Specifications. Additionally, OGR shall retain the services of a Certifying Engineer to prepare Construction Monitoring Reports, (with test results and photographs) per applicable regulations. The Certifying Engineer is to be a qualified Registered Professional Engineer or a specialist chosen to represent the Engineer that is knowledgeable of these design documents and operational requirements and is responsible for certifying the disposal of coal refuse in the proposed Facility expansion.

The frequency of site visits in the regulations is a minimum and additional regular site visits may be required at the discretion of the Certifying Engineer. The Plan with these GTS is intended to be of sufficient detail for OGR to complete the work required to construct the proposed Facility expansion. However, if this work were to be sub-contracted by OGR, additional contract documents would be required.

2.0 SITE PREPARATION

2.1 CLEARING AND GRUBBING

In areas where coarse coal refuse is to be placed on natural ground or on revegetated refuse disposal areas, the areas shall be cleared and grubbed prior to refuse disposal. Outside of this zone, the area shall not be grubbed unless additional topsoil is needed to cover the completed embankment slope.

In areas beneath the proposed embankment stages, the natural ground surface shall be cleared, grubbed and stripped of all trees, brush, and combustible or compressible debris. All buildings, building foundations, and utilities shall be raised or excavated and all demolition waste removed and properly disposed.

In no case shall any combustible material be disposed in the embankment.

2.2 TOPSOIL STRIPPING

Topsoil shall be stripped to a minimum depth of 18 inches or to the maximum possible depth designated by the engineer.

2.3 SITE 3A EXPANSION

2.3.1 EXCAVATION

Cover soil materials from the existing ponds and soft unsuitable materials inside the embankment toe footprint of the Site 3a embankment shall be excavated to competent natural soil or rock. Additionally, the removal of all existing outlet structures and spillways from the ponds will occur during the removal of sediments and loose unstable materials from existing ponds. If necessary, loose fills and natural soils may have to be over excavated and replaced with coarse coal refuse or an acceptable natural soil that is free of organics and has been moisture conditioned so it can be placed as a structural fill material per Section 2.3.2 below. The excavation of the ponds and removal and replacement of unsuitable materials shall be performed in the presence of the Certifying

Engineer or authorized representative and shall not disturb the toe of the existing refuse facility until the majority of the pond has been backfilled to the approximate top of the existing pond embankment. Removal of these materials shall be done in stages to avoid complete undercutting of the materials adjacent to the existing toe of the refuse embankment. The first stage of excavation should be about 50 feet from the existing toe.

2.3.2 BACKFILL

Prior to placement of backfill in the pond excavations, the cleared surface shall be proof rolled with heavy pneumatic or steel drum compactors in order to delineate soft soils near the ground surface.

The excavated areas will then be backfilled following the "100 Percent Compaction Zone" requirements in Section 3.2.4.1, until the elevation reaches the approximate original grade. At that time, CCR placement in Site 3a can proceed following the requirements for "Non-Structural Zone" discussed in Section 3.2.4.2.

3.0 COARSE COAL REFUSE DISPOSAL

3.1 GENERAL

The CCR disposal at Site 3a of this Facility should under this Plan adhere to the following. The area of new CCR placement in this Plan is Site 3a CCR disposal buttress embankment and it should follow the requirements for "Non-Structural Zone". Other locations for CCR placement in this Plan are already approved under Almes, 1991 and/or PERC 2007.

3.1.1 CRITICAL CONSTRUCTION ITEMS

Per the MSHA COAL MINE IMPOUNDMENT INSPECTION AND PLAN REVIEW HANDBOOK (Handbook Number PH07-V-1 (1)). The following activities are considered to be "Critical construction" for this project and the mine operator should notify MSHA in advance of their start:

1. Construction of drains, filters, and placement of geo-fabrics and geo-grids.

3.2 COARSE COAL REFUSE PLACEMENT AND CONSTRUCTION (NON-UPSTREAM CONSTRUCTION)

3.2.1 LINES AND GRADES

Refuse shall be placed to the lines and grades shown on the drawings. Control for placement can be established from the control points and coordinate system provided on the drawings.

3.2.2 MATERIAL

Run-of-plant coarse coal refuse produced at the coal preparation plant shall be used for construction of the Site 3a CCR disposal buttress embankment.

3.2.3 PLACEMENT

Coarse coal refuse shall be spread in nearly horizontal lifts using a bulldozer or other earth-moving equipment. The maximum lift thickness shall not exceed 12 inches in the 100 percent compaction zone and structural zone of the impounding embankment and not more than 2 feet in the non-structural zone. Structural and non-structural zones shall be followed for Site 3a CCR disposal buttress embankment. All lifts shall be placed parallel to the longitudinal axis of the embankment in continuous nearly horizontal lifts with each lift extending to its full length and width prior to the placement of subsequent lifts. The refuse shall be placed in the central portion of the embankment, away from the slopes during wet weather or when drainage is insufficient and near the inside or outside slopes during drier periods.

3.2.4 COMPACTION

3.2.4.1 100 PERCENT COMPACTION ZONE

A field density testing program shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction zone and structural zone. The number of passes by the compaction equipment shall be based on

the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be perfonned on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2.000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed. Additional field density tests should be conducted any time there is a suspicion of the effectiveness of compaction. A supplementary Standard Proctor laboratory compaction test (ASTM D698) shall be performed for every 20 field density tests (approximately every 40,000 cubic yards).

Field tests shall be performed at random locations in the fill. Records of the test results, as well as the test locations, shall be kept at the mine.

Any time there is reason to suspect that the characteristics of the construction material have changed, reasons such as a change in preparation plant processing or unusual compaction test results, the material shall be further investigated. Grain-size compaction, shear-strength, and other tests shall be performed as warranted.

3.2.4.2 NON-STRUCTURAL ZONE

The coarse coal refuse material placed in the non-structural zone shall be compacted to a density greater than or equal to 90 percent maximum dry density, as determined by the Standard Proctor compaction test (ASTM D698).

A field density testing program shall be established during disposal operations to determine the actual dry density being achieved. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be performed on each lift of coarse coal

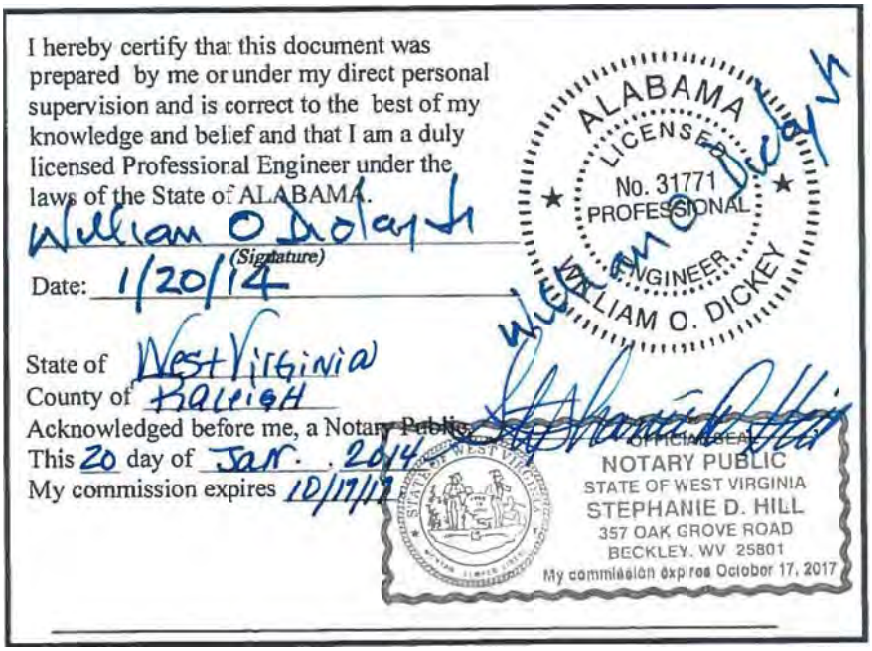
refuse placed and compacted in the structural zone of the impounding embankment. A density test shall be performed for every 10,000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed.

3.2.5 COMPACTION REQUIREMENTS

The coal refuse shall advance upward in nearly horizontal layers throughout the entire disposal area. To minimize infiltration of precipitation the coal refuse surface shall be sloped, backbladed and compacted as it is spread.Surface material too wet to support consouction equipment must be removed to expose drier material prior to placement of the next coal refuse layer. After drying, these wet materials can be reused in the embankment. As the level of the embankment is raised, it shall be graded smoothly to the contours shown on the plans.

APPENDIX C

Calculation Brief


I hereby certify that this document was prepared by me or under my direct personal supervision and is correct to the best of my knowledge and belief and that I am a duly licensed Professional Engineer under the laws of the State of ALABAMA.

William O Dickey

(Signature)

Date: 1/20/14

State of West Virginia
County of Raleigh
Acknowledged before me, a Notary Public.
This 20 day of Jan. 2014
My commission expires 10/17/17

ALABAMA LICENSED No. 31771 PROFESSIONAL ENGINEER WILLIAM O. DICKEY

OFFICIAL SEAL
NOTARY PUBLIC
STATE OF WEST VIRGINIA
STEPHANIE D. HILL
357 OAK GROVE ROAD
BECKLEY, WV 25801
My commission expires October 17, 2017

OBJECTIVE:

Evaluate the slope stability of the existing area and proposed expansion of Site 3a (Figure 9) of the OGR Concord Preparation Plant in Jefferson County, Alabama. Site 3a is a non-impounding coarse coal refuse (CCR) disposal area/embankment.

Compare the global slope stability minimum Factors of Safety (FoS) with the FoS of 1.5 required by MSHA for static/steady-state seepage conditions.

NOTE that by inspection of the previous stability analyses reported by Almes & Associates (1991), the Site 3a embankment configurations are stable within an adequate margin of safety (Section E.1). The stability analyses reported subsequently provide added confirmation of the favorable Almes findings.

METHODOLOGY:

The slope stability computer software program, SLIDE 6.0 (Reference 1) was used to evaluate the Site 3a CCR disposal embankment at cross-sections E-E (Almes Cross-Section E-E (Figures E-1.1 and E-1.4)), N-N, and Z-Z (Figure 13).

As is customary, sliver and sloughing-type failure surfaces were excluded from the analyses, as such failures are inconsequential and not representative of the global stability of the embankment. The slope stability of the proposed final embankment was the configuration considered in these analyses.

Site 3a is distant from the 'free' water surface located in the Site 2a, Impoundment #3, and the hydraulic properties of CCR preclude the development of any substantive phreatic surface. The primary source of water to the embankment will be infiltrating precipitation, which can be readily controlled by maintenance of positive drainage from the disposal/fill working surface. Therefore, no phreatic surface was considered in the Site 3a slope stability analyses.

The expansion area of Site 3a is founded almost exclusively on existing CCR. Foundation soils, where they exist and will remain, lie above groundwater and are unsaturated. Similarly, the CCR is unsaturated. As no distinct 'weak layers' exist in the design cross-section (*embankment or foundation*) along a particularly adverse horizon, block failures would not be critical and are not applicable.

The overall slope stability of the proposed coal refuse slopes depends on the material unit weight and shear strength properties, as well as the properties of the underlying foundation soils. Design values were adopted from the results of geotechnical (Section B) data analyses. **Table 1** presents the unit weights and shear strength properties used in the slope stability analyses.

Table 1

Material Properties			
Material Name	**Unit Weight (lbs/ft^3)**	**Cohesion (psf)**	**Friction angle (deg)**
CCR (Existing)	120	0	36
CCR (New)	120	0	36
Native Foundation Soil / Layer	125	0	31
Bedrock	165	2000	40

REFERENCES:

1.SLIDE 6.0, ROCSCIENCE INC., Toronto, Ontario, Canada, 1998-2012

CALCULATION:

SLIDE conducted a vertical slice limit equilibrium analyses utilizing the Spencer method. A thorough search of the minimum FoS was executed for circular surfaces.

For a circular surface an extensive search grid generated circular slip centers and evaluated numerous circular surfaces between the minimum and maximum radii. If a global minimum was located on the perimeter of a search grid, the grid was shifted ensuring the search encompassed the surface with the lowest FoS.

RESULTS:

Graphical SLIDE results displaying global minimum FoS (Figures E-3.11-E-3.13) follow the input data summary for each analysis case. **Table 2** summarizes the slope stability cases analyzed and their corresponding minimum FoS. The embankment stability was determined to be acceptable in all cases.

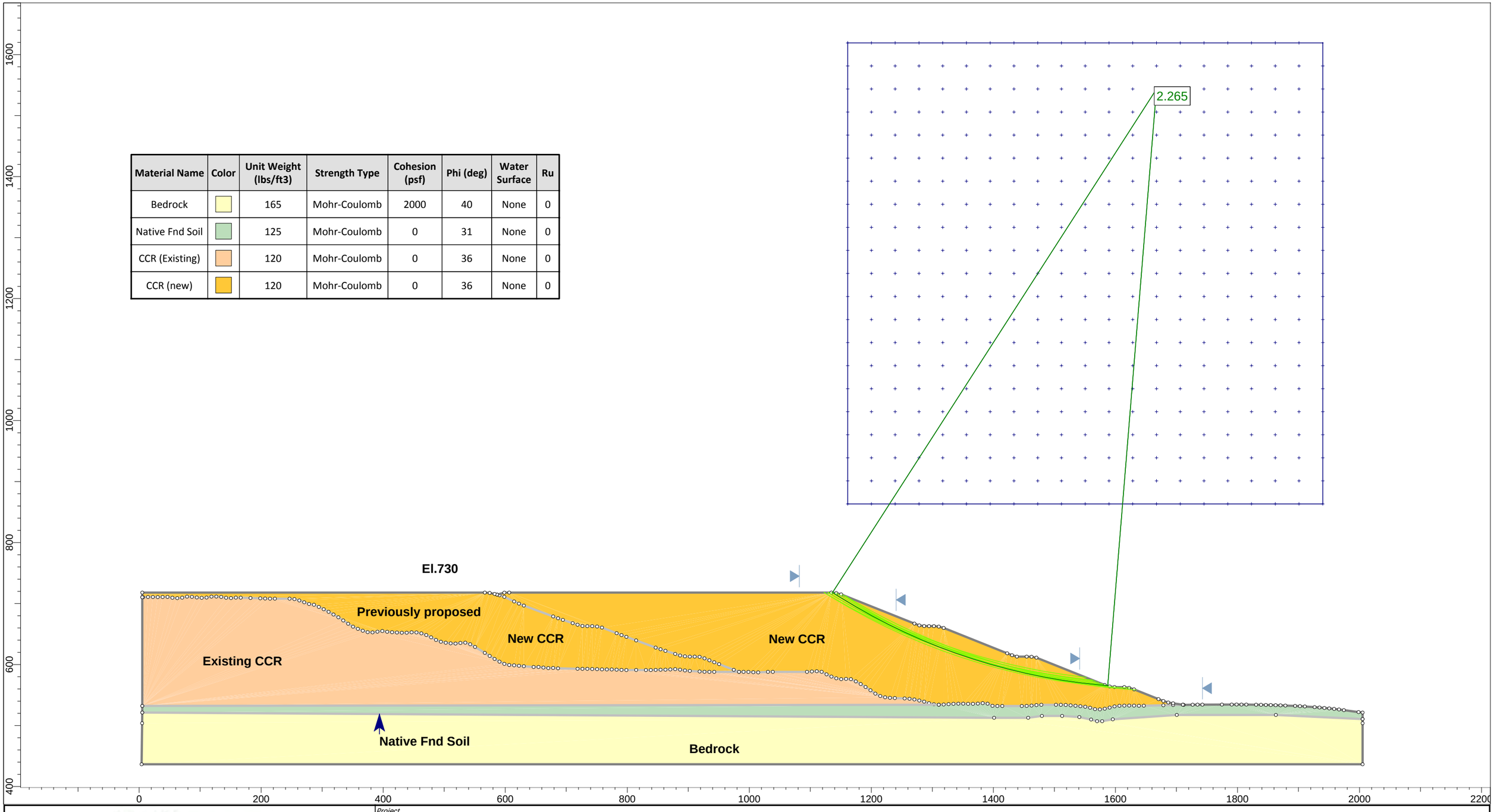
Table 2 – Site 3a embankment

Figure #	Cross-Section	Slope Side	Slope Region	Failure type	Condition	Minimum FoS
3.11	3aEE	Downstream	Entire	Circular	Static	2.26
3.12	3aNN	Downstream	Entire	Circular	Static	2.01
3.13	3aZZ	Downstream	Entire	Circular	Static	1.90

Conclusions:

The global minimum FoS from the analyses met the minimum requirements for slope stability. These results demonstrate that the design for Site 3a is acceptable with regard to slope stability.

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock		165	Mohr-Coulomb	2000	40	None	0
Native Fnd Soil		125	Mohr-Coulomb	0	31	None	0
CCR (Existing)		120	Mohr-Coulomb	0	36	None	0
CCR (new)		120	Mohr-Coulomb	0	36	None	0



Prepared By:

MARSHALL MILLER & ASSOCIATES®

SLIDEINTERPRET 6.015

Project	Cliff's 118, Oak Grove				
Analysis Description	Figure E-3.11 (3aE-E_DS_entire_circular_static_mma)				
Drawn By	Ben Prior	Scale	1:1772	Company	Marshall Miller & Associates
Date	10/13/2011			File Name	3aEE_DS_entire_circular_static_mma_final.slim

Slide Analysis Information

Cliff's 118, Oak Grove

Project Summary

File Name: 3aEE_DS_entire_circular_static_mma_final
Last saved with Slide version: 6.015
Project Title: Cliff's 118, Oak Grove
Analysis: Figure E-3.11 (3aE-E_DS_entire_circular_static_mma)
Author: Ben Prior
Company: Marshall Miller & Associates
Date Created: 10/13/2011
Comments:

No seepage

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116

Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: 10

Material Properties

Property	Bedrock	Native Fnd Soil	CCR (Existing)	CCR (new)
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	165	125	120	120
Cohesion [psf]	2000	0	0	0
Friction Angle [deg]	40	31	36	36
Water Surface	None	None	None	None
Ru Value	0	0	0	0

List Of Coordinates

External Boundary

X	Y
2005.15	503.807
2005.15	510.567
2005.15	521.282
1998.51	521.972
1974.51	525.222
1966.51	526.252
1958.51	527.142
1950.51	528.002
1942.51	528.792
1934.51	529.512
1926.51	530.142
1910.51	531.182
1902.51	531.652
1894.51	532.062
1878.51	532.732
1870.51	533.012
1862.51	533.272
1854.51	533.512

1846.51	533.712
1838.51	533.882
1830.51	534.022
1814.51	534.252
1806.51	534.332
1798.51	534.362
1790.51	534.342
1774.51	534.272
1742.51	534.182
1734.51	534.122
1726.51	534.042
1711.76	533.839
1710.54	534.018
1694.51	536.362
1686.51	537.712
1678.51	540.162
1670.51	543.282
1630.51	559.262
1622.51	561.692
1614.51	562.912
1598.51	562.912
1590.51	563.962
1582.51	566.432
1470.51	611.172
1462.51	612.632
1454.51	612.912
1438.51	612.912
1430.51	615.322
1422.51	618.342
1318.51	659.892
1310.51	662.122
1302.51	662.912
1294.51	662.912
1286.51	663.042
1278.51	664.132
1270.51	667.062
1150.51	714.992
1142.51	717.052
1134.51	717.912
606.511	717.902
598.511	717.772
586.612	714.619
582.511	715.762
574.511	717.342
566.511	717.912
5.151	717.912
5.151	710.254

5.151	532.106
5.151	521.282
4.906	503.807
4.015	436.472
2005.15	436.472

Material Boundary

X	Y
5.151	710.254
6.511	710.342
14.511	710.682
22.511	710.632
30.511	710.532
38.511	710.622
46.511	710.762
54.511	709.452
62.511	708.762
70.511	709.512
78.511	711.232
86.511	710.962
94.511	709.932
102.511	709.272
110.511	709.772
118.511	711.332
126.511	711.382
134.511	710.822
142.511	709.472
150.511	708.902
158.511	709.712
166.511	709.582
182.511	709.072
198.511	708.522
206.511	708.222
214.511	707.992
222.511	707.912
246.511	707.912
254.511	707.162
262.511	705.002
270.511	702.052
278.511	699.232
286.511	697.952
294.511	694.372
302.511	690.562
310.511	686.472
318.511	682.012
326.511	677.422

334.511	672.292
342.511	666.802
350.511	661.992
358.511	658.452
366.511	655.352
374.511	653.002
382.511	652.682
390.511	653.752
398.511	654.852
406.511	653.632
414.511	652.952
422.511	652.422
430.511	652.052
438.511	652.022
446.511	652.862
454.511	652.542
462.511	651.082
470.511	648.362
478.511	644.592
486.511	640.232
494.511	637.272
502.511	635.662
510.511	634.772
518.511	634.302
526.511	635.312
534.511	635.812
542.511	633.262
550.511	628.802
566.511	619.032
574.511	614.062
582.511	609.172
590.511	604.672
598.511	601.012
606.511	599.112
614.511	598.672
622.511	597.942
630.511	597.122
646.511	595.962
654.511	595.912
662.511	594.932
670.511	594.162
678.511	594.352
686.511	593.792
718.511	592.992
726.511	592.812
734.511	592.812
742.511	592.662

750.511	592.382
758.511	592.032
766.511	591.922
774.511	591.912
782.511	591.532
790.511	591.092
798.511	590.922
814.511	591.022
830.511	590.942
838.511	590.962
846.511	591.112
854.511	591.382
862.511	591.522
870.511	591.872
878.511	592.432
886.511	591.572
894.511	590.252
902.511	589.472
918.511	588.562
926.511	588.092
934.511	587.952
942.511	587.912
983.203	587.904
990.511	587.902
998.511	587.812
1006.51	587.282
1014.51	587.142
1030.51	587.892
1038.51	587.912
1094.51	587.912
1102.51	588.542
1110.51	588.972
1118.51	588.062
1126.51	583.862
1134.51	580.222
1142.51	577.392
1150.51	576.062
1158.51	576.352
1166.51	576.022
1174.51	572.342
1182.51	567.972
1190.51	563.142
1198.51	557.792
1206.51	552.272
1214.51	548.262
1222.51	546.172
1230.51	545.342

1238.51	544.942
1254.51	544.322
1262.51	543.772
1270.51	542.682
1278.51	540.892
1286.51	539.052
1294.51	536.532
1302.51	534.752
1310.51	534.042
1318.51	534.402
1326.51	534.982
1334.51	535.512
1342.51	535.812
1350.51	535.782
1358.51	535.492
1366.51	535.572
1374.51	535.892
1382.51	536.582
1390.51	535.742
1398.51	532.152
1406.51	531.942
1414.51	531.912
1446.51	531.912
1454.51	532.042
1462.51	532.682
1470.51	533.462
1478.51	533.912
1502.51	533.912
1510.51	533.872
1518.51	533.702
1526.51	533.082
1534.51	532.332
1542.51	531.622
1550.51	530.662
1558.51	529.072
1566.51	526.772
1574.51	526.452
1582.51	527.482
1590.51	529.302
1598.51	531.392
1606.51	532.272
1614.51	532.542
1622.51	532.662
1630.51	532.602
1638.51	532.312
1646.51	532.432

1678.51	533.212
1694.51	533.542
1710.54	534.018

Material Boundary

X	Y
586.612	714.619
590.511	713.532
598.511	710.912
614.511	703.412
622.511	699.862
630.511	696.602
678.511	678.782
686.511	675.842
694.511	673.152
710.511	667.862
718.511	665.292
726.511	663.132
734.511	662.912
742.511	662.912
750.511	662.322
758.511	660.612
782.511	651.332
790.511	648.292
798.511	645.312
814.511	639.512
846.511	627.752
854.511	625.042
862.511	622.452
878.511	617.382
886.511	614.822
894.511	613.382
902.511	612.912
910.511	612.912
918.511	612.562
926.511	610.072
934.511	606.952
942.511	603.752
950.511	600.582
974.511	591.312
983.203	587.904

Material Boundary

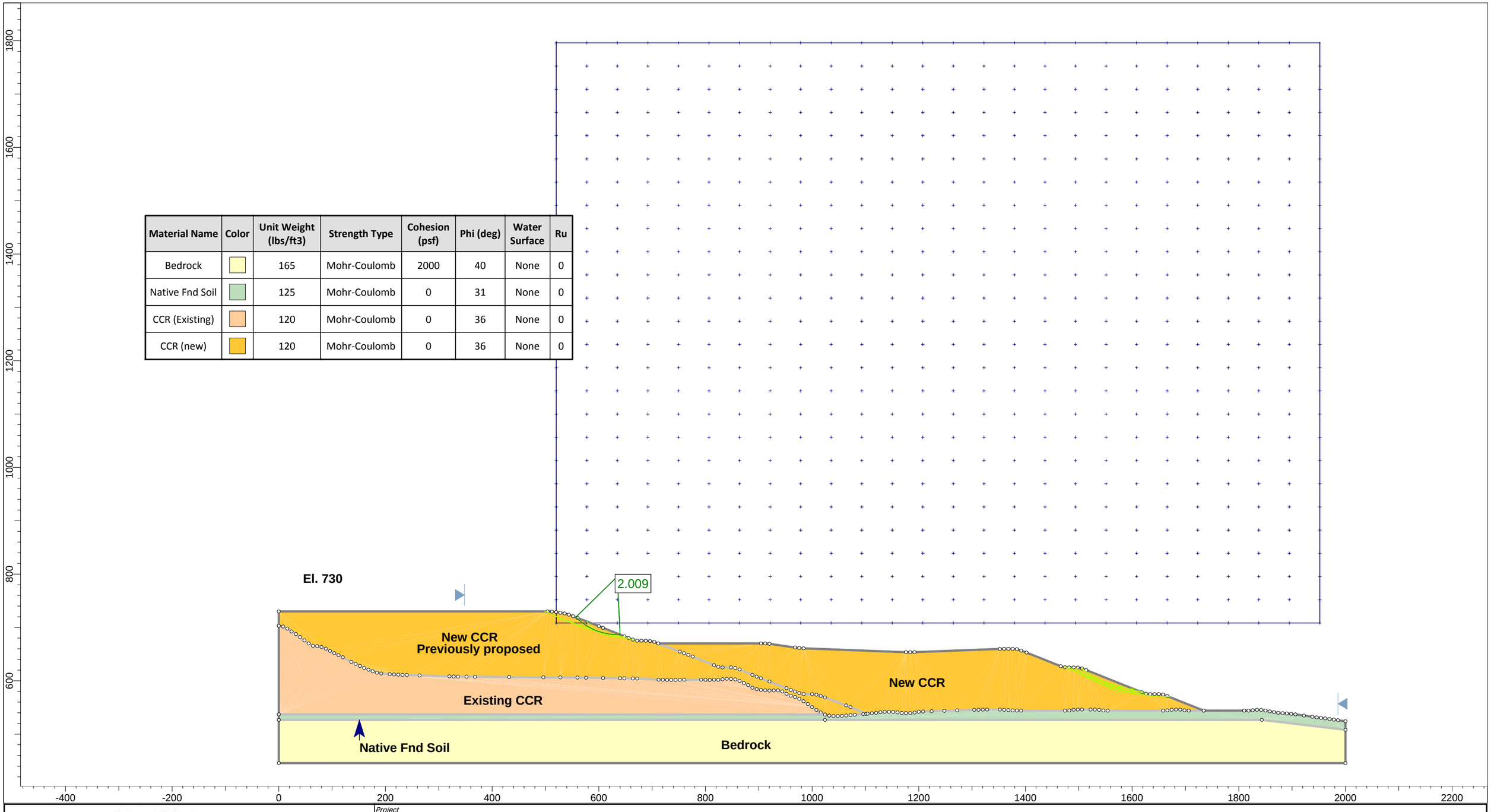
X	Y
5.151	521.282

1401.15	512.58
1457.07	512.58
1479.54	515.689
1512.61	515.689
1540.8	513.815
1560.18	509.744
1569.87	507.03
1578.21	507.03
1595.7	510.178
1700.65	517.261
1862.96	517.261
2005.15	510.567

Material Boundary

X	Y
5.151	532.106
1310.51	534.042

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock		165	Mohr-Coulomb	2000	40	None	0
Native Fnd Soil		125	Mohr-Coulomb	0	31	None	0
CCR (Existing)		120	Mohr-Coulomb	0	36	None	0
CCR (new)		120	Mohr-Coulomb	0	36	None	0



Prepared By:

MARSHALL MILLER & ASSOCIATES®

SLIDEINTERPRET 6.015

Project	Cliff's 118, Oak Grove			
Analysis Description	Figure E-3.12 (3aN-N_DS_circualr_static_mma)			
Drawn By	Ben Prior	Scale	1:2024	Company: Marshall Miller and Associates
Date	1/17/2012, 4:48:08 PM			File Name: 3aNN_DS_entire_circular_static_mma.slim

Slide Analysis Information

Cliff's 118, Oak Grove

Project Summary

File Name: 3aNN_DS_entire_circular_static_mma
Last saved with Slide version: 6.015
Project Title: Cliff's 118, Oak Grove
Analysis: Figure E-3.12 (3aN-N_DS_circualr_static_mma)
Author: Ben Prior
Company: Marshall Miller and Associates
Date Created: 1/17/2012, 4:48:08 PM
Comments:

No Phreatic Surface

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116

Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: 10

Material Properties

Property	Bedrock	Native Fnd Soil	CCR (Existing)	CCR (new)
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	165	125	120	120
Cohesion [psf]	2000	0	0	0
Friction Angle [deg]	40	31	36	36
Water Surface	None	None	None	None
Ru Value	0	0	0	0

List Of Coordinates

External Boundary

X	Y
1666.13	571.19
1658.13	574.04
1650.13	574.95
1642.13	575
1634.13	575
1626.13	575.73
1618.13	578.39
1514.13	619.99
1506.13	623.05
1498.13	624.72
1490.13	625
1482.13	625
1474.13	625.4
1466.13	627.19
1402.13	652.79
1392	656.54
1384	659.18
1376	659.66

1368	659.92
1360	659.82
1352	659.65
1192	653.65
1184	653.44
1176	653.45
984	660.77
976	661.44
968	662.39
920	669.27
912	669.92
904	670
711.509	670
704	672.83
696	674.49
688	675
680	675
672	675.15
664	677.21
656	680.08
648	683.22
608	699.19
600	702.34
560	717.85
552	720.99
544	723.87
536	726.15
528	727.62
520	728.94
512	729.71
504	730
0	730
0	703.17
-3.55271e-015	536.931
-3.55271e-015	526.563
0	445.545
2000	445.545
2000	507.989
2000	524.03
1986.13	525.96
1978.13	527.14
1970.13	528.28
1962.13	529.39
1954.13	530.41
1946.13	531.41
1938.13	532.45
1922.13	534.73

1906.13	536.98
1898.13	537.94
1890.13	538.68
1882.13	539.25
1874.13	539.99
1866.13	541.13
1858.13	542.61
1850.13	544.15
1842.13	545.49
1834.13	545.54
1826.13	544.68
1818.13	544.02
1810.13	544
1734.1	544

Material Boundary

X	Y
0	703.17
8	701.69
16	697.73
24	692.43
32	687.48
40	681.81
48	675.76
56	669.87
64	665.46
72	664.81
80	663.34
88	660.24
96	655.89
104	651.7
112	647.97
120	643.96
136	635.36
144	631.54
152	627.85
160	624.21
168	620.74
176	617.79
184	615.13
192	613.62
208	612.29
216	611.79
224	611.41
232	611.09
240	610.79

264	609.95
320	608.23
328	608.01
336	607.88
352	607.74
368	607.54
432	606.98
496	606.48
528	606.26
560	605.99
576	605.72
608	605.15
640	604.68
648	604.52
664	604.3
672	604.14
712	602.1
720	601.86
728	601.68
736	601.54
744	601.45
752	601.81
760	602
792	602
800	601.74
808	601.35
816	601.93
824	601.84
832	602.7
840	603.7
848	603.36
856	602.45
864	599.75
872	595.94
880	591.73
888	586.9
896	584.17
904	582.83
912	582.08
920	581.5
928	581.87
936	581.88
944	579.96
952	575.51
960	572.01
968	569.58
976	566.18

984	561.63
992	556.36
1000	550.67
1008	545.34
1016	540.59
1024	536.58

Material Boundary

X	Y
711.509	670
752	654.74
760	651.66
768	648.54
776	645.35
816	629.16
824	626.19
832	625
848	625
856	623.89
864	621.15
888	611.11
896	607.84
904	604.72
920	598.6
952	586.15
960	583.01
968	579.77
976	576.88
984	575
1000	575
1008	573.85
1016	571.59
1024	568.56
1064	553.65
1072	550.61
1101.4	537.969

Material Boundary

X	Y
-3.55271e-015	536.931
1024	536.58
1032	534.63

Material Boundary

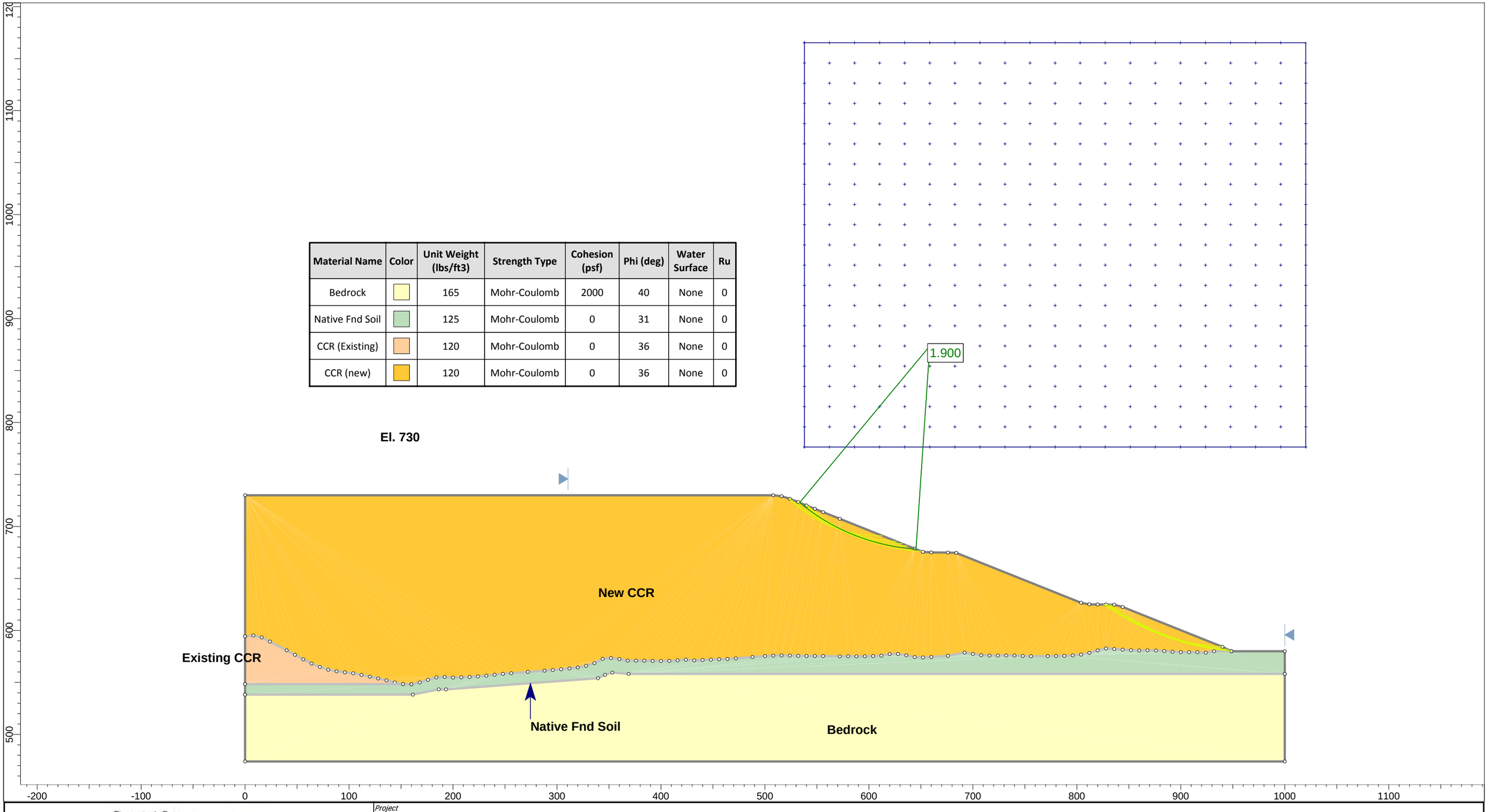
X	Y
1032	534.63
1040	533.76
1048	533.74
1056	534.22
1064	534.89
1072	535.63
1080	536.29
1096	537.49
1101.4	537.969
1104	538.2
1112	539.07
1120	540.01
1128	540.9
1136	541.67
1144	541.9
1152	541.53
1160	540.63
1168	539.62
1176	539.41
1184	539.44
1192	540.36
1200	541.93
1208	542.31
1224	542.86
1248	543.64
1272	544.48
1304	545.37
1312	545.62
1320	545.89
1328	546
1352	546
1360	545.6
1368	544.97
1376	544.42
1384	544.11
1392	544.02
1474.13	544
1482.13	544.32
1490.13	545.68
1498.13	545.97
1506.13	546
1522.13	546
1530.13	545.95
1538.13	545.36
1546.13	544.33
1554.13	544

1658.13	544
1666.13	544.49
1674.13	545.5
1682.13	545.96
1690.13	545.82
1698.13	544.62
1706.13	544
1734.1	544

Material Boundary

X	Y
-3.55271e-015	526.563
1024	526.563
1843.05	526.563
2000	507.989

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock		165	Mohr-Coulomb	2000	40	None	0
Native Fnd Soil		125	Mohr-Coulomb	0	31	None	0
CCR (Existing)		120	Mohr-Coulomb	0	36	None	0
CCR (new)		120	Mohr-Coulomb	0	36	None	0



Prepared By:

MARSHALL MILLER & ASSOCIATES

SLIDEINTERPRET 6.015

Project	Cliff's 118, Oak Grove		
Analysis Description	Figure E-3.13 (3aZZ_DS_circular_static_mma)		
Drawn By: Ben Prior	Scale: 1:1036	Company: Marshall Miller and Associates	
Date: 1/27/2012, 11:21:09 AM		File Name: 3ZZ_DS_circular_static_mma.slim	

Slide Analysis Information

Cliff's 118, Oak Grove

Project Summary

File Name: 3ZZ_DS_circular_static_mma
Last saved with Slide version: 6.015
Project Title: Cliff's 118, Oak Grove
Analysis: Figure E-3.13 (3aZZ_DS_circular_static_mma)
Author: Ben Prior
Company: Marshall Miller and Associates
Date Created: 1/27/2012, 11:21:09 AM

General Settings

Units of Measurement: Imperial Units
Time Units: days
Permeability Units: feet/second
Failure Direction: Left to Right
Data Output: Standard
Maximum Material Properties: 20
Maximum Support Properties: 20

Analysis Options

Analysis Methods Used

Spencer

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50
Check malpha < 0.2: Yes
Initial trial value of FS: 1
Steffensen Iteration: Yes

Groundwater Analysis

Groundwater Method: Water Surfaces
Pore Fluid Unit Weight: 62.4 lbs/ft3
Advanced Groundwater Method: None

Random Numbers

Pseudo-random Seed: 10116
Random Number Generation Method: Park and Miller v.3

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: 10

Material Properties

Property	Bedrock	Native Fnd Soil	CCR (Existing)	CCR (new)
Color				
Strength Type	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb	Mohr-Coulomb
Unit Weight [lbs/ft3]	165	125	120	120
Cohesion [psf]	2000	0	0	0
Friction Angle [deg]	40	31	36	36
Water Surface	None	None	None	None
Ru Value	0	0	0	0

List Of Coordinates

External Boundary

X	Y
940	584.24
844	622.64
836	624.75
828	625
820	625
812	625.1
804	626.65
684	674.63
676	674.94
660	675.06
652	675.56
644	678.64
572	707.44
556	713.8
548	717.01
540	720.24
532	723.44
524	726.62
516	729.12
508	730

0	730
0	594.36
0	548.34
0	538.332
0	474.006
1000	474.006
1000	558.257
1000	580
948.713	579.992

Material Boundary

X	Y
0	594.36
8	595.14
16	593.25
24	589.3
40	580.88
48	576.58
56	572.15
64	568.18
72	564.91
80	562.26
88	560.72
96	559.74
104	558.8
112	557.3
120	555.58
128	553.83
136	552.02
144	550.03
152	548.34

Material Boundary

X	Y
0	548.34
152	548.34
160	548.22

Material Boundary

X	Y
160	548.22
168	550.01
176	552.55
184	554.82

192	555.29
200	554.73
208	554.94
216	555.31
224	555.76
232	556.53
240	557.42
248	558.24
256	558.89
272	560.09
288	561.31
296	561.95
304	562.67
312	563.45
320	564.44
328	565.97
336	568.55
344	572.69
352	573.42
360	572.4
368	570.96
376	570.98
384	570.9
392	570.73
400	570.69
408	570.77
416	571.28
424	571.92
432	571.19
440	571.51
448	571.9
456	572.26
464	572.57
472	573.09
488	574.45
500	575.37
508	575.77
516	576.01
524	575.83
532	575.54
540	575.42
548	575.42
556	575.37
572	575.08
580	575.17
588	575.13
596	575.14

604	575.32
612	575.81
620	577.27
628	577.46
636	576.04
644	574.41
652	574.03
660	574.51
676	575.61
692	578.74
700	577.39
708	576.19
716	575.86
724	575.82
732	575.93
740	575.85
748	575.43
756	575.23
772	575.31
780	575.41
788	575.56
796	575.98
804	576.77
812	578.48
820	580.8
828	582.73
836	582.17
844	581.56
852	580.98
860	580.68
868	580.88
876	580.64
884	580.17
892	579.5
900	579.09
908	579.12
916	579.06
924	578.56
932	579.99
948.713	579.992

Material Boundary

X	Y
0	538.332
161.353	538.332
186.314	543.339

193.342	543.339
339.491	554.04
346.194	557.327
353.26	559.447
368.953	558.257
1000	558.257

PROJECT NO. 90-55-27
SEPTEMBER 1991

REPORT
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN

CONCORD COAL REFUSE DISPOSAL FACILITY

U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS
BECKLEY, WV PITTSBURGH, PA

1211-AL7-00093-01

REPORT

PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN

CONCORD COAL REFUSE DISPOSAL FACILITY

HUEYTOWN, ALABAMA

REPORT
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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90-55-E111	PLAN - DIKED IMPOUNDMENT
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DRAWING NO.	TITLE
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REPORT
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

1.0 INTRODUCTION

U.S Steel Mining Company, Inc. (USM) currently operates a coal refuse disposal facility adjacent to their Concord coal preparation plant, located near Hueytown, Alabama. The Concord coal refuse disposal facility has been in operation since approximately 1946. This area, which covers approximately 300 acres, is a combination hilltop and head-of-hollow type facility used for disposal of both coarse and fine coal refuse. Coarse refuse is trucked from the Concord preparation plant to the refuse disposal area, where it is spread and compacted forming a fine coal refuse slurry impoundment within the interior portions of the coarse refuse embankment. The fine coal refuse slurry is delivered to the north end of the slurry impoundment by a pipeline. The current refuse disposal area configuration is shown on the "Existing Conditions" Drawing No. 90-55-E101.

The Concord refuse disposal area is approaching the currently approved limits and USM desires to expand the facility for continued coarse and fine coal refuse disposal operations. This expansion will provide fine and coarse refuse disposal capacity in support of mining operations at the Oak Grove mine located west of the facility.

A conceptual plan for the expansion of the Concord refuse disposal facility was submitted (by others) to the Mine Safety and Health Administration (MSHA) in 1988. MSHA's review of the conceptual plan resulted in a request for a thorough geotechnical investigation of the refuse area to support the expansion plans. The specific items discussed in the November 30, 1988 MSHA[1] letter were:

- Additional drilling and testing was requested to determine the subsurface conditions and strength of the foundation materials;

- Analysis of the liquefaction potential of the fine refuse materials;

---

[1] Mine Safety and Health Administration letter dated November 30, 1988.

- Subsidence effects on the embankment;

- Determine the original ground surface under the pile to assist in the foundation evaluation;

- Determine the phreatic surface within the refuse pile and install monitoring devices; and

- Provide hydrology calculations for the new design.

In response to MSHA's letter, USM entered into a contract with Almes & Associates, Inc., Consulting Engineers (ALMES) to develop and execute a geotechnical study of the current refuse disposal area, prepare a plan for the expansion of the refuse disposal facility, and assist USM in obtaining approval for the expansion plan.

This report contains the results of the geotechnical explorations, design drawings, calculations and technical specifications for the expansion project at the Concord refuse disposal facility.

Included in this report are the results of field activities which included drilling, sampling and field material testing programs. During the field activities, samples were collected for laboratory testing to determine design properties of coarse refuse, fine refuse, and foundation materials.

The plans for the expansion of the refuse disposal facility includes five stages. The initial stages specify the enlargement of the existing slurry impoundment accompanied by selective coarse refuse placement to form buttresses which will improve the stability of the impoundment dikes. During subsequent stages of the expansion plan, a new fine refuse slurry disposal impoundment will be constructed.

Stage 1 of the proposed expansion plan was designed to provide needed fine refuse disposal capacity and to improve the stability of the embankment slopes by selective placement of coarse refuse to buttress the existing slopes. Stages 2 and 3 continue with this approach. During Stage 2, construction of the first stage of an embankment to form a new fine refuse disposal impoundment shall begin adjacent to the northwest side of the disposal area. Construction of the new embankment continues through Stages 3 and 4. During Stage 4, the new embankment will be raised to its final elevation while commencing closure of the old slurry impoundment. Stage 5, the

final stage of the proposed plan, continues with coarse refuse disposal on the main area and fine refuse slurry disposal in the new impoundment area.

2.0 SITE CONDITIONS

2.1 BACKGROUND

Development of the Concord refuse disposal site began concurrent with the construction and development of the Concord deep mine during 1946. The preparation plant was placed into service in 1950 and the refuse embankment has been operated and maintained continually since that time.

According to the USM facility files and permitting information, the original structure was constructed on a cleared and grubbed site by successive deposition of approximately one-foot layers of coarse refuse materials. Larger refuse rock, "plus 2 inches", was placed in the low areas to provide drainage for water seeping through the pile. In 1964, the height of the lifts was increased to 16 feet because of advances in the equipment available for transporting and compacting the refuse. In 1969 and 1970, the slurry pond located within the interior of the refuse pile was extended to the north to the configuration and size of the present slurry impoundment.

Because of the location of the disposal area and the materials used in the construction, the embankment does not impound or contain any water except slurry water pumped to or rainfall intercepted by the slurry pond. Therefore, there are no diversion channels or spillways associated with the refuse pile or slurry pond. Most of the water collected in the slurry pond is lost to seepage through the coarse refuse drains constructed in the valleys underlying the refuse pile or evaporation. The seepage emanates at several locations around the toe of the pile as shown on Drawing No. 90-55-E101. Collection ponds have been constructed to collect flows from the three seepage areas. To meet effluent limitations, this under drainage flow is pumped from the ponds to a treatment facility and treated prior to release.

The refuse embankment outslopes are 2.5H:1V (Horizontal:Vertical) or flatter. Most of the slopes have been covered with a minimum of 6 inches of soil and vegetated with grasses and pine seedlings. Several benches have been constructed around the perimeter of the pile at vertical intervals of 25 feet.

The Concord refuse area has been free of fire or signs of combustion except for one area in the southeast portion of the pile, which burned from 1958 to 1961. According to USM, this area was improperly constructed with an abnormally high bench height without surface sealing and properly sloped edges. The fire was extinguished by sealing the area with clay and sloping the edge. Subsequent to the extinguishing operation, the area was planted with pine trees to provide additional soil stability and to serve as a warning of reignition. No indication of heating in any area of the embankment has been observed since that time.

2.2 PHYSICAL CHARACTERISTICS OF THE SITE

The existing Concord refuse disposal area is located on the drainage divide between two unnamed tributaries to Lick Creek. A freshwater reservoir used as a water supply for the coal preparation plant, is located on the head waters of the unnamed tributary along the west side of the refuse disposal area as shown on Drawing No. 90-55-E101. The Concord coal preparation plant is located on the north side of the refuse area. A series of sedimentation ponds, water treatment ponds and associated features are located on the eastern side of the refuse area. Most of the older areas of the refuse pile support varying degrees of vegetation ranging from grasses to 30-foot pine trees. Areas adjacent to the refuse disposal area are primarily forested.

2.3 GEOLOGY

The Concord refuse disposal area is located on the southeast limb of the Coalburg syncline approximately 3,500 feet southeast of the synclinal axis and 5,000 feet northwest of the Warrior Basin. The area is characterized by moderate topographic relief composed of gently rolling to steep hillsides and deeply incised stream drainages. Stratigraphically, the bedrock in the area belongs to the Pennsylvanian aged Pottsville Formation.

The strata below the Concord permit area consists of sandstones and shales which contain occasional coal seams and fire clays. These strata are nearly flat lying with a regional dip of 50 feet per mile to the southwest. Several thin coal seams, the Thompson Mill, Upper Cobb and Lower Cobb occur in the upper 300 feet of rock strata below the site. These coal seams are thin and unmineable but are easily recognizable in drillhole logs and provide the basis for correlation of strata in the Concord permit area.

According to the surface mine permit, the Thompson Mill seam is generally not more than one foot thick and is rather discontinuous. However, two or three fire clay seams associated with the coal mark the Thompson Mill horizon where the coal is absent. These fire clays are apparently continuous beneath the site and are probably important as barriers to the downward movement of groundwater. The Thompson Mill seam and fire clays outcrop at approximately elevation 500 around the perimeter of the refuse pile.

The Upper and Lower Cobb coal seams occur about 150 to 200 feet below the Thompson Mill seam. The Lower Cobb occurs about 40 feet below the Upper Cobb Seam.

The Pratt coal seam, which occurs between 620 and 670 feet below the site, has been room and pillar mined below the refuse disposal area.

3.0 MINING OPERATIONS AND COAL REFUSE PRODUCTION

3.1 MINING OPERATIONS

The Concord deep mine, which is in the Pratt coal seam, underlies the refuse disposal area. Mining was by the room and pillar mining method. Based on a review of available deep mine maps, deep mining beneath the northwest portion of the refuse disposal facility, shown as Area 1 on Figure 1, was not as extensive as in adjacent areas. In this area, large blocks of coal were not mined to provide support for the slope shafts and coal preparation facility located to the north of the refuse disposal area. In the main refuse disposal area, Area 2, mining of the coal was to approximately 50 percent extraction. In Area 3, adjacent to the eastern side of the disposal area, the pillars were removed in a second mining effort which occurred in approximately 1964.

From the mine maps, it was determined that the base of the deep mined coal seam occurs between 620 and 670 feet below the base of the refuse embankment between approximate elevations -40 and -90 feet (below sea level). One of the slope entries associated with the deep mine daylights in the vicinity of the old mine buildings, located in the northwest portions of the project area, as shown on Drawing No. 90-55-E101. According to information provided by USM, the near surface portions of the slope were sealed with concrete and the shallow areas backfilled. Details of the slope shaft seal are shown on U.S. Steel Drawings 4854-1-1 and M226, which are included in Appendix E.

3.2 COAL REFUSE PRODUCTION

Current refuse production from the Concord preparation plant is produced from cleaning of coal from USM's Oak Grove mine. The Concord coal cleaning facility contains a wet process preparation plant with a coal washer and thickener, thermal drier and rail load-out facilities. Coarse coal refuse generated at the preparation plant will continue to be transported by conveyor to a refuse storage bin located adjacent to the plant and then trucked to the disposal area for final placement. The fine coal refuse is currently pumped in slurry form through surface pipelines to an existing slurry impoundment. During the initial stages of the proposed disposal area expansion, this method of fine refuse disposal will continue. In latter stages of the proposed disposal expansion plan, the existing slurry impoundment will be closed and a newly constructed slurry impoundment, located adjacent to the northwest side of the coarse refuse disposal area, will receive the pumped slurry discharge.

The slurry line discharge pipe into the new slurry impoundment will be located along the coarse refuse embankment slope (southeast side) and periodically relocated to promote a relatively uniform distribution of fine coal refuse along the coarse refuse embankment slope. This technique will create a delta of settled fines against the slope. This procedure for discharging slurry, coupled with the highly compacted coarse refuse blanket along the interior slopes, should minimize seepage losses into the coarse refuse.

The refuse production rates used for design of the expansion project were supplied by USM. The preparation plant production figures indicate total refuse production rates of approximately:

- Total Refuse 343.7 tons per hour
- Coarse Refuse 303.3 tons per hour
- Fine Refuse 40.4 tons per hour

Assuming the coal preparation plant operates 20 hours per day for 240 days per year, total annual coarse and fine refuse production is estimated to be:

- Coarse Refuse 1,455,840 tons per year
- Fine Refuse 193,920 tons per year

Using a mine life of 20 years, total coarse and fine refuse production is estimated at:

- Coarse Refuse 29,116,800 tons
- Fine Refuse 3,878,400 tons

To determine disposal volume requirements, the tonnages were converted to cubic yards using in-place dry densities of 55 pounds per cubic foot for the fine refuse and 110 pounds per cubic foot for the coarse refuse. Estimates of the total coarse and fine refuse disposal requirements are:

- Coarse Refuse 19,607,273 cubic yards
- Fine Refuse 5,223,434 cubic yards

4.0 SUBSURFACE EXPLORATION

Field studies at the Concord refuse disposal area were conducted in January and February of 1991. The field studies included drilling, sampling and field testing of the existing coarse and fine refuse disposal areas and adjacent areas. An important goal of the drilling program was to determine the original ground surface and bedrock elevation beneath the existing refuse embankment and the engineering characteristics of these materials as relates to constructing future embankment stages, and associated structures.

A total of 21 borings were completed at the site. Standard Penetration Test (SPT) split-spoon sampling was conducted in the borings at 5-foot intervals. Undisturbed 3-inch diameter Shelby tube samples of the fine refuse and natural soils were collected in the borings. A summary of the boring and sampling data are presented in Table 1.

Bulk samples of the coarse and fine refuse were collected from the surface of the refuse disposal areas for laboratory testing. In addition, in-place density testing was performed at 16 locations using a field density gauge (nuclear device).

Two-inch diameter open standpipe piezometers were installed in 9 of the boreholes. Seven of the piezometers were installed at locations around the perimeter of the existing slurry impoundment. Two of the piezometers were located in adjacent proposed expansion areas. All piezometers were developed and initial water level readings were obtained. Table 2 presents a summary of the piezometer installations and the static water level readings collected.

The location of the borings and test pits is depicted on Drawing No. 90-55-E101. Boring logs are included in Appendix B.

Generally, the soils encountered in the area adjacent the northwest side of the refuse area where the new impoundment embankment will be constructed consist of a brown sandy clay. The thickness of the soils in this area ranged from 5 to 10 feet. The underlying bedrock is classified as a soft to medium hard sandstone varying in color from reddish to gray.

5.0 FIELD AND LABORATORY TESTING

5.1 FIELD TESTING

In-place field density tests were performed at 16 locations on the surface of the coarse and fine refuse disposal areas and in the natural soils at the location shown on Drawing No. 90-55-E101. The testing was performed with a Troxler Nuclear device which determined total unit weight and in-place moisture. Oven-dried moisture contents were used to compute the dry densities. The results of the field density test are included in Appendix D - Test Data.

The field density data expressed as in-place dry unit weights in pounds per cubic foot (pcf) varied as follows:

- Coarse Coal Refuse - 103 to 122 pcf
- Fine Coal Refuse - 50 to 57 pcf
- Natural Soils - 90 to 134 pcf

5.2 LABORATORY TESTING

Samples of the coarse refuse, fine refuse and natural soils obtained from the SPT split spoons, Shelby tubes and test pits were used for laboratory testing. The scope of the testing is discussed below and the results are presented in Appendix D and on the boring logs (Appendix B).

The testing included the following:

- Classification Tests - This testing included determination of water content and visual classification of the samples. The results are summarized on the boring logs in Appendix B.

- Grain-Size Analyses - Grain-size analyses were performed on coarse and fine refuse samples. A plot showing the grain size distribution for both materials are presented on Figures 2 and 3.

- Permeability - Constant head permeability tests were performed on remolded samples to determine the permeability characteristics of the coarse refuse material which will be used for embankment construction. Results of the permeability test indicate the compacted coarse refuse to be used in construction of the embankment has a permeability of 1.51×10^{-7} cm/sec compacted to 95 percent of Standard Proctor.

- Shear Strength Tests - Consolidated, undrained triaxial tests with pore pressure measurements were performed on Shelby tube samples of fine refuse and natural soil. Shear strength tests were also performed on remolded samples of coarse refuse. Shear strength results on the in-place fine coal refuse in boring B-20 at 27.0 to 29.5 feet indicate a Φ angle of approximately 38 degrees. Shear strength results for the natural soils in borehole B-3A indicate a Φ value of approximately 31 degrees. Remolded samples of the coarse coal refuse to 95 percent of Standard Proctor resulted in Φ values of 35 degrees.

- Compaction Tests - A Standard Proctor compaction test (ASTM D 698) was performed on coarse refuse samples collected from the preparation plant and disposal areas. Maximum dry density for the fresh coarse refuse was determined to be 115.1 pcf at an optimum moisture content of 6.2 percent.

- Atterberg Limits Test - Both liquid and plastic limits testing (ASTM 4318) were performed on several coarse and fine refuse samples and a soil sample. Results of these tests are included in Appendix D - Test Data. Both the coarse and fine refuse were determined to be non-plastic. Test on soil samples obtained from sample location 3A indicated the soils to be mostly clay with a low plasticity (USCS type CL).

6.0 SITE DEVELOPMENT

The Concord coal refuse disposal facility is actively used for disposal of coarse coal refuse and fine coal refuse slurry. Implementation of the proposed disposal plan described herein will require a transition of certain aspects of the operations including phasing out of the existing slurry impoundment, construction of a new slurry impoundment, and restaging of the coarse refuse disposal areas. Other features include new sedimentation pond construction and routing of surface water runoff.

Site preparation activities to be conducted include clearing and grubbing of new construction and existing refuse disposal areas, in preparation for the sediment ponds and perimeter runoff collection ditches. The location, profiles and cross-sections for the sediment ponds and ditches are presented in the drawings. The following is a description of the site development and sediment pond construction requirements.

6.1 SEDIMENT PONDS

Four sediment ponds are proposed to control runoff and sediment load from the proposed refuse disposal expansion areas. Sediment Ponds 1 and 4, located adjacent to the new slurry impoundment, collect runoff from the northern refuse disposal area, dike embankment area and flow from the dike embankment subsurface drains prior to release to an unnamed tributary to Lick Creek. The location of these sediment ponds are shown on Drawing No. 90-55-E116. Sediment Ponds 2 and 3 are designed to control runoff from the southern half of the refuse area and discharge to existing collection ponds. The construction of the sediment ponds will be staged and will be constructed in the order as numbered. Scheduling for the construction of the sediment ponds is discussed in the refuse disposal plan presented in Section 7.0 of this report. The sediment ponds storage capacities are designed for the maximum disturbed area to occur at any one time, which is Stage 5 of this plan. Each sediment pond is designed to provide sediment storage capacity and meet settleable solids discharge criteria of the Alabama Surface Mine Commission. All sediment pond embankments are less than 20 feet high, measured from the upstream toe to the crest of the spillway invert, and have storage capacities less that 20 acre-feet and, therefore, will not be considered impounding structures under MSHA criteria.

The following criteria were used in the design of the sediment ponds:

- Sediment Storage - Each pond is designed with a capacity to store sediment based on a sediment loss of 0.1 acre-feet per acre for the largest disturbed area within the drainage area. The pond must be cleaned when less than 40 percent of the required storage volume remains.

- Principal Spillway - A fiber bonded, corrugated metal pipe (CMP) will be used as the principal spillway. The pipe spillway will consist of a horizontal and vertical riser section. The pipe will be coated and lined to provide corrosion protection due to possible deterioration in water quality. The riser inlet elevations for each pond are shown on Drawing No. 90-55-E117.

- Emergency Spillway - An emergency spillway has been provided for each pond to convey runoff from the 25-year, 6-hour design storm event around the embankment. The location and dimensions of the emergency spillway for each pond are shown on Drawing Nos. 90-55-E116 and 90-55-E117.

- Seepage Cutoff Trench - A minimum 8-foot wide seepage cutoff trench is required to reduce seepage losses through the foundation and embankment materials. The trench will be extended at least 5 feet into the foundation soils and embankment or as determined by the field engineer. The trench shall be backfilled with well compacted coarse refuse. Additional subsurface exploration may be required once the clearing and grubbing has been performed in the embankment and abutment areas to verify the design assumptions and construction requirements. All ponds constructed on refuse materials must be lined with soil or compacted coarse refuse.

7.0 COAL REFUSE DISPOSAL PLAN

The proposed coal refuse disposal expansion plan at the Concord facility provides additional disposal capacity of approximately 20 years of coarse refuse and 13 years of fine coal refuse based on production rates provided by USM.

The proposed coal refuse disposal plan has been developed in accordance with prudent engineering principles and practices and current MSHA and Alabama Surface Mine Commission criteria for

coal refuse disposal facilities. A summary of the construction staging is included in Table 3. A brief description of the disposal plan is presented below:

1) The initial phase of the disposal area expansion, Stage 1A, begins with the enlargement of the existing embankment to provide needed fine refuse disposal capacity. During Stage 1B, which follows immediately, a coarse refuse buttress with an excavated toe key trench is constructed along the northern end of the refuse embankment. Upon completion of Stages 1A and 1B, which should take approximately one year to construct, the disposal operation will meet or exceed MSHA hydrologic and stability criteria and provide approximately three years of fine refuse disposal capacity.

2) Prior to proceeding with the remaining stages of Stage 1, sediment pond 1 should be constructed. Upon completion of the sediment pond construction, coarse refuse material will be used to construct Stages 1C and 1D. The construction of Stage 2 through Stage 5 will follow with sediment pond 2, 3, and 4 being installed, as needed, to control surface runoff.

3) Under Stage 2D, construction of a new fine refuse disposal area begins with the construction of a starter dike adjacent the northwest side of the disposal area. The new fine refuse disposal area embankment will be enlarged in two stages using downstream construction techniques.

4) Perimeter ditches, haul road ditches, bench gutters and culverts will be installed to control surface runoff and minimize erosion. All final surfaces will be revegetated upon completion.

The plans and cross-sections for the five stages of the refuse disposal area expansion are presented in Drawing Nos. 90-55-E102 through 90-55-E108. Construction details are presented on Drawing Nos. 90-55-E111 through 90-55-E115. A discussion of the requirements for each stage of the disposal plan is presented below.

As an integral part of the design, the construction of the facility must be monitored by experienced persons, knowledgeable of the design, regulatory requirements, subsurface conditions, and the plans and specifications presented in this report, and in the design drawings and the Guideline Technical Specifications.

7.1 STAGE 1

Stage 1 is comprised of four substages. The first substage, Stage 1A, requires the enlargement of the existing slurry impoundment by raising the dike. Stage 1B enlarges and buttresses the northern embankment. Stage 1C begins construction on the eastern slope of the coarse refuse pile in preparation for future disposal area expansion. Stage 1D begins construction of a compacted structural fill along the northwestern slope in preparation for the future fine refuse impoundment. Stages 1A, 1B, 1C and 1D require approximately 1.35 years to construct and will provide approximately 3 years of slurry disposal capacity. Plans and cross sections depicting this phase of the expansion plan are presented on Drawing Nos. 90-55-E102, 90-55-E107 and 90-55-E108.

7.1.1 Stage 1A

Construction of Stage 1A specifies the raising of the existing slurry impoundment perimeter dike to elevation 670 and will require approximately 2 months to construct using coarse coal refuse. Construction of this embankment provides 3 years of slurry disposal capacity with 2 PMF storm storage capacity and 3 feet of freeboard. The coarse refuse material used to raise the embankment shall be placed on the existing embankment using downstream construction techniques. The coarse refuse shall be placed and compacted in uniform lifts in accordance with the structural fill requirements, as described in Section 2.4.4 of the Guideline Technical Specifications.

At the completion of Stage 1A, the slurry impoundment will provide 3 years of fine refuse disposal capacity with a maximum fines level at elevation 658. At this level, the impoundment will have the capacity to store two PMF storms plus 3 feet of freeboard. Dewatering capacity for one PMF will be provided by a portable dedicated pump system. Gasoline or diesel powered portable pumps capable of evacuating one PMF within 30 days will be maintained at the site. Details for the pump system are included in Section 3.2 of the Guideline Technical Specifications. The impoundment pool elevation should be maintained at the lowest practical level at all times.

7.1.2 Stage 1B

During Stage 1B, a coarse refuse buttress will be placed along the northern slope of the existing impoundment. Prior to increasing the height of the embankment, an 85-foot by 900-foot trench will be excavated to original ground through the fine refuse material and backfilled with compacted coarse refuse. This trench will be excavated and backfilled with compacted coarse in 50 feet by

85 feet (approximately) strips oriented perpendicular to the slope face, in order to minimize the undermining of the existing embankment slope. If signs of instability occur, the excavation areas will have to be decreased in size. Details regarding the cutoff trench excavation are included in Appendix A, Guideline Technical Specifications.

Compacted coarse refuse shall be used to backfill the key trench excavations. After completion of the key trench the north buttress shall be raised to elevation 675. This buttress will provide increased stability of the northern embankment slope and increased height to offset concern for liquefaction potential of the existing fine refuse (see discussions in Section 8.3, Liquefaction Analysis).

7.1.3 Stage 1C

During Stage 1C, coarse refuse will be placed along the east side of the refuse pile to elevation 580, as shown in plan and cross-section on Drawing Nos. 90-55-E107 and 90-55-E107. This substage begins the build up of the eastern refuse slope to enlarge and buttress the embankment.

7.1.4 Stage 1D

Stage 1D begins the reconstruction of the northwestern coarse refuse embankment slope in preparation for the new fine refuse impoundment. Compacted coarse refuse will be placed along this slope, in accordance with structural fill requirements, forming a minimum 40-foot wide blanket. This will minimize leakage through this area of the future impoundment and increase the stability by flattening the slope to an overall 3H:1V.

Prior to placement of the structural fill, a rock underdrain will be constructed along the toe of the existing slope to provide drainage and control the phreatic level in this area. The location and details for the rock underdrain for the northwest embankment slope is shown on Drawing Nos. 90-55-E112 and 90-55-E115.

7.2 STAGE 2

Stage 2 is composed of four substages. The initial substage, Stage 2A, increases the impoundment size by building upon Stage 1A. Stage 2B increases the elevation of the northern coarse refuse buttress. Stage 2C continues coarse refuse construction along the eastern slope of the existing

embankment. During substage 2D, construction of the new fine refuse impoundment embankment shall commence.

Stage 2 requires approximately 2.5 years to construct and provides an additional 2 years of fine refuse disposal capacity, in the main impoundment.

7.2.1 Stage 2A

Coarse refuse will be used to raise the main impoundment embankment to elevation 680. The coarse coal refuse used to construct the embankment will be placed in accordance with Section 2.4.4 of the Guideline Technical Specifications included in Appendix A.

At the end of Stage 2, the fine refuse impoundment will have a maximum fine refuse capacity to elevation 667. At this level, the impoundment provides storage for two PMF storms plus 3 feet of freeboard. The impoundment water level should be maintained at the lowest practical level at all times. Capacity to evacuate 1 PMF within 30 days from the impoundment will be provided by dedicated portable pumping equipment. Details for the pump system are included in Appendix A, Guideline Technical Specifications.

7.2.2 Stage 2B

Construction under Stage 2B will raise the coarse refuse embankment to elevation 690 along the north end of the impoundment and to elevation 660 in a second lift further to the north. This construction caps the old fine refuse area and develops the eastern side slope embankment for the new fine refuse impoundment. Raising the embankment provides massive support along the north slope of the embankment and provides additional height to mitigate settlement of the crest due to the unlikelihood of liquefaction of the fines beneath the embankment.

7.2.3 Stage 2C

Stage 2C continues with the development of the eastern area by raising the embankment with coarse refuse to elevation 630.

7.2.4 Stage 2D

Construction of the new fine refuse impoundment begins with the construction of a starter embankment during Stage 2D. During this stage, a dike is constructed to elevation 600 to form a new fine refuse impoundment area. The dike includes a highly compacted (100 percent Standard Proctor density) core and key trench. The new impoundment is capable of providing fine refuse disposal capacity to elevation 591 with one PMF of storm storage capacity plus 3 feet of freeboard. Storm dewatering capacity will be provided by a dedicated pump dewatering system. The pump dewatering system will have the capacity to evacuate the PMF from the impoundment in 10 days. Plans and cross-sections for the dike embankment are presented in Drawing Nos. 90-55-E103, 90-55-E107, 90-55-E111, and 90-55-E112. The pump dewatering system specifications are included in Appendix A, Guideline Technical Specifications.

7.3 STAGE 3

Stage 3 includes four substages of construction: Stage 3A raises the existing impoundment embankment to the final elevation of 690; Stage 3B continues the build up of the northern buttress area; Stage 3C continues with the construction of the dike impoundment embankment; and Stage 3D raises the southern end of the disposal area to elevation 660.

7.3.1 Stage 3A

Construction under Stage 3A will raise the main impoundment embankment to the final elevation of 690. At this elevation the impoundment provides an additional 2.7 years of fine refuse disposal capacity with a maximum fine refuse elevation of 678. At this stage the impoundment provides 2 PMF storm storage capacity and 3 feet of freeboard. A pump system to evacuate one PMF in 30 days will be maintained for the life of this impoundment.

7.3.2 Stage 3B

During Stage 3B, the northern area of the embankment will be raised to elevation 710 adjacent to the impoundment and elevation 690 in the northern part of this area. as shown on Drawing No. 90-55-E104.

7.3.3 Stage 3C

Construction of the dike impoundment embankment continues in Stage 3C with the raising of the embankment to elevation 620. Prior to this raising of the embankment, the finger drains and internal drains shall be constructed. Stage 3C of the embankment should be constructed in five increments to facilitate the installation of the internal drains and finger drain connection. The layout of the drains, plans and cross-sections for Stage 3C are presented in Drawing Nos. 90-55-E104, 90-55-E107, 90-55-E111, and 90-55-E112. After the internal drains are installed, the embankment can be raised to elevation 620. The embankment will be raised by placing compacted coarse refuse downstream of the starter embankment constructed in Stage 2D. The upstream face of the embankment shall be constructed with a 40-foot wide (measured horizontally from the slope face) 100 percent Standard Proctor compaction zone. This highly compacted zone shall extend from elevation 600 to 620. The location is shown in cross-section on Drawing No. 90-55-E112. Specifications are included in Appendix A.

At the completion of Stage 3C, the dike impoundment will have the capacity to store fine refuse to an elevation of 611 plus 1 PMF with 3 feet of freeboard. The dedicated pump dewatering system capable of evacuating 1 PMF in 10 days will be maintained for the life of the impoundment.

7.3.4 Stage 3D

Coarse refuse will be placed in the southern portion of the refuse disposal area during Stage 3D to elevation 660.

7.4 STAGE 4

Stage 4 of the refuse disposal plan includes four substages. Construction of the dike embankment to final elevation 640 will occur in Stage 4A. Closure of the main area impoundment , Stage 4B, will begin when the fine refuse level reaches elevation 678. Coarse refuse disposal occurs in the east and south areas of the embankment to elevation 690 during Stage 4C and 4D.

7.4.1 Stage 4A

Construction of the impoundment embankment to elevation 640 under Stage 4A of the disposal plan requires approximately one year to construct and provides approximately 3.2 years of

additional fine refuse disposal capacity. Coarse refuse will be placed downstream of the embankment constructed in Stage 3. A portion of the upstream slope of the embankment between elevation 620 and 640 shall be placed at 100 percent Standard Proctor maximum dry density, as shown on Drawing No. 90-55-E112 and specified in Appendix A.

Fine refuse will be pumped to the impoundment and discharged along the southeast impoundment slope to a maximum average elevation of 632. As determined by the operator, periodic relocation of the slurry discharge line may be necessary to promote a more uniform distribution of fines along the slope.

Surface drainage shall be provided on the final slopes with bench and gutters and haul road ditches as shown on Drawing Nos. 90-55-E111 and 90-55-E113.

7.4.2 Stage 4B

Fine refuse disposal will continue in the main impoundment until the fine refuse level reaches elevation 678. At this point closure and abandonment of the impoundment will begin. The impoundment will be closed by capping with coarse refuse to elevation 690. This will involve filling the impoundment with coarse coal refuse in 100-foot wide sections from north to south. The area on the crest of the impoundment will be graded to drain away from the impoundment. This will allow the impoundment to maintain proper storm storage (2 PMF) through abandonment.

7.4.3 Stage 4C

The east buttress area will be raised to elevation 690 with coarse refuse, under Stage 4C.

7.4.4 Stage 4D

The south area of the main refuse disposal area will be raised to elevation 690 during Stage 4D.

7.5 STAGE 5

Stage 5, the final stage of the proposed expansion plan, contains two construction substages. These two substages, Stage 5A and Stage 5B, are located in the east and main area of the pile. During Stage 5 fine refuse disposal continues in the diked impoundment area.

7.5.1 Stage 5A

Coarse refuse disposal in the east portion of the disposal area to elevation 690, provides approximately four years of capacity. At the completion of this stage the main refuse disposal area should be at an average elevation of 690.

7.5.2 Stage 5B

Coarse refuse disposal will continue in the coarse refuse area for the remainder of the proposed expansion plan. During disposal operations, the disposal area will be sloped approximately 2 percent to promote drainage off the pile. Coarse refuse disposal capacity at elevation 730 provides approximately 20 years of site life. Additional capacity beyond 20 years is available by increasing the embankment elevation. Upon reaching the final elevation of the coarse refuse disposal area, the pile should be sloped to drain towards the perimeter of the area.

7.6 ABANDONMENT

Due to the potential for additional coarse refuse disposal capacity, the final abandonment plan should be evaluated at least five years prior to abandonment using actual refuse production rates and the existing site conditions and embankment configuration. Based on this evaluation, a final abandonment plan will be developed and submitted to the MSHA District Manager for approval approximately two years prior to beginning the abandonment plan construction. The pertinent construction items in the abandonment plan include:

- Fine Coal Refuse Cover - Coarse coal refuse will be placed in the impoundment to provide at least a 3-foot cover above the settled fine coal refuse.

- Impoundment Elimination - To eliminate the impounding capacity of the diked impoundment, an abandonment channel will be excavated through the embankment crest. The channel should be sized to convey the peak runoff from a 100-year, 24-hour recurrence interval storm event.

- Revegetation - All final surfaces will be vegetated by planting with appropriate vegetation in accordance with the revegetation plan specified in the surface mine permit.

The general criteria and sequence of closing and abandoning the impoundments is included in Section 2.5 of the Guideline Technical Specifications.

8.0 ENGINEERING ANALYSES

The disposal plan described herein was developed in accordance with prudent engineering principles and our understanding of current MSHA and Alabama Surface Mine Commission design criteria. In support of the plan, engineering analyses included slope stability of the embankment staging and the hydrologic and hydraulic studies for the impoundment and surface drainage structures. In addition, evaluations of potential affects on the structures from liquefaction of settled fine coal refuse and mine subsidence were performed. The calculations describing the design assumptions, methodology and results are included in Appendix C.

8.1 HYDROLOGIC AND HYDRAULIC ANALYSES

The existing fine refuse disposal impoundment will be raised in increments during Stages 1, 2, and 3 to provide needed disposal capacity and additional site life. Each stage is designed to be operated at a maximum fines level with sufficient capacity to store 2 PMF of storm events plus 3 feet of freeboard. Storm storage evacuation capability for 1 PMF (within 30 days) will be provided by a dedicated portable pump system.

The proposed new fine refuse impoundment is designed to store the runoff associated with the PMF storm event (extended to 72 hours) and a dedicated pump system is provided to evacuate at least 90 percent of the PMF in 10 days or less. The pump system will have a minimum pumping capacity of 2,400 gallons per minute. Specifications for the pump system are included in Appendix A - Guideline Technical Specifications.

The hydrologic characteristics of the impoundment's watershed areas are summarized below:

Existing Impoundment

Stage	Drainage Area Acres	Runoff Curve No.*	Six-Hour All Season PMP Inches	Total PMF Runoff in Million Cubic Feet
1	34.7	--	31	11.5
2	37.7	--	31	12.5
3	39.9	--	31	13.3

Proposed Impoundment

Stage	Drainage Area Acres	Runoff Curve No.*	Six-Hour All Season PMP Inches	Total PMF Runoff in Million Cubic Feet
2	21.8	--	31	3.61
3	24.8	--	31	4.11
4	35.0	--	31	4.62

*Since nearly all of the drainage area of each impoundment is the impoundment itself, it was assumed that all rainfall in the area would be runoff.

The surface drainage facilities, including bench gutters, haul road ditches and perimeter ditches, have been sized to convey the 100-year, 24-hour recurrence interval storm event. The computed peak discharges were based on procedures outlined by the U. S. Soil Conservation Service. All permanent facilities have been provided with appropriate protection to minimize the potential for channel erosion.

8.2 SLOPE STABILITY ANALYSES

Slope stability analyses were performed for several embankment configurations using PCSTABL5, a computerized version of the modified Bishop Method of Slices developed by Purdue University and the Indiana State Highway Commission. The critical potential failure surfaces, minimum factors of safety and material properties used in the analyses are presented on Drawing Nos. 90-55-E109 and 90-55-E110.

Slope stability was analyzed for both static and seismic (pseudo-static) loading conditions. For the seismic analyses, a horizontal acceleration of 0.1g was used. Since no upstream coarse coal refuse

stages are planned for this facility and relatively large coarse coal refuse stages will be used to impound the slurry, a pseudo-static seismic stability analysis was considered appropriate for the design.

The phreatic level used in the static and seismic analyses for the various stages of the embankment were conservatively based on expected impoundment levels and the location of the proposed internal drains. The calculations include an analysis of the size and location of the drains for controlling the phreatic level. Piezometers installed during the exploration phase of this plan will be used to monitor the phreatic level to determine the adequacy of the system and the need for modifications during operations.

As shown on Drawing Nos. 90-55-E109 and 90-55-E110, the minimum factors of safety for the respective stages are summarized below:

Stage	Minimum Static F.S.	Minimum Seismic F.S.
Stage 1, A_1-A_1	2.2	1.6
Stage 1, C_1-C_1	1.9	1.4
Stage 3, F-F	1.9	1.3
Stage 3, G-G	2.0	1.5
Stage 4, A_1-A_1	1.7	1.2
Stage 5, D_1-D_1	1.9	1.5
Stage 5, A_1-A_1	2.1	1.5
Stage 5, C_1-C_1	1.9	1.4
Stage 5, H-H	1.7	1.3
Stage 5, I-I	1.7	1.3
Stage 5, J-J	2.2	1.5
Dike Embankment	1.8	1.4

Slope stability analyses were also performed for the proposed dike embankment. The critical failure surfaces, minimum factors of safety and material properties used in the analyses are presented on Drawing Nos. 90-55-E109 and 90-55-E110. The selected material properties were based on results from testing performed on the coarse refuse material.

8.3 LIQUEFACTION ANALYSIS

An analysis of the affects of liquefaction of the fines present under the northern portion of the existing embankment was conducted. Due to the limited extent and thickness of these fines, and the long-term consolidation of these fines, liquefaction is not anticipated to be a problem at this site. However, as a safeguard against the worst case scenario of liquefaction, the expansion plan incorporates several design features.

As described previously, staging of the coarse refuse embankment includes partial removal of the settled fines during Stage 1B. This will essentially eliminate any concern for potential of loss of shear strength of the fines due to an earthquake event. For the portion of the embankment that will overlay fines, an embankment elevation has been specified that will maintain impoundment integrity under normal operating conditions in the unlikely event of fines liquefaction. As shown, the maximum thickness of the fines based on borehole B-20 is 17 feet or less and, in our opinion, will have minimal impact on the integrity of the embankment stability even under a significant earthquake event. After the construction of Stage 2, impact of the potential liquefaction of fines on stability is negligible, due to the massive coarse refuse buttresses constructed.

8.4 SUBSIDENCE EVALUATIONS - UNDERGROUND COAL MINING

Subsidence prediction for any type of mine is extremely complex due to the large number of variables involved. Nevertheless, reasonably, accurate conclusions can be reached for specific geologic and mining conditions provided the limitations on the predictive methodologies are considered.

The strength and characteristics of the overlying and underlying strata will affect the way in which the overburden rocks respond to the stresses created by mine voids. Weak roof and floor rock conditions will tend to accelerate or increase subsidence, while hard rock may have a self-supporting action which could delay or reduce subsidence. The roof and floor rock for the Pratt seam within the study area can be characterized as somewhat fractured, medium to hard rock. This suggests that subsidence fracturing and deformation should develop in accordance with traditional subsidence prediction methodologies for the Appalachian coal fields.

Although many factors affect the extent and magnitude of subsidence, surface manifestations of subsidence are commonly broadly categorized as either sinkholes or troughs. The mode of

subsidence that could ultimately occur is closely related to mining method, seam depth, seam thickness, overburden composition and other factors. The maps of the mine workings and geologic structural information support the conclusion that there are no major faults within the study area, and that the geologic dip is relatively small. Accordingly, neither of these factors are expected to have a significant effect on subsidence or subsidence impacts.

Sinkholes (also known as "pits" or "caves") are discrete, occasionally abrupt depressions in the ground surface. Sinkholes are most frequently associated with shallow room-and-pillar mining, and in areas where the soil is very thick and there is little rock strata overlying the mine workings. The sinkhole occurs when the overburden collapses into an open space in the mine, such as an entry or room between pillars, and the collapse travels upward until the shift in the overburden reaches the surface. The name sinkhole comes from the discontinuous surface deformation observed on the surface where the rock and soil settled.

In areas where the overburden is thick, subsidence studies have indicated that similar formations within the Appalachian region will form rubble or gob in the area of caving. This gob, with its increase in volume due to swelling caused by displacement will, in turn, provide some support for the overlying rock structure.

Based upon established theories and research findings associated with subsidence in the northern Appalachian coal fields for conditions similar to those existing within the study area, it can be concluded that the surface effects can be related to the generalized fracture pattern which develops within the overburden above the mined-out area.

Above this level, the rock strata will experience some fracturing, but the premining stratigraphic integrity will be maintained. Accordingly, subsidence that may occur within the study area will be in the form of trough subsidence or subsidence with continuous surface deformation. Associated with the surface deformation, a potential exists for tensile and compressive strain to develop.

In considering the effects of mining subsidence on the overburden, three different zones have been defined. The first is the caved or "gob" zone with associated roof collapse and extensive overburden fracturing. The second is the fractured zone, where the overburden may be fractured and deformed but continues to retain some stratigraphic integrity. The final zone is the zone of deformation, where trough subsidence may occur.

The caved or gob zone has been reported in the literature, to range from 2 to 8 times the height of mineral extraction. In the caved zone, the zone breaks down into blocks or rubble. As rubble, it increases in volume (also referred to as "swelling"), and offers some support to the overlying strata.

Above the rubble or gob area, the rock strata will begin to exhibit "bridging" support that will tend to dampen or mask the subsidence effect. Subsidence in this zone will cause fracturing of the rock strata, but without breaking the rock into blocks or rubble. The fractured zone has been reported to range from 20 to 40 times the height of extraction.

The height of the caved and fractured zones for a particular mine under conditions found in the Appalachian coal fields can be estimated from the formula given by Jones and Kohli, 1985.(2) Based upon the geologic conditions, the overburden in the study area can be classified as medium to hard rock; thus, the maximum height of the caved zone and fractured zone can be determined as follows:

$$\frac{100\ H}{4.7\ H + 19} \pm 2.2 \qquad \text{Caved Zone}$$

$$\frac{100\ H}{1.6\ H + 3.6} \qquad \text{Fractured Zone}$$

Where H = mining height in meters.

At the Concord refuse disposal facility, this would yield, based upon the above formulas, a caved zone in the range of approximately 56 feet, and a fractured zone in the range of 81 to 118 feet, for a combined caved and fractured zone in the range of 137 to 174 feet. Figure 1 provides a schematic representation of potential subsidence occurrences within the study area. Conservative maximums based upon observations throughout the Appalachian coal field suggests the maximum caved zone could be as high as 112 feet, and the maximum fractured zone could be as high as 280 feet above the coal seam.

In most mined coal areas, potential for surface subsidence is often inevitable. The methods of controlling or mitigating subsidence impacts are as varied as the range of mining situations encountered. The most common and widespread methods of minimizing potential subsidence

(2) Jones, T.Z., and K. K. Kohli, 1985. "Subsidence Engineer," West Virginia Institute of Technology, Montgomery, West Virginia.

impacts include leaving sufficiently large mine roof support pillars and conducting mining in a planned manner. Based on review of the available mapping and records, both of these approaches were followed at the facility.

Geologic and mining conditions encountered in the Appalachian coal fields have been studied to allow the prediction of surface deformation over mined out areas. While specific occurrences of subsidence cannot be predicted utilizing these formulas due to uncertainties involved in defining the size, location, extent and timing of any area that may subside in the future, it is possible to make a reasonable prediction of the maximum amount of surface deformation that could occur from such a subsidence event.

Prediction of the maximum surface deformation has been conducted utilizing modeling techniques developed by England's National Coal Board and U. S. Bureau of Mines.(3)

For the purpose of calculating maximum trough subsidence and the maximum strains resulting from the surface deformation, the area can be divided into three distinct areas. The first area, Area 1, is the northwest area where the dike embankment will be built. Deep mining under Area 1, consisted of development panels 150 to 200 feet wide with 300-foot wide unmined panels of coal between. In Area 2, the main refuse disposal area, mining was by the room-and-pillar method. Area 3 underlies a portion of the east side of the refuse disposal area. From the mine maps it appears that Area 3 was room and pillar mined and the pillars were removed in approximately 1964.

The maximum surface subsidence predicted for Area 1 is 0.46 feet. Post-subsidence profiles generated from the maximum predicted subsidence indicate that a maximum subsidence event could create minor tensile stresses within the refuse disposal area caused by the change in the surface configuration. The maximum predicted strains resulting from surface deformation due to subsidence (assuming no previous subsidence) has been estimated to be 1.0×10^{-3} feet per foot of tensile strain and 4.6×10^{-4} feet per foot of compressive strain.

The maximum predicted surface subsidence for Area 2, is 0.59 feet. The maximum predicted strains resulting from the surface deformation due to the subsidence has been estimated to be 5.7×10^{-4} feet per foot of tensile strain and 4.7×10^{-4} feet per foot of compressive strain.

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(3) Peng, S., 1985, Coal Mine Ground Control, Wiley and Sons, NY.

For Area 3 where pillar extraction occurred, the maximum predicted subsidence, assuming no subsidence has occurred, is 6.2 feet. Maximum strains resulting from this amount of subsidence is estimated to be 6×10^{-3} feet per foot of tensile strain and 4.6×10^{-3} feet per foot of compressive strain. However, all or most of the subsidence predicted for this area should have already occurred. Typically, roof collapse and subsidence deformation occur shortly after the roof support is removed. Therefore, it is anticipated that the majority of subsidence over Area 3 has already occurred. Any future subsidence potential would be in the form of minor settlements.

Based upon the foregoing discussion and related evaluations, the following conclusions and recommendations are made regarding potential subsidence and subsidence impacts within the study area at the Concord facility.

- Sinkhole subsidence or subsidence with discontinuous surface deformation will not occur within the study area. Subsidence that has occurred, and for which there is a future potential, will be in the form of trough subsidence or subsidence with continuous surface deformation.

- Subsidence within the study area will be accompanied by a gob or caved zone, predicted to be in the range of 56 feet, with a maximum of 112 feet. Above the caved zone a fractured zone may develop which is predicted to be in the range of 81 to 118 feet, extending a maximum of 280 feet above the mined seam.

- Based upon the subsidence analysis, the caved zone will not reach the surface within the study area.

- The maximum predicted surface deformation from possible future subsidence at the Concord facility can be reasonably estimated by using established subsidence models. Based upon the predicted post-subsidence profile, it can be concluded that maximum subsidence within Area 1 is negligible. In addition, tensile or compressive stress which may develop at the surface as a result of the subsidence in Area 1 is also negligible.

- The maximum subsidence and strains for the main refuse disposal area are small. Due to the flexibility of the coarse refuse materials, affects from subsidence will most likely be undiscernible.

- Future subsidence affects from Area 3 are unlikely since the majority of subsidence in this area has probably already occurred.

9.0 SUMMARY

The design plans for the expansion of the Concord coal refuse disposal facility are supported by the engineering analyses described herein. We trust that the plans, design calculations, and Guideline Technical Specifications, as presented herein, are acceptable to USM and the appropriate regulatory agencies. The only warranty or guarantee made by ALMES in connection with the services performed for this project is that such services were performed with care and skill ordinarily exercised by reputable members of the profession practicing under similar conditions at the same time and the same or similar locality. No other warranty, expressed or implied, is made or intended by rendition of these consulting services or by furnishing oral or written reports of the findings made.

If there are any questions, or if further clarification is required, please contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood, C.P.G.
Project Manager

Richard G. Almes, P.E.
Principal Engineer

RMW/RGA:nam/pkm
Enclosures

I, Richard G. Almes, P.E., certify[1] the expansion plan entitled "Proposed Coal Refuse Disposal Area Expansion Plan, Concord Coal Refuse Disposal Facility, U.S. Steel Mining Company, Inc., Hueytown, Alabama" was developed in accordance with prudent engineering principles and practices, and applicable Mine Safety and Health Administration (MSHA) design criteria.

SIGNED

Richard G. Almes, P.E.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

[1] The term "certify," as used herein, is defined as follows: "An Engineer's certification of conditions is a declaration of professional judgement. It does not constitute a warranty or guarantee, either expressed or implied, nor does it relieve any other party of their responsibility to abide by contract documents, applicable codes, standards, regulations and ordinances."

TABLES

TABLE 1
SUMMARY OF EXPLORATION BORINGS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Boring Number	Total Depth (ft)	Soil Depth (ft)	Rock Coring (ft)	Undisturbed Samples (ea)	Piezometer Installation(1) (ft)	Comments
B-1	38	28	10	1	-	-
B-2	26	11	15	-	23.5	-
B-3	16.5	16.5	-	-	-	-
B-3A	5.5	5.5	-	1	-	-
B-4	54.5	54.5	-	-	53.0	-
B-5	98.5	98.5	-	1	98.0	Fine Coal Refuse 84'-96'
B-6	28	28	-	1	-	Fine Coal Refuse 0'-12'
B-7	33.5	33.5	-	-	-	-
B-8	33	23	10	-	-	-
B-9	78	78	-	-	78.0	-
B-10	42	30	12	1	-	-
B-11	111.5	111.5	-	-	111.0	-
B-12	111	111	-	-	110.0	-
B-13	129.3	129.3	-	-	129.3	-
B-14	121	121	-	-	-	-
B-15	18.5	18.5	-	-	-	-
B-16	26	12	14	1	-	-
B-17	113.5	113.5	-	-	113.5	-
B-18	106.5	106.5	-	-	105.0	Fine Coal Refuse 78'-83'
B-19	106.5	106.5	-	1	-	Fine Coal Refuse 78'-96'
B-20	46.5	46.5	-	2	-	Fine Coal Refuse 18'-30'
B-21	120.5	120.5	-	-	-	Fine Coal Refuse 97'-112'
Totals	**1,464.3**	**1,403.3**	**61**	**9**	**821.3**	

(1) Depth to the bottom of the monitoring zone.

TABLE 2
SUMMARY OF PIEZOMETERS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Boring Number	Total Depth (ft)	Depth of Piezometer (ft)	Surrounding Material	Static Water Level (ft)(1)	Water Level Elevation (MSL)	Date Measured	Comments
B-2	26	23.5	natural	17.30	553.60	2-15-91	
				16.10	557.60	4-15-91	measured from top of casing
B-4	54.5	53	coarse (0-45)	Dry	-	2-07-91	
			natural (45-54.5)	Dry	-	2-15-91	
				Dry	-	4-15-91	measured from top of casing
B-5	98.4	98	coarse (0-84)	78.30	563.00	2-07-11	measured immediately after bailing
			fine (84-96)	77.10	564.20	2-11-91	
			natural (96-98.4)	80.50	564.20	2-15-91	measured from top of casing
				78.15	566.55	4-15-91	measured from top of casing
B-9	78	78	coarse (0-76)	75.20	461.10	2-07-91	
			natural (76-78)	75.00	461.30	2-15-91	
				75.05	465.38	4-15-91	measured from top of casing
B-11	111.5	111	coarse (0-108)	107.50	550.80	2-07-91	
			natural (108-111.5)	106.75	551.55	2-11-91	
				107.00	551.30	2-15-91	
				111.00	550.23	4-15-91	measured from top of casing
B-12	110.9	110	coarse (0-105)	105.90	551.50	2-14-91	measured approx. 2 hrs after bailing
			natural (105-110.9)	105.90	551.50	2-15-91	
				103.00	558.34	4-15-91	measured from top of casing
B-13	129.3	129.3	coarse (0-124)	Dry	-	2-14-91	
			natural (124-129.3)	Dry	-	2-15-91	
				118.40	517.79	4-15-91	measured from top of casing
B-17	113.7	113.5	coarse (0-110)	103.50	531.20	2-14-91	measured before bailing; very muddy
			natural (110-113.7)	108.50	526.20	2-15-91	
				109.50	529.29	4-15-91	measured from top of casing
B-18	106.5	105	coarse (0-78)	81.25	577.55	2-15-91	measured from top of casing
			fine (78-83)	77.55	584.45	4-15-91	
			coarse (83-103)				
			natural (103-106.5)				

(1) Static water levels were measured from the ground surface except where noted.

TABLE 3

CONSTRUCTION STAGING SUMMARY
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Construction Stage	Time to Construct (Years)	Coarse Refuse Needed to Construct (cy)	Fine Refuse Disposal Capacity Created (cy)
Stage 1			
1A - Exist. Imp. to El. 670		83,300	669,000
1B - North Buttress to El. 675		957,000	
1C - East Buttress to El. 580		175,000	
1D - Northwest Embankment		112,000	
Stage 1 Sub Total	1.35	1,327,300	669,000
Cumulative Total	1.35	1,327,300	669,000
Stage 2			
2A - Exist. Imp. to El. 680		89,700	507,000
2B - N. Buttress to El. 690/660		1,711,000	
2C - East Berm to El. 630		257,000	
2D - Dike Embank. to El. 600		322,000	459,000
Stage 2 Sub Total	2.43	2,379,700	966,000
Cumulative Total	3.78	3,707,000	1,635,000
Stage 3			
3A - Exist. Imp. to El. 690		997,000	568,000
3B - N. Buttress to El. 710/690		34,000	
3C - Dike Embank. to El. 620		45,300	562,000
3D - South Area to El. 660		668,000	
Stage 3 Sub Total	1.78	1,744,300	1,130,000
Cumulative Total	5.56	5,451,300	2,765,000
Stage 4			
4A - Dike Embank. to El. 640		795,000	
4B - Close Exist. Imp.		620,000	738,000
4C - East Buttress to El. 690		403,000	
4D - South Area to El. 690		871,000	
Stage 4 Sub Total	2.74	2,689,000	738,000
Cumulative Total	8.30	8,140,300	3,503,000
Stage 5			
5A - East Area to El. 690		3,896,403	
5B - Main Area to El. 730		7,485,950	
Stage 5 Sub Total	11.61	11,382,353	0
Cumulative Total (Fine)	13.26		3,503,000
Cumulative Total (Coarse)	19.91	19,522,653	
Final Total (Fine)	13.41		3,503,000
Final Total (Coarse)	19.91	19,522,653	

TABLE 4

MAXIMUM FINE REFUSE ELEVATIONS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Stage	Substage	Maximum Fine Refuse Elevation (MSL)[1] Existing Impoundment	Proposed Impoundment
1	A	658	-
	B	658	-
	C	658	-
	D	658	-
2	A	667	-
	B	667	-
	C	667	-
	D	667	591
3	A	678	591
	B	678	591
	C	678	611
	D	678	611
4	A	-	632
	B	-	632
	C	-	632
	D	-	632
5	A	-	632
	B	-	632

[1] The maximum fine refuse elevations are the maximum operating levels allowable at the associated stage in order to maintain required stormwater storage capacity and freeboard.

TABLE 5

MAXIMUM ALLOWABLE WATER LEVELS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Piezometer[2]	Maximum Allowable Water Level[1]				
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
B-2	NR	NR	575	575	575
B-4	NR	NR	575	575	575
B-5	590	655	665	665	665
B-9	NR	NR	NR	NR	485
B-11	655	665	675	675	675
B-12	590	600	610	610	610
B-13	NR	NR	550	550	550
B-17	NR	NR	550	550	550
B-18	650	[3]	NR	NR	NR

NR - Not Required

[1] The engineer should be notified immediately if the maximum allowable water level is reached in any piezometer.
[2] All piezometers should be maintained and monitored in accordance with the expansion plan Guideline Technical Specifications.
[3] Piezometer B-18 will be decommissioned prior to construction of Stage 2 of the expansion plan.

FIGURES

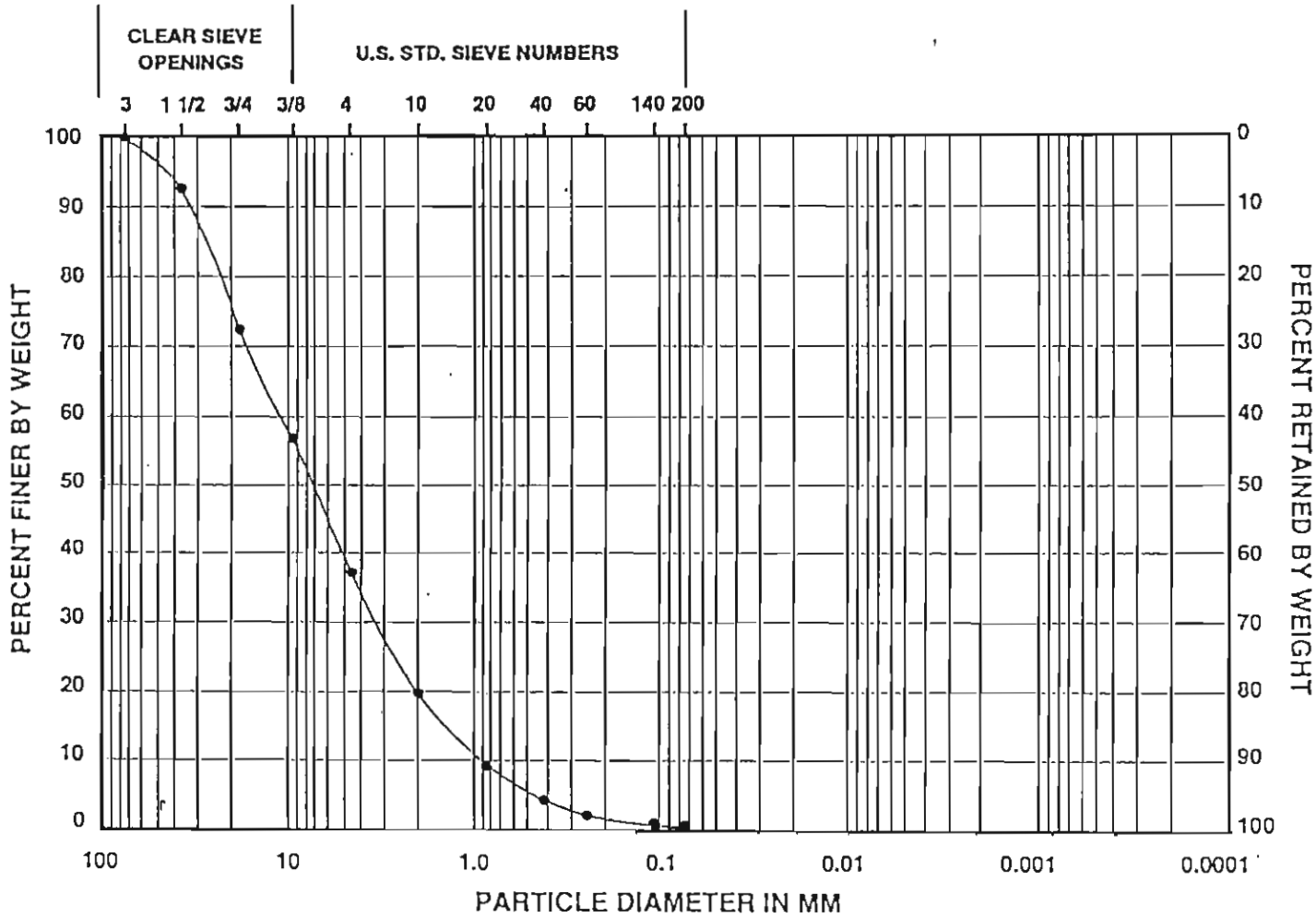


FIGURE 2
COARSE COAL REFUSE GRAIN SIZE DISTRIBUTION
CONCORD COAL REFUSE DISPOSAL AREA
U.S. STEEL MINING CO.

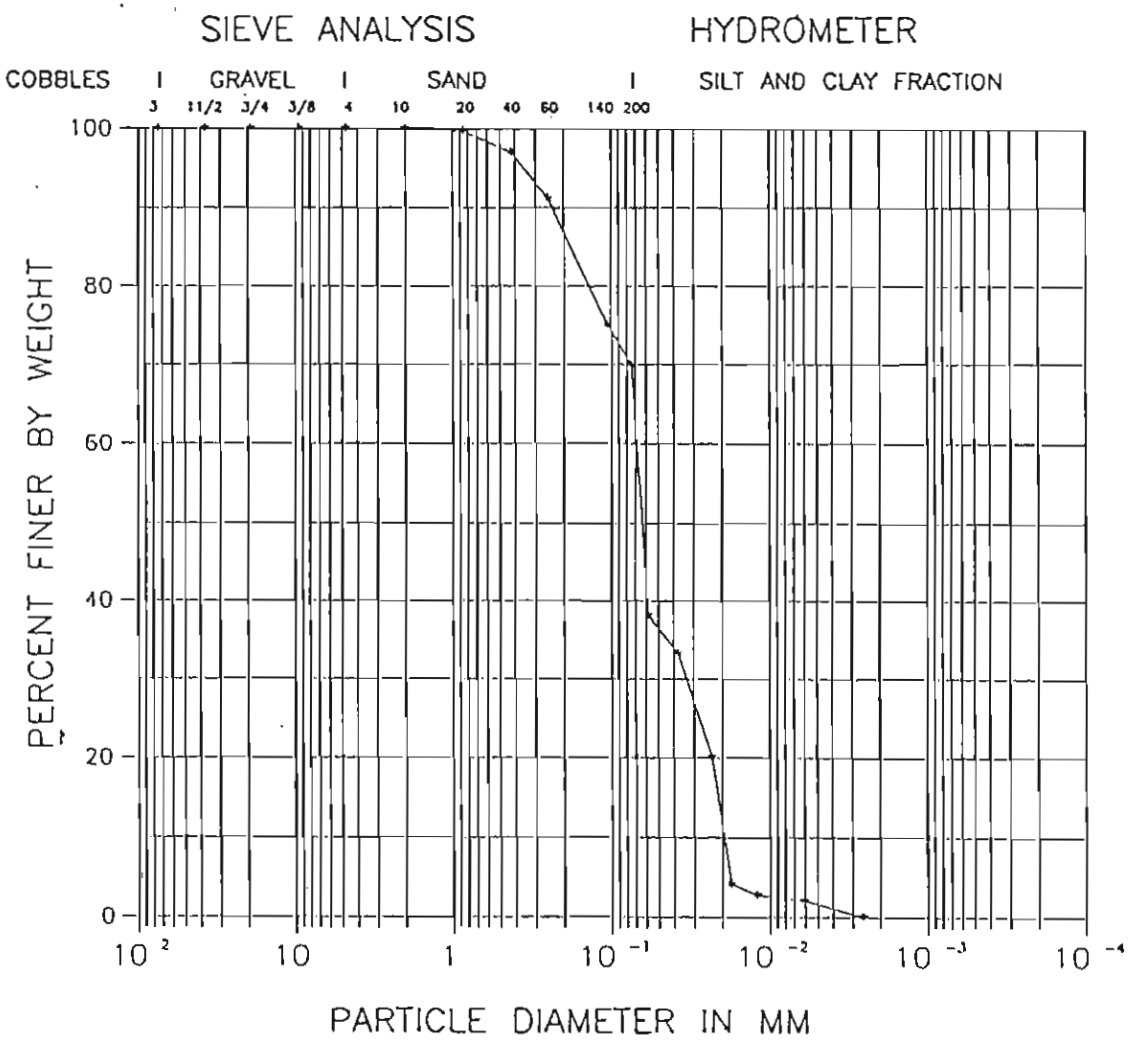
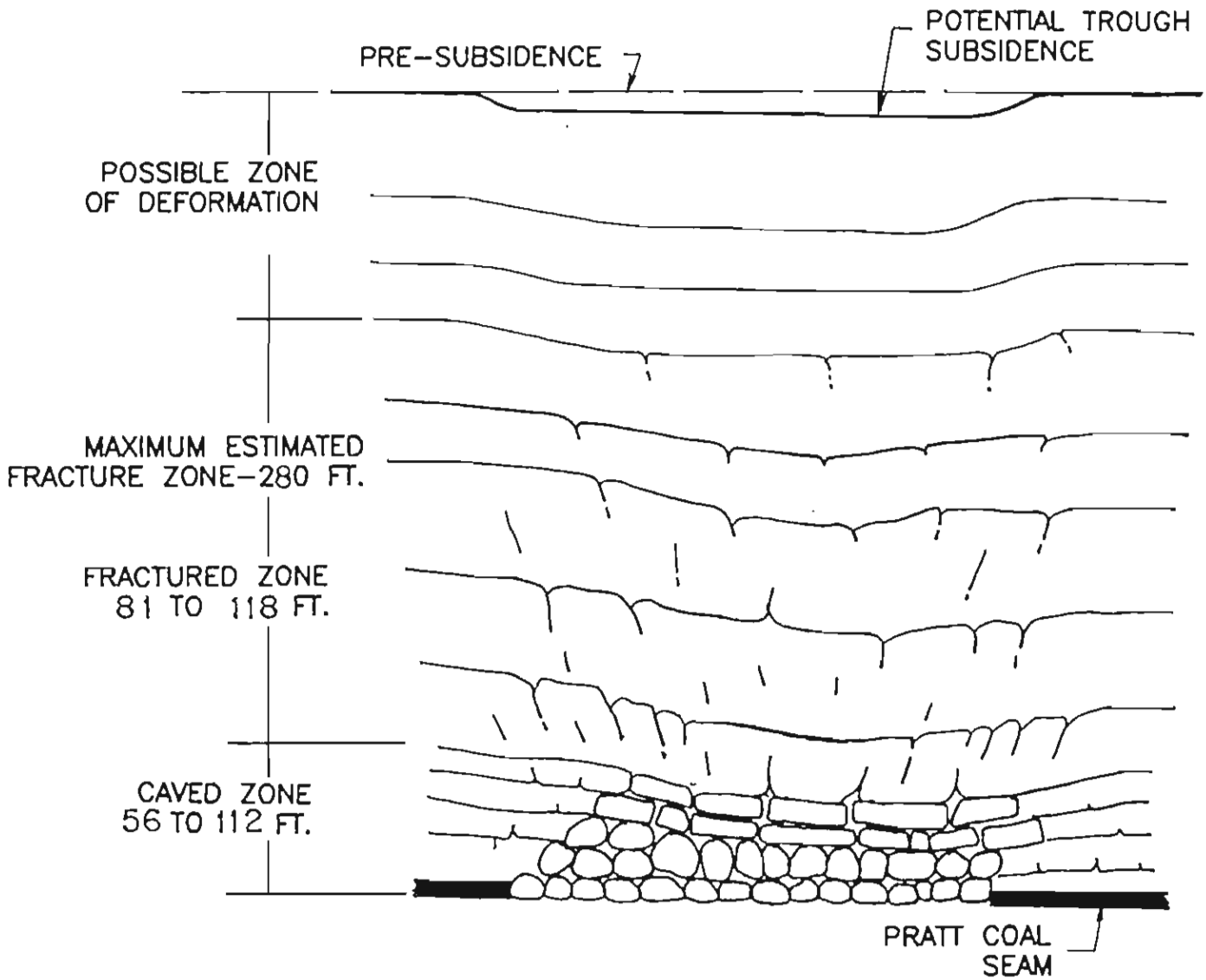


FIGURE 3
FINE COAL REFUSE GRAIN SIZE DISTRIBUTION
CONCORD COAL REFUSE DISPOSAL AREA
U.S. STEEL MINING CO.



PITTSBURGH, PA.
BECKLEY, WV.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

SCHEMATIC REPRESENTATION OF SUBSIDENCE

PREPARED FOR

U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY		
CHECKED BY	RMW	9/12/91
APPROVED BY	RMW	9/12/91
SCALE N.T.S.	DRAWING NO. 90-55-A2	

FIGURE 4

APPENDIX A

GUIDELINE TECHNICAL SPECIFICATIONS

APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

INTRODUCTION

These Guideline Technical Specifications (Specifications) have been prepared by Almes & Associates, Inc., Consulting Engineers (ALMES) for the proposed Concord coal refuse disposal facility expansion planned near Hueytown, in Jefferson County, Alabama. The facility will serve the Concord coal preparation plant located adjacent to the disposal area. The information contained herein is sufficiently detailed to provide U.S. Steel Mining Company, Inc. (USM) with technical guidance to perform coal refuse disposal operations in a manner consistent with the design assumptions and prudent engineering practice. It is noted that design recommendations, as used for a basis of construction, are particularly sensitive to the need for adjustment in the field, depending upon findings during construction that previously could only be assumed based on sampling and related procedures. In this regard, it is recommended that representatives of our firm or other qualified persons be present on site to monitor the construction of the facility and to verify that the conditions encountered are consistent with the design assumptions as described herein and in the report and drawings. These specifications are intended to be supplemented with regular site visits by persons knowledgeable of these design documents and operational requirements for disposal of coal refuse. ALMES waives any and all responsibility and liability for problems which may occur when its recommendations are not followed.

These Specifications are not of sufficient detail for use in subcontracting the work. Should any portion of the work be subcontracted by USM, more detailed specifications will be required.

The Concord refuse disposal facility will continue to be used for the disposal of coarse and fine coal refuse over the next 13 to 20 years based on refuse production rates supplied by USM. These Specifications pertain to the construction of the refuse disposal facility and associated sedimentation ponds. Major work items include the following:

1. Site Preparation - Prior to any construction activities, Sediment Pond 1 shall be constructed. All areas proposed for coal refuse disposal will be cleared and grubbed. Additionally, areas beneath the coarse coal refuse, impoundment dike embankment and sediment pond

embankments will be grubbed and stripped of all combustible, compressible, or unsuitable material. Buildings located within the northwest area of the proposed expansion shall be raised and all debris removed from the site and properly disposed.

2. Coarse Coal Refuse Disposal - Coarse coal refuse shall be used to raise the existing refuse embankment and enlarge the existing fine refuse impoundment to provide needed fine refuse disposal capacity and to provide storm storage and proper freeboard. Coarse refuse not needed in construction will be disposed of in adjacent embankments.

3. Embankment Construction - A new impoundment embankment will be constructed from coarse refuse to provide additional fine refuse disposal capacity and storm storage. The initial stage of the embankment will contain a highly compacted coarse refuse cutoff trench and core. Internal drains will be installed during subsequent embankment stages. The upstream face of the embankment and the southeast slope of the impoundment will contain a highly compacted zone. Subsequent embankment stages will be raised with coarse coal refuse placed downstream of the initial stage to provide additional fine coal refuse disposal capacity.

4. Haul Road Construction - Existing haul roads will be extended and relocated as necessary to provide access to the embankment area.

5. Subsurface Drainage - During the disposal operations, a series of internal drains, finger drains and a slope drain will be installed within the new slurry impoundment embankment.

6. Surface Drainage Facilities - To aid in stabilizing the refuse surface and to minimize erosion, a system of haul road gutters, bench gutters and perimeter ditches shall be constructed,as required. Sedimentation ponds are provided adjacent to the refuse embankment to collect runoff from the disturbed areas.

7. Revegetation - All completed embankment surfaces must be revegetated to provide erosion protection. The revegetation shall be performed concurrent with the embankment construction, and in accordance with the surface mining permit for the site.

8. Monitoring and Maintenance - A program for obtaining and reporting data on embankment performance is presented herein.

LIST OF DRAWINGS

The following drawings form part of these specifications:

Drawing No.	Title
90-55-E100	Title Sheet
90-55-E101	Existing Site Conditions
90-55-E102	Plan - Stage 1
90-55-E103	Plan - Stage 2
90-55-E104	Plan - Stage 3
90-55-E105	Plan - Stage 4
90-55-E106	Plan - Stage 5
90-55-E107	Cross-Section A-A, B-B and C-C
90-55-E108	Cross-Sections D-D and E-E
90-55-E109	Stability Cross-Sections Sheet 1 of 2
90-55-E110	Stability Cross-Sections Sheet 2 of 2
90-55-E111	Plan - Diked Impoundment
90-55-E112	Diked Impoundment and Embankment Profiles
90-55-E113	Details Sheet 1 of 3
90-55-E114	Details Sheet 2 of 3
90-55-E115	Details Sheet 3 of 3
90-55-E116	Erosion and Sediment Control Plan
90-55-E117	Sediment Pond Cross Sections and Profile
90-55-E118	Sediment Pond Details

1.0 SITE PREPARATION

1.1 CLEARING AND GRUBBING

In areas where coarse coal refuse is to be placed on natural ground or on revegetated refuse disposal areas, the areas shall be cleared and grubbed prior to refuse disposal. Outside of this zone, the area shall not be grubbed unless additional topsoil is needed to cover the completed embankment slope.

In areas beneath the proposed embankment stages, the natural ground surface shall be cleared, grubbed and stripped of all trees, brush, and combustible or compressible debris. All buildings, building foundations, and utilities shall be raised or excavated and all demolition waste removed and properly disposed.

The new slurry impoundment area shall be cleared and grubbed and all brush, fallen timber, loose debris, buildings, building materials and utilities removed. In no case shall any combustible material be disposed in the embankment.

1.2 TOPSOIL STRIPPING

Topsoil shall be stripped to a minimum depth of 18 inches or to the maximum possible depth designated by the engineer beneath the dike impoundment embankment.

1.3 GAS LINE RELOCATION

A natural gas pipeline is located adjacent to the new fine refuse disposal area. This pipeline will require relocation prior to the construction of Sediment Pond No. 1 and the new fine refuse impoundment embankment.

2.0 COAL REFUSE DISPOSAL, IMPOUNDMENT EMBANKMENT AND SEDIMENTATION POND EMBANKMENT CONSTRUCTION

2.1 GENERAL

The existing coarse refuse disposal site and impounding embankment will be enlarged and a new fine refuse storage impoundment will be constructed in five stages to provide disposal capacity for approximately 20 years of coarse refuse and 13 years of fine coal refuse and flood storage associated with the PMF design storm event. Stages 1 through 5 will be constructed using downstream construction with coarse coal refuse. Drawing Nos. 90-55-E102 through 90-55-E108 present the plans and sections of the Stage 1 through 5.

2.2 STAGE 1 KEY TRENCH

During Stage 1B, prior to raising the north buttress slope, a key trench will be constructed along the toe of this proposed stage. A trench approximately 85 feet wide by 900 feet long will be excavated through the existing fine refuse to original ground at the location as shown on Drawing No. 90-55-E102. The actual length and depth of the trench will be determined by the engineer in the field. The trench shall be excavated and backfilled with

compacted refuse in 50-foot by 85-foot increments. The coarse refuse shall be placed and compacted in accordance with Sections 2.4.3 and 2.4.4 of this specification.

2.3 IMPOUNDMENT EMBANKMENT

A new dike embankment shall be constructed northwest of the existing embankment. This embankment shall be constructed in three increments as shown in Drawing No. 90-55-E111. The initial embankment starter dike shall be constructed with compacted coarse refuse and shall contain a highly compacted core and key trench founded a minimum of 2 feet in bedrock. This core material shall be compacted in 1-foot lifts to a density of 100 percent maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698). The remainder of the dike embankment shall be constructed as structural fill in accordance with placement and compaction requirements in Sections 2.4.3 and 2.4.4.

The upstream slope face of the dike embankment between elevation 600 and 640, shall also be highly compacted. A zone 40 feet wide, measured horizontally from the slope face, shall be placed in 1-foot lifts and compacted to 100 percent maximum dry density, within -2 to +3 percent of the optimum water content, as determined by Standard Proctor compaction test (ASTM D698).

A field density testing program as specified in Section 2.4.4 shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction and structural fill zones.

The reconstruction of the existing coarse refuse embankment slope in Stage 1D, which forms the southeast side of the new fine refuse impoundment, shall be constructed in accordance with the structural zone specifications as detailed in Section 2.4.3 and 2.4.4. This compacted zone shall be at least 40 feet wide as measured horizontally from the slope face. The location and extent of this zone are shown on Drawing Nos. 90-55-E111 and 90-55-E112.

2.4 COARSE COAL REFUSE PLACEMENT AND CONSTRUCTION

2.4.1 Lines and Grades - Refuse shall be placed to the lines and grades shown on the drawings. Control for placement can be established from the control points and coordinate system provided on the drawings.

2.4.2 Material - Run-of-plant coarse coal refuse produced at the coal preparation plant shall be used for construction of Stages 1 through 5 and the sediment ponds.

2.4.3 Placement - Coarse coal refuse shall be spread in nearly horizontal lifts using a bulldozer or other earth-moving equipment. The maximum lift thickness shall not exceed 12 inches in the 100 percent compaction zone and structural zone of the impounding embankment and not more than 2 feet in the non-structural zone. The 100 percent compaction, structural and non-structural zones are delineated for each of the stages on Drawing Nos. 90-55-E102 through 90-55-E106. All lifts shall be placed parallel to the longitudinal axis of the embankment in continuous nearly horizontal lifts with each lift extending to its full length and width prior to the placement of subsequent lifts. The refuse shall be placed in the central portion of the embankment, away from the slopes during wet weather or when drainage is insufficient and near the inside or outside slopes during drier periods.

2.4.4 Compaction

- 100 Percent Compaction Zone - The coarse coal refuse material within the 100 percent compaction zone of the impounding embankments shall be compacted to a density greater than or equal to 100 percent of the maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction zone and structural zone. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan

may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2,000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed. Additional field density tests should be conducted any time there is a suspicion of the effectiveness of compaction. A supplementary Standard Proctor laboratory compaction test (ASTM D698) shall be performed for every 20 field density tests (approximately every 40,000 cubic yards).

Field tests shall be performed at random locations in the fill. Records of the test results, as well as the test locations, shall be kept at the mine.

Any time there is reason to suspect that the characteristics of the construction material have changed, reasons such as a change in preparation plant processing or unusual compaction test results, the material shall be further investigated. Grain-size compaction, shear-strength, and other tests shall be performed as warranted.

- Structural Zone - The coarse coal refuse material within the structural zone of the impounding embankments shall be compacted to a density greater than or equal to 95 percent of the maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction zone and structural zone. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2,000 cubic

yards placed. As a minimum, density testing shall be performed on each lift placed. Additional field density tests shall be conducted any time there is a suspicion of the effectiveness of compaction. A supplementary Standard Proctor laboratory compaction test (ASTM D698) shall be performed for every 20 field density tests (approximately every 40,000 cubic yards).

Field tests shall be performed at random locations in the fill. Records of the test results, as well as the test locations, shall be kept at the mine.

In cases where a record of consistent test results is established, or in cases involving low-hazard dams, less frequent testing may be acceptable if justification is provided. Any time there is reason to suspect that the characteristics of the construction material have changed, reasons such as a change in preparation plant processing or unusual compaction test results, the material shall be further investigated. Grain-size compaction, shear-strength, and other tests shall be performed as warranted.

- Non-Structural Zone - The coarse coal refuse material placed in the non-structural zone shall be compacted to a density greater than or equal to 90 percent maximum dry density, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A density test shall be performed for every 10,000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed.

2.4.5 Compaction Procedures - The coal refuse shall advance upward in nearly horizontal layers throughout the entire disposal area. To minimize infiltration of precipitation,

the coal refuse surface shall be sloped, backbladed and compacted as it is spread. Surface material too wet to support construction equipment must be removed to expose drier material prior to placement of the next coal refuse layer. After drying, these wet materials can be reused in the embankment. As the level of the embankment is raised, it shall be graded smoothly to the contours shown on the plans.

2.5 IMPOUNDMENT ABANDONMENT

2.5.1 Existing Impoundment - The existing fine refuse impoundment shall be abandoned by capping with coarse refuse. The impoundment shall be filled in approximate 100-foot wide sections from south to north. The top of the refuse piles should be graded away from the crest of the impoundment so that surface water runs off the pile and not into the impoundment.

2.5.2 Proposed Dike Impoundment - The diked impoundment shall be abandoned by eliminating the storm storage capacity. This shall be accomplished by excavating a channel through the crest of the embankment. The channel shall be large enough to convey peak runoff from a 100-year, 24-hour storm event. The fine coal refuse shall then be capped with a 3-foot layer of coarse coal refuse. The final abandonment plan shall be evaluated at least 5 years prior to abandonment using actual refuse production rates and the existing site conditions and embankment configurations.

2.6 SUBSURFACE DRAINS

2.6.1 General - To minimize the increase in the phreatic level as the impoundment level rises, an internal drainage system shall be installed within the embankment as shown on Drawing No. 90-55-E111. The internal drainage system consists of a slope underdrain, and internal drains connected by finger drains. The drains shall consist of sandstone cobbles and boulders wrapped entirely within filter cloth. Water collected by the slope and internal underdrains shall be conveyed to the perimeter ditch and routed through the sedimentation pond.

2.6.2 Rock Cobbles - Competent durable sandstone rock of 3 to 6 inches in diameter with a maximum size of 12 inches shall be used. Limestone or other calcareous rock materials are not acceptable. Larger rock cobbles and boulders are acceptable provided smaller stones (3 to 6 inches) are placed adjacent to the filter cloth.

2.6.3 Filter Cloth - The filter cloth shall be "Supac 3.5NP", manufactured by Phillips Petroleum Company, or an approved equivalent. The filter cloth material must be protected from ultra-voilet radiation prior to installation.

2.6.4 Installation - Details of the rock underdrains are shown on Drawing No. 90-55-E114. The rock cobble drain is wrapped entirely in filter cloth with a minimum 2-foot overlap and totally enclosed in soil or coarse coal refuse, as shown on the detail. At the discharge point for the finger drains, a 6-inch plastic pipe shall be incorporated to make the transition to the perimeter surface ditch, as shown in the detail on Drawing No. 90-55-E115. The drains shall be constructed to the dimensions shown on Drawing No. 90-55-E115. To protect the filter cloth, smaller sandstone cobbles shall be placed between the cloth and the larger boulders. The rock cobbles should be placed on the filter fabric with no dropping (zero drop height) to prevent damage to the filter fabric. The rock drains shall be immediately covered with a minimum of 4 feet of loose coarse coal refuse after construction. This coarse refuse cover shall protect the filter fabric from UV light exposure and heavy equipment traffic. All underdrains shall be constructed with a minimum 2 percent slope.

2.7 PIEZOMETERS

Piezometers installed at the locations shown on the plans and in detail on Drawing No. 90-55-E114 must be maintained and monitored on a routine schedule. Details of the piezometer installations are shown on the boring logs in Appendix B. The piezometers shall be extended as required. Details for the piezometer extension procedure are shown on Drawing No. 90-55-E114.

actual bedrock conditions. Where soil is encountered, the spillway side slope shall be 2H:1V and lined with erosion protection. as discussed in Section 4.2.

4.2 EROSION PROTECTION

Some areas of the sediment pond embankment may become susceptible to erosion damage because of the spillway construction. thus requiring erosion protection. The upstream portion of the embankment adjacent the spillway entrance shall be protected with a 3-foot thick layer of 12- to 24-inch diameter riprap. If adequate quality, the rock obtained from the spillway excavation may be used for this purpose.

In areas where any portion of the spillway channel is in natural soil, it shall be protected with a minimum 3-foot thick layer of 1-foot to 2-foot diameter hard, durable rock boulders. The soil shall be covered with a layer of Supac 3.5NP filter cloth (or approved equivalent) prior to placing the boulders. Large voids between the boulders shall be choked with smaller stones; however, sufficient void space for proper grout penetration shall be maintained. The boulders shall be grouted in accordance with Section 5.5.5 of these Specifications.

5.0 EMBANKMENT SURFACE DRAINAGE FACILITIES

5.1 GENERAL

During construction of the embankment, benches, bench gutters and perimeter ditches shall be constructed to control surface runoff and minimize erosion. The location of these facilities are shown on the stage drawings with details presented on Drawing No. 90-55-E113. All permanent ditches shall be lined with the erosion protection specified in the table on Drawing No. 90-55-E113 and discussed in these Specifications.

5.2 BENCHES AND BENCH GUTTERS

Benches shall slope at about 3 percent toward the bench gutter at their upstream edge and at about 1 percent toward the perimeter ditch or dropover ditch where the runoff will discharge. The direction of slope on the benches is shown on the drawings. All final gutters shall be lined with compacted soil and seeded to reduce erosion. At the abutments, the benches shall grade smoothly into the perimeter ditches to avoid abrupt changes in ditch alignment and slope.

5.3 PERIMETER DITCHES

Perimeter ditches shall be constructed at the abutments to collect runoff from the hillside and to convey runoff discharges from bench and haul road gutters on the face of the embankment to a point beyond the toe of the embankment. Details of the ditches are shown on Drawing No. 90-55-E113. All final ditches shall be appropriately lined to minimize erosion. In areas where the depth to bedrock is shallow, it may be more economical to construct the ditches by excavating into rock. The ditches are designed to convey the estimated discharge rates shown on Drawing No. 90-55-E113. In addition, the rock shall be capable of providing erosion protection for the expected flow velocities.

5.4 HAUL ROAD GUTTERS

Surface runoff intercepted by the haul road shall be kept off the road surface and in gutters on the uphill side. The roadway shall slope at three percent toward the gutter, with the gutter having the same gradient as the haul road.

5.5 ROCK RIPRAP

Where rock riprap protection is required in ditches and gutters because of high flow velocity, the riprap must have the following characteristics:

5.5.1 Material - Riprap shall be hard, durable cobbles and boulders of sandstone or limestone in the sizes specified on the details.

5.5.2 Size Gradation - Riprap size shall be predominantly in the range specified on the drawings.

5.5.3 Subgrade Preparation - The riprap subgrade shall be well compacted before riprap is placed. A layer of Supac 3.5NP filter cloth, or approved equivalent, shall be placed on the subgrade prior to the riprap placement.

5.5.4 Riprap Placement - Riprap shall be spread to the thickness required in a single lift.

5.5.5 Grouted Riprap - The grout shall be a sand-cement mixture proportioned to result in a minimum 28-day compressive strength of 2,000 pounds per square inch (psi). The grouted riprap lining shall be underlain by a layer of Supac 5NP filter cloth or approved equivalent.

The stones shall be placed on the prepared slope and thoroughly moistened. Any excess fines shall be sluiced to the underside of the stone blanket before grouting. The grout may be delivered to the site by any means that will assure uniformity and prevent segregation of the particles. If penetration of grout is to be obtained by gravity flow into the voids, the grout shall be spaded or rodded to completely fill the voids in the stone blanket. If pressure grouting is used, care shall be taken to avoid unseating the stones. Penetration of the grout shall be to the depth specified. For a smooth surface, grout shall fill the void spaces to within 1/2 inch of the surface. Weep holes shall be provided through the blanket.

Grout shall be placed only when the temperature is above 35 degrees Fahrenheit and rising. It shall be protected from freezing and cured the same as for concrete. After grouting is completed, no weight shall be placed on the grouted riprap until the grout has cured properly.

6.0 REVEGETATION OF COMPLETED AREAS

6.1 SOIL SLOPES

Final soil slopes and the soil linings in bench gutters shall be seeded and mulched to provide a continuous stand of vegetation.

6.2 COAL REFUSE SLOPES

Revegetation of coal refuse slopes can be accomplished by placing a cover of natural soil or other materials capable of supporting vegetation on the surface of all final coal refuse slopes and subsequently planting to establish a continuous stand of vegetation. Soil cover and vegetation shall be in accordance with the Alabama Surface Mine Commission regulations and the approved permit.

7.0 MONITORING AND MAINTENANCE

7.1 PIEZOMETER AND IMPOUNDMENT LEVEL

Water level readings from the piezometers and the impoundment level shall be recorded weekly and the data plotted on a suitable chart and reviewed. Table 5 showing maximum water elevations in each piezometer for each stage is included in the design report. Should the water surfaces reach these elevations, the engineer of record shall be contacted immediately to evaluate the effects on stability of the embankment. Should the piezometers become damaged during operations, they shall be repaired or replaced. Piezometer B-18 shall be decommissioned prior to the construction of Stage 2.

A gauging staff to determine fines levels within the impoundments shall be installed. The gauging staff shall be clearly marked in 1-foot increments and labeled every 5 feet. The gauging staff marks shall be surveyed relative to the embankment crest so that a quick determination of fines level elevation can be made, relative to each embankment stage.

7.2 SETTLEMENT MONUMENTS

Concrete settlement monuments shall be carefully surveyed semiannually, both in elevation and in plan, to assist in evaluating the integrity of the embankment. In addition, the monument at the governing crest shall be monitored monthly to assure that the crest is at the design elevation.

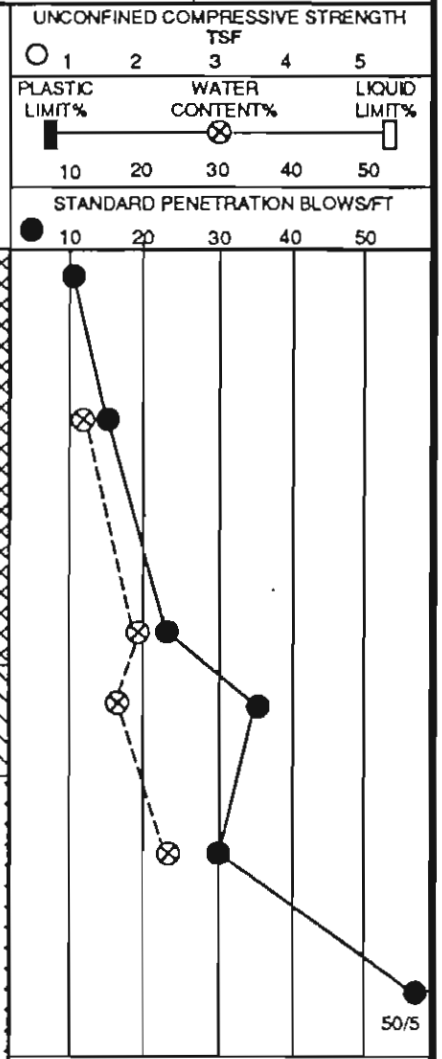
APPENDIX B

BORING LOGS

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-1	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-23-91
				DATE COMPLETED:	1-23-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 584.7	
	S-1	1.5	100	-	LOOSE TO MEDIUM DENSE, BLACK COARSE, COAL REFUSE	
5	S-2	1.5	100	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, SEVERELY WEATHERED	
10	ST-1	2.3	92	-	SANDY CLAY WITH SOME REFUSE	
	S-3	0.95	63	-	STIFF, ORANGE AND RED, SANDY CLAY, MOIST, TRACE COARSE, MOIST	
15	S-4	1.5	100	-	VERY STIFF, ORANGE AND RED SANDY CLAY, TRACE SANDSTONE FRAGMENTS, MOIST	
20	S-5	1.5	100	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED, MOIST	
25	S-6	0.9	60	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED, MOIST	
	1	0.9	90	0	SANDSTONE - MEDIUM GRAINED, LIGHT GRAY, SOFT, VERY BROKEN, SEVERELY WEATHERED TO RED AND ORANGE, SOME CLAY LENSES	
30	2	7.8	82	73	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, MASSIVE, FRESH, TRACE COAL STRINGERS	
35					INTERBEDDED GRAY SANDSTONE AND CARBONEOUS SHALE, HARD, BROKEN, FRESH	
40					BOTTOM OF BORING AT 37.9 FEET	



AUGER REFUSAL AT 28 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

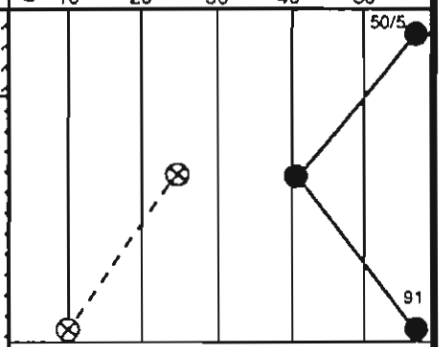
BORING NUMBER	B-2	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.9	
	S-1	0.9	60	-	VERY DENSE, LIGHT GRAY SLAG	
5	S-2	1.5	100	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO RED AND ORANGE	
10	S-3	1.2	80	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO RED AND ORANGE	
	1	2.75	55	9	SANDSTONE - CLAYEY, LIGHT GRAY, SOFT TO MEDIUM HARD, VERY BROKEN, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
15						
	2	5	100	42		
20						
	3	4.55	92	52	BRECCIA - QUARTZ AND SHALE FRAGMENTS, GRAY AND WHITE, HARD, BROKEN, SLIGHTLY WEATHERED	
25					SANDSTONE - FINE GRAINED, GRAY, HARD, BROKEN, FRESH, TRACE COAL STRINGERS	
					BOTTOM OF BORING AT 26 FEET	
30						
35						
40						



AUGER REFUSAL AT 11 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

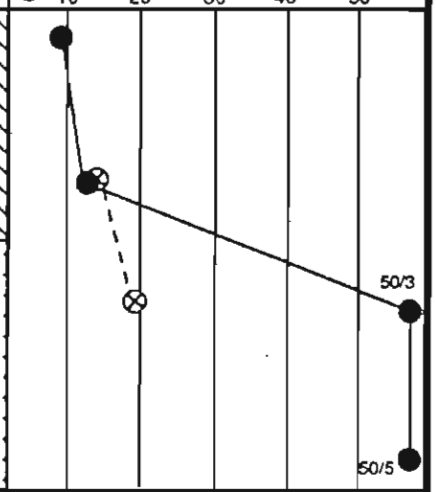
BORING NUMBER	B-3	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.7	
	S-1	0.9	60	-	VERY STIFF, RED AND ORANGE, SANDY CLAY, MOIST	
5	S-2	1.5	100	-	STIFF, RED AND ORANGE, SANDY CLAY, MOIST	
10	S-3	0.6	40	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
15	S-4	0.4	27	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
					BOTTOM OF BORING AT 16.6 FEET	
20						
25						
30						
35						
40						

UNCONFINED COMPRESSIVE STRENGTH TSF
○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



AUGER REFUSAL AT 16.6 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-3A	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-8-91
				DATE COMPLETED:	2-8-91
BORING LOCATION	REFER TO PLAN			FIELD ENGINEER:	DOUG CLARK
				CHECKED BY: R. WOOD	DATE: 3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.7	
5	ST-1	2.5	100	-	ORANGE, SANDY CLAY	
					BOTTOM OF BORING AT 5.5 FEET	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-4	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-28-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

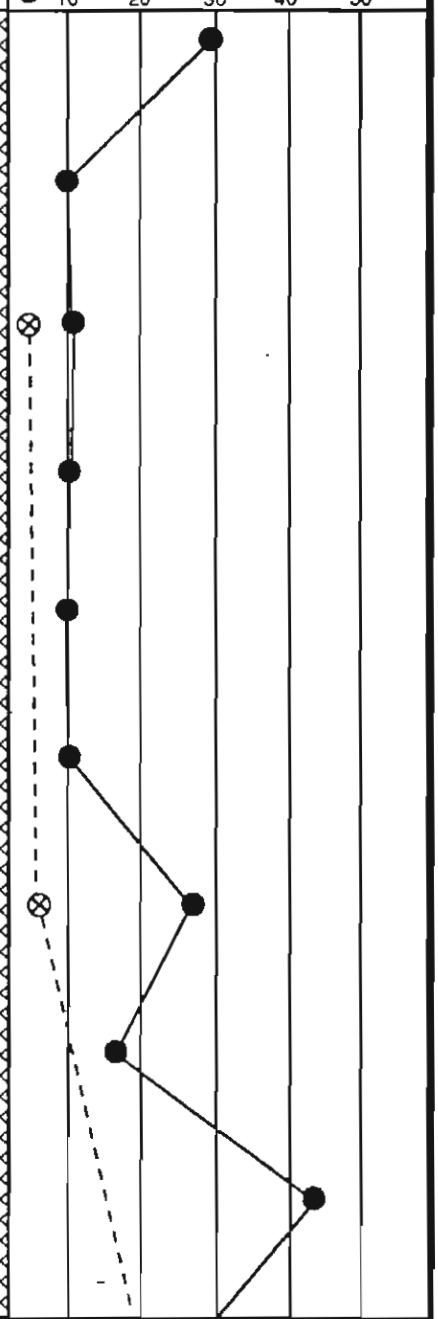
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 614.7
	S-1	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE
5	S-2	1.1	73	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
10	S-3	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
15	S-4	1.4	93	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
20	S-5	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
25	S-6	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
30	S-7	1.5	100	-	MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
35	S-8	1.5	100	-	MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE
40	S-9	1.5	100	-	DENSE, GRAY AND BROWN, COARSE, COAL REFUSE

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-4	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-28-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-10	1.5	100	-	MEDIUM STIFF, BROWN TO ORANGE, SANDY CLAY, MOIST	
50	S-11	1.5	100	-	VERY DENSE, RED AND ORANGE, CLAYEY SAND	
55					BOTTOM OF BORING AT 54.5 FEET	
60						
65						
70						
75						
80						
85						

AUGER REFUSAL AT 54.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

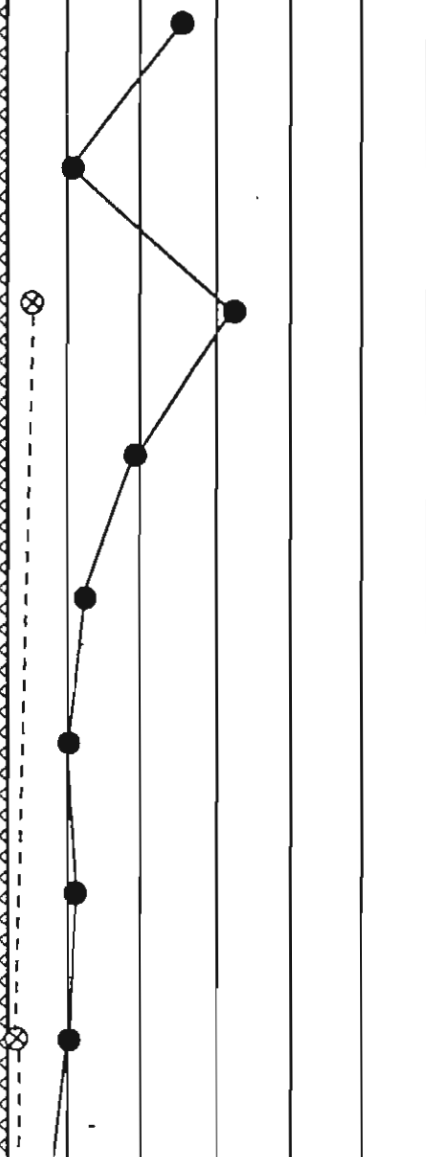
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 641.31
5	S-1	1.4	93	-	MEDIUM DENSE TO DENSE, GRAY, COARSE , COAL REFUSE, DRY
10	S-2	1.3	87	-	LOOSE TO MEDIUM DENSE, COARSE, COAL REFUSE, DRY
15	S-3	1.2	80	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.3	87	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
35	S-7	0.9	60	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
40	S-8	0.7	47	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

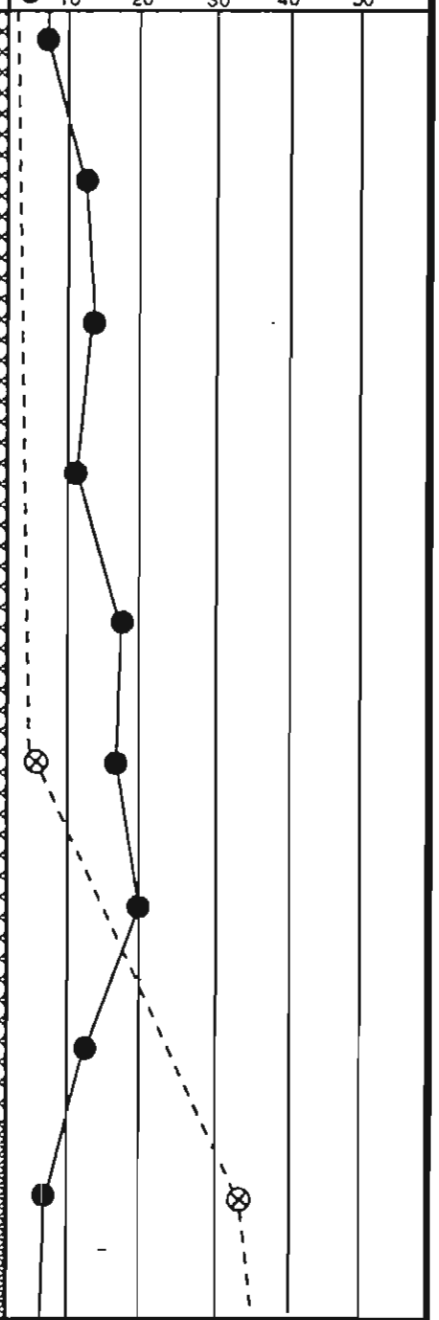
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.1	73	-	LOOSE, GRAY, COARSE COAL REFUSE, DRY
50	S-10	0.9	60	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, DRY
55	S-11	0.6	40	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, DRY
60	S-12	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-13	0.9	60	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
75	S-15	0.9	60	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
80	S-16	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, WET
85	S-17	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET
	ST-1	1.8	90	-	BLACK, FINE, COAL REFUSE

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%

10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-18	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET	
	ST-2	0	0	-		
	S-19	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET	
95					SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOLTLED TO RED AND ORANGE	
	S-20	0.4	100	-		
100					BOTTOM OF BORING AT 98.4 FEET	
105						
110						
115						
120						
125						
130						

50/5

SPOON REFUSAL AT 98.4 FEET

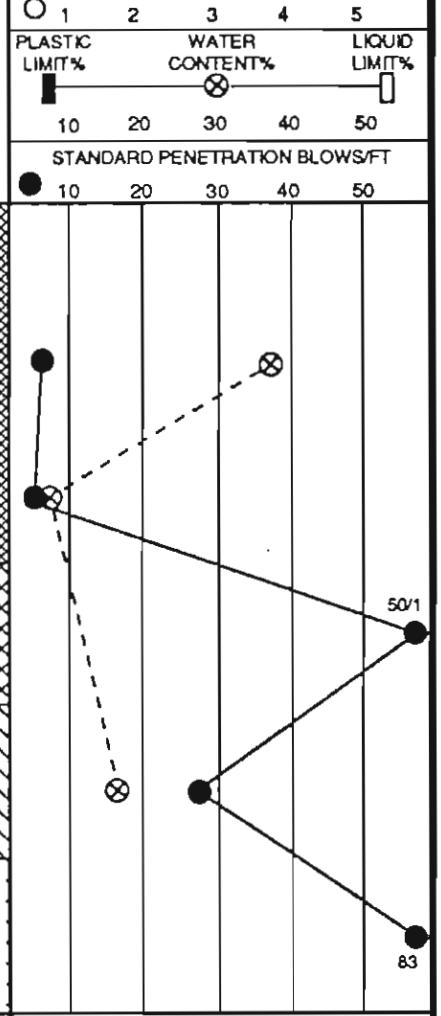
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-6	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-31-91
				DATE COMPLETED:	1-31-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 578.6	
5	S-1	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, WET	
	ST-1	1.5	75	-	BLACK, FINE, COAL REFUSE	
10	S-2	1.5	100	-	VERY SOFT, BLACK, FINE, COAL REFUSE, WET	
15	S-3	0.5	100	-	DENSE, GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST	
20	S-4	1.5	100	-	MEDIUM DENSE, RED AND ORANGE, SANDY CLAY	
25	S-5	1.4	93	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED	
30					BOTTOM OF BORING AT 28 FEET	
35						
40						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-7	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-24-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

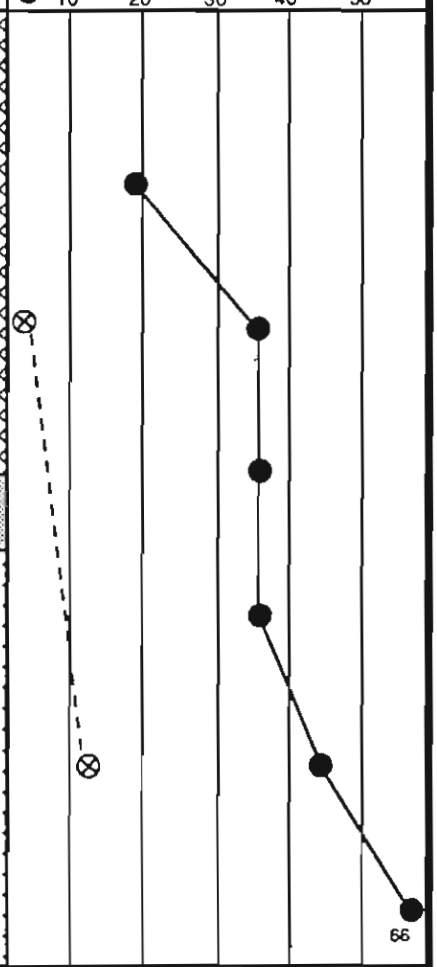
PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%

10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 585.1
5	S-1	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
10	S-2	1.0	67	-	DENSE, BLACK, COARSE, COAL REFUSE, DRY
15	S-3	1.4	93	-	DENSE, GRAY, COARSE, COAL REFUSE; MEDIUM DENSE, LIGHT BROWN, CLAYEY SAND AT BOTTOM OF SAMPLE
20	S-4	1.5	100	-	SANDSTONE - ORANGE AND BROWN, VERY SOFT, SEVERELY WEATHERED.
25	S-5	1.3	87	-	SANDSTONE - ORANGE AND RED, VERY SOFT, SEVERELY WEATHERED.
30	S-6	1.1	73	-	SANDSTONE - CLAYEY, RED AND ORANGE, VERY SOFT, SEVERELY WEATHERED
35					BOTTOM OF BORING AT 33.4 FEET
40					

PROFILE



AUGER REFUSAL AT 33.4 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

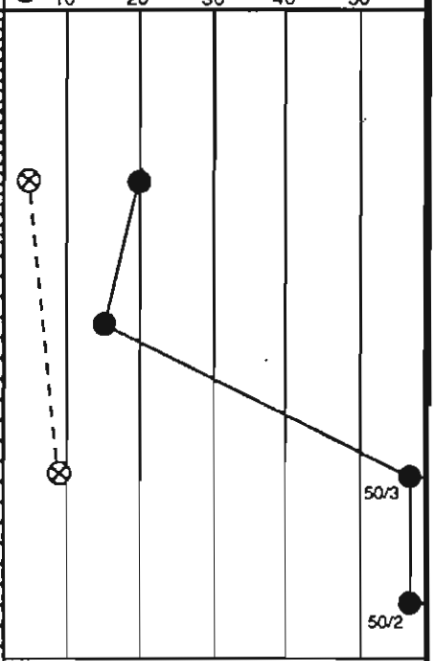
BORING NUMBER	B-8	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-24-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 551.8	
5	S-1	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY	
10	S-2	0.9	60	-	SANDSTONE - CLAYEY VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
15	S-3	1.0	67	-	SANDSTONE - CLAYEY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
20	S-4	0.2	100	-	SANDSTONE - VERY SOFT, SEVERELY WEATHERED TO ORANGE AND BROWN	
	1	1.7	74	71	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, BROKEN TO MASSIVE, SLIGHTLY WEATHERED AND STAINED ORANGE, TRACE IRONSTONE LAYERS AND COAL STRINGERS	
25	2	4.05	100	47	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, MASSIVE, FRESH	
30	3	4.7	100	94	CONGLOMERATE - ROCK FRAGMENT PEBBLES, GRAY, HARD, SLIGHTLY BROKEN TO BROKEN, SLIGHTY WEATHERED TO ORANGE, TRACE COAL STRINGERS	
35					BOTTOM OF BORING AT 32.8 FEET	
40						



AUGER REFUSAL AT 27.35 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

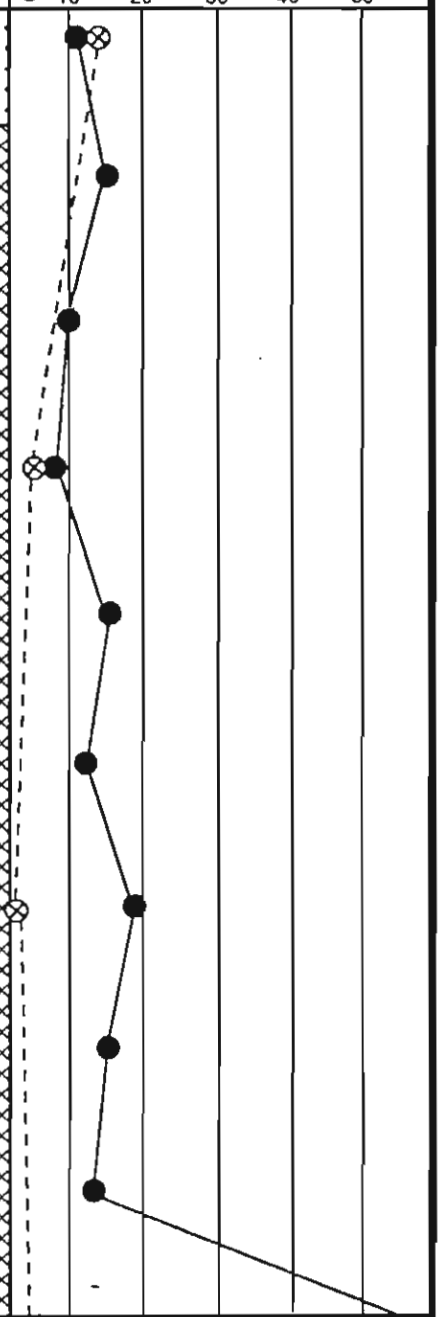
BORING NUMBER	B-9	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-29-91
				DATE COMPLETED:	1-30-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 536.3	
	S-1	1.5	100	-	MEDIUM DENSE, ORANGE AND RED, CLAYEY, SAND AND SANDSTONE FRAGMENTS, MOIST	
5	S-2	0.6	40	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
10	S-3	0.4	27	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE	
15	S-4	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN	
20	S-5	1.5	100	-	MEDIUM DENSE, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN	
25	S-6	1.5	100	-	MEDIUM DENSE, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN	
30	S-7	1.3	87	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE	
35	S-8	0.9	60	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
40	S-9	1.0	67	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

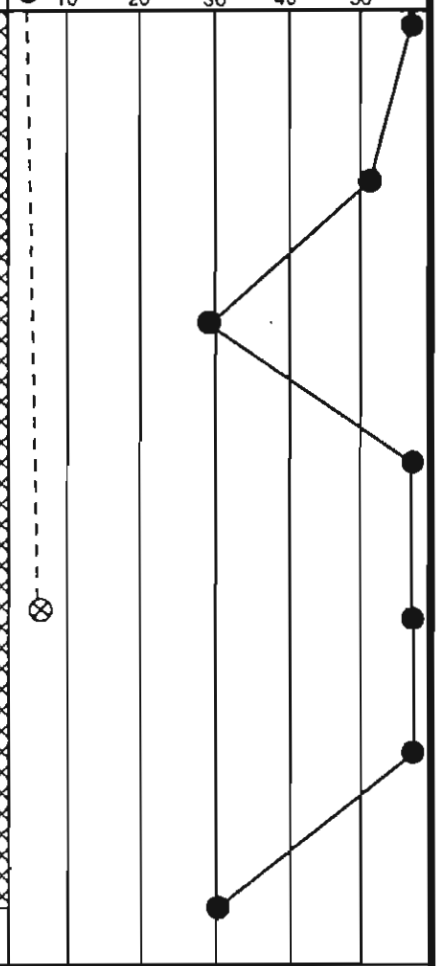
BORING NUMBER	B-9	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-29-91
				DATE COMPLETED:	1-30-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% □ LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
50	S-10	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
	S-11	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
55	S-12	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
60	S-13	0.5	71	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
65	S-14	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
70	S-15	0.4	80	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
75	S-16	1.3	87	-	DENSE, SEVERELY WEATHERED, COARSE, REFUSE WITH LIGHT GRAY SANDSTONE AT BOTTOM OF SAMPLE	
80					BOTTOM OF BORING AT 78 FEET	AUGER REFUSAL AT 78 FEET
85						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-10	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-25-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

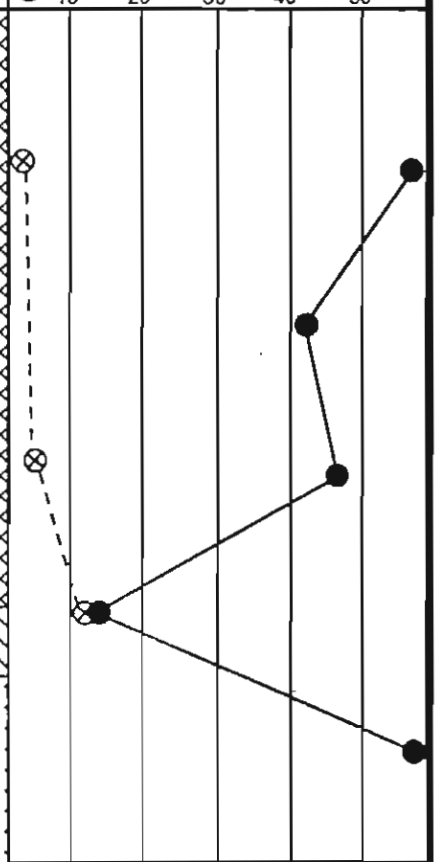
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% ▯ LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT ● : 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 549.59
	S-1	-	-	-	NOT SAMPLED
5	S-2	0.9	100	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE
10	S-3	1.3	87	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE
15	S-4	1.5	100	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE
20	S-5	1.0	67	-	COARSE, COAL REFUSE AND STIFF, ORANGE SANDY CLAY
	ST-1	1.9	95	-	
25	S-6	0.35	100	-	SANDSTONE - RED, VERY SOFT, SEVERELY WEATHERED
30	1	0.3	14	0	SANDSTONE - RED AND ORANGE, VERY SOFT, VERY BROKEN, SOME INTERBEDDED CLAY
	2	4.45	89	35	SANDSTONE - GRAY AND BROWN, MEDIUM HARD, BROKEN TO SLIGHTLY BROKEN WITH ANGULAR CLAY FILLED FRACTURES, SLIGHTLY WEATHERED TO ORANGE
35					SANDSTONE - GRAY, SEVERELY WEATHERED TO ORANGE, SOFT TO MEDIUM HARD, VERY BROKEN TO BROKEN
	3	4.5	90	50	SANDSTONE AND CONGLOMERATE - COARSE GRAINED AND PEBBLES, DARK GRAY, HARD, SLIGHTLY BROKEN, SLIGHTLY WEATHERED, TRACE COAL STRINGERS
40					BOTTOM OF BORING AT 41.6 FEET

PROFILE



AUGER REFUSAL AT 29.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

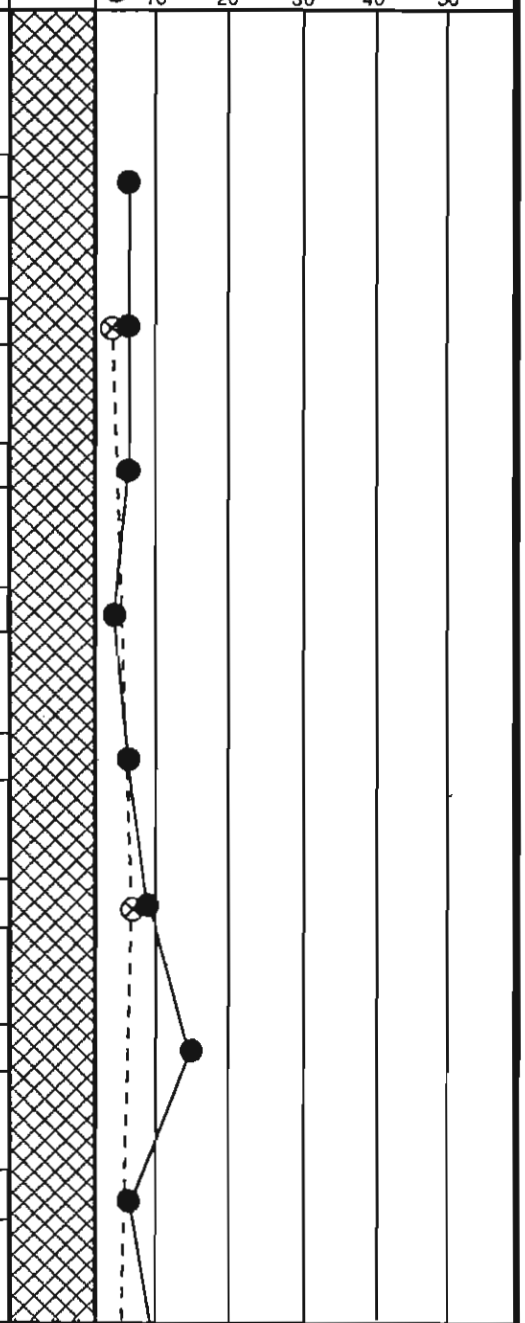
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% □ LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, (FT.)	RECOVERY, (%)	ROCK RQD, (%)	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 658.3
5	S-1	1.2	80	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.7	47	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
15	S-3	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.0	67	-	VERY LOOSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.4	93	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, SOME SAND, MOIST
35	S-7	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
40	S-8	1.3	87	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

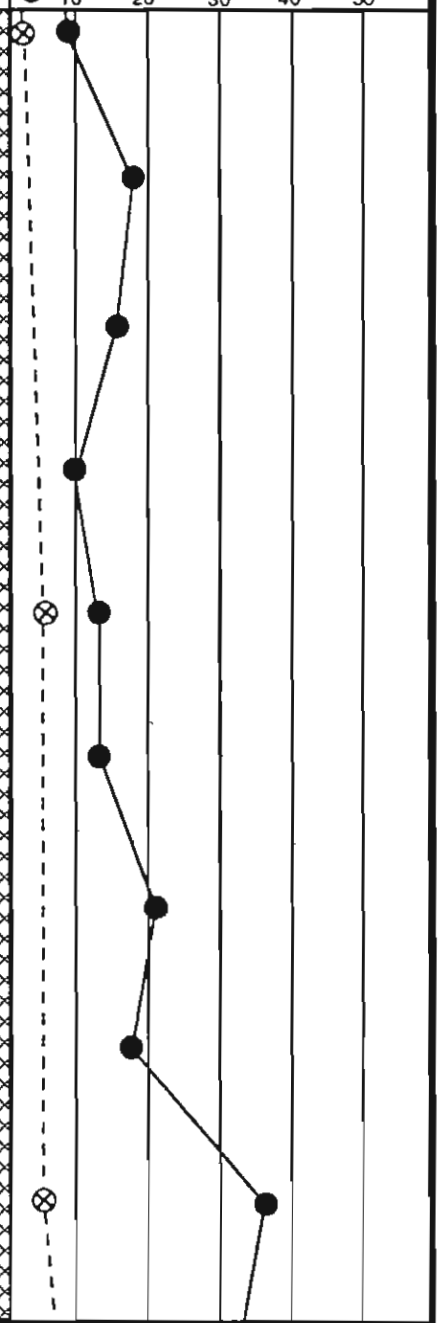
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.2	80	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
50	S-10	1.3	87	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
55	S-11	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-13	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
70	S-14	1.5	100	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
75	S-15	0	0	-	
80	S-16	1.3	87	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
85	S-17	1.1	73	-	DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN MOIST

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
95	S-18	1.0	67	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN, DRY TO MOIST
	S-19	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
100	S-20	1.0	67	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
105	S-21	0.4	27	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
110	S-22	-	-	-	SAMPLE NOT RECOVERED
					BOTTOM OF BORING AT 111.5 FEET
115					
120					
125					
130					

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50

AUGER REFUSAL AT 111.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91
				DATE COMPLETED: 2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING			

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% ⊗ — LIQUID LIMIT%: 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 657.4	
5	S-1	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
10	S-2	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
15	S-3	0.7	47	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
20	S-4	1.2	80	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
25	S-5	1.1	73	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
30	S-6	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
35	S-7	0.9	60	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
40	S-8	0.8	53	-	LOOSE, BLACK AND BROWN, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91
				DATE COMPLETED: 2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING			

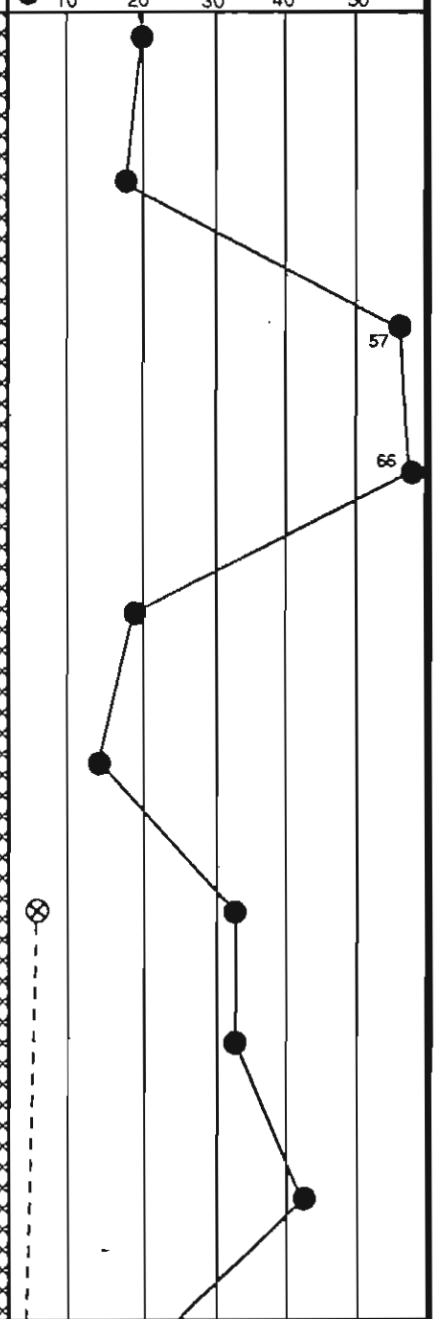
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	0.7	47	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
50	S-10	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
55	S-11	1.5	100	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
60	S-12	1.3	87	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY
70	S-14	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY
75	S-15	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST TO WET
80	S-16	1.3	87	-	DENSE, BLACK AND GRAY, COARSE COAL REFUSE, DRY
85	S-17	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 3 4 5

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91
				DATE COMPLETED: 2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING			

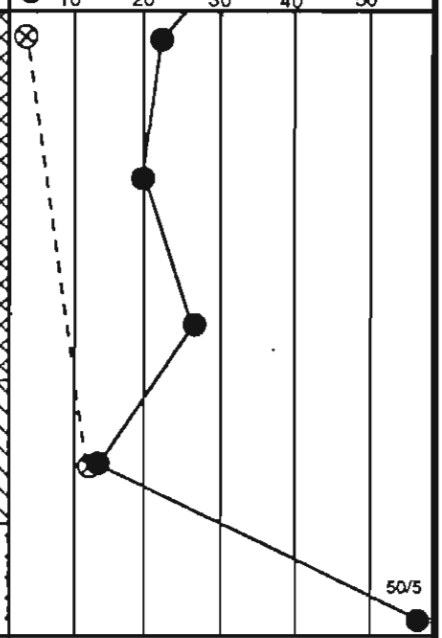
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% ⊗ — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
95	S-18	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
	S-19	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
100	S-20	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, MOIST
105	S-21	1.1	73	-	STIFF, LIGHT BROWN, SANDY CLAY, MOIST
110	S-22	0.9	60	-	SANDSTONE- VERY SOFT, SEVERELY WEATHERED TO RED AND YELLOW
					BOTTOM OF BORING AT 110.9 FEET
115					
120					
125					
130					

PROFILE



SPOON REFUSAL AT 120.9 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91
				DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING			

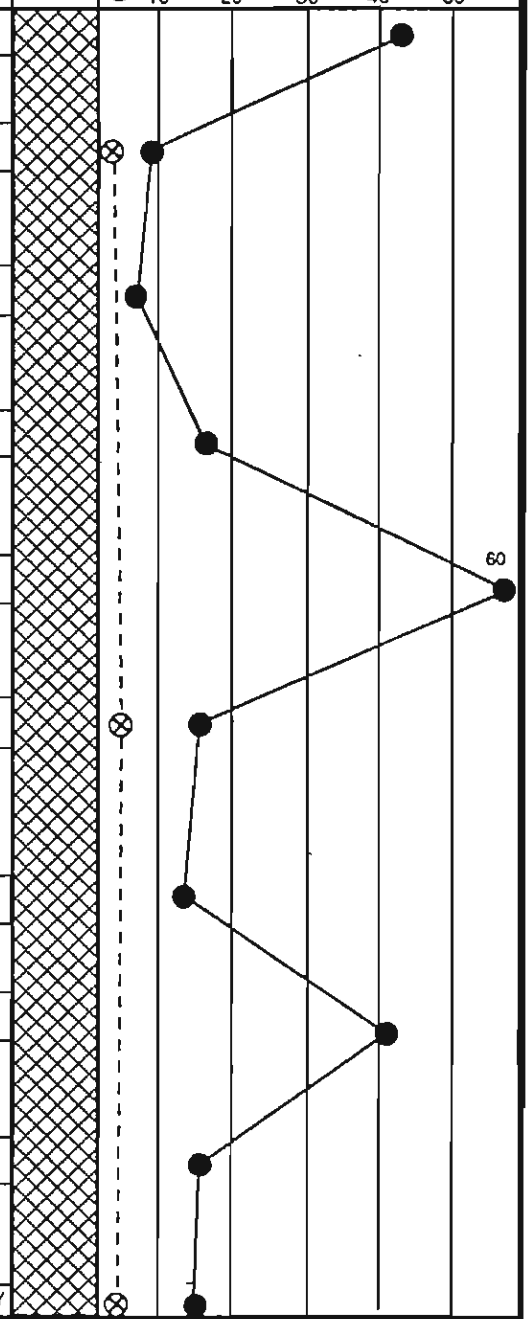
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 632.82
	S-1	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY
5	S-2	-	-	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-3	-	-	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
15	S-4	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-5	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-6	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
30	S-7	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
35	S-8	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
40	S-9	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
	S-10	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
○ 1 2 3 4 5

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91
				DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING			

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-10	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
50	S-11	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
55	S-12	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
60	S-13	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
65	S-14	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
70	S-15	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
75	S-16	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
80	S-17	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
85	S-18	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
	S-19	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE	STANDARD PENETRATION BLOWS/FT
	S-19	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY		
95	S-20	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE		97
100	S-21	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST		
105	S-22	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE DRY TO MOIST		
110	S-23	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN		50/5
115	S-24	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN		
120	S-25	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN		50/5.5
125	S-26	-	-	-	VERY SOFT, SEVERELY WEATHERED, LIGHT BROWN SANDSTONE		79
	S-27	-	-	-	SANDSTONE-LIGHT BROWN, VERY SOFT, SEVERELY WEATHERED		50/2.5
130					BOTTOM OF BORING AT 129.3 FEET		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					APPROXIMATE SURFACE ELEVATION: 658
5	S-1	1.3	87	-	DENSE, GRAY AND BLACK, COARSE , COAL REFUSE
10	S-2	0.8	53	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
15	S-3	1.0	67	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
20	S-4	0.9	60	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
25	S-5	1.3	87	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
30	S-6	1.3	87	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
35	S-7	1.2	80	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE , COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, MOIST
40	S-8	1.4	93	-	MEDIUM DENSE, BLACK AND GRAY COARSE COAL REFUSE, MOIST

PROFILE

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-6-91
				DATE COMPLETED: 2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91

DRILLING METHOD: HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING

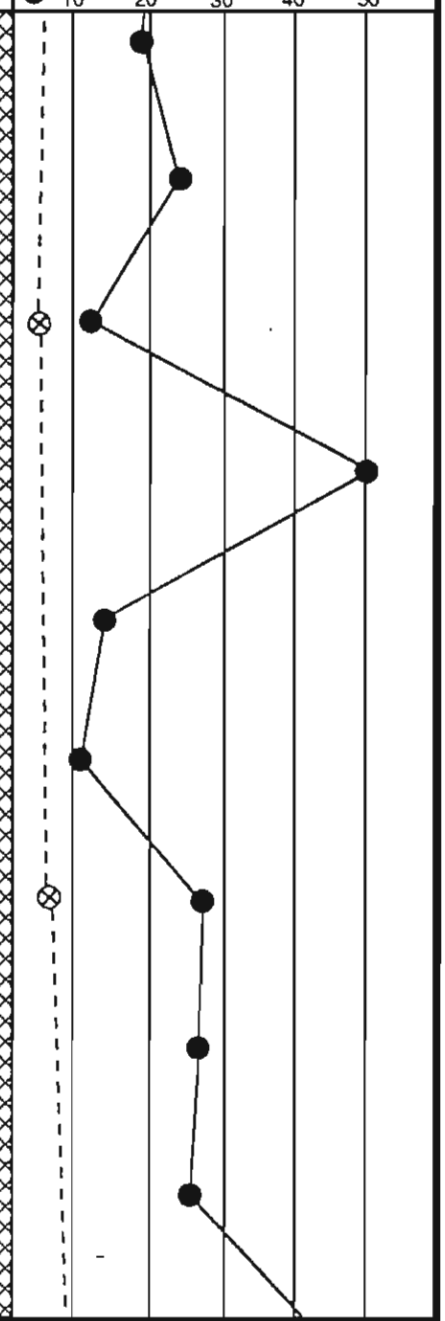
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK QUD. [%]	DESCRIPTION OF MATERIAL
	S-9	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
50	S-10	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO ORANGISH BROWN, MOIST
55	S-11	1.1	73	-	MEDIUM DENSE, GRAY, COARSE COAL, REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN, MOIST
60	S-12	1.3	87	-	DENSE TO VERY DENSE, GRAY AND BLACK, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
70	S-14	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
75	S-15	1.5	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
80	S-16	1.3	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
85	S-17	1.5	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 3 4 5

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 2 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

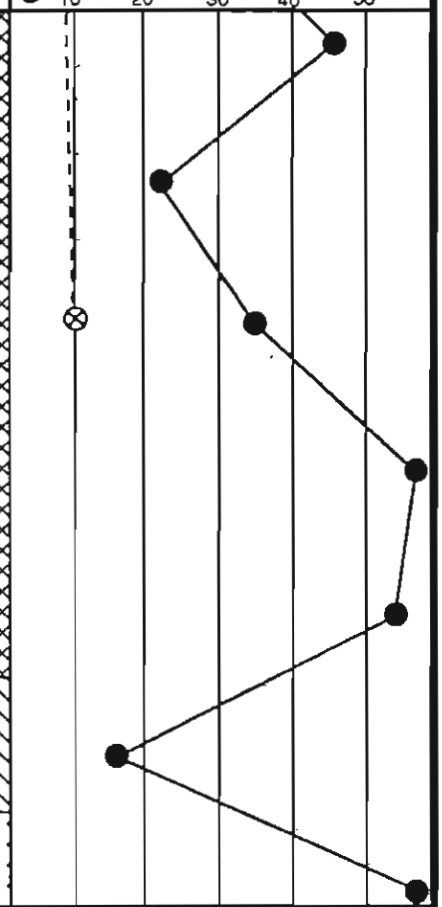
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% ▯ LIQUID LIMIT%

10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-18	0.8	53	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE	
	S-19	0.9	60	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE	
100	S-20	0.7	47	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE	
105	S-21	0.9	60	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED	
110	S-22	0.8	53	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED	
115	S-22	0.8	53	-	STIFF, LIGHT BROWN, SANDY CLAY, MOIST	
120	S-24	0.9	60	-	SANDSTONE - VERY SOFT, SEVERELY WEATHERED AND MOTTLED RED AND ORANGE	
125					BOTTOM OF BORING AT 120.9 FEET	
130					SPOON REFUSAL AT 120.9 FEET	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

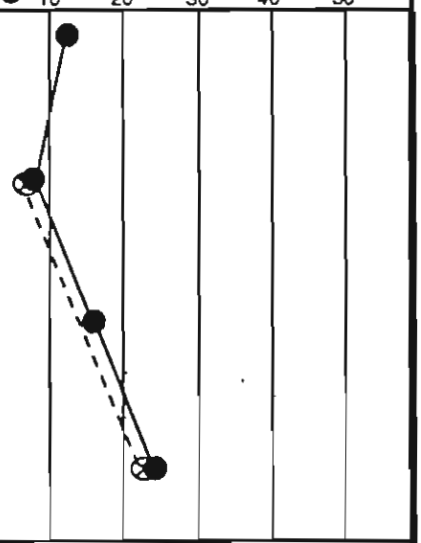
BORING NUMBER	B-15	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-21-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGER WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 568.0	
0	S-1	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REGUSE, DRY	
5	S-2	0.5	33	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE	
10	S-3	1.5	100	-	MEDIUM DENSE, ORANGE, CLAYEY SAND, MOIST	
15	S-4	1.5	100	-	SANDSTONE, ORANGE AND BROWN VERY SOFT, SEVERELY WEATHERED,	
20					BOTTOM OF BORING AT 18.5 FEET	
25						
30						
35						
40						

UNCONFINED COMPRESSIVE STRENGTH TSF
○ 1 2 3 4 5

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



AUGER REFUSAL AT 18.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

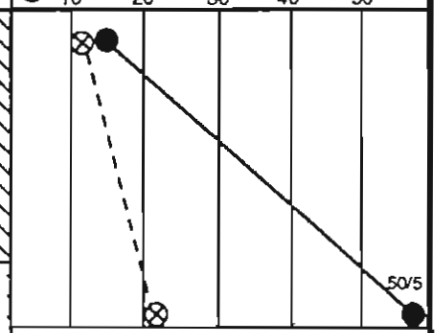
BORING NUMBER	B-16	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGER WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 573.6	
	S-1	1.5	100	-	VERY STIFF, ORANGE, SANDY CLAY WITH SOME REFUSE FRAGMENTS, MOIST	
5	ST-1	1.85	74	-	ORANGE, SANDY CLAY	
10	S-2	0.9	-	-	VERY SOFT, SANDSTONE - LT. GRAY, SEVERLY WEATHERED, TO ORANGE AND RED	
15	1	1.8	36	0	SANDSTONE - LIGHT GRAY, SOFT, VERY BROKEN, SEVERLY WEATHERED TO RED AND ORANGE	
20	2	7.55	100	100	SANDSTONE - GRAY,HARD, MASSIVE, FRESH, TRACE COAL STRINGERS	
25	3	1.85	100	100		
					BOTTOM OF BORING AT 26.25 FEET	
30						
35						
40						



AUGER REFUSAL AT 11.85 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

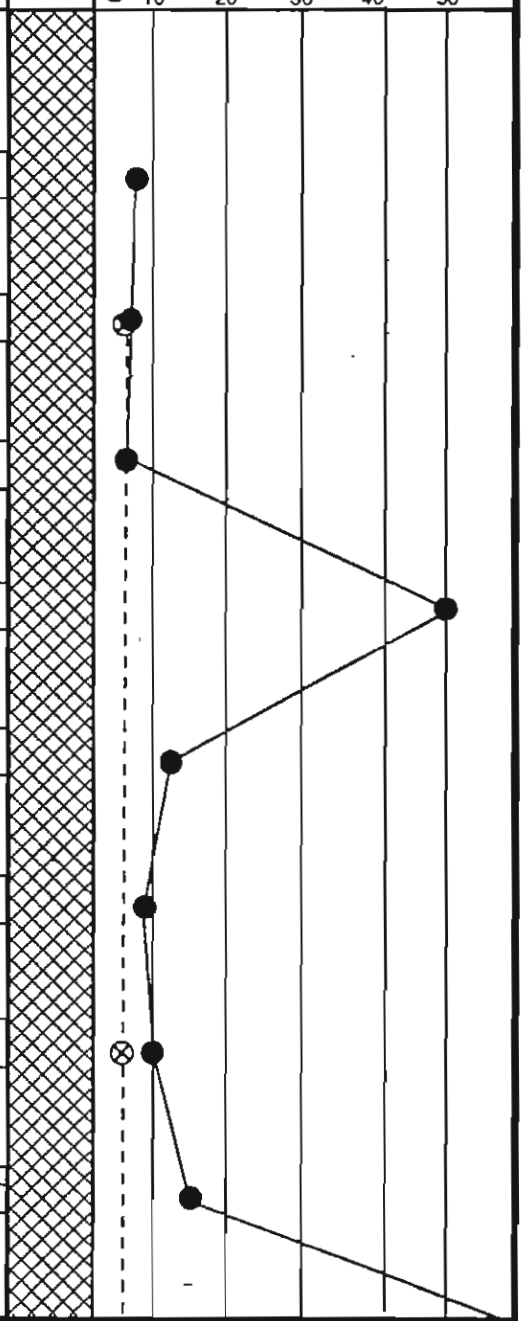
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 634.7
5	S-1	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.8	53	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
15	S-3	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.2	80	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.1	73	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
35	S-7	1.3	87	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, DRY TO MOIST
40	S-8	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

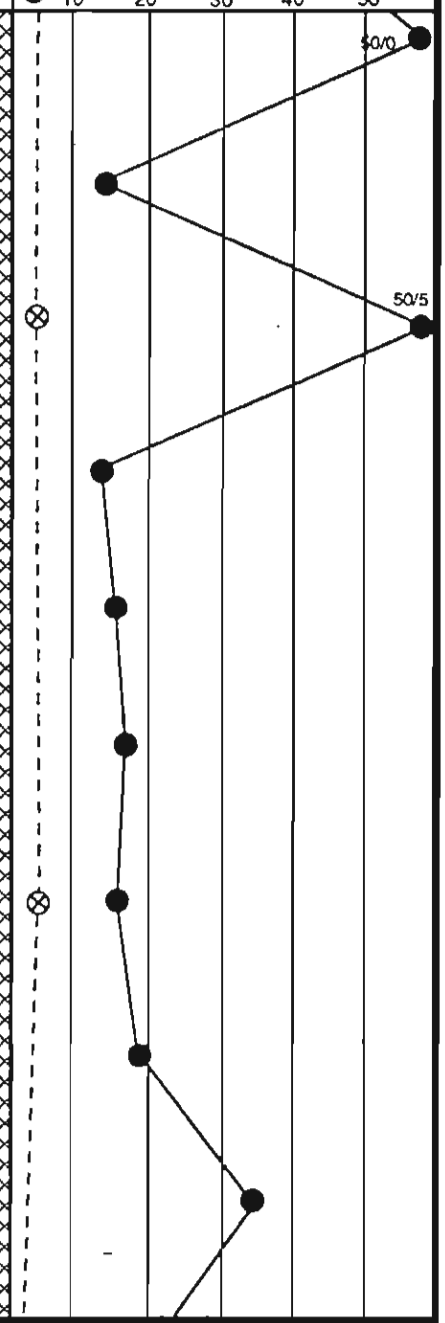
BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
50	S-10	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
55	S-11	0.8	53	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.2	80	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
85	S-17	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
95	S-18	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
	S-19	1.3	87	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
100	S-20	1.4	93	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
105	S-21	1.2	80	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
110	S-22	1.2	80	-	DENSE, LIGHT BROWN CLAYEY SAND, MOIST
	S-23	0.2	100	-	VERY SOFT, SEVERELY WEATHERED RED AND ORANGE SANDSTONE
115					BOTTOM OF BORING AT 113.7 FEET
120					
125					
130					

PROFILE

50/2

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 658.8	
5	S-1	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
10	S-2	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
15	S-3	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
20	S-4	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
25	S-5	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
30	S-6	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
35	S-7	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
40	S-8	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

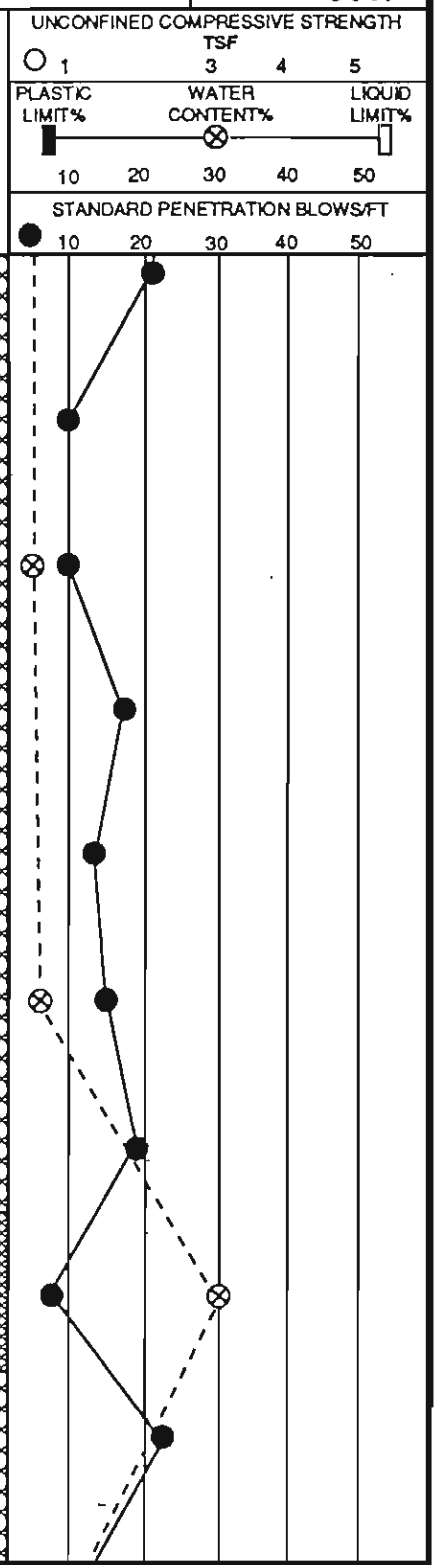
SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
50	S-10	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
55	S-11	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
65	S-13	0.8	53	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.0	67	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST
85	S-17	0.8	53	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, WET

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

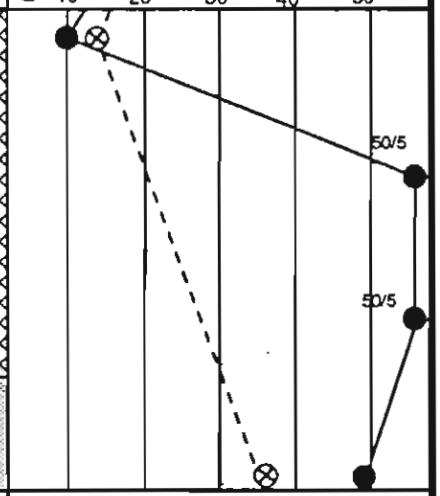
BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD. [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-18	-	-	-	LOOSE TO MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, WET	
	S-19	0.7	47	-	DENSE TO VERY DENSE, BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
100	S-20	0.4	27	-	VERY DENSE, BLACK, COARSE, COAL REFUSE, MOIST	
105	S-21	1.1	73	-	DENSE, ORANGE, CLAYEY SAND, MOIST	
					BOTTOM OF BORING AT 106.5 FEET	
110						
115						
120						
125						
130						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

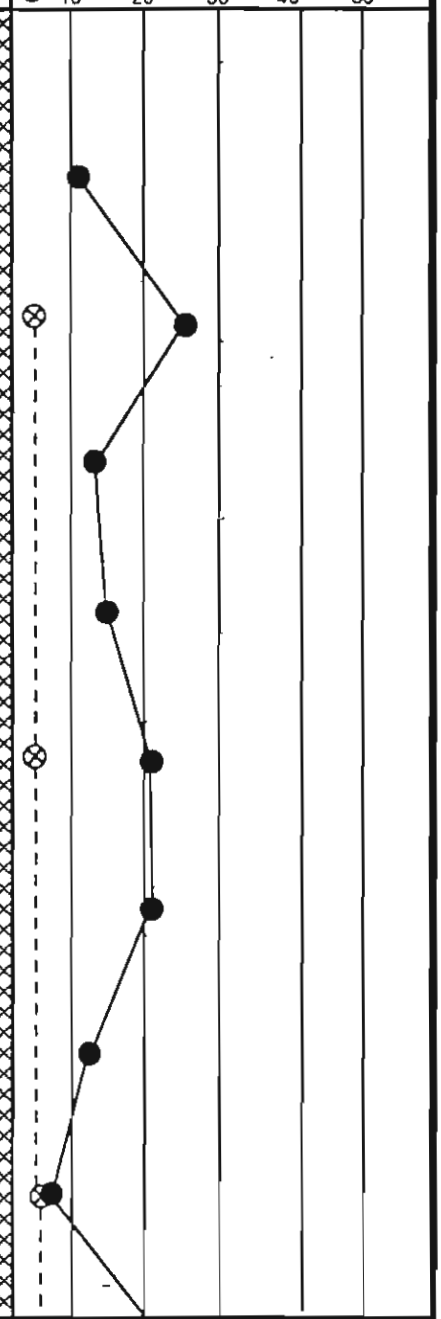
BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% □ LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT ● : 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 658.1	
5	S-1	-	-	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, MOIST	
10	S-2	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
15	S-3	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST	
20	S-4	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
25	S-5	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
30	S-6	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
35	S-7	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
40	S-8	-	-	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

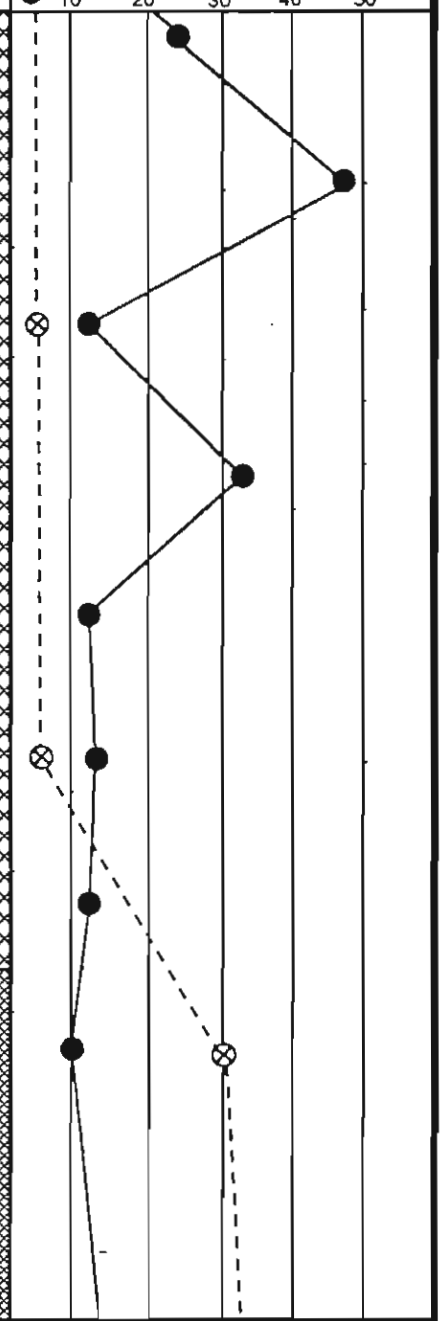
BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK QUD, [%]	DESCRIPTION OF MATERIAL
	S-9	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
50	S-10	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
55	S-11	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
60	S-12	-	-	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
70	S-14	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.5	100	-	MEDIUM STIFF TO STIFF, BLACK, FINE, COAL REFUSE, MOIST
85	ST-1	2.5	100	-	BLACK, FINE, COAL REFUSE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91

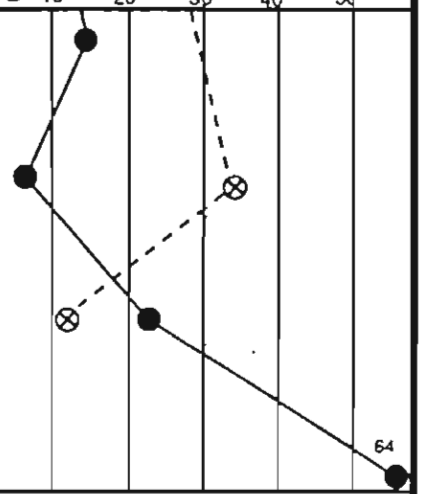
DRILLING METHOD: HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-17	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE WITH SOME COARSE, MOIST TO WET	
	S-18	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET. LIGHT BROWN CLAY IN BOTTOM OF SPOON	
100	S-19	1.3	87	-	STIFF TO VERY STIFF, LIGHT BROWN, SANDY CLAY, MOIST	
105	S-20	1.5	100	-	SANDSTONE-LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED RED AND ORANGE	
					BOTTOM OF BORING AT 106.5 FEET	
110						
115						
120						
125						
130						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-20	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-11-91
				DATE COMPLETED:	2-12-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

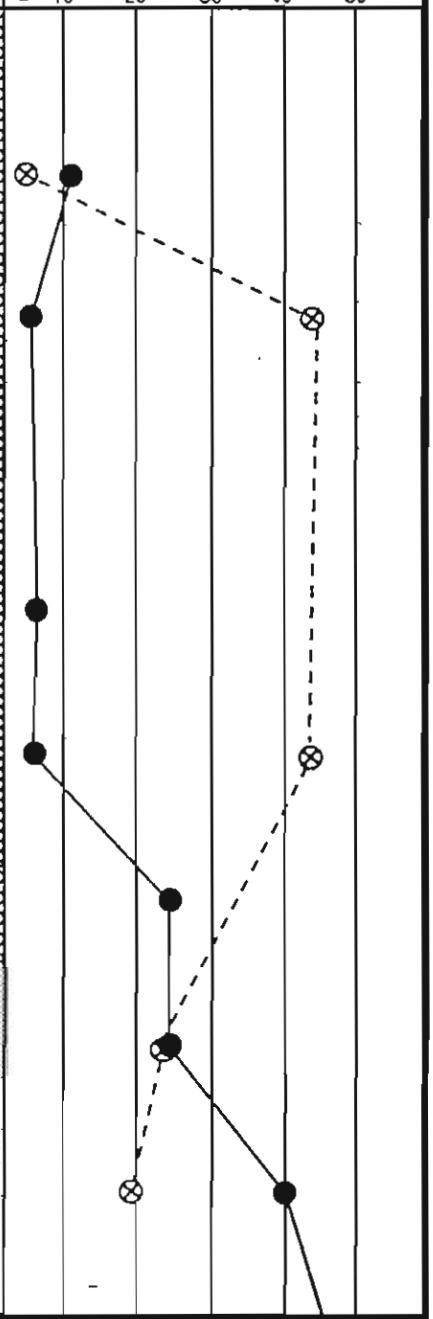
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 592.4
5	S-1	1.5	100		MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.7	100		VERY LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
15	ST-1	2.5	100		BLACK, FINE, COAL REFUSE
20	S-3	1.0	67		VERY SOFT, BLACK, FINE, COAL REFUSE, WET
25	S-4	1.5	100		VERY SOFT, BLACK, FINE, COAL REFUSE, WET
	ST-2	2.5	100		BLACK, FINE, COAL REFUSE
30	S-5	1.5	100		MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
35	S-6	1.5	100		MEDIUM DENSE, BROWNISH ORANGE, CLAYEY SAND, MOIST
40	S-7	1.5	100		DENSE, BROWNISH ORANGE, CLAYEY SAND, MOIST

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-20	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-11-91
				DATE COMPLETED:	2-12-91
BORING LOCATION	REFER TO PLAN		FIELD ENGINEER: DOUG CLARK		
			CHECKED BY: R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-8	1.1	73		SANDSTONE-LIGHT GRAY VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO ORANGE AND RED	
					BOTTOM OF BORING AT 46.5 FEET	
50						
55						
60						
65						
70						
75						
80						
85						

UNCONFINED COMPRESSIVE STRENGTH TSF
O 1 3 4 5

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91
				DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING			

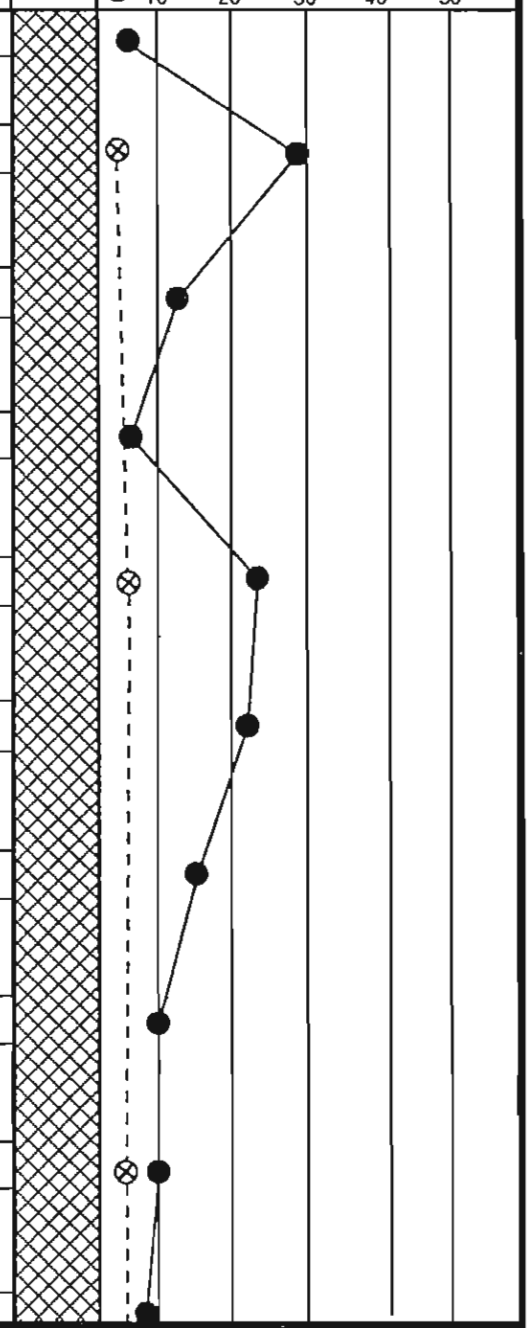
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 655.8
	S-1	-	-	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
5	S-2	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-3	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
15	S-4	-	-	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
20	S-5	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
25	S-6	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
30	S-7	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
35	S-8	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
40	S-9	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
	S-10	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

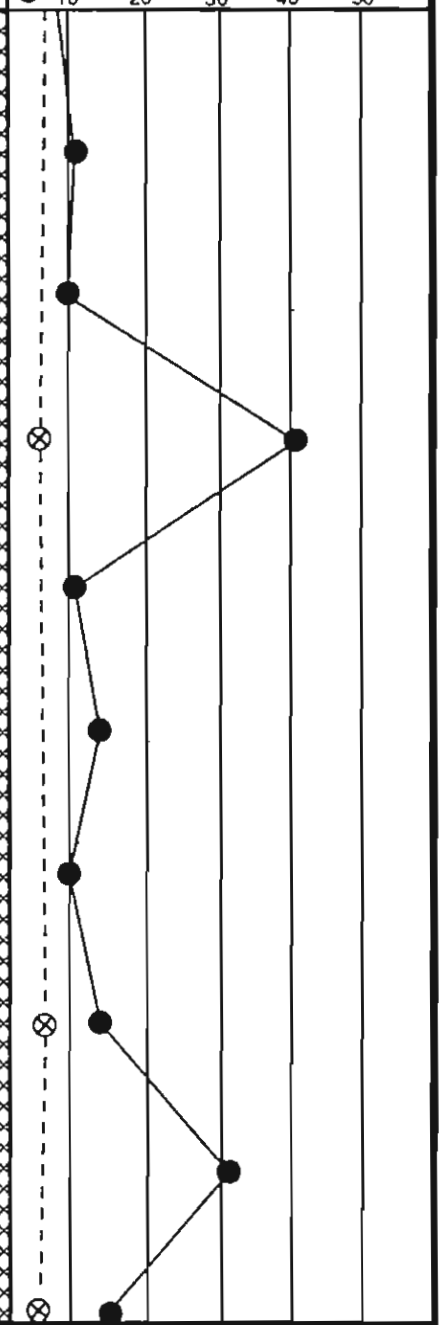
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
	S-10	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE COAL REFUSE, MOIST
50	S-11	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
55	S-12	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
60	S-13	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-14	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
70	S-15	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
75	S-16	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
80	S-17	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
85	S-18	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
	S-19	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED, MOIST

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

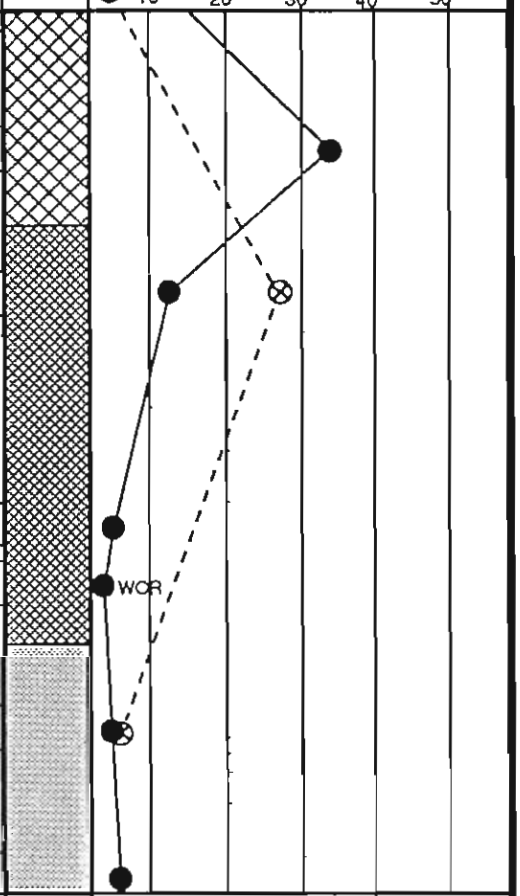
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
	S-19	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
95	S-20	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, WET TO MOIST
100	S-21	-	-	-	VERY STIFF, BLACK, FINE, COARSE, COAL REFUSE, MOIST
	ST-1	0	0	-	
105	ST-2	0	0	-	
	S-22	-	-	-	HARD, BLACK, FINE, COAL REFUSE, MOIST
110	S-23	-	-	-	MEDIUM STIFF, FINE, COAL REFUSE, WET
115	S-24	-	-	-	LOOSE, LIGHT BROWN, CLAYEY SAND, WET
120	S-25	-	-	-	STIFF, ORANGE AND RED, SANDY CLAY, MOIST
125					BOTTOM OF BORING AT 120.5 FEET
130					

PROFILE



AUGER REFUSAL AT 120.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

APPENDIX C

CALCULATION BRIEF

APPENDIX C
CALCULATION BRIEF
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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PROJECT NAME: U.S. STEEL BY: RMW DATE: 1/3/91

PROJECT NUMBER: 90-55-27 CHK: DMC DATE:3/15/91

DESCRIPTION: CONCORD PREPARATION PLANT
LONG TERM SLURRY DISPOSAL VOLUME ESTIMATES
REVISED BASED ON PREPARATION PLANT OUTPUT

ASSUMPTIONS:

Coal Preparation Plan Output:

Total Refuse = 337 Ton/Hour

Coarse Refuse = 303.3 Ton/Hour

Fine Refuse = 40.4 Ton/Hour

Average Plant Operation = 20 Hours/Day; 240 Days/Year

Estimated Years of Production = 20 Years

Unit Weight of Coarse Refuse = 110 lbs/cf

Unit Weight of Fine Refuse = 55 lbs/cf

ESTIMATED YEARLY PRODUCTION

	TONS	CUBIC YARDS
Total Refuse = 337 T/H * 20H/D * 240 D/YR =	1,617,600	
Coarse Refuse = 303.3 T/H * 20 H/D * 240 D/YR =	1,455,840	980,364
Fine Refuse = 40.4 T/H * 20 H/D * 240 D/YR =	193,920	261,172

ESTIMATED LIFE REFUSE PRODUCTION (20 YEARS)

	TONS	CUBIC YARDS
Total Refuse = 1,617,600 T/YR * 20YR =	32,352,000	
Total Coarse Refuse = 1,455,840 T/YR * 20 YR =	29,116,800	19,607,273
Total Fine Refuse = 193,920 T/YR * 20 YR =	3,878,400	5,223,434

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 4-25-92 CHKD BY: RMW DATE: 5/6/92
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION PMF Calculations

The purpose of the following calculations is to determine the total runoff from the PMP storm event for the existing and proposed impoundments

72 hr PMP = 50 in (Fig 22, p 52, Hydromet Report No 51)

Since the area contributing to each impoundment is largely the impoundment itself, it will be assumed all rainfall in the drainage area will runoff to the impoundments

Existing Impoundment

The existing impoundment will have no outlet structures for storm discharge, Therefore, the storage will be determined using the 2PMF criteria

2 PMF = 2 PMP rainfall = 2 × 50 in. = 100 in.

Stage 3

Drainage Area = 1,740,000 sf

Runoff = 1,740,000 sf × 100 in × $\frac{1 ft}{12 in}$ = 14,500,000 cf = 537,000 cy

Stage 2

Drainage Area = 1,642,000 sf

Runoff = 1,642,000 sf × $\frac{100 in.}{12 in/ft}$ = 13,680,000 cf = 507,000 cy

Stage 1

Drainage Area = 1,513,000 sf

Runoff = 1,513,000 sf × $\frac{100 in}{12 in/ft}$ = 12,610,000 cf = 467,000 cy

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: CMC DATE: 4-25-92 CHKD BY: RMW DATE: 5/6/92
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION PMF Calculations

Proposed Impoundment

Stage 2

Drainage Area = 950,000 ft²

Runoff = 950,000 ft² × $\frac{50 \text{ in}}{12 \text{ in/ft}}$ = 3,960,000 = 147,000 cy

Stage 3

Drainage Area = 1,081,000 ft²

Runoff = 1,081,000 ft² × $\frac{50 \text{ in}}{12 \text{ in/ft}}$ = 4,500,000 cf = 167,000 cy

Stage 4

Drainage Area = 1,216,000 ft²

Runoff = 1,216,000 ft² × $\frac{50 \text{ in}}{12 \text{ in/ft}}$ = 5,070,000 cf = 188,000 cy

PROJECT: U.S. STEEL - CONCORD **BY: DMC** **DATE: 3-28-91**

PROJECT NO.: 90-55-27 **CHK:** **DATE:**

DESCRIPTION: SCS Type II 6-Hour PMP Storm Distribution

6-Hour Rainfall= 31

Time (Hours)	0	1	2	3	4	5	6	7	8	9
%PMP	0.0	9.0	22.0	70.0	82.0	92.0	100.0	102.0	104.0	106.0
Cum. Rainfall (in)	0.0	2.8	6.8	21.7	25.4	28.5	31.0	31.6	32.2	32.9

Time (Hours)	10	11	12	13	14	15	16	17	18	19
%PMP	108.0	109.5	111.0	112.5	114.0	115.0	116.0	117.0	118.0	119.0
Cum. Rainfall (in)	33.5	33.9	34.4	34.9	35.3	35.7	36.0	36.3	36.6	36.9

Time (Hours)	20	21	22	23	24	25	26	27	28	29
%PMP	120.0	121.0	122.0	123.0	124.0	124.8	125.7	126.5	127.3	128.2
Cum. Rainfall (in)	37.2	37.5	37.8	38.1	38.4	38.7	39.0	39.2	39.5	39.7

Time (Hours)	30	31	32	33	34	35	36	37	38	39
%PMP	129.0	129.8	130.7	131.5	132.2	133.2	134.0	134.5	135.1	135.6
Cum. Rainfall (in)	40.0	40.2	40.5	40.8	41.0	41.3	41.5	41.7	41.9	42.0

Time (Hours)	40	41	42	43	44	45	46	47	48	49
%PMP	136.1	136.7	137.2	137.7	138.3	138.8	139.3	139.9	140.4	140.8
Cum. Rainfall (in)	42.2	42.4	42.5	42.7	42.9	43.0	43.2	43.4	43.5	43.6

Time (Hours)	50	51	52	53	54	55	56	57	58	59
%PMP	141.1	141.5	141.8	142.2	142.5	142.9	143.2	143.6	143.9	144.3
Cum. Rainfall (in)	43.7	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7

Time (Hours)	60	61	62	63	64	65	66	67	68	69
%PMP	144.6	144.8	145.1	145.3	145.5	145.8	146.0	146.2	146.5	146.7
Cum. Rainfall (in)	44.8	44.9	45.0	45.0	45.1	45.2	45.3	45.3	45.4	45.5

Time (Hours)	70	71	72
%PMP	146.9	147.2	147.4
Cum. Rainfall (in)	45.5	45.6	45.7

PROJECT U.S. Steel - Concord BY: DMC Date: 5-9-91

PROJECT No. 90-55-27 CHK: JDD Date: 5-23-91

Description Exsisting Impoundment Volumes

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change In Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
642	0	61,000				0	0
			699,500.0	8.0	5,596,000		
650	0	1,338,000				5,596,000	207,259
			1,475,500.0	30.0	44,265,000		
680	0	1,613,000				49,861,000	1,846,704
			1,674,500.0	10.0	16,745,000		
690	0	1,736,000				66,606,000	2,466,889

PROJECT U.S. Steel - Concord BY: DMC Date: 4-15-91

PROJECT No. 90-55-27 CHK: JDD Date: 5-23-91

Description Proposed Impoundment Volumes

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
558	0	0				0	0
			151,500.0	12.0	1,818,000		
570	0	303,000				1,818,000	67,333
			411,500.0	10.0	4,115,000		
580	0	520,000				5,933,000	219,741
			613,000.0	20.0	12,260,000		
600	0	706,000				18,193,000	673,815
			817,000.0	20.0	16,340,000		
620	0	928,000				34,533,000	1,279,000
			1,061,000.0	20.0	21,220,000		
640	0	1,194,000				55,753,000	2,064,926

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 1 Volumes

Stage 1 Substages	Volume (Cy)
1A	83,300
1B	957,000
1C	175,000
1D	112,000

Stage 1 total = 1,327,300 cy

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I- AREA 1A

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DM/ 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
660	7.78	3.11E+05	2.25E+05	10	2.25E+06	0.00E+00	0.00E+00
670	3.46	1.38E+05				2.25E+06	8.33E+04

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I - AREA 1B

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DMC 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
580	2.37	9.48E+04				0.00E+00	0.00E+00
			1.39E+05	20	2.78E+06		
600	4.57	1.83E+05				2.78E+06	1.03E+05
			1.80E+05	20	3.60E+06		
620	4.43	1.77E+05				6.38E+06	2.36E+05
			1.93E+05	20	3.86E+06		
640	5.21	2.08E+05				1.02E+07	3.79E+05
			4.04E+05	20	8.08E+06		
660	14.98	5.99E+05				1.83E+07	6.78E+05
			5.01E+05	15	7.52E+06		
675	10.09	4.04E+05				2.58E+07	9.57E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I - AREA 1C-1

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DMC 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
540	1.95	7.80E+04				0.00E+00	0.00E+00
			9.94E+04	20	1.99E+06		
560	3.02	1.21E+05				1.99E+06	7.36E+04
			1.36E+05	20	2.73E+06		
580	3.80	1.52E+05				4.72E+06	1.75E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I - 1D

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DML 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
580	1.21	4.84E+04				0.00E+00	0.00E+00
			4.44E+04	20	8.88E+05		
600	1.01	4.04E+04				8.88E+05	3.29E+04
			4.72E+04	20	9.44E+05		
620	1.35	5.40E+04				1.83E+06	6.79E+04
			5.96E+04	20	1.19E+06		
640	1.63	6.52E+04				3.02E+06	1.12E+05

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 2 volumes

Stage 2 Substages	Volume to Construct from Current Topo (CY)	Previous Stages Volume (CY)	Stage 2 Volume
2A	173,000	83,300 (1A)	89,700
2B	2,780,000	1,069,000 (1B, 1D)	1,711,000
2C	432,000	175,000 (1C)	257,000
2D	322,000	–	322,000

Stage 2 total = 2,379,700 CY

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE II - 2A

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
660	8.43	3.37E+05				0.00E+00	0.00E+00
			2.34E+05	20	4.68E+06		
680	3.27	1.31E+05				4.68E+06	1.73E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE II - 2B

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
600	20.63	8.25E+05				0.00E+00	0.00E+00
			8.46E+05	20	1.69E+07		
620	21.65	8.66E+05				1.69E+07	6.26E+05
			8.71E+05	20	1.74E+07		
640	21.90	8.76E+05				3.43E+07	1.27E+06
			9.43E+05	20	1.89E+07		
660	25.23	1.01E+06				5.32E+07	1.97E+06
			7.27E+05	30	2.18E+07		
690	11.13	4.45E+05				7.50E+07	2.78E+06

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD STAGE II - 2C *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
540	2.02	8.08E+04				0.00E+00	0.00E+00
			1.05E+05	20	2.09E+06		
560	3.21	1.28E+05				2.09E+06	7.75E+04
			1.37E+05	20	2.73E+06		
580	3.62	1.45E+05				4.82E+06	1.79E+05
			1.42E+05	20	2.85E+06		
600	3.50	1.40E+05				7.67E+06	2.84E+05
			1.29E+05	20	2.58E+06		
620	2.96	1.18E+05				1.03E+07	3.80E+05
			1.41E+05	10	1.41E+06		
630	4.08	1.63E+05				1.17E+07	4.32E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD STAGE II - 2D (DIKE) *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
570	11.86	4.74E+05				0.00E+00	0.00E+00
			4.11E+05	10	4.11E+06		
580	8.71	3.48E+05				4.11E+06	1.52E+05
			2.29E+05	20	4.59E+06		
600	2.76	1.10E+05				8.70E+06	3.22E+05

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 3 Volumes

Stage 3 Substages	Volume to Construct from Current Topo (c.y.)	Previous Stages Volume (c.y.)	Stage 3 Volume (c.y.)
3A	1,170,000	173,000 (14.C4)	997,000
3B	3,120,000	2,780,000 (18.25)	340,000
3C	775,000	322,000 (20')	453,000
3D	669,000	-	668,000

Stage 3 total = 2,458,000 cy

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE III - 3A

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
660	32.35	1.29E+06				0.00E+00	0.00E+00
			1.05E+06	30	3.16E+07		
690	20.37	8.15E+05				3.16E+07	1.17E+06

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE III - 3B

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
600	19.22	7.69E+05				0.00E+00	0.00E+00
			8.28E+05	20	1.66E+07		
620	22.20	8.88E+05				1.66E+07	6.14E+05
			8.74E+05	40	3.50E+07		
660	21.50	8.60E+05				5.15E+07	1.91E+06
			7.77E+05	30	2.33E+07		
690	17.36	6.94E+05				7.48E+07	2.77E+06
			4.67E+05	20	9.34E+06		
710	5.98	2.39E+05				8.42E+07	3.12E+06

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD STAGE III - 3C *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
570	17.30	6.92E+05				0.00E+00	0.00E+00
			6.12E+05	10	6.12E+06		
580	13.31	5.32E+05				6.12E+06	2.27E+05
			4.77E+05	20	9.54E+06		
600	10.54	4.22E+05				1.57E+07	5.80E+05
			2.63E+05	20	5.26E+06		
620	2.60	1.04E+05				2.09E+07	7.75E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD
STAGE III - 3D *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL (CU.YD.)
640	27.40	1.10E+06	9.01E+05	20	1.80E+07	0.00E+00	0.00E+00
660	17.67	7.07E+05				1.80E+07	6.68E+05

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 4 Volumes

Stage 4 Substages	Volume to Construct from Current Topo (cy)	Previous Stages Volume (cy	Stage 4 Volume (cy)
4A	–	–	620,000
4B	1,570,000	775,000 (20,3C)	795,000
4C	–	–	403,000
4D	–	–	871,000

Stage 4 total = 2,689,000 cy

PROJECT U.S. Steel - Concord BY: DMC Date: 5-25-91

PROJECT No. 90-55-27 CHK: Date:

Description Stage 4A-Close exsisting Impoundment

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevetion (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
680	0	1,613,000				0	0
			1,674,500.0	10.0	16,745,000		
690	0	1,736,000				16,745,000	620,185

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE IV - 48

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
570	23.89	9.56E+05				0.00E+00	0.00E+00
			9.07E+05	10	9.07E+06		
580	21.44	8.58E+05				9.07E+06	3.36E+05
			7.82E+05	20	1.56E+07		
600	17.67	7.07E+05				2.47E+07	9.15E+05
			5.76E+05	20	1.15E+07		
620	11.14	4.46E+05				3.62E+07	1.34E+06
			3.07E+05	20	6.15E+06		
640	4.23	1.69E+05				4.24E+07	1.57E+06

PROJECT U.S. Steel - Concord BY: DMC Date: 5-25-91

PROJECT No. 90-55-27 CHK: Date:

Description Stage 4C - East Buttress to El. 690

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
630	0	148,000				0	0
			163,000.0	30.0	4,890,000		
660	0	178,000				4,890,000	181,111
			199,500.0	30.0	5,985,000		
690	0	221,000				10,875,000	402,778

PROJECT U.S. Steel - Concord BY: DMC Date: 5-25-91

PROJECT No. 90-55-27 CHK: Date:

Description Stage 4D - South Area to El. 690

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
660	0	875,000				0	0
			783,500.0	30.0	23,505,000		
690	0	692,000				23,505,000	870,556

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 5 Volumes

Stage 5 Substages	Volume (cy)
5A	3,896,000
5B	7,486,000

Stage 5 total = 11,382,000 cy

Stage 5 East Area

PROJECT: U.S.Steel Mining Co.
Concord Disposal Area
PROJECT NO.: 90-55-27

BY: DMC Date: 3-22-91
CHK: RMW Date: 4/6/91

Description: Stage 5A East Area to 690

Elevation (Ft.)	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
540	81,120				0	0
		200,830	40.0	8,033,200		
580	320,540				8,033,200	297,526
		691,611	50.0	34,580,550		
630	1,062,682				42,613,750	1,578,287
		1,043,152	60.0	62,589,120		
690	1,023,622				105,202,870	3,896,403

Stage 5B

PROJECT: U.S.Steel Mining Co. Concord Disposal Area
PROJECT NO.: 90-55-27

BY: DMC Date: 3-22-91
CHK: RMW Date: 6/6/91

Description: Stage 5B, Entire Pile to 730

Elevation (Ft.)	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
690	5,515,530				0	0
		5,053,010	40.0	202,120,380		
730	4,590,489				202,120,380	7,485,940

PROJECT NAME: U.S. STEEL - CONCORD BY: DMC Date: 5-5-91 5-2-92

PROJECT NUMBER: 90-55-27 CHK: [illegible] Date: 5/12/92

DESCRIPTION: CONSTRUCTION STAGING VOLUME SUMMARY

ASSUMPTIONS:

		TONS	CUBIC YARDS
Total Annual Refuse Production =		1,617,600	
	Coarse Refuse=	1,455,840	980,364
	Fine Refuse=	193,920	261,172

CONSTRUCTION STAGE	YEAR	COARSE REFUSE USED IN CONSTRUCTION (CY)	FINE REFUSE DISPOSAL CAPACITY (CY)	REFUSE PRODUCTION COARSE (CY)	REFUSE PRODUCTION FINES (CY)
	1.00			980,364	261,172
Stage 1					
1A - Exist. Imp. to El. 670		83,300	669,000		
1B - North Buttress to El. 675		957,000			
1C - East Buttress to El. 580		175,000			
1D - Northwest Embankment		112,000			
Stage 1 Sub Total	1.35	1,327,300	669,000	1,327,300	353,597
Cumulative Total	1.35	1,327,300	669,000	1,327,300	353,597
Stage 2					
2A - Exist. Imp. to El. 680		89,700	507,000		
2B - N. Buttress to El. 690/660		1,711,000			
2C - East Berm to El. 630		257,000			
2D - Dike Embank. to El. 600		322,000	459,000		
Stage 2 Sub Total	2.43	2,379,700	966,000	2,379,700	633,959
Cumulative Total	3.78	3,707,000	1,635,000	3,707,000	987,556
Stage 3					
3A - Exist. Imp. to El. 690		997,000	568,000		
3B - N. Buttress to El. 710/690		34,000			
3C - Dike Embank. to El. 620		45,300	562,000		
3D - South Area to El. 660		668,000			
Stage 3 Sub Total	1.78	1,744,300	1,130,000	1,744,300	464,687
Cumulative Total	5.56	5,451,300	2,765,000	5,451,300	1,452,243
Stage 4					
4A - Dike Embank. to El. 640		795,000			
4B - Close Exist. Imp.		620,000	738,000		
4C - East Buttress to El. 690		403,000			
4D - South Area to El. 690		871,000			
Stage 4 Sub Total	2.74	2,689,000	738,000	2,689,000	716,358
Cumulative Total	8.30	8,140,300	3,503,000	8,140,300	2,168,601
Stage 5					
5A - East Area to El. 690		3,896,403			
5B - Main Area to El. 730		7,485,950			
Stage 5 Sub Total	11.61	11,382,353	0	11,382,353	3,032,294
Cumulative Total (Fine)	13.41		3,503,000		
Cumulative Total (Coarse)	19.91	19,522,653		19,522,653	5,200,895
Final Total (Fine)	13.41		3,503,000		
Final Total (Coarse)	19.91	19,522,653		19,522,653	5,200,895

Revised 5/92

PROJECT: U.S. STEEL - CONCORD BY: DMC DATE: 4-17-91 5-2-92

PROJECT NO.: 90-55-27 CHK: RMW DATE: 5/12/92

DESCRIPTION: Impoundment Fine Elevations

Existing Impoundment

Stage (end)	Year	Impoudment Volume (cy)	Cumulative Volume (cy)	Elevation	
	0.00	000	000	642.00	
	0.79	207,259	207,259	650.00	
	1.21	316,555	316,555	652.00	
	1.63	425,851	425,851	654.00	
	2.05	535,148	535,148	656.00	
1	2.47	644,444	644,444	658.00	
	2.89	753,740	753,740	660.00	
	3.30	863,016	863,016	662.00	
	3.72	972,293	972,293	664.00	
	4.14	1,081,569	1,081,569	666.00	
2	4.35	1,136,207	1,136,207	667.00	
	4.56	1,190,846	1,190,846	668.00	
	4.98	1,300,122	1,300,122	670.00	
	5.40	1,409,438	1,409,438	672.00	
	5.82	1,518,755	1,518,755	674.00	
	6.23	1,628,071	1,628,071	676.00	
3	6.65	1,737,388	1,737,388	678.00	Max. Elev.
		1,792,046		679.00	
		1,846,704	-	680.00	
		1,970,741	-	682.00	
		2,094,778	-	684.00	
		2,218,815	-	686.00	
		2,342,852	-	688.00	
		2,466,889	-	690.00	

New Impoundment

Stage	Year	Impoudment Volume (cy)	Cumulative Volume (cy)	Elevation	
	6.65	0	1,737,388	558.00	
	6.91	67,333	1,804,721	570.00	
	7.20	143,537	1,880,925	575.00	
	7.49	219,741	1,957,129	580.00	
	7.93	333,260	2,070,648	585.00	
	8.36	446,778	2,184,166	590.00	
2	8.45	469,482	2,206,870	591.00	
	8.80	560,297	2,297,685	595.00	
	9.23	673,815	2,411,203	600.00	
	9.81	825,111	2,562,499	605.00	
	10.39	976,408	2,713,796	610.00	
3	10.51	1,006,667	2,744,055	611.00	
	10.97	1,127,704	2,865,092	615.00	
	11.55	1,279,000	3,016,388	620.00	
	12.30	1,475,482	3,212,870	625.00	
	13.05	1,671,963	3,409,351	630.00	
4	13.35	1,750,556	3,487,944	632.00	Max. Elev.
		1,868,445	-	635.00	
		2,064,926	-	640.00	

Revised 5/92

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMC DATE: 4-25-92 CHKD BY: RMW DATE: 5/6/92
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 1 OF 1
DESCRIPTION Maximum Fine Refuse Elevations

Existing Impoundment

Stage	Crest	Crest-Freeboard	Volume (1)	Volume-Storage (2)	Max Fine
1	670	667	1,136,208	669,000	658 ±
2	680	677	1,682,730	1,176,000	667 ±
3	690	687	2,280,834	1,749,000	678 ±

Proposed Impoundment

2	600	597	605,704	459,000	591 ±
3	620	617	1,188,222	1,021,000	611 ±
4	640	637	1,947,037	1,759,000	632 ±

(1) Impoundment Volumes were intepolated from the table on p C-35

(2) Storage Volumes were determine in PMF calcs

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-2-92 CHKD BY: RMV DATE: 5/6/92
PROJECT NAME: Carr-rd
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION Storm Evacuation Pump Capacity

The purpose of this calculation is to determine the capacity of the pump needed to evacuate PMF design storms from both the existing and proposed impoundments.

Existing Impoundment

Since the existing impoundment provides 2 PMF of flood storage, it is required to evacuate 90% of the PMF in 30 days.

The maximum PMF runoff occurs during Stage 3

Runoff from 1 PMF = 7,250,000 cf

$$\text{Pump Capacity} = \frac{(7{,}250{,}000 \text{ cf})(7.48 \text{ gal/cf})(0.9)}{(30 \text{ days})(24 \text{ hr/day})(60 \text{ min/hr})}$$

$$= \underline{1130 \text{ gpm}}$$

Proposed Impoundment

Since the proposed impoundment provides only 1 PMF of flood storage, it will be required to evacuate 90% of the PMF in 10 days

The maximum PMF runoff occurs during Stages 4 and 5

Runoff from 1 PMF = 5,070,000 cf

$$\text{Pump Capacity} = \frac{(5{,}070{,}000 \text{ cf})(7.48 \text{ gal/cf})(0.9)}{(10 \text{ days})(24 \text{ hr/day})(60 \text{ min/hr})}$$

$$= \underline{2370 \text{ gpm}}$$

BY: ADW DATE: 5-31-91
CHK: TMC DATE: 6-10-91

STAGE 5 (FINAL) SURFACE DRAINAGE

The purpose of the following calculation is to design surface drainage facilities for the subject report. The surface drainage facilities are sized for the 100 year, 24 hour storm event with freeboard (where applicable).

The following data was used in the surface drainage design:

- The 100 year, 24 hour rainfall for Jefferson County, Alabama is 8.5 inches. (from Figure B-8, Soil Conservation Service Technical Release 55)
- The hydrologic soil group chosen for the cover soil is type "B" since the on-site soil would be texturally classified as a loam or sandy loam. (from Appendix A, Soil Conservation Service Technical Release 55)
- The Curve Number chosen is 75 since the site will be vegetated (grass covered open space, poor to fair condition) when permanent slopes are achieved. (from Table 2-2a, Soil Conservation Service Technical Release 55)

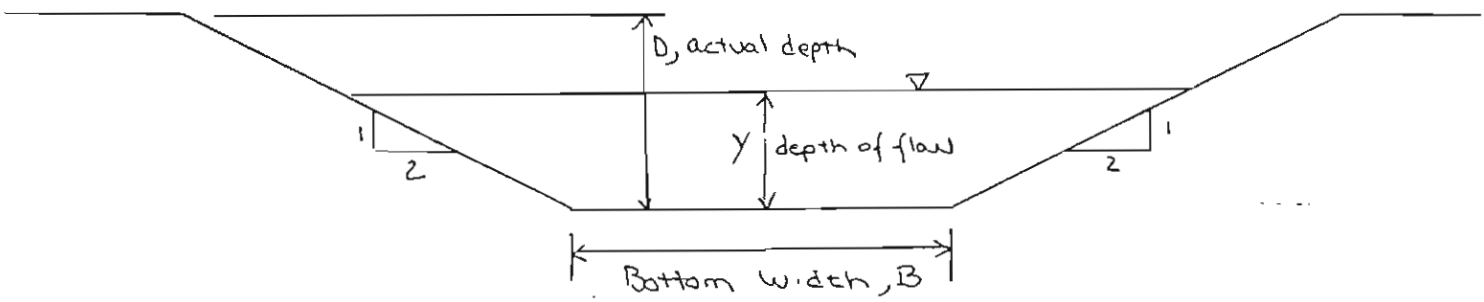
Peak flows were determined using the Soil Conservation Service Tabular Hydrograph Method

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DML DATE: 5-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 2 OF 27
DESCRIPTION Stage 5 (final) surface drainage

Typical Trapezoidal Channel

These channel dimensions are typical for perimeter and drop over ditches.



Freeboard

Ditches are designed with at least 0.5 ft. of freeboard.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/5/91 CHKD BY: DWL DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 3 OF 17

DESCRIPTION Stage 5 (final) surface drainage

Haul Road Ditch : This is a typical design for the main haul road ditches in all stages. By inspection, the maximum area draining to a haul road is 36.0 acres

INTERMEDIATE HAUL ROAD

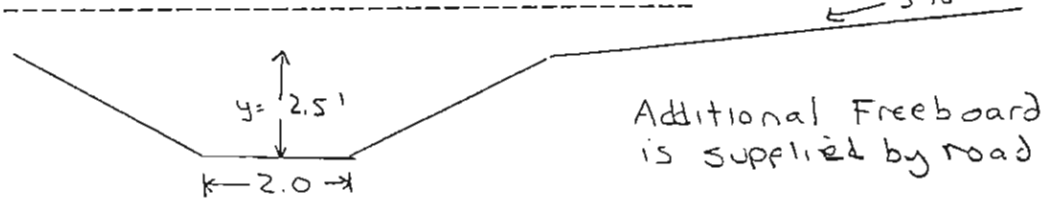
)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
HAUL ROAD	36.00	75.0	0.20	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 36.00 acres or 0.05625 sq.mi
Peak discharge = 175 cfs

SOLUTION FOR MANNING'S EQUATION: HAUL ROAD DITCH : RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.08
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	175.00
VELOCITY (fps)	10.97
DEPTH OF FLOW (ft)	2.37
FLOW AREA (sf)	15.96
WETTED PERIMETER (ft)	12.59
HYDRAULIC RADIUS (ft)	1.27
ACTUAL MANNINGS N	.045
D50 RIPRAP SIZE (in)	8.00



Additional Freeboard is supplied by road slope.

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked DWL Date 6/6/91

Circle one: Present (Developed) E. Intermediate Haul Road

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)		refuse		
2. Manning's roughness coeff., n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	4.2		
5. Land slope, s	ft/ft	0.005		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.07	+	= 0.07

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)		unpaved		
8. Flow length, L	ft	300		
9. Watercourse slope, s	ft/ft	0.005		
10. Average velocity, V (figure 3-1)	ft/s	1.2		
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.07	+	= 0.07

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	10.97		
18. Flow length, L	ft	2000		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.05	+	= 0.05

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.19

use 0.2

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/6/91 CHKD BY: DMC DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 5 OF 27

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch A-1 : Ditch starts at uppermost point of ditch (along northeast haulroad) and terminates at the intersection with the main haul road ditch (west side of site)

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH A-1

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH A-1	6.20	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 6.20 acres or 0.00969 sq.mi
Peak discharge = 35 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH A-1 : GRASS LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.01
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	35.00
VELOCITY (fps)	3.66
DEPTH OF FLOW (ft)	1.74
FLOW AREA (sf)	9.55
WETTED PERIMETER (ft)	9.79
HYDRAULIC RADIUS (ft)	.98

The depth of the chamel = 1.74 + 0.5' = 2.24'
Freeboard = 0.76 ft

Actual Depth = 2.5'

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By AOW Date 6/6/91

Location 90-55-27 Checked DM/ Date 6-10-91

Circle one: Present (Developed) Perimeter Ditch A-1

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr			

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr			

Channel flow		Segment ID	Along Northeast Railroad	A-1
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		10.97	3.66
18. Flow length, L	ft		1200	800
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.03 +	0.06 = 0.09

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DMC DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 6 OF 22

DESCRIPTION Stage 5 (final) Surface Drainage

Perimeter Ditch A-2 : Ditch starts at the culvert under the haul road and empties into the existing sediment pond

Ditch A-2 carries the combined peak flow from Ditch A-1 and the Haul Road Ditch.

The combined peak flow from Ditch A-1 and the Haul Road Ditch is 203 cfs. See below:

File Summary for Composite Hydrograph

Time (hrs)	(A-1) PERDITCH (cfs)	(HAUL ROAD) INTHAUL (cfs)	(A-2) PER-A2 (Total)
11.00	2.0	8.0	10.0
11.10	2.0	9.0	11.0
11.20	2.0	10.0	12.0
11.30	2.0	11.0	13.0
11.40	2.0	12.0	14.0
11.50	3.0	14.0	17.0
11.60	3.0	15.0	18.0
11.70	5.0	22.0	27.0
11.80	7.0	30.0	37.0
11.90	9.0	37.0	46.0
12.00	13.0	54.0	67.0
12.10	23.0	80.0	103.0
12.20	35.0	139.0	174.0
12.30	28.0	175.0	203.0
12.40	18.0	149.0	167.0
12.50	14.0	111.0	125.0
12.60	10.0	84.0	94.0

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DML DATE: 6-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 7 OF 12
DESCRIPTION Stage 5 (final) Surface drainag

Perimeter Ditch A-2 (cont.)

The peak flow through Perimeter Ditch A-2 = 203cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH A-2 ; RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	

SLOPE (ft/ft)	.03
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	3.00
OUTPUT VALUES	

FLOWRATE (cfs)	203.00
VELOCITY (fps)	8.14
DEPTH OF FLOW (ft)	2.86
FLOW AREA (sf)	24.94
WETTED PERIMETER (ft)	15.79
HYDRAULIC RADIUS (ft)	1.58
ACTUAL MANNINGS N	.043
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 2.86' + 0.5 = 3.36'

Actual Depth = 3.5 ft

Freeboard = 0.64 ft.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/5/91 CHKD BY: JMC DATE: 6-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 8 OF ??
DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch B

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH B

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH B	9.40	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 9.40 acres or 0.01469 sq.mi
Peak discharge = 53 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH B : RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.03
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	4.00
OUTPUT VALUES	
FLOWRATE (cfs)	53.00
VELOCITY (fps)	5.08
DEPTH OF FLOW (ft)	1.49
FLOW AREA (sf)	10.43
WETTED PERIMETER (ft)	10.68
HYDRAULIC RADIUS (ft)	.98
ACTUAL MANNINGS N	.05
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 1.49 + 0.5 = 1.99 ft Actual Depth = 2.0'
Freeboard = 0.51 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By AOW Date 6/6/91

Location 90-55-27 Checked CMC Date 6.10.91

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea

Perimeter Ditch B

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

		Segment ID		
Sheet flow (Applicable to T_c only)				
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=
Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=
Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.08		
18. Flow length, L	ft	1900		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.1	+	= 0.1
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 5/6/91 CHKD BY: DMA DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 10 OF 22

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch C

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH C

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/P input/used
DITCH C	5.00	75.0	0.10	0.00	8.50	5.50	.08 .10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 5.00 acres or 0.00781 sq.mi
Peak discharge = 28 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH C ; RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.2
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	28.00
VELOCITY (fps)	7.96
DEPTH OF FLOW (ft)	.92
FLOW AREA (sf)	3.52
WETTED PERIMETER (ft)	6.10
HYDRAULIC RADIUS (ft)	.58
ACTUAL MANNINGS N	.058
D50 RIPRAP SIZE (in)	9.00

The depth of the channel = 0.92' + 0.5' = 1.42'

Actual Depth = 1.5 ft Freeboard = 0.58 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked TJM Date 6-10-91

Circle one: Present (Developed) Perimeter Ditch C

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1)				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		7.96	
18. Flow length, L	ft		600	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.02	= 0.02

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AJW DATE: 6/5/91 CHKD BY: DMC DATE: 6-16-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 12 OF 27

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch D

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH D

>>>> Input Parameters Used to Compute Hydrograph <<<<

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH D	7.40	75.0	0.20	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 7.40 acres or 0.01156 sq.mi
Peak discharge = 36 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH D : GRASS LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.01
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	36.00
VELOCITY (fps)	3.69
DEPTH OF FLOW (ft)	1.76
FLOW AREA (sf)	9.75
WETTED PERIMETER (ft)	9.89
HYDRAULIC RADIUS (ft)	.99

The depth of the chamel = 1.76' + 0.5' = 2.26 ft

Actual Depth: 2.5 ft Freeboard: 0.74 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked DML Date 6-10-91

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea Perimeter Ditch D

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	3.69		
18. Flow length, L	ft	3000		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.2	+	= 0.2
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.2

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 5/6/91 CHKD BY: DMC DATE: 5-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 14 OF 77
DESCRIPTION Stage 5 (final) Surface Drainage

Drop over Ditch 1

Watershed in TypeIII 24hr Storm Hydrograph

DROP OVER DITCH 1

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DROP OVER #1	47.60	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 47.60 acres or 0.07437 sq.mi
Peak discharge = 271 cfs

SOLUTION FOR MANNING'S EQUATION: DROP OVER DITCH 1 ; RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.1
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	5.00
OUTPUT VALUES	
FLOWRATE (cfs)	271.00
VELOCITY (fps)	13.07
DEPTH OF FLOW (ft)	2.20
FLOW AREA (sf)	20.73
WETTED PERIMETER (ft)	14.85
HYDRAULIC RADIUS (ft)	1.40
ACTUAL MANNINGS N	.045
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 2.2' + 0.5' = 2.7'
Actual Depth = 3.0ft. Freeboard = 0.8 ft.

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By AOW Date 6/6/91

Location 90-55-27 Checked CML Date 6-10-91

Circle one: Present (Developed) Drop over Ditch 1

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID	Bench Gutter	Channel	
12. Cross sectional flow area, a	ft^2				
13. Wetted perimeter, p_w	ft				
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft				
15. Channel slope, s	ft/ft				
16. Manning's roughness coeff., n					
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		4.36	13.07	
18. Flow length, L	ft		1700	900	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.1	+ 0.019	= 0.12
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr				Use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/6/91 CHKD BY: DML DATE: 6-29-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 16 OF 22

DESCRIPTION Stage 5 (final) Surface Drainage

Drop Over Ditch 2

Watershed in TypeIII 24hr Storm Hydrograph

DROP OVER DITCH 2

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used
DROP OVER #2	41.50	75.0	0.10	0.00	8.50	5.50	.08 .10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 41.50 acres or 0.06484 sq.mi
Peak discharge = 236 cfs

SOLUTION FOR MANNING'S EQUATION: DROP OVER DITCH 2 : RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.3
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	8.00
OUTPUT VALUES	
FLOWRATE (cfs)	236.00
VELOCITY (fps)	16.32
DEPTH OF FLOW (ft)	1.35
FLOW AREA (sf)	14.46
WETTED PERIMETER (ft)	14.04
HYDRAULIC RADIUS (ft)	1.03
ACTUAL MANNINGS N	.051
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 1.35' + 0.5' = 1.85'
Actual depth = 2.0 ft. Freeboard = 0.65 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked DML Date 6-10-91

Circle one: Present (Developed) Drop over Ditch 2

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID	Bench Gutter	Channel
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		4.36	16.32
18. Flow length, L	ft		1500	600
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.095 + 0.01	= 0.105

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr Use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DML DATE: 6-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 19 OF 27
DESCRIPTION Stage 5 (final) Surface Drainage

Drop Over Ditch 3

Watershed in TypeIII 24hr Storm Hydrograph

DROP OVER DITCH 3

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/P input/used	
DROP OVER #3	45.90	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 45.90 acres or 0.07172 sq.mi
Peak discharge = 261 cfs

SOLULTION FOR MANNING'S EQUATION: DROP OVER DITCH 3

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.4
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	10.00
OUTPUT VALUES	
FLOWRATE (cfs)	261.00
VELOCITY (fps)	16.41
DEPTH OF FLOW (ft)	1.27
FLOW AREA (sf)	15.91
WETTED PERIMETER (ft)	15.67
HYDRAULIC RADIUS (ft)	1.01
ACTUAL MANNINGS N	.058
D50 RIPRAP SIZE	10.00

The depth of the channel = 1.27' + 0.5' = 1.77'
Actual Depth = 2.0ft Freeboard = 0.73 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/5/91

Location 90-55-27 Checked DMC Date 6-10-91

Circle one: Present (Developed) Drop over D.Pt in 3

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	13.58		
18. Flow length, L	ft	500		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.009	+	= 0.009
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ACW DATE: 6/6/91 CHKD BY: DMC DATE: 6/10/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 70 OF 77
DESCRIPTION Stage 5 (final) Surface drainage

Final Bench Gutters

This is a typical design for all the bench gutters. By inspection, the maximum area draining to a bench gutter is 23.7 acres. The bench will be vegetated, manning's n = 0.4. The bench will be 20 ft wide, with a 3% slope adjoining a V-shaped ditch. See diagram below:

Freeboard will be supplied by the bench slope.

GRASS LINED PERMANENT BENCH

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
BENCH	23.70	75.0	0.75	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 23.70 acres or 0.03703 sq.mi
Peak discharge = 70 cfs

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DWL DATE: 6-11-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 31 OF 32

DESCRIPTION Stage 5 (final) surface drainage

Final Bench Gutters (continued)

SOLUTION FOR MANNING'S EQUATION: PERMANENT GRASSED BENCHES

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	

SLOPE (ft/ft)	.01
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	0.00
OUTPUT VALUES	

FLOWRATE (cfs)	70.00
VELOCITY (fps)	4.36
DEPTH OF FLOW (ft)	2.83
FLOW AREA (sf)	16.05
WETTED PERIMETER (ft)	12.67
HYDRAULIC RADIUS (ft)	1.27

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 70-55-27 Checked TJM/ Date 6-10-91

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea

Permanent Bench with Maximum Tributary Area

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)	Segment ID			
1. Surface description (table 3-1)		Short Grass		
2. Manning's roughness coeff., n (table 3-1) ..		0.15		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	4.2		
5. Land slope, s	ft/ft	0.005		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.60	+	= 0.60

Shallow concentrated flow	Segment ID			
7. Surface description (paved or unpaved)		Short Grass		
8. Flow length, L	ft	430	80	
9. Watercourse slope, s	ft/ft	0.005	0.40	
10. Average velocity, V (figure 3-1)	ft/s	1.2	10.0	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.01	+ 0.002	= 0.012

Channel flow	Segment ID			
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.36		
18. Flow length, L	ft	1600		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.1	+	= 0.1

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.7

used .75

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-11-91 CHKD BY: AOW DATE: 6-13-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION Stage 5 (Final) surface drainage

Culverts

Culverts are required to carry storm water flow at 2 points along Perimeter channel A-2. First, at the start of the channel under the main haul road, and second, under the northeast site access road. Design flows and slopes are the same as ditch A-2 (203 cfs and 3%). Culverts are designed using procedures in "Hydraulic Design of Highway Culverts", USDOT, Report No. FHWA-IP-85-15

PROJECT: Concord 90-55-27

STATION: _____

SHEET _____ OF _____

CULVERT DESIGN FORM

DESIGNER / DATE: DMC / 6-11-91

REVIEWER / DATE: AD(a) / 6/13/91

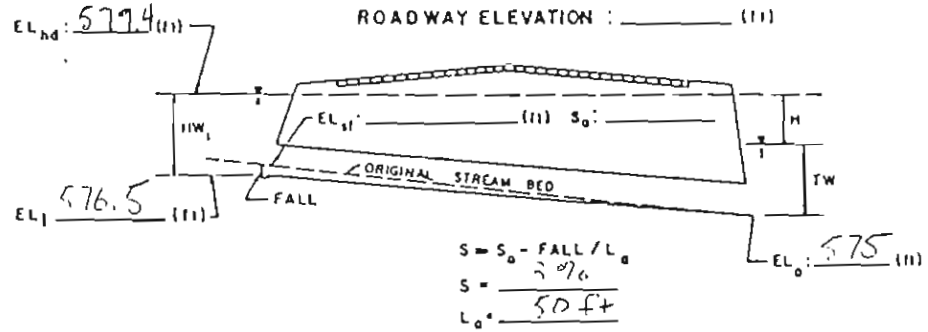
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD: Tabular hydrograph
- ☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: 3%
- ☐ CHANNEL SHAPE: Trapezoidal
- ☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
100	203	2.9



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_hi (4)	OUTLET CONTROL TW (5)	d_c	(d_c+D)/2	h_o (6)	k_e	H (7)	EL_ho (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
RCCMP 57x38 Arch (3 on.)	203	68	1.1	3.5	0	580	2.9	1.7	2.5	2.9	0.9	1.6	579.5	579.0		

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW /D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) EL_{hi} = HW_i + EL_i (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29n^2 L)/R^{1.33}\right] v^2/2g$

(8) EL_{ho} = EL_o + H + h_o

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f. CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho. HEADWATER IN OUTLET CONTROL
- i. INLET CONTROL SECTION
- o. OUTLET
- sf. STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 57x38

SHAPE: Arch

MATERIAL: CMP n 0.024

ENTRANCE: Projected

57x38 Equiv. diam = 48"

Area = $\pi r^2 = 12.6$ ft^2

CHART 43

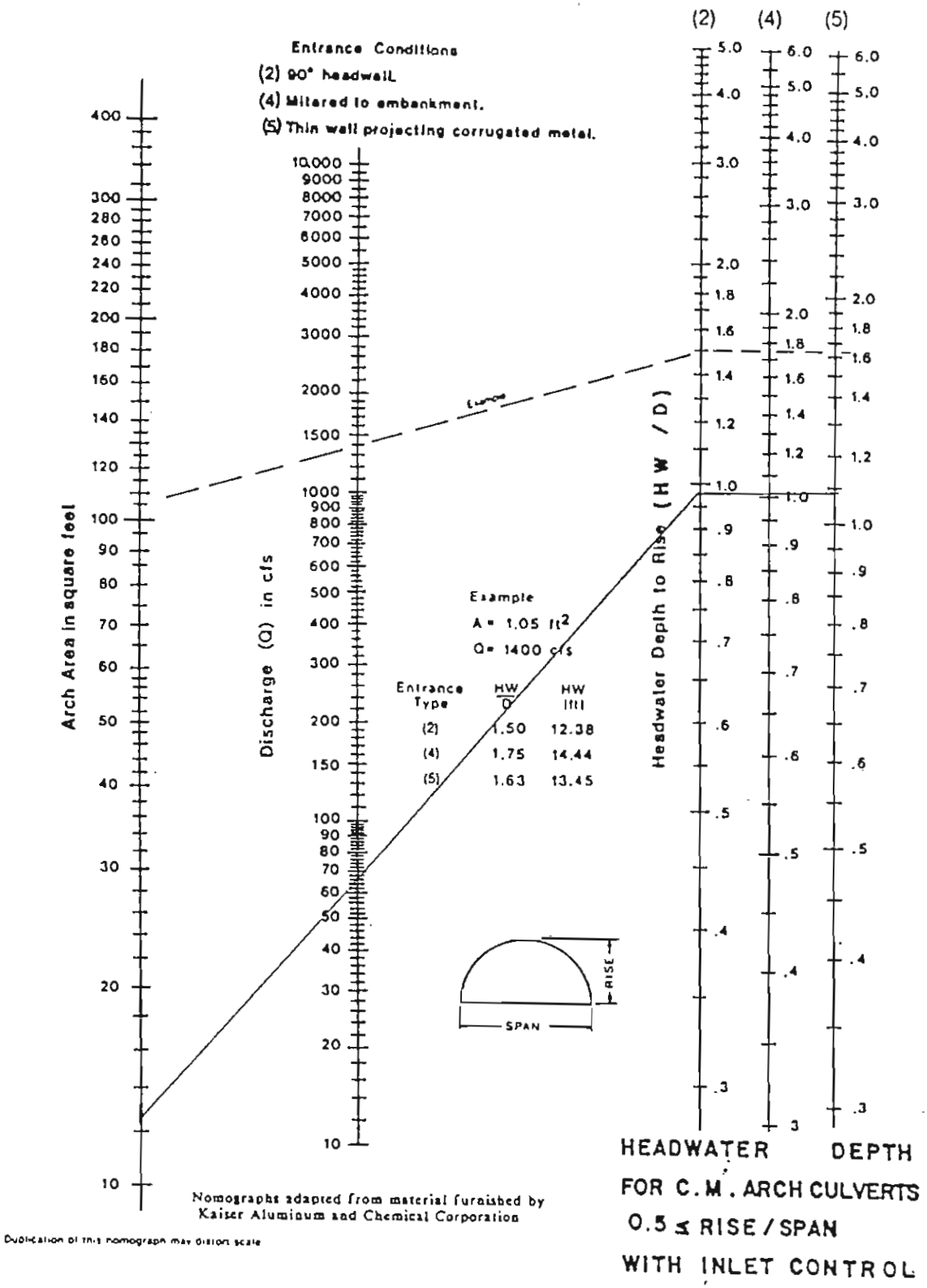
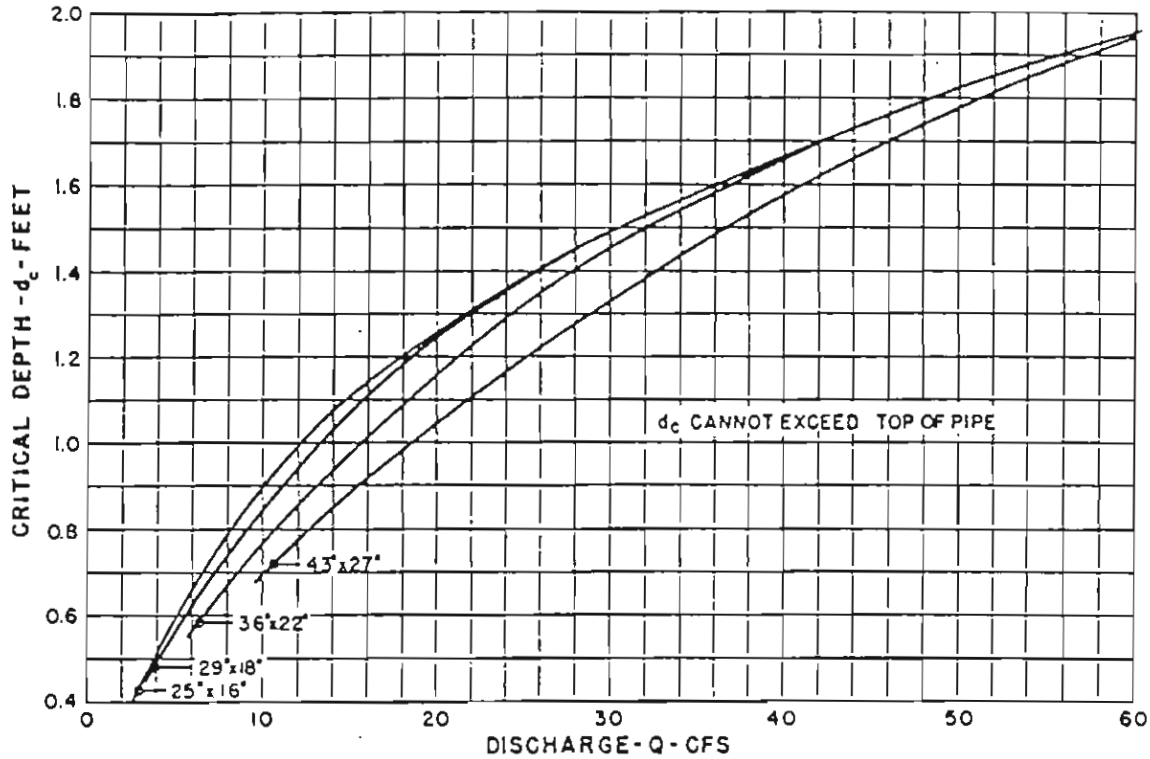
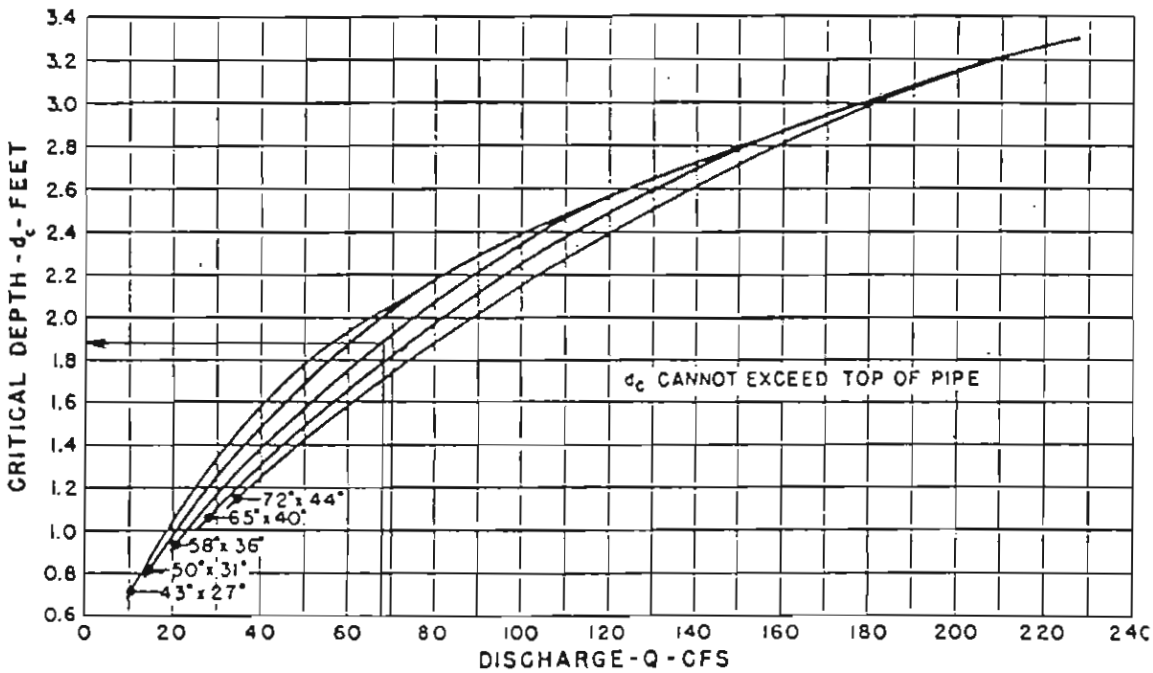

Entrance Conditions
(2) 90° headwall.
(4) Mitered to embankment.
(5) Thin wall projecting corrugated metal.
Arch Area in square feet
Discharge (Q) in cfs
Headwater Depth to Rise (H W / D)
(2)
(4)
(5)
Example
A = 1.05 ft²
Q = 1400 cfs
Entrance Type
HW/D
HW
(2) 1.50 12.38
(4) 1.75 14.44
(5) 1.63 13.45
RISE
SPAN
HEADWATER DEPTH
FOR C.M. ARCH CULVERTS
0.5 ≤ RISE / SPAN
WITH INLET CONTROL
Nomographs adapted from material furnished by
Kaiser Aluminum and Chemical Corporation
Duplication of this nomograph may distort scale

CHART 37



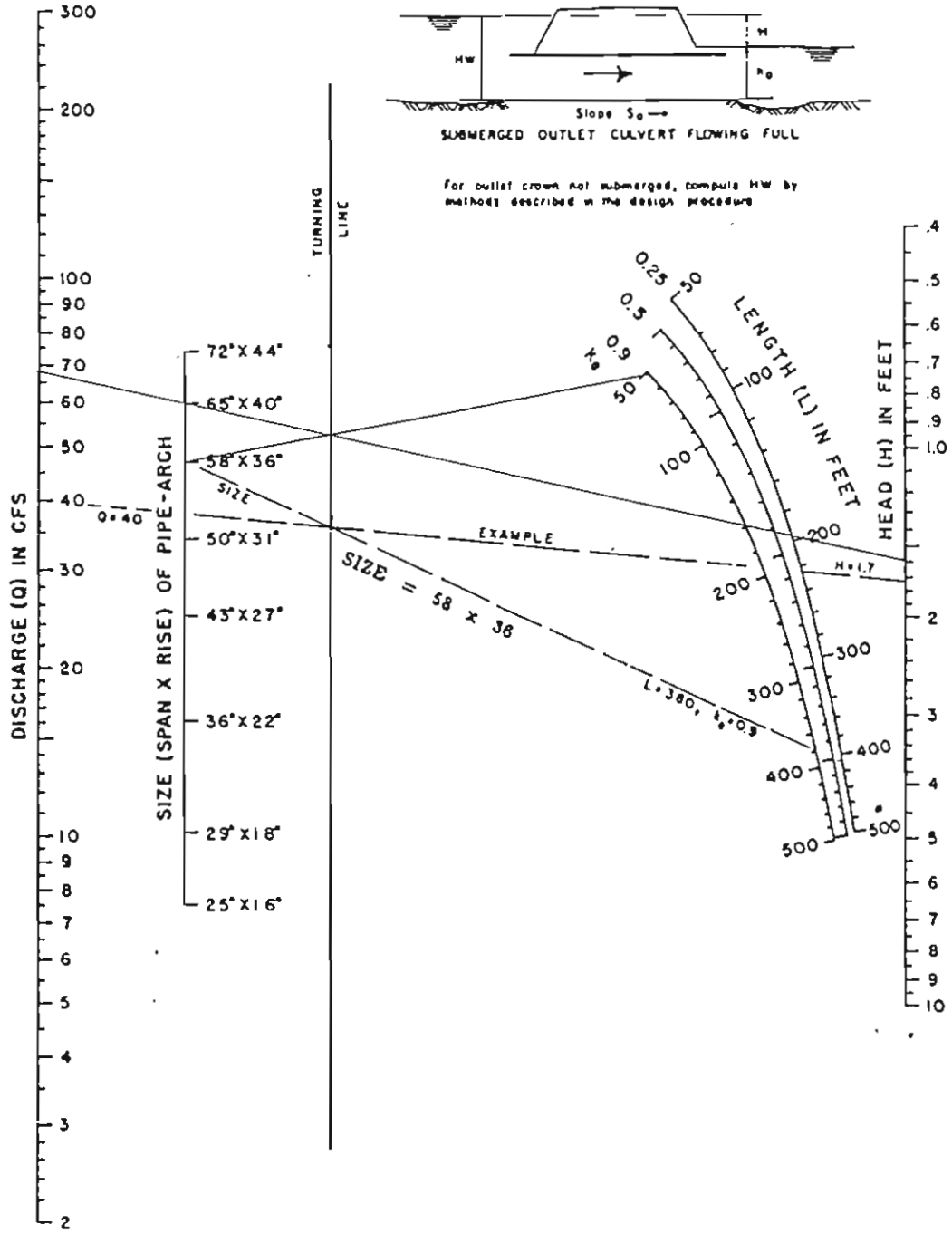


BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH.
STANDARD C.M. PIPE-ARCH

CHART 39



HEAD FOR STANDARD C. M. PIPE-ARCH CULVERTS FLOWING FULL n=0.024

BUREAU OF PUBLIC ROADS JAN. 1963

C-4, [illegible] below HL [illegible] road

PROJECT: Concord 90-55-27	STATION: ____ SHEET ____ OF ____	CULVERT DESIGN FORM DESIGNER / DATE: DMC / 6-11-91 REVIEWER / DATE: ADW / 6/13/91

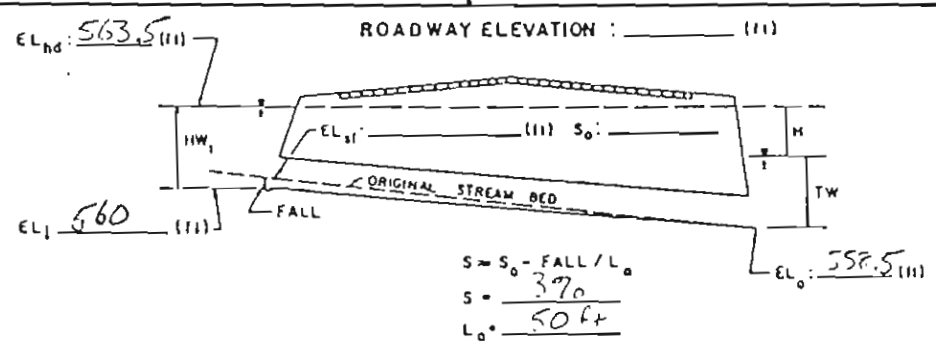
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD: Tabular hydrograph
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE: 3%
- ☐ CHANNEL SHAPE: Trapezoidal
- ☐ ROUTING: ____ ☐ OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
100	203	2.26



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c + D}{2}$	h_o (6)	k_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
BCCMP 57x38 Arch (s.c.)	203	68	1.1	3.5	0	563.5	2.9	1.9	2.5	2.9	0.9	1.6	563	563.5		

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i/D = HW/D$ OR HW_i/D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29n^2 L)/R^{1.33}\right] V^2/2g$ [illegible]

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f. CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho. HEADWATER IN OUTLET CONTROL
- i. INLET CONTROL SECTION
- o. OUTLET
- sf. STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 57x38

SHAPE: Arch

MATERIAL: CMP n 0.024

ENTRANCE: Projected

57x38 Equiv diam. = 48"

Area = $\pi 2^2$ = 12.6 ft²

CHART 43

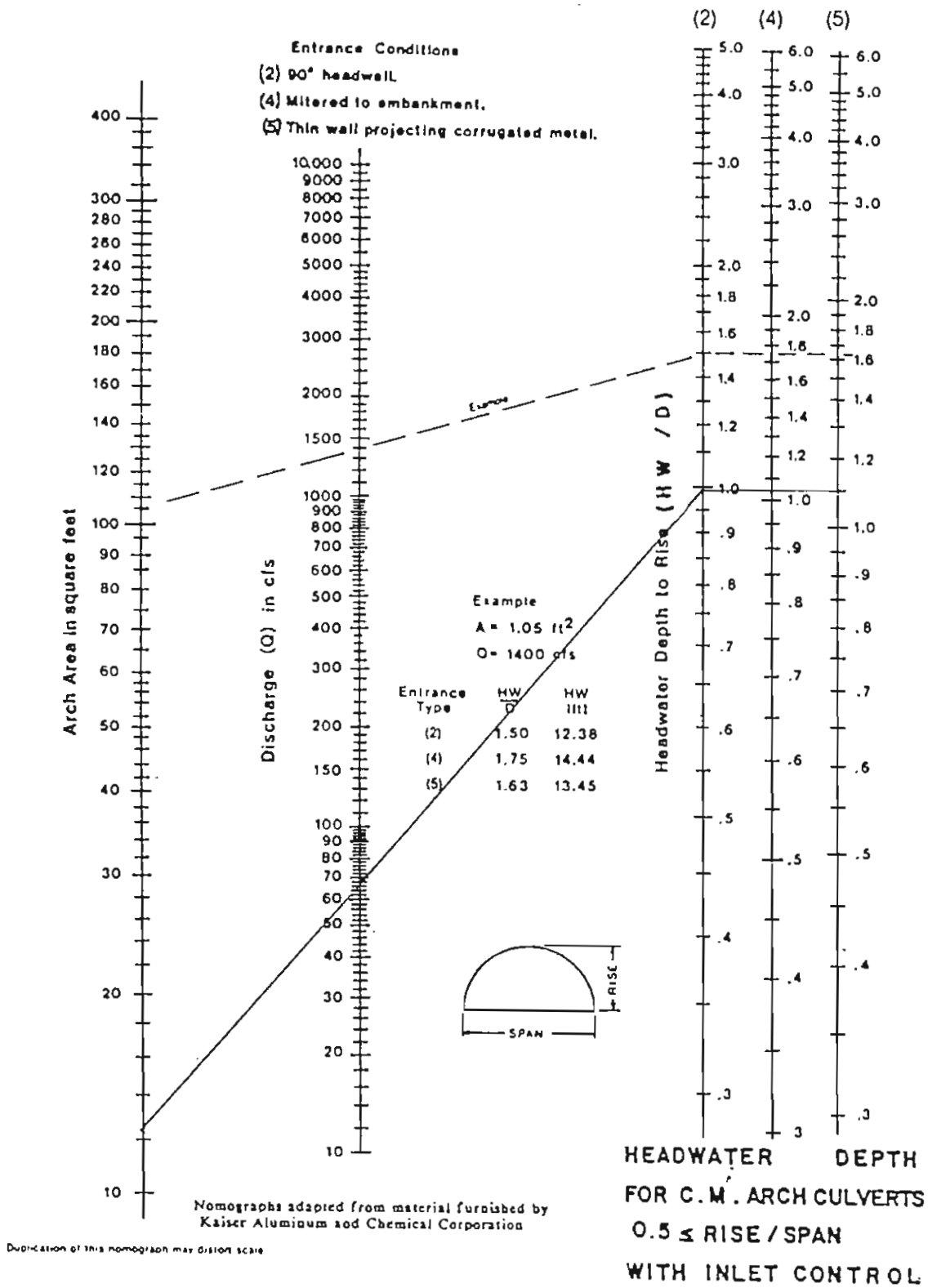
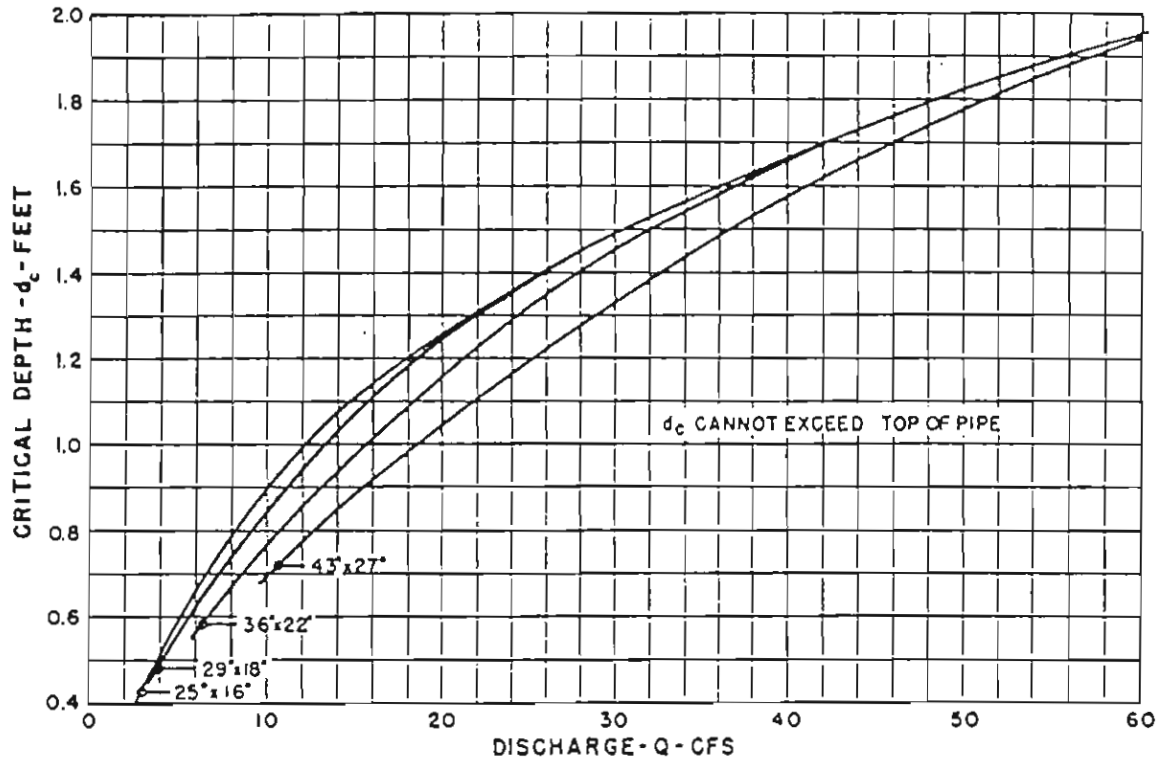
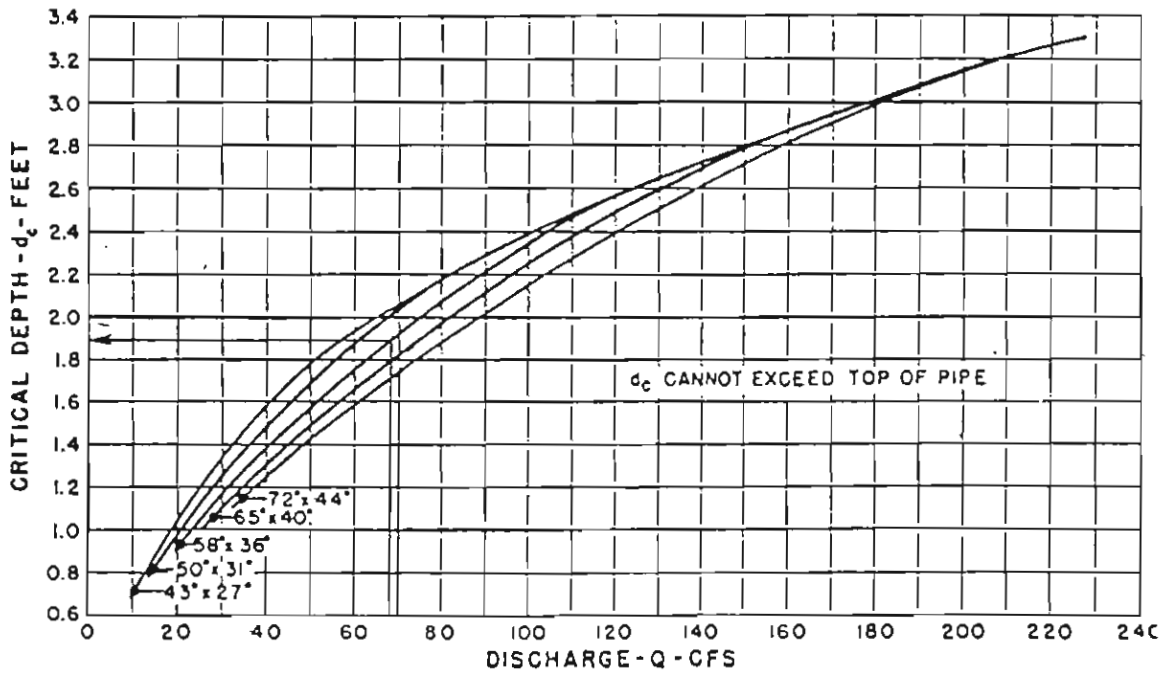

Entrance Conditions
(2) 90° headwall.
(4) Mitered to embankment.
(5) Thin wall projecting corrugated metal.
Arch Area in square feet
Discharge (Q) in cfs
Headwater Depth to Rise (H W / D)
(2)
(4)
(5)
Example
A = 1.05 ft²
Q = 1400 cfs
Entrance Type
HW/D
HW
(2) 1.50 12.38
(4) 1.75 14.44
(5) 1.63 13.45
RISE
SPAN
HEADWATER DEPTH
FOR C.M. ARCH CULVERTS
0.5 ≤ RISE / SPAN
WITH INLET CONTROL
Nomographs adapted from material furnished by
Kaiser Aluminum and Chemical Corporation
Duplication of this nomograph may distort scale

CHART 37



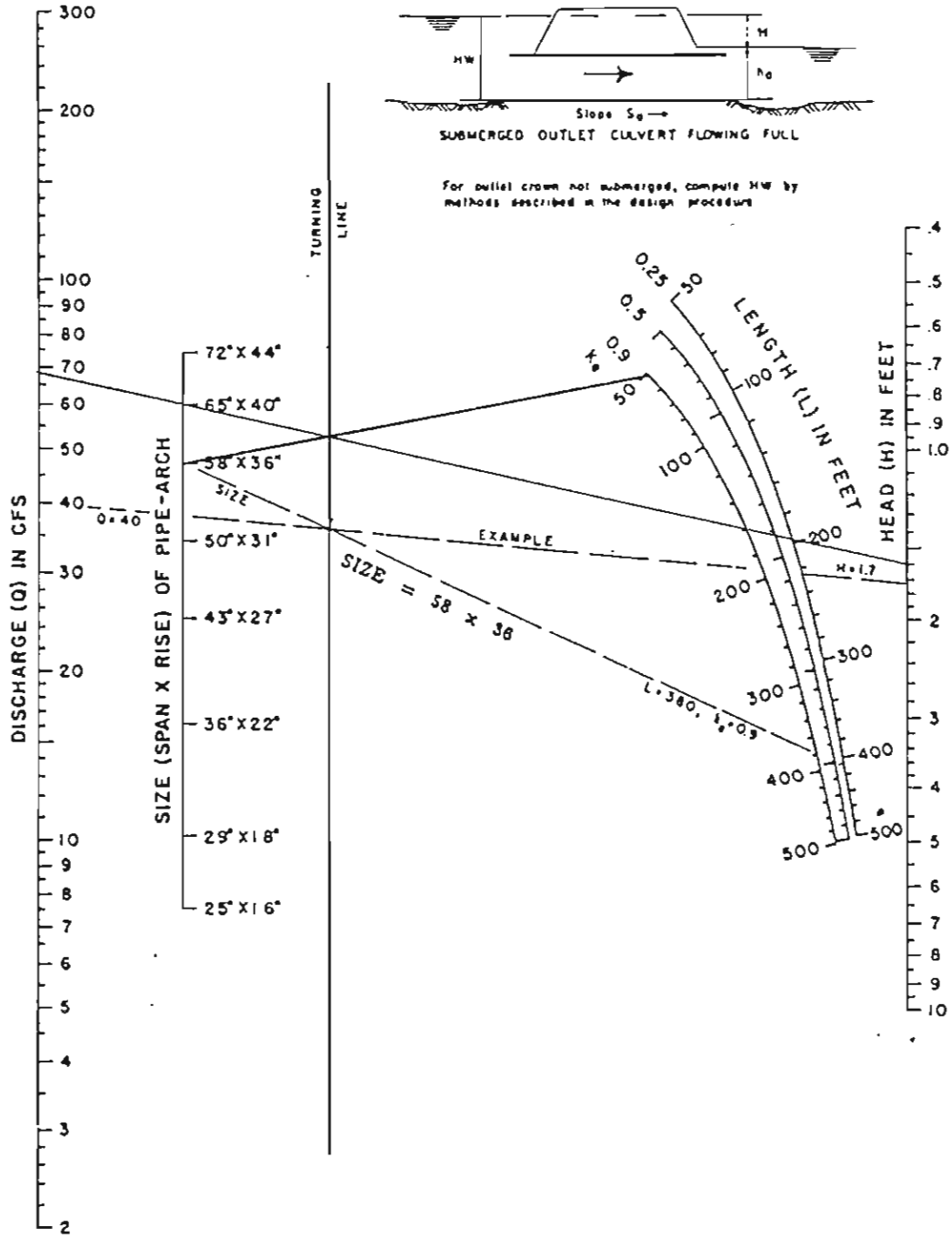


BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH.
STANDARD C.M. PIPE-ARCH

CHART 39



HEAD FOR
STANDARD C. M. PIPE-ARCH CULVERTS
FLOWING FULL
n=0.024

BUREAU OF PUBLIC ROADS JAN. 1963

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-13-91 CHKD BY: RMW DATE: 6/17/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 3

DESCRIPTION Intermediate Stage (Temporary) Surface Drainage

Outlet Ditch 1

This ditch will carry outflow from the principle spillway of Sediment Pond 1 to the existing collection pond. This needs only to be designed for the maximum flow from the spillway since it will be abandoned with the pond when the pile is vegetated and closed

Q = 76.16 cfs S = 30%

SOLUTION FOR MANNING'S EQUATION: OPEN CHANNEL FLOW

24 HOUR STORM FREQUENCY (years)	10
INPUT PARAMETERS	
SLOPE (ft/ft)	.3
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	5.00
OUTPUT VALUES	
FLOWRATE (cfs)	76.16
VELOCITY (fps)	11.59
DEPTH OF FLOW (ft)	.95
FLOW AREA (sf)	6.57
WETTED PERIMETER (ft)	9.26
HYDRAULIC RADIUS (ft)	.71
ACTUAL MANNINGS N	.057
D50 RIPRAP SIZE (in)	8.00

Channel Depth = 0.95 ft + 0.5 = 1.45 say 1.5 ft

Freeboard = 0.55 ft

Riprap lined

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: TMC DATE: 5-13-91 CHKD BY: PNW DATE: 6/17/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 2 OF 3

DESCRIPTION Intermediate Stage (Temporary) Surface Drainage

Outlet Ditch 2

This ditch will carry outflow from the principle spillway of Sediment Pond 2 to the existing collection pond. This ditch needs only to be designed for the maximum flow from the spillway since it will be abandoned with the pond when the pile is revegetated and closed

$Q = 35.79$ cfs $S = 9.1\%$

SOLUTION FOR MANNING'S EQUATION: OPEN CHANNEL FLOW

24 HOUR STORM FREQUENCY (years)	10
INPUT PARAMETERS	
SLOPE (ft/ft)	.091
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	4.00
OUTPUT VALUES	
FLOWRATE (cfs)	35.79
VELOCITY (fps)	6.26
DEPTH OF FLOW (ft)	.96
FLOW AREA (sf)	5.72
WETTED PERIMETER (ft)	8.31
HYDRAULIC RADIUS (ft)	.69
ACTUAL MANNINGS N	.057
D50 RIPRAP SIZE (in)	8.00

Actual Channel Depth = 0.96 + 0.5 = 1.46 ft say 1.5 ft

Freeboard = 0.54 ft

riprap lined

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DNC DATE: 5-13-91 CHKD BY: RMW DATE: 6/17/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 3 OF 3
DESCRIPTION Intermediate Stage (Temporary)
Surface drainage

Outlet Ditch 3

This ditch will carry outflow from the principle spillway of sediment pond 3A into sediment pond 3B. This needs only to be designed for the maximum flow from the spillway since it will be abbandoned with the pond when the pile is vegitated and closed

$Q = 40.46$ cfs $S = 16.7\%$

SOLUTION FOR MANNING'S EQUATION: OPEN CHANNEL FLOW

24 HOUR STORM FREQUENCY (years)	10
INPUT PARAMETERS	
SLOPE (ft/ft)	.167
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	3.00
OUTPUT VALUES	
FLOWRATE (cfs)	40.46
VELOCITY (fps)	8.26
DEPTH OF FLOW (ft)	.99
FLOW AREA (sf)	4.90
WETTED PERIMETER (ft)	7.41
HYDRAULIC RADIUS (ft)	.66
ACTUAL MANNINGS N	.056
D50 RIPRAP SIZE (in)	8.00

Actual Channel Depth = 0.99 + 0.5 = 1.49 feet

Say 1.5 feet

Freeboard = 0.51 feet

riprap lined

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: SP DATE: June 3 1991

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 5

DESCRIPTION Design of Underdrains

Determination of Seepage

The top flow line has been constructed assuming:

1. The maximum crest El. 640
2. The overage water El. 632 for this stage
3. no underdrains are installed
4. The effect due to the settled fine refuse on the total discharge is neglected.

The preceeding assumption will lead to a conservative design

Determine q:

$$q = KS$$

where:

q = unit discharge per foot of dam section

K = permeability of the dam material

$S = \sqrt{d^2 + h_1^2} - d$ (see attached drawing)

$= 10.0$ ft

assuming $K = 10^{-3}$ cm/sec (very conservative, actual test shows 1.5×10^{-2} cm/s)

$$q = KS = \left(10^{-3}\ \text{cm/sec}\right)\left(10\ \text{ft}\right)\left(\frac{1\ \text{ft}}{30.48\ \text{cm}}\right)\left(\frac{86400\ \text{sec}}{\text{Day}}\right)$$

$$= 28.3\ \text{ft}^2/\text{day}/\text{ft}$$

Ref.: Fundamentals of Soil Mechanics by DW Taylor, 1948, p 178

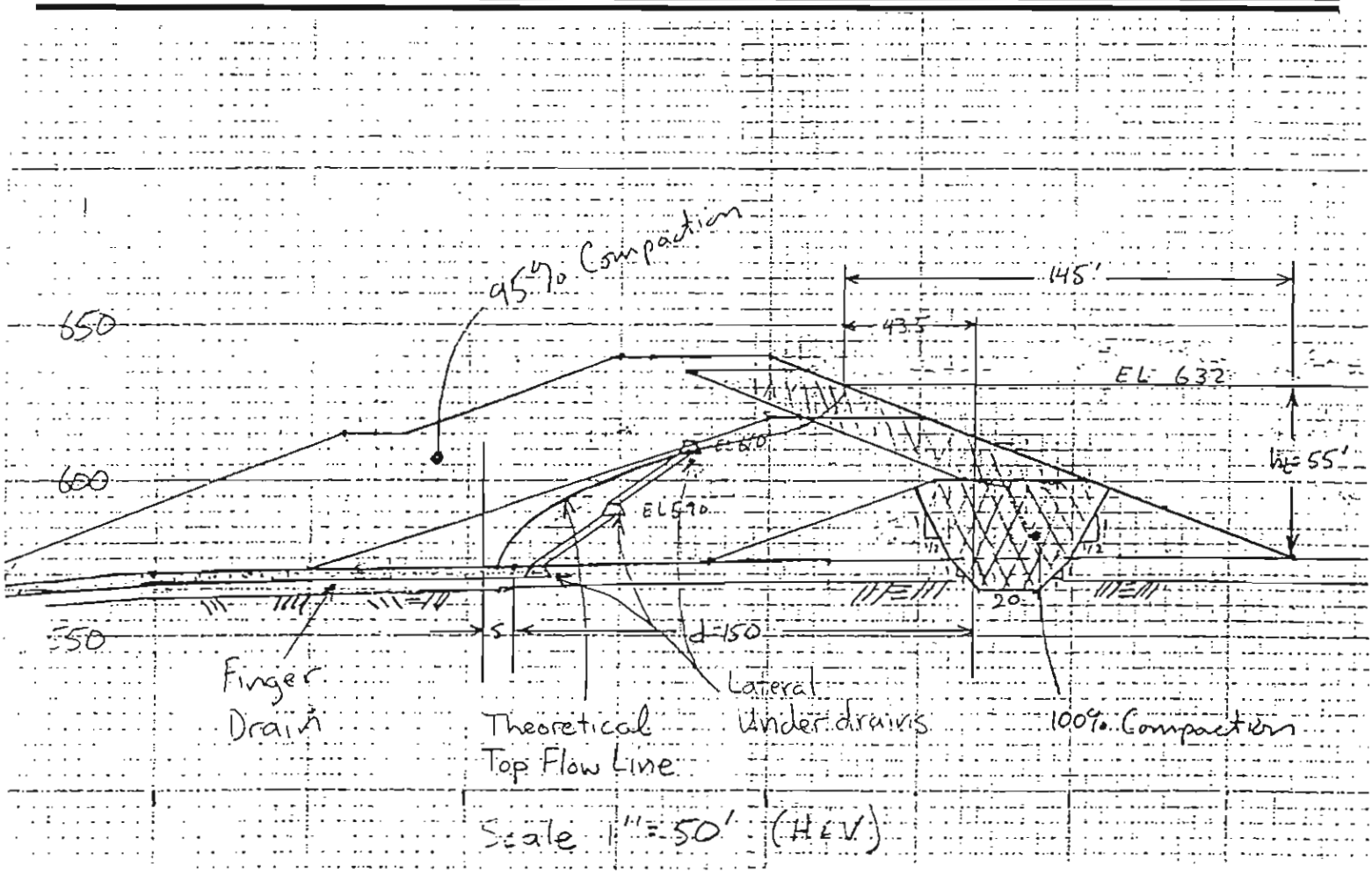
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: _____ DATE: _____

PROJECT NAME: Concord

PROJECT NO. 90-55-7 SHEET 2 OF 5

DESCRIPTION Design of Underdrains



$$S = \sqrt{d^2 + h^2} - d = \sqrt{150^2 + 55^2} - 150 = 9.76 \text{ ft} \approx 10.0 \text{ ft}$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: _____ DATE: _____

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 3 OF 5

DESCRIPTION Design of Underdrains

Lateral Underdrains and Finger Drains

Total number of Lateral underdrains = 3

$q = 28.3$ ft²/day/ft

Max discharge per underdrain = $\frac{28.3}{3} = 9.4$ ft²/day/ft

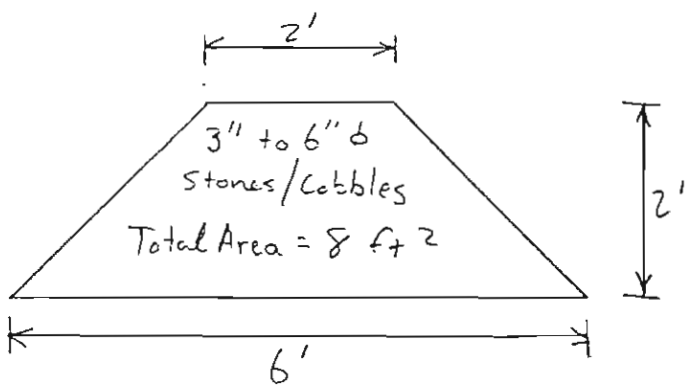
Max length of underdrain sloping to finger drain = 200 ft

Max discharge through lateral underdrain =

$= 9.4 \times 200$

$= 1880$ ft³/Day

The lateral underdrains are laid at 2% (min) slope of the size shown below:



Estimation of Permeability of 3" to 6" ϕ Stones

From Seepage, Drainage, and Flow Nets by H. R. Cedergren, 2nd Ed, 1972

Effective Diameter = $\frac{D}{6.5}$ where D = diamter of particle (p 180)

Avg. Diameter = $(3+6)/2 = 4.5$ in

Deff = $\frac{4.5}{6.5} = 0.69$ say 0.7 in

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DML DATE: 5-30-91 CHKD BY: ? DATE: ?

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 4 OF 5

DESCRIPTION Design of Underdrains

From Fig 2, the minimum permeability of 3" to 6" ϕ Stone
= 300 cm/sec

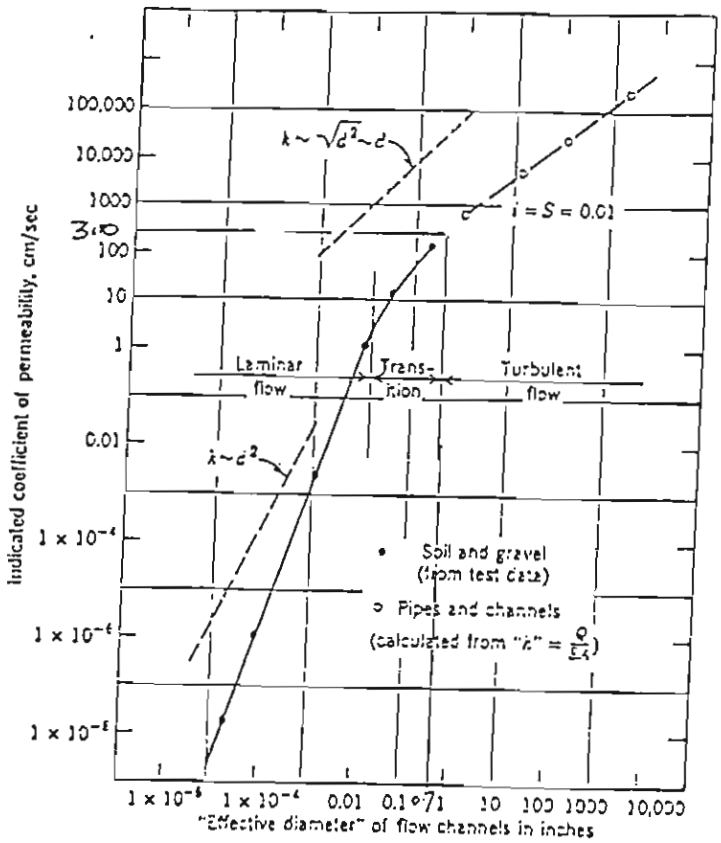


FIG. 2. Variations in "permeability" with size of flow channels.

(From Seepage Drainage & Flownets by Cedergren)

Also, from Hazen formula $K = C_1 D_{10}^2$

where

D_{10} = the effective size in cm

C_1 varies from about 90 to 120 (100 is often used)

so: $K = C_1 D_{10}^2 = (100)(0.7 \times 2.54)^2 = 316$ cm/sec $\approx$ 300 cm/sec

Assume K = 300 cm/sec or 850,394 ft/day

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DM/ DATE: 5-30-91 CHKD BY: JP DATE: 5/31/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 5 OF 5
DESCRIPTION Design of Underdrains

Capacity of Lateral Underdrains

$Q = K i A$ where:

Q = Total discharge in cfs
i = min gradient (2%)
A = Area of Underdrain = 8 ft²
K = permeability = 850,394 ft/day

$$Q = (850,394)(0.02)(8) = 136,063$$

$$F.S. = \frac{136,063}{1880} = 72 \quad \text{ok}$$

Capacity of Finger Drains

A maximum of 6 200 ft Lateral Underdrains will drain into each Finger Drain

$$Q_{finger} = Q_{under} \times 6$$

$$= 1880 \text{ ft}^3/\text{D} \times 6 = 11280 \text{ ft}^3/\text{D}$$

$$FS = \frac{136,063 \text{ ft}^3/\text{D}}{11280 \text{ ft}^3/\text{D}} = 12 \quad \text{ok}$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: SDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 1 OF 8
DESCRIPTION Geotextile Design

Design Calculations to varify the obility of the geotextile to resist piping and clogging

Following are the design Criterion recommended by various organizations
Reference: Designing with Geosynthetics by R. M. Koerner, Prentice Hall, 1990

(A) AASHTO -- Task Force #25

1. Soil ≤ 50% passing the No. 200 sieve
   AOS of the fabric ≥ No. 30 sieve (i.e., $O_{95} < 0.59$ mm)
2. Soil > 50% passing the No. 200 sieve
   AOS of the fabric ≥ No. 50 sieve (i.e., $O_{95} < 0.297$ mm)

AOS - The number of the U.S. standard sieve having openings closest in size to the largest openings in a filter fabric

In the most recent publication "Designing With Geosynthetics" by R. M. Koerner Published by Prentice Hall 2nd Ed. 1990 beside the Task Force #25 following slightly more conservative recommendations are also given

(B) $O_{95} < (2 \text{ to } 3)\, d_{85}$ (Slight more conservative)

where d_{85} = particle size in millimeters for which 85% of the sample is finer

(C) - The most conservative method is after Giroud (1982), who presents a table for recommended O_{95} values (i.e. the opening size in millimeters corresponding to AOS value) in terms of relative density (D_R), coefficient of uniformity (CU) and average particle size (d_{50}) (see table on the next page)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-[illegible]-97 SHEET 2 OF 8
DESCRIPTION Geotextile Design

(C) (Continued)

TABLE 2.14 RELATIONSHIPS USED TO OBTAIN FABRIC OPENING SIZE TO PREDICT EXCESSIVE LOSS OF FINES DURING FILTRATION[a]

Relative density	1 < CU < 3	CU > 3
Loose (D_R < 50%)	$0_{95} < (CU)(d_{50})$	$0_{95} < (9d_{50})/CU$
Intermediate (50% < D_R > 80%)	$0_{95} < 1.5(CU)(d_{50})$	$0_{95} < (13.5d_{50})/CU$
Dense (D_R > 80%)	$0_{95} < 2(CU)(d_{50})$	$0_{95} < (18d_{50})/CU$

Source: After Giroud [42]

[a] d_{50}, Soil particle size corresponding to 50% finer; CU, coefficient of uniformity ($=d_{60}/d_{10}$); d_{10}, soil particle size corresponding to 10% finer; d_{60}, soil particle size corresponding to 60% finer; 0_{95}, apparent opening size of geotextile (if data are not given by the manufacturer, this value is approximately the AOS sieve value in millimeters).

(D) U.S. Army Corps of Engineer

(1) REF. NO: 1 GEOTEXTILE ENGINEERING MANUAL COURSE TEXT PREPARED FOR THE FEDERAL HIGHWAY ADMIN., PREPARED CYST. CONSULTANTS LTD, DATED MARCH, 198[illegible]

a. for natural soils containing 50% or less by weight passing the U.S. No. 200 (0.074 mm) sieve:

$$\frac{D_{85}\text{ soil (mm)}}{\text{EOS geotextile (mm)}} \geq 1$$

b. all other soil types:

EOS of geotextile ≤ U.S. No. 70 (0.211 mm) sieve. Note: a geotextile should not be used where D_{85} is less than U.S. No. 200 (0.074 mm) sieve.

c. no geotextile should be specified with an EOS less than U.S. No. 100 (0.149 mm) sieve.

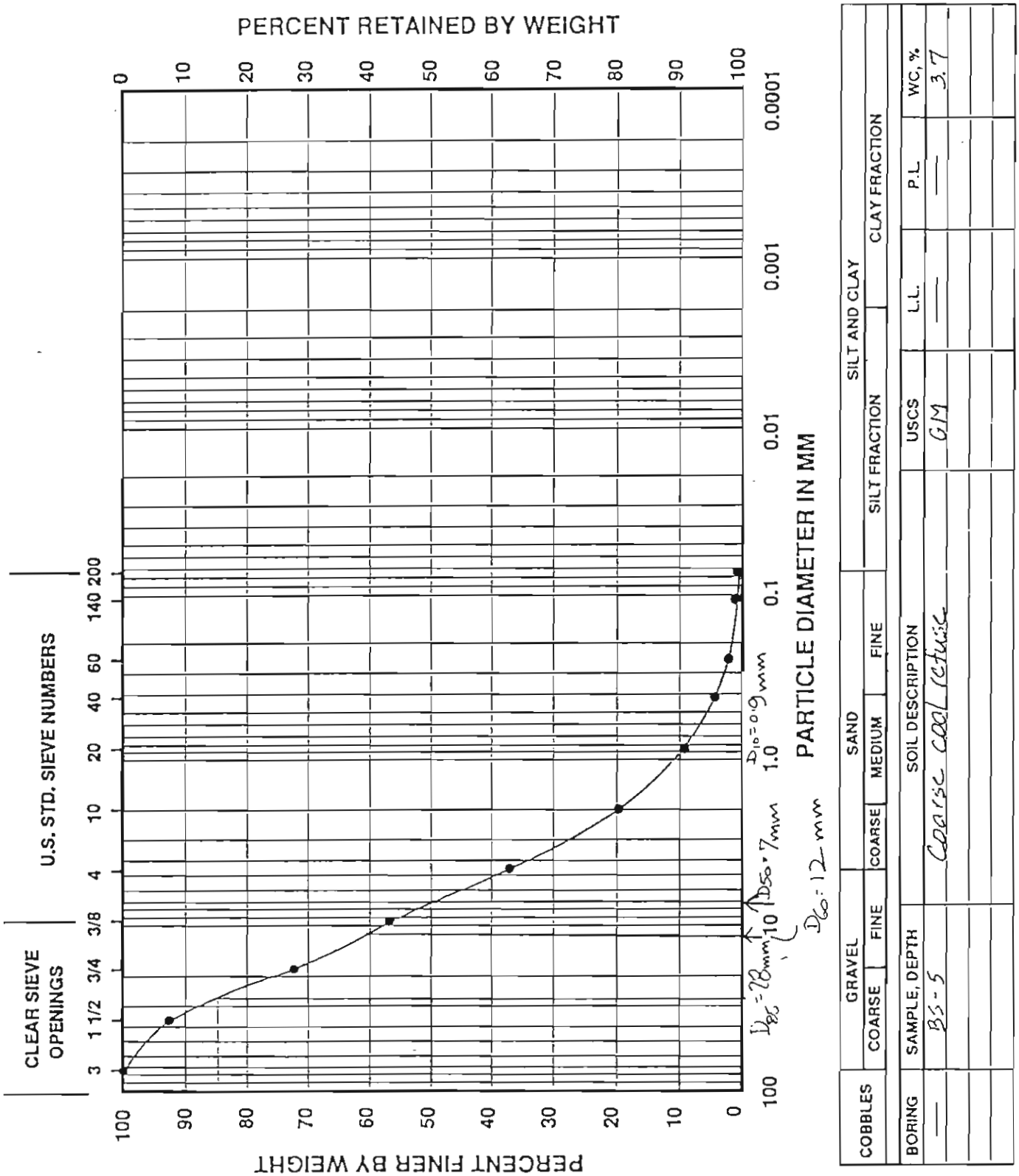
d. specify a fabric with openings as large as allowed by the criteria.

The grain size distribution of the coarse coal refuse which may cause the piping and clogging of the geotextile is shown on the next page.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: MS 5/11/91

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY					
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION				

BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	L.L.	P.L	WC, %
—	B5 - 5	Coarse coal refuse	GM	—	—	3.7

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: U D DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Conrad
PROJECT NO. 90-55-27 SHEET 4 OF 8
DESCRIPTION Geotextile Design

The coarse coal refuse grain size has following characteristics:
Less than 50% material passes through #200 sieve

$D_{85} = 28$ mm

$D_{60} = 12$ mm

$D_{50} = 7$ mm

$D_{10} = 0.9$ mm

$$C_u = \frac{D_{60}}{D_{10}} = \frac{12}{0.9} = 13.3 > 3$$

Criterion (A)

For less than 50% material passing the #200 sieve

$$O_{95} < 0.59 \text{ mm}$$

Criterion (B)

$$O_{95} < (2 \text{ to } 3) D_{85} = (2 \text{ to } 3)\, 20$$

$$O_{95} < 56 \text{ to } 84 \text{ mm}$$

Criterion (C)

For Dense compacted soil ($D_R > 80\%$) and $C_u > 3$

$$O_{95} < \frac{18\, D_{50}}{C_u}$$

$$< \frac{18 \times 7}{13.3}$$

$$< 9.5 \text{ mm}$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 5 OF 8
DESCRIPTION Geotable Design

Criterion (4)

(a) $\frac{O_{85}}{O_{95}} \geq 1$

$D_{85} \geq O_{95}$

$O_{95} \leq D_{85}$

$O_{95} \leq 28$ mm

(b) Not Applicable

(c) $O_{95} >$ U.S. No. 100 (0.149 mm)

(d) Specify a fabric and large as allowed by the criteria

Based on above criteria the O_{95} opening should be restricted to following size

$0.15\text{mm} < O_{95} > 0.6$ mm

SUPAC 3½ NP has following properties:

Structure	woven needlepunched
Thickness, mils	30
EOS	50 to 80 Sieve Size (0.3 to 0.18 mm)
Permittivity (sec^{-1})	2.3
Puncture strength (lbs)	55
Mullen Burst Strength (psi)	158
Trapezoidal Tear Strength (lbs)	90
Elongation	110

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Colcord
PROJECT NO. 90-55-27 SHEET 6 OF 8
DESCRIPTION Geotextile Design

Required Minimum Puncture Resistance

Reference: "Designing with Geosynthetics" by R. M. Koerner, Prentice Hall, 2nd Ed. 1990 page 131.

The vertical force exerted on the geotextile is as follows:

$$F_{vert} = [(\pi d_h)(h_h)p']S' \qquad (2.26)$$

where

F_{vert} = the total vertical force imposed on the fibers adjacent to the puncture;
d_h = the average diameter of the hole, where d_h (maximum) = d_a = average diameter of the aggregate (or stump, etc.);
h_h = the propagation height ($\approx d_a$);
p' = the pressure exerted on the geotextile (usually 75% to 100% of tire inflation pressure at the ground surface); and
S' = the shape factor varying from 0 for rounded blunt objects to 1.0 for sharp angular objects (for aggregate particles, the shape factor can be assumed to be $(1.0 - S)$, where S is the sphericity, from $S = A_p/A_c$, where A_p is the projected area of the particle and A_c is the area of the smallest circumscribing circle around the particle; typical values of S are 0.8 for Ottawa sand, 0.7 for run-of-bank gravel, 0.4 for crushed rock, and 0.3 for shot rock).

This vertical force must now be converted into a tensile force in the fibers of the geotextile. This is indeed a complex problem, since both radial friction and axial rotation of the fibers against the protrusion are involved. As an approximation, however, we can use

$$\frac{F_{vert}}{T_{reqd}} = \frac{d_a}{d_i} \qquad (2.27)$$

where

F_{vert} = the total vertical force on fibers,
T_{reqd} = the required tensile force in fibers,
d_a = the average diameter of the stone, and
d_i = the initial average void diameter of geotextile.

Combining equations, with the assumptions noted above, one obtains

$$T_{reqd}\left(\frac{d_a}{d_i}\right) = (\pi d_a^2 p')S'$$

$$T_{reqd} = (\pi d_i d_a)\, p'S' \qquad (2.28)$$

This value of T_{reqd} can be compared to the puncture test (if the object is blunt, causing puncture) or to the tear test (if the object is sharp, causing tear).

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: DDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 7 OF 8
DESCRIPTION Geotextile Design

For Concord Site
Maximum height of fill = 70 ft
Density of fill = 120 pcf
Average size of rock in underdrain = 2" to 8" Assumed average size 6"
S = 0.3 for shot rock

d_i = 0.3 mm = 0.0118 in

$p' = \frac{120 \times 70}{144}$ = 58.3 psi. Say 60 psi (neglecting arching effect)

$T_{reqd} = \pi \times 0.0118 \times 6 \times 60 \times (1-0.3)$

= 9.34 lbs

Required Factor of Safety

Required Factor of Safety

$$T_{allow} = T_{ult}\left(\frac{1}{FS_{ID} \times FS_{CR} \times FS_{CD} \times FS_{BD}}\right)$$

where

T_{allow} = the allowable tensile strength, or T_{reqd}
T_{ult} = the ultimate tensile strength,
FS_{ID} = the factor of safety for installation damage, $= \frac{1.1+2.5}{2} = 1.8$
FS_{CR} = the factor of safety for creep, $\frac{1+1.2}{2} = 1.1$
FS_{CD} = the factor of safety for chemical degradation, and $\frac{1+1.5}{2} = 1.25$
FS_{BD} = the factor of safety for biological degradation. $\frac{1+1.2}{2} = 1.1$

See attached table on next page

$T_{reqd} = T_{ult.}\left(\frac{1}{1.8 \times 1.1 \times 1.25 \times 1.1}\right) = \frac{T_{ult.}}{2.72}$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 8 OF 8

DESCRIPTION Geotextile Design

TABLE 2.12 RECOMMENDED PARTIAL FACTOR OF SAFETY VALUES FOR USE IN EQUATION 2.18

Application area	Various partial factors of safety			
	Installation damage	Creep*	Chemical degradation	Biological degradation
separation	1.1 to 2.5	1.0 to 1.2	1.0 to 1.5	1.0 to 1.2
cushioning	1.1 to 2.0	1.2 to 1.5	1.0 to 2.0	1.0 to 1.2
unpaved roads	1.1 to 2.0	1.5 to 2.5	1.0 to 1.5	1.0 to 1.2
walls	1.1 to 2.0	2.0 to 4.0	1.0 to 1.5	1.0 to 1.3
embankments	1.1 to 2.0	2.0 to 3.0	1.0 to 1.5	1.0 to 1.3
bearing capacity	1.1 to 2.0	2.0 to 4.0	1.0 to 1.5	1.0 to 1.3
slope stabilization	1.1 to 1.5	1.5 to 2.0	1.0 to 1.5	1.0 to 1.3
pavement overlays	1.1 to 1.5	1.0 to 1.2	1.0 to 1.5	1.0 to 1.1
railroads	1.5 to 3.0	1.0 to 1.5	1.5 to 2.0	1.0 to 1.2
flexible forms	1.1 to 1.5	1.5 to 3.0	1.0 to 1.5	1.0 to 1.1
silt fences	1.1 to 1.5	1.5 to 2.5	1.0 to 1.5	1.0 to 1.1

*The low end of the range refers to results that have been compensated for creep in the performance of the tests.

$T_{ult.} = T_{reqd} \times 2.72$

For $d_1 = 0.3$ mm $T_{reqd} = 9.34$ lbs

$T_{ult.} = 2.72 \times 9.34$

$= 25.4$ lbs for SUPAC 3½NP Puncture resistance is 55 lbs O.K.

The recommended geotechile should have EOS between 0.15 & 0.6 mm with minimum puncture resistance of 26 lbs

SUPAC 3½ or Equivalent which satisfy the above minimum requirement should be used at Concord disposal site

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DLC DATE: [illegible] CHKD BY: UD DATE: 6/7/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 2

DESCRIPTION Filter Fabric Permeability Design

The purpose of this calculation is to check the selected filter fabric from the plugro / pipe calculation for sufficient permeability. The selected fabric is Supac 3.5N nonwoven needlepunched polyester. It has the following properties:

thickness = t = 0.8 mm or 30 mils

permittivity = Ψ = 2.3 sec^{-1}

This fabric will be used to wrap all buried underdrains. The permeability of the fabric is given by the equation:

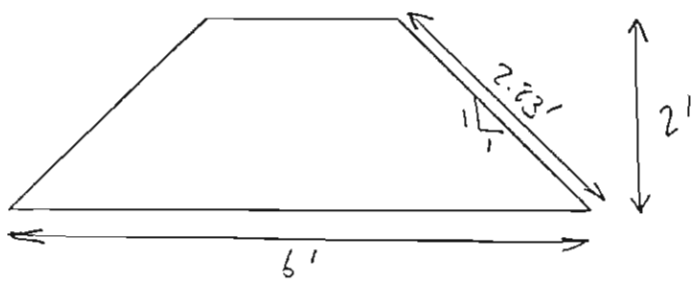
$$K = \Psi t$$

$$= (2.3\ sec^{-1})(0.8\ mm) = 1.84\ mm/s$$

$$= (1.84\ mm/s)\left(\frac{1\ cm}{10\ mm}\right) = 0.184\ cm/s$$

The maximum flow rate into the lateral drains was determined in the underdrain design to be 27.3 ft^2/day/ft. The 3 lateral drains are spaced 20' apart vertically, and 25' apart horizontally so the gradient acting on the drain is 20 ÷ 25 = 0.8

The typical dimensions of a lateral drain are:



ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: LML DATE: 5-6-91 CHKD BY: U D DATE: 6/7/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 2 OF 2
DESCRIPTION Filter Fabric Permeability Design

Using Darcy's Law, and assuming flow enters the underdrain only along the front face, we can determine the flow rate through the fabric.

$Q = kAi$ (Darcy Law)

where: Q = flow rate
k = permeability = 0.184 cm/s
A = area = 2.83 ft x 1 ft
i = gradient = 0.2 ft/ft

$$Q = \left(0.184 \frac{cm}{sec}\right)\left(2.83\ ft^2\right)\left(0.2 \frac{ft}{ft}\right)\left(\frac{3.28\ ft}{10^2\ cm}\right)\left(\frac{86400\ sec}{1\ day}\right)$$

$$= 1180.5\ ft^3/D \quad \text{or} \quad 1180.5\ ft^2/D/ft$$

So.

$$FS = \frac{1180.5\ ft^2/day/ft}{\frac{28.3\ ft^2/day/ft}{3\ drains}} = 125.1 \quad \underline{ok}$$

U.S. STEEL: CONCORD REFUSE SITE

SEDIMENTATION POND SPECIFICATIONS:

The following is a summary of the sedimentation pond characteristics:

SEDIMENTATION POND NO. 1

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 520 ft.
- Crest of Embankment: 540.58 ft.
- Inside Height of Embankment: 20.58 ft.
- Width of Embankment Crest: 20 ft.
- Design Sediment Level Elevation: 533 ft.
- Sediment Clean-out Elevation (80% sediment volume): 531.5 ft.

Principal Spillway Riser:
- Diameter: 18 in.
- Crest Elevation: 536 ft.
- Bottom Elevation: 530 ft.
- Height: 6 ft.
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16
- Concrete Foundation: 4 ft. x 4 ft. square x 1.5 ft. deep

Riser Perforations:

invert elevation	number of orifices	orifice size
534.0 ft.	1	6 in.
534.5 ft.	1	6 in.
535.0 ft.	1	6 in.
535.5 ft.	1	6 in.

Principal Spillway Barrel:
- Diameter: 18 in.
- Inlet Invert Elevation: 530 ft.
- Outlet Invert Elevation: 518 ft.
- Length of Barrel: 140 ft.
- Slope of Barrel: 8.6 %
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 537 ft.
- Spillway Width: 10 ft.
- Side Slopes: 1:1
- Control Section Length: 30 ft.
- Control Section Slope: 6%
- Exit Section Length: 48 ft.
- Exit Section Slope: 15%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

SEDIMENTATION POND NO. 2

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 520 ft.
- Crest of Embankment: 540 ft.
- Inside Height of Embankment: 20 ft.
- Width of Embankment Crest: 20 ft.
- Design Sediment Level Elevation: 528.5 ft.
- Sediment Clean-out Elevation (80% sediment volume): 527.5 ft.

Principal Spillway Riser:
- Diameter: 18 in.
- Crest Elevation: 532.5 ft.
- Bottom Elevation: 525.5 ft.
- Height: 7 ft.
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16
- Concrete Foundation: 4 ft. x 4 ft. square x 1.5 ft. deep

Riser Perforations:

invert elevation	number of orifices	orifice size
529.5 ft.	3	3 in.
530.0 ft.	3	3 in.
530.5 ft.	3	3 in.
531.0 ft.	3	3 in.
531.5 ft.	3	3 in.

Principal Spillway Barrel:
- Diameter: 18 in.
- Inlet Invert Elevation: 525.5 ft.
- Outlet Invert Elevation: 495 ft.
- Length of Barrel: 200 ft.
- Slope of Barrel: 15.3 %
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 533.5 ft.
- Spillway Width: 10 ft.
- Side Slopes: 1:1
- Control Section Length: 70 ft.
- Control Section Slope: 6%
- Exit Section Length: 85 ft.
- Exit Section Slope: 22.7%
- Both Control and Exit Sections Riprap Lined; D_{50}=6 inches

SEDIMENTATION POND NO. 3A

Pond 3A discharges through an outlet pipe into a channel which discharges into Pond 3B.

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 600 ft.
- Crest of Embankment: 620 ft.
- Inside Height of Embankment: 20 ft.
- Width of Embankment Crest: 12 ft.
- Design Sediment Level Elevation: 611 ft.
- Sediment Clean-out Elevation (80% sediment volume): 609.5 ft.

There is no Principal Spillway Riser in this Pond.

Principal Spillway Barrel:
- Diameter: 12 in.
- Inlet Invert Elevation: 615 ft.
- Outlet Invert Elevation: 612.5 ft.
- Length of Barrel: 50 ft.
- Slope of Barrel: 5%
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 617 ft.
- Spillway Width: 15 ft.
- Side Slopes: 2:1
- Control Section Length: 40 ft.
- Control Section Slope: 6%
- Exit Section Length: 60 ft.
- Exit Section Slope: 27.7%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

SEDIMENTATION POND NO. 3B

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 540 ft.
- Crest of Embankment: 560 ft.
- Inside Height of Embankment: 20 ft.
- Width of Embankment Crest: 20 ft.
- Design Sediment Level Elevation: 546 ft.
- Sediment Clean-out Elevation (80% sediment volume): 545 ft.

Principal Spillway Riser:
- Diameter: 18 in.
- Crest Elevation: 550 ft.
- Bottom Elevation: 543 ft.
- Height: 7 ft.
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16
- Concrete Foundation: 4 ft. x 4 ft. square x 1.5 ft. deep

Riser Perforations:

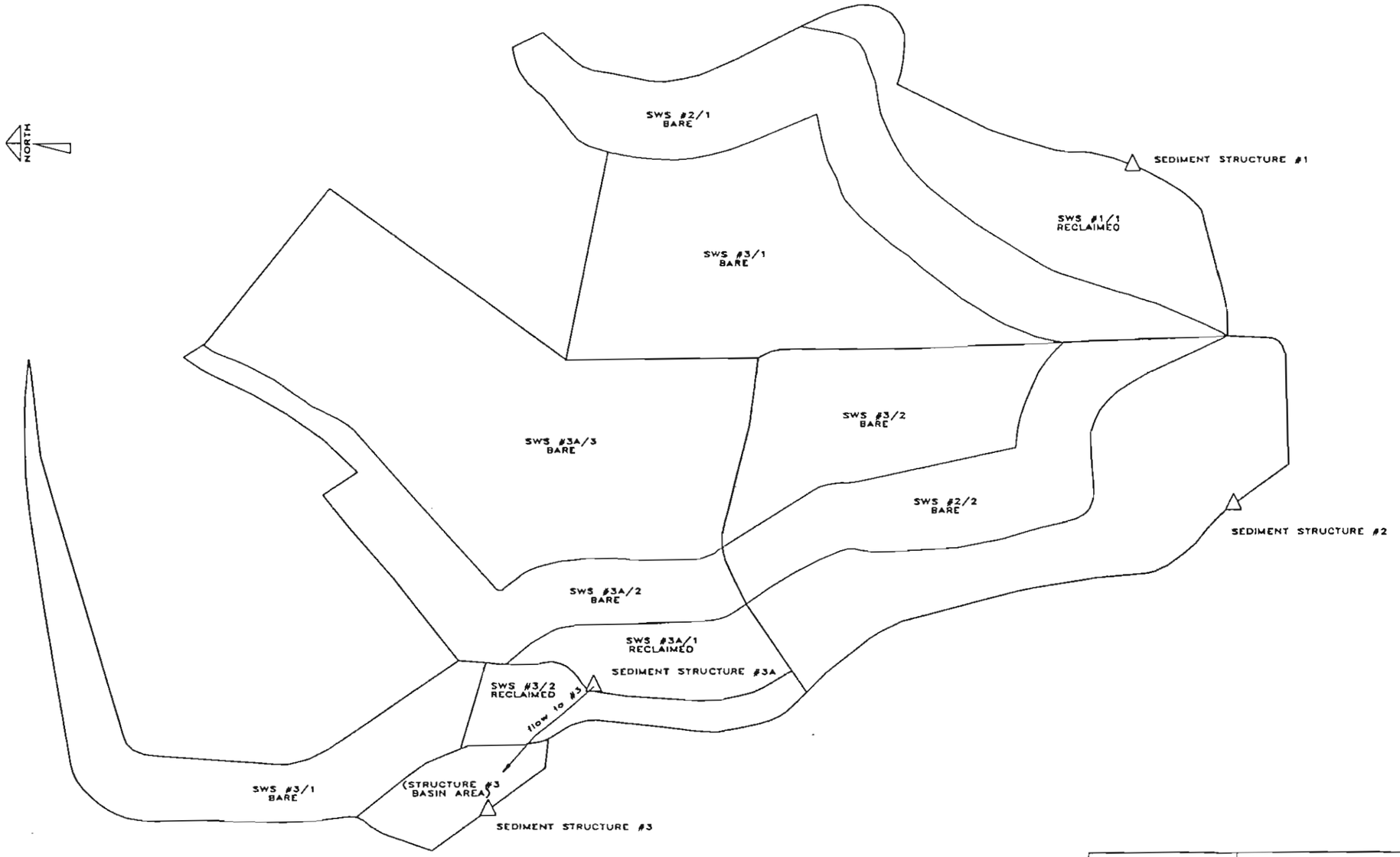
invert elevation	number of orifices	orifice size
547.0 ft.	1	0.5 in.
547.5 ft.	1	0.5 in.
548.0 ft.	1	0.5 in.
548.5 ft.	1	0.5 in.
549.0 ft.	1	0.5 in.

Principal Spillway Barrel:
- Diameter: 18 in.
- Inlet Invert Elevation: 543 ft.
- Outlet Invert Elevation: 523 ft.
- Length of Barrel: 240 ft.
- Slope of Barrel: 8.3 %
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 551 ft.
- Spillway Width: 10 ft.
- Side Slopes: 1:1
- Control Section Length: 80 ft.
- Control Section Slope: 6%
- Exit Section Length: 70 ft.
- Exit Section Slope: 23%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

Please note that some of the above design characteristics are different from those used in the SEDCAD3 run performed by Challenge Engineering Consultants (ie: barrel inlet inverts, emergency spillway crest width, and emergency spillway exit section slopes).

These values were changed in order to maintain structural integrity and better conform to the site conditions. These changes will not affect the sediment discharge level due to the fact that the principal spillway is inlet controlled.



REVISIONS		
NO.	DATE	REMARKS

SUBWATERSHED DIAGRAM

U.S. STEEL MINING COMPANY

CONCORD REFUSE
DISPOSAL AREA

Challenge
ENGINEERING CONSULTANTS, INC.
181 EAST VINE STREET, FIFTH FLOOR, LEXINGTON, KENTUCKY 40507

SCALE
DESIGNED BY
DRAWN BY
CHECKED BY
DATE
SHEET NO.
OF SHEETS
JOB NO.

U.S. Steel – Concord Refuse Area Impoundment Structure Information

POND INFORMATION

Pond ID: Pond 1

	Stage/ Dimension	Elevation
Bottom of Impoundment.....	0 *Ft.*	520.00 *msl.*
Top of Impoundment.....	20.6 *Ft.*	540.58 *msl.*
Min Top Width.....	10.0 *Ft.*	
Upstream Slope.....	3 *: 1*	
Downstream Slope.....	3 *: 1*	
Sediment Depth *.....	13.00 *Ft.*	533.00 *msl.*
RISER SPILLWAY INFORMATION		
Riser Diameter	18 *In.*	
Riser Height **	3 *Ft.*	536.00 *msl.*
SLOTTED RISER INFORMATION		
Diameter	6 *In.*	
No. of Slots/Elevation	1	
Beginning Height **	1 *Ft.*	534.00 *msl.*
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	18 *In.*	
Slope	8.6 *%*	
Spillway Height **.....	–13.00 *Ft.*	520.00 *msl.*
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	10 *Ft.*	
Side Slopes	1 *: 1*	
Bed Slope	6 *%*	
Exit Slope	15 *%*	
Spillway Height **.....	4.00 *Ft.*	537.00 *msl.*
Flow In Sp'way – 10yr	1.60 *Ft.*	538.60 *msl.*
Flow In Sp'way – 25yr	1.40 *Ft.*	538.40 *msl.*

Notes:

* Above bottom of Pond
** Above sediment level
NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

Stage Storage Calculations and Graph

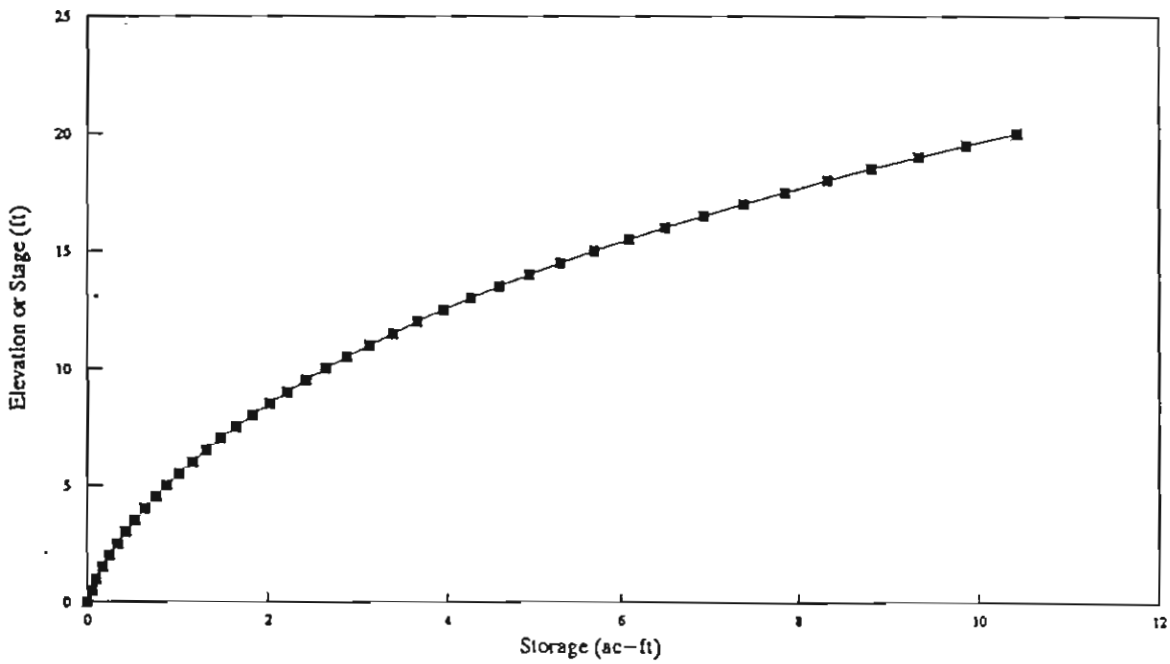
U.S. Steel – Concord Refuse Area

Pond Id: Pond 1

Stage	Area (acres)	Capacity (ac–ft)
0	0.09	0
0.5	0.1	0.05
1	0.12	0.1
1.5	0.14	0.17
2	0.16	0.24
2.5	0.17	0.33
3	0.19	0.42
3.5	0.21	0.52
4	0.23	0.63
4.5	0.25	0.75
5	0.26	0.87
5.5	0.28	1.01
6	0.3	1.16
6.5	0.32	1.31
7	0.34	1.47
7.5	0.35	1.65
8	0.37	1.83
8.5	0.39	2.02
9	0.41	2.22
9.5	0.43	2.42

Stage	Area (acres)	Capacity (ac–ft)
10	0.44	2.64
10.5	0.48	2.87
11	0.51	3.12
11.5	0.54	3.38
12	0.58	3.66
12.5	0.61	3.96
13	0.64	4.27
13.5	0.68	4.6
14	0.71	4.95
14.5	0.74	5.31
15	0.78	5.69
15.5	0.81	6.09
16	0.84	6.51
16.5	0.88	6.94
17	0.91	7.38
17.5	0.95	7.85
18	0.98	8.33
18.5	1.01	8.83
19	1.05	9.34
19.5	1.08	9.87
20	1.11	10.42

Stage Storage



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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 1

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL1

Date: 06-10-1991

Civil Software Design -- SEDCAD+ Version 3
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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Refuse Area % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	12.64*	74	M	0.028	0.000	0.000	0.0	3.36	22.98
111	2	17.14*	75	M	0.011	0.029	0.377	0.0	4.69	31.83
111	3	21.09*	75	S	0.193	0.029	0.377	0.0	5.77	28.42
		Type: Pond Label: Pond 1								
111	Structure	50.88							13.81	
111	Total IN	50.88							13.81	83.23
111	Total OUT								13.79	67.16

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	27.6				
R	111	2	0.22	30.0	40.0	0.800	0.029	1	947.5				
R	111	3	0.22	50.0	3.0	0.800	0.029	1	85.0				
				Type: Pond Label: Pond 1									
	111	Structure							1059.2				
	111	Total IN							1059.2	99420	78.04	42.83	13.70
	111	Total OUT							18.4	1607	0.28	0.17	0.09

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.81	83.23	1059.2	99420	78.04	42.83	13.70
OUT	13.79	67.16	18.4	1607	0.28	0.17	0.09

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.6	98.26	2.68

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.81	83.23	1059.2	99420	78.04	42.83	13.70
OUT	13.79	67.16	18.4	1607	0.28	0.17	0.09

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.6	98.26	2.68

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>6.00	0.0	0.0
1.50	0.7>6.00	0.0	0.7
2.00	1.6>6.00	0.0	1.6
2.50	2.8>6.00	0.0	2.8
3.00	4.1	0.0	4.1
3.50	5.2	0.0	5.2
4.00	8.5	0.0	8.5
4.50	10.4	8.4	18.9
4.70	11.1	11.8	22.9
4.80	11.4	15.3	26.7
4.90	11.7	18.9	30.7
5.00	12.0	23.1	35.1
5.50	13.5	48.9	62.4
6.00	14.7	80.7	95.5
6.50	15.9	120.2	136.1
7.00	17.0	167.3	184.3
7.50	18.0	221.3	239.3
8.00	19.0	282.1	301.1
8.50	20.0	349.9	369.9
9.00	20.8	424.8	445.6
9.50	21.7	506.7	528.4
10.00	22.5	596.0	618.5
10.50	23.1	692.6	715.7
11.00	23.3	796.7	820.0
11.50	23.4	908.5	932.0

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.7	0.33	0.00	
1.0	1.0	0.7	0.67	0.00	Low Orifice of SW#1
1.5	1.5	0.8	1.04	0.67	
2.0	2.0	0.8	1.42	1.61	
2.5	2.5	0.8	1.83	2.77	
3.0	3.0	0.9	2.25	4.11	Stage of SW#1
3.5	3.5	0.9	2.69	5.16	
4.0	4.0	0.9	3.15	8.51	Stage of SW#2
4.5	4.5	1.0	3.63	18.86	
4.7	4.7	1.0	3.83	22.88	
4.8	4.8	1.0	3.93	26.71	
4.9	4.9	1.0	4.03	30.65	
5.0	5.0	1.0	4.13	35.10	
5.5	5.5	1.0	4.64	62.35	
5.6	5.6	1.0	4.72	67.16	Peak Stage
6.0	6.0	1.1	5.18	95.46	
6.5	6.5	1.1	5.73	136.13	
7.0	7.0	1.2	6.30	184.34	
7.5	7.5	1.2	6.89	239.33	
8.0	8.0	1.2	7.50	301.15	
8.5	8.5	1.3	8.13	369.87	
9.0	9.0	1.3	8.78	445.59	
9.5	9.5	1.4	9.44	528.43	
10.0	10.0	1.4	10.12	618.49	
10.5	10.5	1.4	10.81	715.69	
11.0	11.0	1.4	11.51	820.01	
11.5	11.5	1.4	12.22	931.97	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 1

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL1

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Refuse Area % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	12.64*	74	M	0.028	0.000	0.000	0.0	2.49	25.70
111	2	17.14*	75	M	0.011	0.029	0.377	0.0	3.50	35.69
111	3	21.09*	75	S	0.193	0.029	0.377	0.0	4.31	29.01
		Type: Pond Label: Pond 1								
111	Structure	50.88							10.30	
111	Total IN	50.88							10.30	88.99
111	Total OUT								10.29	56.14

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
111	1	0.22	30.0	27.0	0.050	0.000	2	24.8				
111	2	0.22	30.0	40.0	0.800	0.029	1	857.6				
111	3	0.22	50.0	3.0	0.800	0.029	1	73.0				
				Type: Pond Label: Pond 1								
111	Structure							954.7				
111	Total IN							954.7	108269	84.98	52.12	6.93
111	Total OUT							16.3	1743	0.30	0.20	0.12

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.10	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	10.30	88.99	954.7	108269	84.98	52.12	6.93
OUT	10.29	56.14	16.3	1743	0.30	0.20	0.12

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.4	98.29	2.46

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
phon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	10.30	88.99	954.7	108269	84.98	52.12	6.93
OUT	10.29	56.14	16.3	1743	0.30	0.20	0.12

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.4	98.29	2.46

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>6.00	0.0	0.0
1.50	0.7>6.00	0.0	0.7
2.00	1.6>6.00	0.0	1.6
2.50	2.8>6.00	0.0	2.8
3.00	4.1	0.0	4.1
3.50	5.2	0.0	5.2
4.00	8.5	0.0	8.5
4.50	10.4	8.4	18.9
4.70	11.1	11.8	22.9
4.80	11.4	15.3	26.7
4.90	11.7	18.9	30.7
5.00	12.0	23.1	35.1
5.50	13.5	48.9	62.4
6.00	14.7	80.7	95.5
6.50	15.9	120.2	136.1
7.00	17.0	167.3	184.3
7.50	18.0	221.3	239.3
8.00	19.0	282.1	301.1
8.50	20.0	349.9	369.9
9.00	20.8	424.8	445.6
9.50	21.7	506.7	528.4
10.00	22.5	596.0	618.5
10.50	23.1	692.6	715.7
11.00	23.3	796.7	820.0
11.50	23.4	908.5	932.0

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.7	0.33	0.00	
1.0	1.0	0.7	0.67	0.00	Low Orifice of SW#1
1.5	1.5	0.8	1.04	0.67	
2.0	2.0	0.8	1.42	1.61	
2.5	2.5	0.8	1.83	2.77	
3.0	3.0	0.9	2.25	4.11	Stage of SW#1
3.5	3.5	0.9	2.69	5.16	
4.0	4.0	0.9	3.15	8.51	Stage of SW#2
4.5	4.5	1.0	3.63	18.86	
4.7	4.7	1.0	3.83	22.88	
4.8	4.8	1.0	3.93	26.71	
4.9	4.9	1.0	4.03	30.65	
5.0	5.0	1.0	4.13	35.10	
5.4	5.4	1.0	4.52	56.14	Peak Stage
5.5	5.5	1.0	4.64	62.35	
6.0	6.0	1.1	5.18	95.46	
6.5	6.5	1.1	5.73	136.13	
7.0	7.0	1.2	6.30	184.34	
7.5	7.5	1.2	6.89	239.33	
8.0	8.0	1.2	7.50	301.15	
8.5	8.5	1.3	8.13	369.87	
9.0	9.0	1.3	8.78	445.59	
9.5	9.5	1.4	9.44	528.43	
10.0	10.0	1.4	10.12	618.49	
10.5	10.5	1.4	10.81	715.69	
11.0	11.0	1.4	11.51	820.01	
11.5	11.5	1.4	12.22	931.97	

U.S. Steel – Concord Refuse Area Impoundment Structure Information

POND INFORMATION

Pond ID: Pond 2

	Stage/ Dimension	Elevation
Bottom of Impoundment	0 *Ft.*	520.00 *msl.*
Top of Impoundment	16.3 *Ft.*	536.28 *msl.*
Min Top Width	10.0 *Ft.*	
Upstream Slope	3 *: 1*	
Downstream Slope	3 *: 1*	
Sediment Depth *	8.50 *Ft.*	528.50 *msl.*
RISER SPILLWAY INFORMATION		
Riser Diameter	18 *In.*	
Riser Height **	4 *Ft.*	532.50 *msl.*
SLOTTED RISER INFORMATION		
Diameter	3 *In.*	
No. of Slots/Elevation	3	
Beginning Height **	1 *Ft.*	529.50 *msl.*
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	18 *In.*	
Slope	15.3 *%*	
Spillway Height **	–8.50 *Ft.*	520.00 *msl.*
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	10 *Ft.*	
Side Slopes	1 *: 1*	
Bed Slope	6 *%*	
Exit Slope	9 *%*	
Spillway Height **	5.00 *Ft.*	533.50 *msl.*
Flow In Sp'way – 10yr	1.00 *Ft.*	534.50 *msl.*
Flow In Sp'way – 25yr	0.80 *Ft.*	534.30 *msl.*

Notes:

* Above bottom of Pond

** Above sediment level

NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

Stage Storage Calculations and Graph

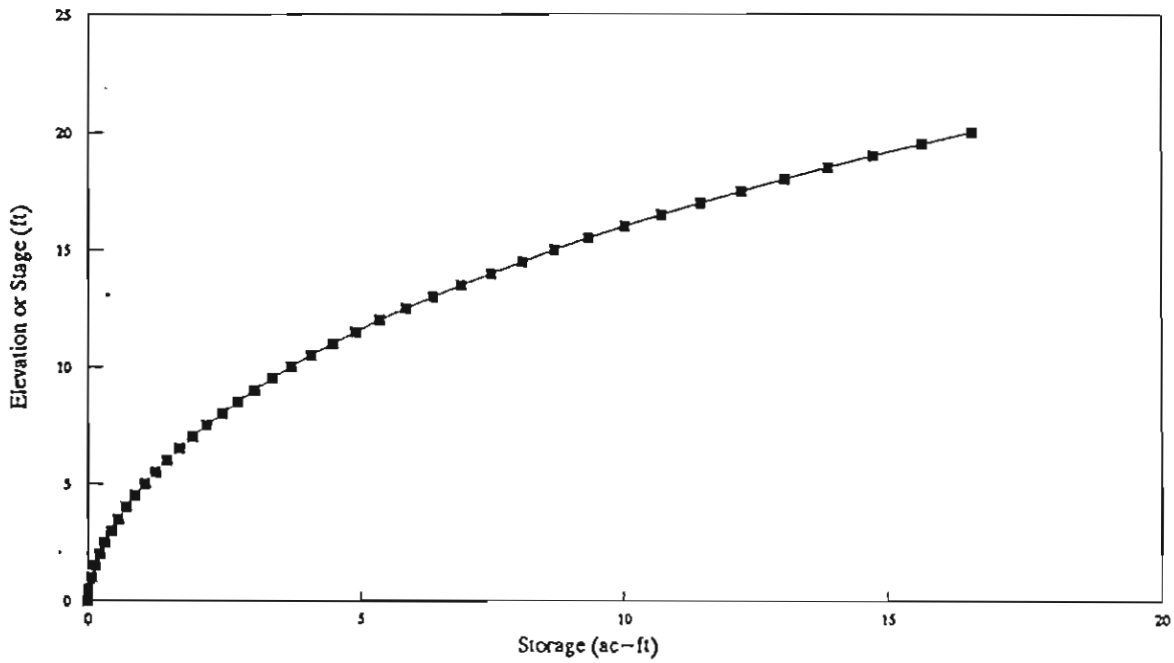
U. S. Steel – Concord Refuse Area

Pond Id: Pond 2

Stage	Area (acres)	Capacity (ac–ft)
0	0.04	0
0.5	0.08	0.03
1	0.11	0.08
1.5	0.14	0.14
2	0.17	0.22
2.5	0.21	0.31
3	0.24	0.42
3.5	0.27	0.55
4	0.31	0.7
4.5	0.34	0.86
5	0.37	1.04
5.5	0.4	1.23
6	0.44	1.44
6.5	0.47	1.67
7	0.5	1.91
7.5	0.54	2.17
8	0.57	2.45
8.5	0.6	2.74
9	0.64	3.05
9.5	0.67	3.38

Stage	Area (acres)	Capacity (ac–ft)
10	0.7	3.72
10.5	0.76	4.08
11	0.82	4.48
11.5	0.88	4.9
12	0.93	5.35
12.5	0.99	5.83
13	1.05	6.34
13.5	1.11	6.88
14	1.17	7.45
14.5	1.22	8.05
15	1.28	8.68
15.5	1.34	9.33
16	1.4	10.02
16.5	1.46	10.73
17	1.52	11.48
17.5	1.57	12.25
18	1.63	13.05
18.5	1.69	13.88
19	1.75	14.74
19.5	1.81	15.63
20	1.86	16.55

Stage Storage



File: usteel2s

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 2

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL2

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Rerfuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.00*	74	M	0.323	0.000	0.000	0.0	5.04	29.60
111	2	12.42*	75	F	0.009	0.312	0.273	0.0	3.40	23.07
111	3	12.08*	75	S	0.165	0.038	0.382	0.0	3.31	17.05
		Type: Pond Label: Pond 2								
111	Structure	43.51							11.75	
111	Total IN	43.51							11.75	68.28
111	Total OUT								11.68	35.79

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	39.9				
R	111	2	0.22	30.0	40.0	0.800	0.312	1	660.6				
R	111	3	0.22	50.0	3.0	0.800	0.038	1	46.7				
				Type: Pond Label: Pond 2									
	111	Structure							741.6				
	111	Total IN							741.6	80181	62.04	34.95	11.51
	111	Total OUT							21.5	1926	0.33	0.24	0.17

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========
NON-POND STRUCTURE INPUT/OUTPUT TABLE
==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	11.75	68.28	741.6	80181	62.04	34.95	11.51
OUT	11.68	35.79	21.5	1926	0.33	0.24	0.17

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.11	4.37

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	11.75	68.28	741.6	80181	62.04	34.95	11.51
OUT	11.68	35.79	21.5	1926	0.33	0.24	0.17

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.11	4.37

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>3.00	0.0	0.0
1.50	0.5>3.00	0.0	0.5
2.00	1.2>3.00	0.0	1.2
2.50	2.1>3.00	0.0	2.1
3.00	3.1>3.00	0.0	3.1
3.50	4.2	0.0	4.2
4.00	4.3	0.0	4.3
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	19.0	282.1	301.1
9.50	20.0	349.9	369.9
10.00	20.8	424.8	445.6
10.50	21.7	506.7	528.4
11.00	22.5	596.0	618.5
11.50	23.3	692.6	715.9

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Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
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U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.6	0.31	0.00	
1.0	1.0	0.7	0.63	0.00	Low Orifice of SW#1
1.5	1.5	0.7	0.98	0.50	
2.0	2.0	0.8	1.34	1.21	
2.5	2.5	0.8	1.74	2.08	
3.0	3.0	0.9	2.16	3.08	
3.5	3.5	0.9	2.62	4.20	
4.0	4.0	1.0	3.10	4.31	Stage of SW#1
4.5	4.5	1.0	3.61	5.16	
5.0	5.0	1.1	4.15	8.51	Stage of SW#2
5.5	5.5	1.2	4.71	18.86	
5.7	5.7	1.2	4.95	22.88	
5.8	5.8	1.2	5.07	26.71	
5.9	5.9	1.2	5.19	30.65	
6.0	6.0	1.2	5.31	35.10	
6.0	6.0	1.2	5.33	35.79	Peak Stage
6.5	6.5	1.3	5.94	62.35	
7.0	7.0	1.3	6.59	95.46	
7.5	7.5	1.4	7.27	136.13	
8.0	8.0	1.5	7.99	184.34	
8.5	8.5	1.5	8.73	239.33	
9.0	9.0	1.6	9.50	301.15	
9.5	9.5	1.6	10.30	369.87	
10.0	10.0	1.7	11.13	445.59	
10.5	10.5	1.7	11.99	528.43	
11.0	11.0	1.8	12.88	618.49	
11.5	11.5	1.9	13.80	715.91	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 2

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL2

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Rerfuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.00*	74	M	0.323	0.000	0.000	0.0	3.74	30.67
111	2	12.42*	75	F	0.009	0.312	0.273	0.0	2.54	25.87
111	3	12.08*	75	S	0.165	0.038	0.382	0.0	2.47	17.49
		Type: Pond Label: Pond 2								
111	Structure	43.51							8.75	
111	Total IN	43.51							8.75	71.55
111	Total OUT								8.73	27.16

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
111	1	0.22	30.0	27.0	0.050	0.000	2	34.4				
111	2	0.22	30.0	40.0	0.800	0.312	1	597.9				
111	3	0.22	50.0	3.0	0.800	0.038	1	40.2				
		Type: Pond Label: Pond 2										
111	Structure							667.5				
111	Total IN							667.5	85972	66.52	42.35	5.77
111	Total OUT							18.9	2063	0.36	0.28	0.21

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Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========
LAST POND ONLY TABLE
==========

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	8.75	71.55	667.5	85972	66.52	42.35	5.77
OUT	8.73	27.16	18.9	2063	0.36	0.28	0.21

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.8	97.17	4.32

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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Company Name: Challenge Engineering Consultants
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Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========
LAST POND ONLY TABLE
==========

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
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J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage⅓ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

⅓Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	8.75	71.55	667.5	85972	66.52	42.35	5.77
OUT	8.73	27.16	18.9	2063	0.36	0.28	0.21

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.8	97.17	4.32

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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U.S. Steel - Concord Refuse Area - Pond 2
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Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>3.00	0.0	0.0
1.50	0.5>3.00	0.0	0.5
2.00	1.2>3.00	0.0	1.2
2.50	2.1>3.00	0.0	2.1
3.00	3.1>3.00	0.0	3.1
3.50	4.2	0.0	4.2
4.00	4.3	0.0	4.3
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	19.0	282.1	301.1
9.50	20.0	349.9	369.9
10.00	20.8	424.8	445.6
10.50	21.7	506.7	528.4
11.00	22.5	596.0	618.5
11.50	23.3	692.6	715.9

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U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.6	0.31	0.00	
1.0	1.0	0.7	0.63	0.00	Low Orifice of SW#1
1.5	1.5	0.7	0.98	0.50	
2.0	2.0	0.8	1.34	1.21	
2.5	2.5	0.8	1.74	2.08	
3.0	3.0	0.9	2.16	3.08	
3.5	3.5	0.9	2.62	4.20	
4.0	4.0	1.0	3.10	4.31	Stage of SW#1
4.5	4.5	1.0	3.61	5.16	
5.0	5.0	1.1	4.15	8.51	Stage of SW#2
5.5	5.5	1.2	4.71	18.86	
5.7	5.7	1.2	4.95	22.88	
5.8	5.8	1.2	5.07	26.71	
5.8	5.8	1.2	5.08	27.16	Peak Stage
5.9	5.9	1.2	5.19	30.65	
6.0	6.0	1.2	5.31	35.10	
6.5	6.5	1.3	5.94	62.35	
7.0	7.0	1.3	6.59	95.46	
7.5	7.5	1.4	7.27	136.13	
8.0	8.0	1.5	7.99	184.34	
8.5	8.5	1.5	8.73	239.33	
9.0	9.0	1.6	9.50	301.15	
9.5	9.5	1.6	10.30	369.87	
10.0	10.0	1.7	11.13	445.59	
10.5	10.5	1.7	11.99	528.43	
11.0	11.0	1.8	12.88	618.49	
11.5	11.5	1.9	13.80	715.91	

U.S. Steel – Concord Refuse Area Impoundment Structure Information

POND INFORMATION

Pond ID: Pond 3

	Stage/ Dimension	Elevation
Bottom of Impoundment	0 *Ft.*	540.00 *msl.*
Top of Impoundment	13.9 *Ft.*	553.86 *msl.*
Min Top Width	10.0 *Ft.*	
Upstream Slope	3 *: 1*	
Downstream Slope	3 *: 1*	
Sediment Depth *	6.00 *Ft.*	546.00 *msl.*
RISER SPILLWAY INFORMATION		
Riser Diameter	18 *In.*	
Riser Height **	4 *Ft.*	550.00 *msl.*
SLOTTED RISER INFORMATION		
Diameter	0.5 *In.*	
No. of Slots/Elevation	1	
Beginning Height **	1 *Ft.*	547.00 *msl.*
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	18 *In.*	
Slope	8.3 *%*	
Spillway Height **	–6.00 *Ft.*	540.00 *msl.*
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	10 *Ft.*	
Side Slopes	1 *: 1*	
Bed Slope	6 *%*	
Exit Slope	15 *%*	
Spillway Height **	5.00 *Ft.*	551.00 *msl.*
Flow In Sp'way – 10yr	1.20 *Ft.*	552.20 *msl.*
Flow In Sp'way – 25yr	1.00 *Ft.*	552.00 *msl.*

Notes:

* Above bottom of Pond

** Above sediment level

NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

Stage Storage Calculations and Graph

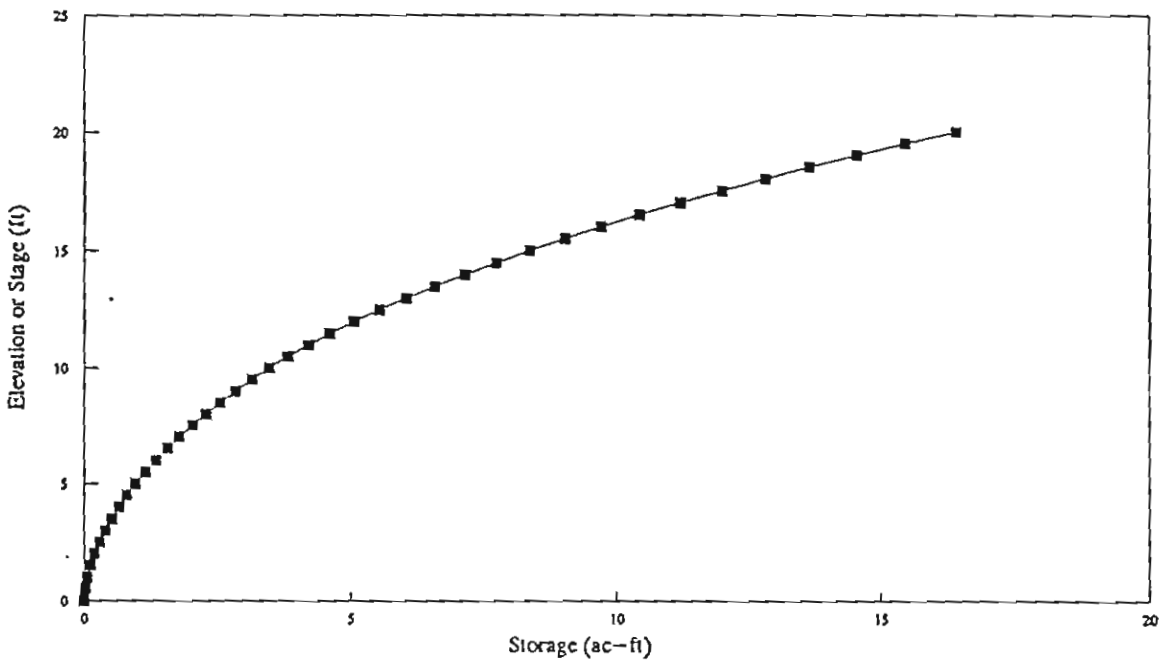
U. S. Steel – Concord Refuse Area

Pond Id: Pond 3

Stage	Area (acres)	Capacity (ac–ft)
0	0.04	0
0.5	0.07	0.03
1	0.1	0.07
1.5	0.13	0.13
2	0.16	0.2
2.5	0.19	0.29
3	0.23	0.4
3.5	0.26	0.52
4	0.29	0.66
4.5	0.32	0.81
5	0.35	0.97
5.5	0.38	1.16
6	0.41	1.35
6.5	0.44	1.57
7	0.47	1.79
7.5	0.5	2.04
8	0.53	2.3
8.5	0.56	2.57
9	0.59	2.86
9.5	0.63	3.17

Stage	Area (acres)	Capacity (ac–ft)
10	0.66	3.49
10.5	0.72	3.83
11	0.78	4.21
11.5	0.85	4.61
12	0.91	5.05
12.5	0.97	5.53
13	1.04	6.03
13.5	1.1	6.56
14	1.17	7.13
14.5	1.23	7.73
15	1.29	8.36
15.5	1.36	9.02
16	1.42	9.71
16.5	1.48	10.44
17	1.55	11.2
17.5	1.61	11.99
18	1.67	12.81
18.5	1.74	13.66
19	1.8	14.55
19.5	1.86	15.46
20	1.93	16.41

Stage Storage



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U.S. Steel – Concord Refuse Area

Impoundment Structure Information

POND INFORMATION Pond ID: Pond 3A

	Stage/ Dimension	Elevation
Bottom of Impoundment	0 Ft.	600.00 msl.
Top of Impoundment	20.0 Ft.	619.95 msl.
Min Top Width	11.0 Ft.	
Upstream Slope	2.5 : 1	
Downstream Slope	2.5 : 1	
Sediment Depth *	11.00 Ft.	611.00 msl.
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	12 In.	
Slope	5 %	
Spillway Height **	4.00 Ft.	615.00 msl.
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	15 Ft.	
Side Slopes	2 : 1	
Bed Slope	6 %	
Exit Slope	9 %	
Spillway Height **	6.00 Ft.	617.00 msl.
Flow In Sp'way – 10yr	1.00 Ft.	618.00 msl.
Flow In Sp'way – 25yr	1.00 Ft.	618.00 msl.
Flow In Sp'way – 100yr	0.00 Ft.	617.00 msl.

Notes:

* Above bottom of Pond

** Above sediment level

NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

File: usteel3a

Stage Storage Calculations and Graph

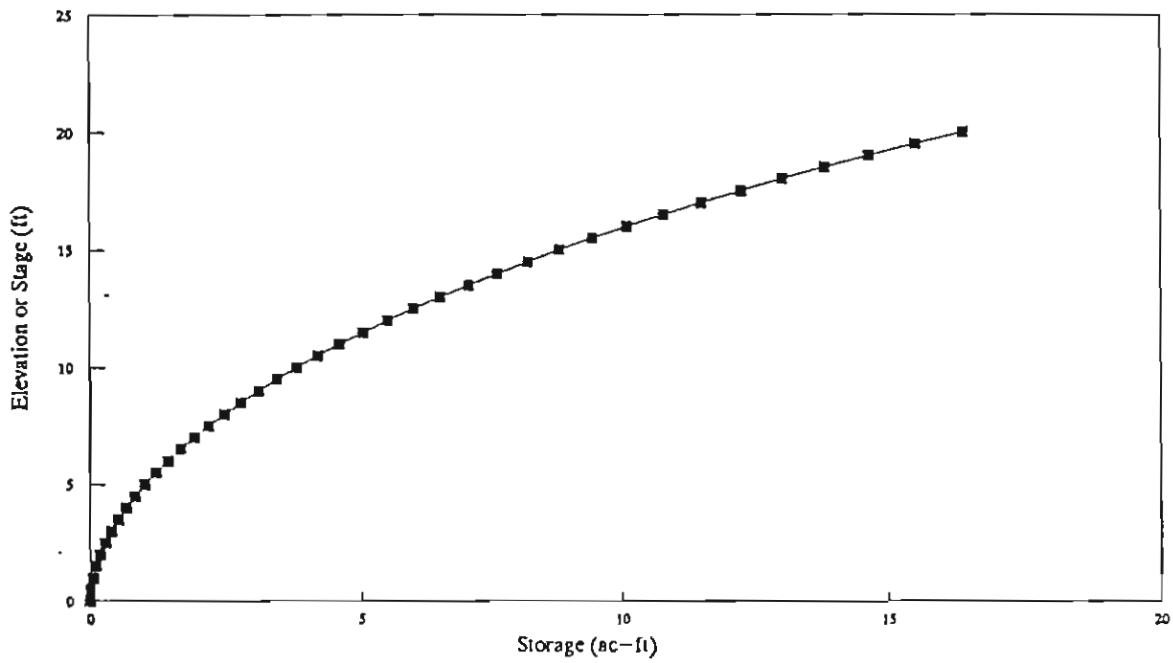
U. S. Steel – Concord Refuse Area

Pond Id: Pond 3A

Stage	Area (acres)	Capacity (ac–ft)
0	0.02	0
0.5	0.06	0.02
1	0.09	0.06
1.5	0.13	0.11
2	0.16	0.19
2.5	0.2	0.28
3	0.24	0.39
3.5	0.27	0.51
4	0.31	0.66
4.5	0.34	0.82
5	0.38	1
5.5	0.42	1.2
6	0.45	1.42
6.5	0.49	1.66
7	0.52	1.91
7.5	0.56	2.18
8	0.6	2.47
8.5	0.63	2.78
9	0.67	3.1
9.5	0.7	3.44

Stage	Area (acres)	Capacity (ac–ft)
10	0.74	3.81
10.5	0.79	4.19
11	0.84	4.6
11.5	0.9	5.03
12	0.95	5.49
12.5	1	5.98
13	1.05	6.49
13.5	1.1	7.03
14	1.15	7.59
14.5	1.21	8.18
15	1.26	8.8
15.5	1.31	9.44
16	1.36	10.11
16.5	1.41	10.8
17	1.46	11.52
17.5	1.52	12.27
18	1.57	13.04
18.5	1.62	13.83
19	1.67	14.66
19.5	1.72	15.51
20	1.77	16.38

Stage Storage



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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U S STEEL - CONCORD REFUSE AREA - POND 3

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL3

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Refuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	5.01*	74	M	0.076	0.000	0.000	0.0	1.33	9.11
111	2	11.00*	75	F	0.011	0.014	0.394	0.0	3.01	20.42
111	3	33.00*	75	S	0.251	0.045	0.382	0.0	9.03	40.97
		Type: Pond Label: Pond 3-A								
111	Structure	49.01							13.36	
111	Total IN	49.01							13.36	68.59
111	Total OUT								13.24	40.46
211	1	0.01	73	F	0.001	0.000	0.000	0.0	0.00	0.02
		Type: Null Label: Null Structure								
211	Structure	0.01							13.37	
211	Total IN/OUT	49.02							13.37	40.46
111	to 211 Routing					0.014	0.394			
221	1	12.81*	75	F	0.335	0.000	0.000	0.0	3.50	22.18
221	2	3.91*	73	M	0.179	0.000	0.000	0.0	1.01	6.62
		Type: Null Label: Null 2								
221	Structure	16.73							4.51	
221	Total IN/OUT	16.73							4.51	28.37
311	1	0.00	75	F	0.335	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: Pond 3								
311	Structure	0.00							17.88	
311	Total IN	65.75							17.88	63.64
311	Total OUT								16.19	47.43
211	to 311 Routing					0.000	0.000			

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	9.8				
R	111	2	0.22	30.0	40.0	0.800	0.014	1	576.4				
R	111	3	0.22	50.0	3.0	0.800	0.045	1	134.0				
					Type: Pond			Label:	Pond 3-A				
	111	Structure							719.8				
	111	Total IN							719.8	97406	76.85	30.43	10.54
	111	Total OUT							8.0	561	0.10	0.08	0.06
R	211	1	0.22	100.0	40.0	0.800	0.000	1	0.4				
					Type: Null			Label:	Null Structure				
	211	Structure							8.4				
	211	Total IN/OUT							8.4	2060	0.42	0.10	0.08
	111	to 211 Routing					0.014						
R	221	1	0.22	30.0	40.0	0.800	0.000	1	657.5				
R	221	2	0.22	30.0	27.0	0.050	0.000	2	7.0				
					Type: Null			Label:	Null 2				
	21	Structure							664.5				
	221	Total IN/OUT							664.5	171354	135.35	80.42	26.71
R	311	1	0.22	40.0	40.0	0.800	0.000	1	0.0				
					Type: Pond			Label:	Pond 3				
	311	Structure							672.9				
	311	Total IN							672.9	129658	101.46	21.98	10.07
	311	Total OUT							14.4	1826	0.31	0.12	0.05
	211	to 311 Routing					0.000						

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	17.88	63.64	672.9	129658	101.46	21.98	10.07
OUT	16.19	47.43	14.4	1826	0.31	0.12	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.2	97.86	1.25

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

DISCHARGE OPTIONS:

	Trickle Tube	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	50.00	----
Barrel Slope (%)	5.00	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	0.9	----
Tailwater Depth (ft)	0.0	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	6.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	2 2
Bottom Width (ft)	----	15.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm

0.00 4.20 20.00 CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.36	68.59	719.8	97406	76.85	30.43	10.54
OUT	13.24	40.46	8.0	561	0.10	0.08	0.06

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7.0	98.90	3.89

****

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----

Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

*Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	17.88	63.64	672.9	129658	101.46	21.98	10.07
OUT	16.19	47.43	14.4	1826	0.31	0.12	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.2	97.86	1.25

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

Elevation	Trickle Tube (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0	0.0	0.0
1.50	0.0	0.0	0.0
2.00	0.0	0.0	0.0
2.50	0.0	0.0	0.0
3.00	0.0	0.0	0.0
3.50	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	0.8	0.0	0.8
5.00	2.1	0.0	2.1
5.50	3.4	0.0	3.4
6.00	4.2	0.0	4.2
6.50	4.5	12.8	17.3
6.70	4.7	17.9	22.6
6.80	4.7	23.3	28.0
6.90	4.8	28.8	33.6
7.00	4.9	35.2	40.1
7.50	5.1	75.3	80.5
8.00	5.4	125.5	130.9
8.50	5.6	188.5	194.1
9.00	5.9	264.5	270.4

****

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)

0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>0.50	0.0	0.0
1.50	0.0>0.50	0.0	0.0
2.00	0.0>0.50	0.0	0.0
2.50	0.0>0.50	0.0	0.0
3.00	0.0>0.50	0.0	0.0
3.50	0.0	0.0	0.0
0.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	18.7	282.1	300.8
9.50	18.9	349.9	368.8
10.00	19.0	424.8	443.7
10.50	19.1	506.7	525.9
11.00	19.3	596.0	615.3
11.50	19.4	692.6	712.0
12.00	19.6	796.7	816.3
12.50	19.7	908.5	928.2
13.00	19.8	1028.1	1047.9
13.50	20.0	1155.5	1175.5
14.00	20.1	1291.0	1311.1

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

SW#1: Trickle Tube
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.8	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.9	0.43	0.00	
1.0	1.0	0.9	0.89	0.00	
1.5	1.5	1.0	1.38	0.00	
2.0	2.0	1.0	1.89	0.00	
2.5	2.5	1.1	2.43	0.00	
3.0	3.0	1.1	2.99	0.00	
3.5	3.5	1.2	3.58	0.00	
4.0	4.0	1.3	4.20	0.00	Stage of SW#1
4.5	4.5	1.3	4.84	0.82	
5.0	5.0	1.4	5.51	2.09	
5.5	5.5	1.4	6.20	3.42	
6.0	6.0	1.5	6.92	4.16	Stage of SW#2
6.5	6.5	1.5	7.66	17.31	
6.7	6.7	1.5	7.97	22.57	
6.8	6.8	1.5	8.12	28.01	
6.9	6.9	1.6	8.28	33.64	
7.0	7.0	1.6	8.43	40.05	
7.0	7.0	1.6	8.44	40.46	Peak Stage
7.5	7.5	1.6	9.23	80.47	
8.0	8.0	1.7	10.05	130.85	
8.5	8.5	1.7	10.90	194.08	
9.0	9.0	1.8	11.77	270.37	

****

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.4	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.4	0.21	0.00	
1.0	1.0	0.5	0.44	0.00	Low Orifice of SW#1
1.5	1.5	0.5	0.68	0.00	
2.0	2.0	0.5	0.94	0.01	
2.5	2.5	0.6	1.21	0.02	
3.0	3.0	0.6	1.50	0.03	
3.5	3.5	0.6	1.80	0.04	
0.0	0.0	0.4	0.07	0.00	
4.0	4.0	0.7	2.12	0.04	Stage of SW#1
4.5	4.5	0.7	2.46	5.16	
5.0	5.0	0.8	2.84	8.51	Stage of SW#2
5.5	5.5	0.8	3.24	18.86	
5.7	5.7	0.9	3.41	22.88	
5.8	5.8	0.9	3.50	26.71	
5.9	5.9	0.9	3.59	30.65	
6.0	6.0	0.9	3.68	35.10	
6.2	6.2	0.9	3.89	47.43	Peak Stage
6.5	6.5	1.0	4.15	62.35	
7.0	7.0	1.0	4.65	95.46	
7.5	7.5	1.1	5.19	136.13	
8.0	8.0	1.2	5.76	184.34	
8.5	8.5	1.2	6.36	239.33	
9.0	9.0	1.3	6.99	300.84	
9.5	9.5	1.4	7.65	368.77	
10.0	10.0	1.4	8.34	443.75	
10.5	10.5	1.5	9.07	525.87	
11.0	11.0	1.5	9.83	615.25	
11.5	11.5	1.6	10.62	712.02	
12.0	12.0	1.7	11.44	816.30	
12.5	12.5	1.7	12.29	928.22	
13.0	13.0	1.8	13.17	1047.90	
13.5	13.5	1.9	14.09	1175.49	
14.0	14.0	1.9	15.04	1311.12	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U S STEEL - CONCORD REFUSE AREA - POND 3

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL3

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Refuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	5.01*	74	M	0.076	0.000	0.000	0.0	0.99	10.19
111	2	11.00*	75	F	0.011	0.014	0.394	0.0	2.25	22.90
111	3	33.00*	75	S	0.251	0.045	0.382	0.0	6.74	41.22
		Type: Pond Label: Pond 3-A								
111	Structure	49.01							9.97	
111	Total IN	49.01							9.97	71.39
111	Total OUT								9.94	32.45
2..	1	0.01	73	F	0.001	0.000	0.000	0.0	0.00	0.02
		Type: Null Label: Null Structure								
211	Structure	0.01							9.97	
211	Total IN/OUT	49.02							9.97	32.45
111	to 211 Routing					0.014	0.394			
221	1	12.81*	75	F	0.335	0.000	0.000	0.0	2.61	23.88
221	2	3.91*	73	M	0.179	0.000	0.000	0.0	0.74	7.08
		Type: Null Label: Null 2								
221	Structure	16.73							3.36	
221	Total IN/OUT	16.73							3.36	30.23
311	1	0.00	75	F	0.335	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: Pond 3								
311	Structure	0.00							13.33	
311	Total IN	65.75							13.33	47.92
311	Total OUT								11.65	36.14
211	to 311 Routing					0.000	0.000			

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	8.8				
R	111	2	0.22	30.0	40.0	0.800	0.014	1	521.7				
R	111	3	0.22	50.0	3.0	0.800	0.045	1	114.1				
					Type: Pond		Label:		Pond 3-A				
	111 Structure								644.3				
	111 Total IN								644.3	95979	75.71	36.59	5.79
	111 Total OUT								6.6	568	0.10	0.09	0.07
R	211	1	0.22	100.0	40.0	0.800	0.000	1	0.4				
					Type: Null		Label:		Null Structure				
	211 Structure								7.0				
	211 Total IN/OUT								7.0	4944	1.02	0.11	0.10
	111 to 211 Routing						0.014						
R	221	1	0.22	30.0	40.0	0.800	0.000	1	581.7				
R	221	2	0.22	30.0	27.0	0.050	0.000	2	6.1				
					Type: Null		Label:		Null 2				
	21 Structure								587.8				
	221 Total IN/OUT								587.8	175215	138.36	95.23	13.20
R	311	1	0.22	40.0	40.0	0.800	0.000	1	0.0				
					Type: Pond		Label:		Pond 3				
	311 Structure								594.8				
	311 Total IN								594.8	139604	109.27	25.41	5.99
	311 Total OUT								12.5	2144	0.37	0.14	0.05
	211 to 311 Routing						0.000						

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

Civil Software Design -- SEDCAD+ Version 3
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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.33	47.92	594.8	139604	109.27	25.41	5.99
OUT	11.65	36.14	12.5	2144	0.37	0.14	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.90	1.25

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

DISCHARGE OPTIONS:

	Trickle Tube	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	50.00	----
Barrel Slope (%)	5.00	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	0.9	----
Tailwater Depth (ft)	0.0	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	6.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	2 2
Bottom Width (ft)	----	15.0

D RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm

0.00 4.20 20.00 CSTRS

¼Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	9.97	71.39	644.3	95979	75.71	36.59	5.79
OUT	9.94	32.45	6.6	568	0.10	0.09	0.07

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.9	98.97	3.84

****

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----

Emergency Spillway Elevation	----	5.0	
Crest Length (ft)	----	25.0	
Z:1 (Left and Right)	-- --	1	1
tom Width (ft)	----	10.0	

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.33	47.92	594.8	139604	109.27	25.41	5.99
OUT	11.65	36.14	12.5	2144	0.37	0.14	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.90	1.25

' atering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

Elevation	Trickle Tube (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0	0.0	0.0
1.50	0.0	0.0	0.0
2.00	0.0	0.0	0.0
2.50	0.0	0.0	0.0
3.00	0.0	0.0	0.0
3.50	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	0.8	0.0	0.8
5.00	2.1	0.0	2.1
5.50	3.4	0.0	3.4
6.00	4.2	0.0	4.2
6.50	4.5	12.8	17.3
6.70	4.7	17.9	22.6
6.80	4.7	23.3	28.0
6.90	4.8	28.8	33.6
7.00	4.9	35.2	40.1
7.50	5.1	75.3	80.5
8.00	5.4	125.5	130.9
8.50	5.6	188.5	194.1
9.00	5.9	264.5	270.4

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)

0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>0.50	0.0	0.0
1.50	0.0>0.50	0.0	0.0
2.00	0.0>0.50	0.0	0.0
2.50	0.0>0.50	0.0	0.0
3.00	0.0>0.50	0.0	0.0
3.50	0.0	0.0	0.0
0.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	18.7	282.1	300.8
9.50	18.9	349.9	368.8
10.00	19.0	424.8	443.7
10.50	19.1	506.7	525.9
11.00	19.3	596.0	615.3
11.50	19.4	692.6	712.0
12.00	19.6	796.7	816.3
12.50	19.7	908.5	928.2
13.00	19.8	1028.1	1047.9
13.50	20.0	1155.5	1175.5
14.00	20.1	1291.0	1311.1

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

SW#1: Trickle Tube
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.8	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.9	0.43	0.00	
1.0	1.0	0.9	0.89	0.00	
1.5	1.5	1.0	1.38	0.00	
2.0	2.0	1.0	1.89	0.00	
2.5	2.5	1.1	2.43	0.00	
3.0	3.0	1.1	2.99	0.00	
3.5	3.5	1.2	3.58	0.00	
4.0	4.0	1.3	4.20	0.00	Stage of SW#1
4.5	4.5	1.3	4.84	0.82	
5.0	5.0	1.4	5.51	2.09	
5.5	5.5	1.4	6.20	3.42	
6.0	6.0	1.5	6.92	4.16	Stage of SW#2
6.5	6.5	1.5	7.66	17.31	
6.7	6.7	1.5	7.97	22.57	
6.8	6.8	1.5	8.12	28.01	
6.9	6.9	1.5	8.24	32.45	Peak Stage
6.9	6.9	1.6	8.28	33.64	
7.0	7.0	1.6	8.43	40.05	
7.5	7.5	1.6	9.23	80.47	
8.0	8.0	1.7	10.05	130.85	
8.5	8.5	1.7	10.90	194.08	
9.0	9.0	1.8	11.77	270.37	

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.4	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.4	0.21	0.00	
1.0	1.0	0.5	0.44	0.00	Low Orifice of SW#1
1.5	1.5	0.5	0.68	0.00	
2.0	2.0	0.5	0.94	0.01	
2.5	2.5	0.6	1.21	0.02	
3.0	3.0	0.6	1.50	0.03	
3.5	3.5	0.6	1.80	0.04	
0.0	0.0	0.4	0.07	0.00	
4.0	4.0	0.7	2.12	0.04	Stage of SW#1
4.5	4.5	0.7	2.46	5.16	
5.0	5.0	0.8	2.84	8.51	Stage of SW#2
5.5	5.5	0.8	3.24	18.86	
5.7	5.7	0.9	3.41	22.88	
5.8	5.8	0.9	3.50	26.71	
5.9	5.9	0.9	3.59	30.65	
6.0	6.0	0.9	3.68	35.10	
6.0	6.0	0.9	3.70	36.14	Peak Stage
6.5	6.5	1.0	4.15	62.35	
7.0	7.0	1.0	4.65	95.46	
7.5	7.5	1.1	5.19	136.13	
8.0	8.0	1.2	5.76	184.34	
8.5	8.5	1.2	6.36	239.33	
9.0	9.0	1.3	6.99	300.84	
9.5	9.5	1.4	7.65	368.77	
.0.0	10.0	1.4	8.34	443.75	
10.5	10.5	1.5	9.07	525.87	
11.0	11.0	1.5	9.83	615.25	
11.5	11.5	1.6	10.62	712.02	
12.0	12.0	1.7	11.44	816.30	
12.5	12.5	1.7	12.29	928.22	
13.0	13.0	1.8	13.17	1047.90	
13.5	13.5	1.9	14.09	1175.49	
14.0	14.0	1.9	15.04	1311.12	

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/12/91 CHKD BY: DMC DATE: 6-13-91
PROJECT NAME: CONCORD REFUSE
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION ____

FOUNDATION DESIGN FOR RISERS

VOLUME OF RISER = $\pi \left(\frac{D}{2}\right)^2 h$

PONDS 2 AND 3 HAVE 7 ft 18"ø RISERS ⇐ DESIGN FOR THIS
POND 1 HAS 6 ft 18"ø RISERS

$$\pi \left(\frac{1.5 ft}{2}\right)^2 (7 ft) = 12.37 ft^3$$

BUOYANCY FORCE = $62.4 \frac{lb}{ft^3} \times 12.37 ft^3 = 771.89$ lbs

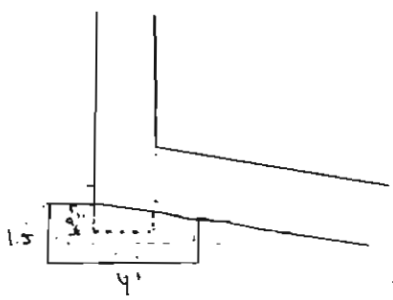
REQUIRED SAFETY FACTOR = 1.5

$771.89 lbs \times 1.5 = 1157.84$ lbs

FOUNDATION SIZING

1 ft^3 OF CONCRETE IS 150 lbs

$$\frac{1157.84 lbs}{150 lb/ft^3} = 7.72 ft^3$$



USE 4' x 4' x 1.5' SQUARE CONCRETE PAD

CORRUGATIONS
BARREL : $2\frac{2}{3} \times \frac{1}{2}$ 16 GAGE
RISER : $2\frac{2}{3} \times \frac{1}{2}$ 16 GAGE

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-6-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	1AASTC1.DAT
Output Filename:	1AASTC1.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION A-A, STATIC

BOUNDARY COORDINATES

11 Top Boundaries
24 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	568.00	345.00	568.00	2
2	345.00	568.00	370.00	572.00	2
3	370.00	572.00	490.00	617.00	1
4	490.00	617.00	520.00	614.00	2
5	520.00	614.00	535.00	619.00	2
6	535.00	619.00	565.00	630.00	1
7	565.00	630.00	585.00	630.00	1
8	585.00	630.00	710.00	675.00	1
9	710.00	675.00	1015.00	675.00	1
10	1015.00	675.00	1065.00	651.00	1
11	1065.00	651.00	1410.00	651.00	3
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	535.00	619.00	820.00	642.00	2
15	820.00	642.00	825.00	638.00	2
16	825.00	638.00	910.00	638.00	2
17	910.00	638.00	945.00	651.00	2
18	945.00	651.00	1065.00	651.00	2
19	1065.00	651.00	1210.00	556.00	2
20	.00	568.00	335.00	560.00	4
21	335.00	560.00	1210.00	556.00	4
22	335.00	560.00	870.00	544.00	4
23	870.00	544.00	1240.00	540.00	4
24	1240.00	540.00	1410.00	542.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	558.00
2	740.00	558.00
3	1020.00	618.00
4	1065.00	551.00
5	1410.00	651.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1410.00	524.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 450.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =531.00 ft.

30.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	350.00	568.80
2	379.98	567.73
3	409.98	568.12
4	439.92	569.95
5	469.74	573.22
6	499.37	577.93
7	528.74	584.06
8	557.77	591.61
9	586.41	600.54
10	614.59	610.85
11	642.23	622.50
12	669.28	635.48
13	695.67	649.75
14	721.34	665.27
15	735.81	675.00

Circle Center At X = 387.1 ; Y = 1189.1 and Radius, 621.4

*** 2.212 ***
(Runs 2 through 10 ranged from 2.236 to 2.328)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-7-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	1AADYC1.DAT
Output Filename:	1AADYC1.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION A-A, DYNAMIC

BOUNDARY COORDINATES

11 Top Boundaries
24 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	568.00	345.00	568.00	2
2	345.00	568.00	370.00	572.00	2
3	370.00	572.00	490.00	617.00	1
4	490.00	617.00	520.00	614.00	2
5	520.00	614.00	535.00	619.00	2
6	535.00	619.00	565.00	630.00	1
7	565.00	630.00	585.00	630.00	1
8	585.00	630.00	710.00	675.00	1
9	710.00	675.00	1015.00	675.00	1
10	1015.00	675.00	1065.00	651.00	1
11	1065.00	651.00	1410.00	651.00	3
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	535.00	619.00	820.00	642.00	2
15	820.00	642.00	825.00	638.00	2
16	825.00	638.00	910.00	638.00	2
17	910.00	638.00	945.00	651.00	2
18	945.00	651.00	1065.00	651.00	2
19	1065.00	651.00	1210.00	556.00	2
20	.00	568.00	335.00	560.00	4
21	335.00	560.00	1210.00	556.00	4
22	335.00	560.00	870.00	544.00	4
23	870.00	544.00	1240.00	540.00	4
24	1240.00	540.00	1410.00	542.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	558.00
2	740.00	558.00
3	1020.00	618.00
4	1065.00	551.00
5	1410.00	651.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1410.00	524.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 450.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =531.00 ft.

30.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	350.00	568.80
2	379.98	567.73
3	409.98	568.12
4	439.92	569.95
5	469.74	573.22
6	499.37	577.93
7	528.74	584.06
8	557.77	591.61
9	586.41	600.54
10	614.59	610.85
11	642.23	622.50
12	669.28	635.48
13	695.67	649.75
14	721.34	665.27
15	735.81	675.00

Circle Center At X = 387.1 ; Y = 1189.1 and Radius, 621.4

*** 1.586 ***

(Runs 2 through 10 ranged from 1.597 to 1.654)

C:\CONCORD\TYPE 1CCSTC1.D 0 2.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	3-4-91
Time of Run:	RUN2
Run By:	DMC
Input Data Filename:	1CCSTC1.DAT
Output Filename:	1CCSTC2.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION C-C, STATIC

BOUNDARY COORDINATES

16 Top Boundaries
36 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	580.00	135.00	580.00	2
2	135.00	580.00	175.00	582.00	2
3	175.00	582.00	370.00	582.00	2
4	370.00	582.00	380.00	585.00	2
5	380.00	585.00	430.00	587.00	2
6	430.00	587.00	450.00	582.00	3
7	450.00	582.00	535.00	577.00	3
8	535.00	577.00	635.00	572.00	3
9	635.00	572.00	725.00	575.00	3
10	725.00	575.00	875.00	630.00	1
11	875.00	630.00	895.00	630.00	1
12	895.00	630.00	1030.00	675.00	1
13	1030.00	675.00	1225.00	675.00	1
14	1225.00	675.00	1255.00	657.00	1
15	1255.00	657.00	1268.00	650.00	2
16	1268.00	650.00	1615.00	650.00	3
17	725.00	575.00	743.00	563.00	3
18	828.00	563.00	848.00	573.00	3
19	848.00	573.00	950.00	577.00	3
20	950.00	577.00	975.00	590.00	2
21	975.00	590.00	1000.00	595.00	2
22	1000.00	595.00	1130.00	660.00	2
23	1130.00	660.00	1255.00	657.00	2
24	1268.00	650.00	1435.00	550.00	2
25	950.00	577.00	1305.00	580.00	3
26	430.00	587.00	470.00	567.00	2
27	470.00	567.00	743.00	563.00	2
28	743.00	563.00	828.00	563.00	2

29	828.00	563.00	925.00	563.00	2
30	925.00	565.00	1140.00	560.00	2
31	1140.00	560.00	1305.00	560.00	2
32	.00	555.00	710.00	560.00	4
33	710.00	560.00	895.00	555.00	4
34	895.00	555.00	1140.00	560.00	4
35	1140.00	560.00	1435.00	555.00	4
36	1435.00	555.00	1615.00	553.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	570.00
2	975.00	570.00
3	1268.00	650.00
4	1615.00	650.00

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 700.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	655.56	572.63
2	704.53	562.61
3	754.51	564.08
4	802.81	577.00
5	846.85	600.68
6	879.30	630.00

Circle Center At X = 723.2 ; Y = 777.7 and Radius, 215.9

*** 1.838 ***

(Run 2 through 10 ranged from 1.899 to 2.004)

C:\CONCORD>TYPE 1CCDYC2.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	3-4-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	1CCDYC1.DAT
Output Filename:	1CCDYC2.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION C-C, DYNAMIC

BOUNDARY COORDINATES

16 Top Boundaries
36 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	580.00	135.00	580.00	2
2	135.00	580.00	175.00	582.00	2
3	175.00	582.00	370.00	582.00	2
4	370.00	582.00	380.00	585.00	2
5	380.00	585.00	430.00	587.00	2
6	430.00	587.00	450.00	582.00	3
7	450.00	582.00	535.00	577.00	3
8	535.00	577.00	635.00	572.00	3
9	635.00	572.00	725.00	575.00	3
10	725.00	575.00	875.00	630.00	1
11	875.00	630.00	895.00	630.00	1
12	895.00	630.00	1030.00	675.00	1
13	1030.00	675.00	1225.00	675.00	1
14	1225.00	675.00	1255.00	657.00	1
15	1255.00	657.00	1268.00	650.00	2
16	1268.00	650.00	1615.00	650.00	3
17	725.00	575.00	743.00	563.00	3
18	828.00	563.00	848.00	573.00	3
19	848.00	573.00	950.00	577.00	3
20	950.00	577.00	975.00	590.00	2
21	975.00	590.00	1000.00	595.00	2
22	1000.00	595.00	1130.00	660.00	2
23	1130.00	660.00	1255.00	657.00	2
24	1268.00	650.00	1435.00	655.00	2
25	350.00	577.00	1305.00	580.00	3
26	430.00	587.00	470.00	567.00	2
27	470.00	567.00	743.00	563.00	2
28	743.00	563.00	828.00	563.00	2

29	628.00	563.00	925.00	563.00	2
30	925.00	565.00	1140.00	560.00	2
31	1140.00	560.00	1305.00	530.00	2
32	.00	555.00	710.00	560.00	4
33	710.00	560.00	835.00	555.00	4
34	835.00	555.00	1140.00	560.00	4
35	1140.00	560.00	1435.00	555.00	4
36	1435.00	555.00	1615.00	553.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	570.00
2	975.00	570.00
3	1268.00	650.00
4	1615.00	650.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	380.00	545.00
3	380.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 700.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	633.33	572.00
2	682.51	563.06
3	732.51	563.66
4	781.46	573.87
5	827.53	593.30
6	869.00	621.23
7	877.75	630.00

Circle Center At X = 704.4 ; Y = 830.9 and Radius, 258.8

*** 1.390 ***

(Run 2 through 10 ranged from 1.407 to 1.447

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	3FFSTC1.DAT
Output Filename:	3FFSTC2.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION F-F, STATIC

BOUNDARY COORDINATES

11 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	575.00	188.00	579.00	2
2	188.00	579.00	380.00	630.00	1
3	380.00	630.00	400.00	630.00	1
4	400.00	630.00	415.00	635.00	1
5	415.00	635.00	455.00	635.00	1
6	455.00	635.00	580.00	680.00	1
7	580.00	680.00	600.00	680.00	1
8	600.00	680.00	625.00	692.00	1
9	625.00	692.00	680.00	692.00	1
10	680.00	692.00	698.00	680.00	1
11	698.00	680.00	1040.00	680.00	3
12	698.00	680.00	730.00	660.00	1
13	188.00	579.00	210.00	580.00	2
14	210.00	580.00	260.00	585.00	2
15	260.00	585.00	280.00	585.00	2
16	280.00	585.00	385.00	620.00	2
17	385.00	620.00	420.00	620.00	2
18	420.00	620.00	435.00	630.00	2
19	435.00	630.00	465.00	630.00	2
20	465.00	630.00	570.00	660.00	2
21	570.00	660.00	730.00	660.00	2
22	730.00	660.00	890.00	560.00	2
23	.00	570.00	390.00	570.00	4
24	390.00	570.00	890.00	560.00	4
25	890.00	560.00	1040.00	560.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	580.00
2	270.00	580.00
3	698.00	680.00
4	1040.00	680.00

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	560.00	390.00	560.00
2	390.00	560.00	890.00	550.00
3	890.00	550.00	1040.00	550.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 300.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =550.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	166.67	578.55
2	215.63	568.42
3	265.28	562.54
4	315.26	560.95
5	365.18	563.66
6	414.69	570.66
7	463.41	581.89
8	510.99	597.27
9	557.07	616.69
10	601.30	640.00
11	643.37	667.02
12	675.75	692.00

Circle Center At X = 308.7 ; Y = 1141.7 and Radius, 580.8

*** 1.880 ***

(Runs 2 through 10 ranged from 1.887 to 1.902)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	3FFDYC1.DAT
Output Filename:	3FFDYC1.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION F-F, DYNAMIC

BOUNDARY COORDINATES

11 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	575.00	188.00	579.00	2
2	188.00	579.00	380.00	630.00	1
3	380.00	630.00	400.00	630.00	1
4	400.00	630.00	415.00	635.00	1
5	415.00	635.00	455.00	635.00	1
6	455.00	635.00	580.00	680.00	1
7	580.00	680.00	600.00	680.00	1
8	600.00	680.00	625.00	692.00	1
9	625.00	692.00	680.00	692.00	1
10	680.00	692.00	698.00	680.00	1
11	698.00	680.00	1040.00	680.00	3
12	698.00	680.00	730.00	660.00	1
13	188.00	579.00	210.00	580.00	2
14	210.00	580.00	260.00	585.00	2
15	260.00	585.00	280.00	585.00	2
16	280.00	585.00	385.00	620.00	2
17	385.00	620.00	420.00	620.00	2
18	420.00	620.00	435.00	630.00	2
19	435.00	630.00	465.00	630.00	2
20	465.00	630.00	570.00	660.00	2
21	570.00	660.00	730.00	660.00	2
22	730.00	660.00	890.00	560.00	2
23	.00	570.00	390.00	570.00	4
24	390.00	570.00	890.00	560.00	4
25	890.00	560.00	1040.00	560.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1.PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	580.00
2	270.00	580.00
3	698.00	680.00
4	1040.00	680.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	560.00	390.00	560.00
2	390.00	560.00	890.00	550.00
3	890.00	550.00	1040.00	550.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 300.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =550.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	122.22	577.60
2	171.37	568.40
3	221.02	562.54
4	270.96	560.04
5	320.95	560.92
6	370.77	565.16
7	420.19	572.76
8	468.99	583.67
9	516.93	597.85
10	563.82	615.23
11	609.42	635.74
12	653.53	659.27
13	692.57	683.62

Circle Center At X = 283.0 ; Y = 1300.7 and Radius, 740.8

*** 1.280 ***

(Runs 2 through 10 ranged from 1.280 to 1.291)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 4
Run By: DMC
Input Data Filename: 3GGSTC1.DAT
Output Filename: 3GGSTC4.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION G-G, STATIC

BOUNDARY COORDINATES

14 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	572.00	122.00	560.00	2
2	122.00	560.00	140.00	555.00	2
3	140.00	555.00	210.00	580.00	1
4	210.00	580.00	230.00	580.00	1
5	230.00	580.00	370.00	630.00	1
6	370.00	630.00	460.00	630.00	1
7	460.00	630.00	500.00	645.00	1
8	500.00	645.00	540.00	645.00	1
9	540.00	645.00	625.00	680.00	1
10	625.00	680.00	645.00	680.00	1
11	645.00	680.00	670.00	690.00	1
12	670.00	690.00	720.00	690.00	1
13	720.00	690.00	745.00	680.00	1
14	745.00	680.00	1010.00	680.00	3
15	745.00	680.00	795.00	660.00	1
16	140.00	555.00	180.00	545.00	2
17	180.00	545.00	210.00	545.00	2
18	210.00	545.00	330.00	580.00	2
19	330.00	580.00	420.00	625.00	2
20	420.00	625.00	430.00	620.00	2
21	430.00	620.00	480.00	620.00	2
22	480.00	620.00	525.00	642.50	2
23	525.00	642.50	530.00	640.00	2
24	530.00	640.00	550.00	640.00	2
25	550.00	640.00	590.00	660.00	2
26	590.00	660.00	795.00	660.00	2
27	795.00	660.00	1010.00	550.00	2
28	.00	515.00	190.00	510.00	4
29	190.00	510.00	335.00	492.00	4
30	335.00	492.00	390.00	520.00	4
31	390.00	520.00	470.00	540.00	4
32	470.00	540.00	585.00	550.00	4
33	585.00	550.00	1010.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	520.00
2	190.00	515.00
3	335.00	492.00
4	745.00	680.00
5	1010.00	680.00

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	505.00	190.00	500.00
2	190.00	500.00	335.00	482.00
3	335.00	482.00	390.00	510.00
4	390.00	510.00	470.00	530.00
5	470.00	530.00	580.00	540.00
6	580.00	540.00	1010.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 540.00 ft.

Each Surface Terminates Between X = 670.00 ft.
and X = 710.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =482.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	540.00	645.00
2	589.70	650.51
3	637.17	666.22
4	677.89	690.00

Circle Center At X = 538.6 ; Y = 884.7 and Radius, 239.7

*** 1.975 ***

(Runs 2 through 10 ranged from 2.062 to 2.204)

nd of input file

:\PCSTABL5\CONCORD) TYPE 3GGDYC1.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	3GGDYC1.DAT
Output Filename:	3GGDYC1.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION G-G, DYNAMIC

BOUNDARY COORDINATES

14 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	572.00	122.00	560.00	2
2	122.00	560.00	140.00	555.00	2
3	140.00	555.00	210.00	580.00	1
4	210.00	580.00	230.00	580.00	1
5	230.00	580.00	370.00	630.00	1
6	370.00	630.00	460.00	630.00	1
7	460.00	630.00	500.00	645.00	1
8	500.00	645.00	540.00	645.00	1
9	540.00	645.00	625.00	680.00	1
10	625.00	680.00	645.00	680.00	1
11	645.00	680.00	670.00	690.00	1
12	670.00	690.00	720.00	690.00	1
13	720.00	690.00	745.00	680.00	1
14	745.00	680.00	1010.00	680.00	3
15	745.00	680.00	795.00	660.00	1
16	140.00	555.00	180.00	545.00	2
17	180.00	545.00	210.00	545.00	2
18	210.00	545.00	330.00	580.00	2
19	330.00	580.00	420.00	625.00	2
20	420.00	625.00	430.00	620.00	2
21	430.00	620.00	480.00	620.00	2
22	480.00	620.00	525.00	642.50	2
23	525.00	642.50	530.00	640.00	2
24	530.00	640.00	550.00	640.00	2
25	550.00	640.00	590.00	660.00	2
26	590.00	660.00	795.00	660.00	2
27	795.00	660.00	1010.00	550.00	2
28	.00	515.00	190.00	510.00	4
29	190.00	510.00	335.00	492.00	4
30	335.00	492.00	390.00	520.00	4
31	390.00	520.00	470.00	540.00	4
32	470.00	540.00	585.00	550.00	4
33	585.00	550.00	1010.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	520.00
2	190.00	515.00
3	335.00	492.00
4	745.00	680.00
5	1010.00	680.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	505.00	190.00	500.00
2	190.00	500.00	335.00	482.00
3	335.00	482.00	390.00	510.00
4	390.00	510.00	470.00	530.00
5	470.00	530.00	580.00	540.00
6	580.00	540.00	1010.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 540.00 ft.

Each Surface Terminates Between X = 670.00 ft.
and X = 710.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =482.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	540.00	645.00
2	589.70	650.51
3	637.17	666.22
4	677.89	690.00

Circle Center At X = 538.6 ; Y = 884.7 and Radius, 239.7

*** 1.465 ***

(Runs 2 through 10 ranged from 1.536 to 1.639)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-3-92 CHKD BY: RMW DATE: 5/6/92

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 8

DESCRIPTION Stability Analysis

Purpose

The purpose of this calculation is to determine the stability of the slope in cross section A-A, during stage 4 construction using a worst case phreatic surface. It will be assumed that both the existing and proposed impoundments will be impounding water and will create a phreatic surface directly connecting the water levels in each impoundment.

Results

Upon performing both seismic and static analyses using the program PCSTABL5 (Modified Bishop Method), the following factors of safety were calculated:

Static F.S. = 1.7 ≥ 1.5

Seismic F.S. = 1.2 ≥ 1.2

Conclusions

The slope meets the MSHA criteria for slope stability. This analysis is felt to be very conservative because the phreatic surface does not take into account effects from the underdrain that will be installed in the embankment.

** POSTAEL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 4-11-92
Time of Run: 3
Run By: DMC
Input Data Filename: 4AASTC1.DAT
Output Filename: 4AASTC3.OUT

PROBLEM DESCRIPTION STAGE 4, SECTION A-A, STATIC

BOUNDARY COCRDINATES

8 Top Boundaries
28 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	820.00	710.00	1
6	820.00	710.00	955.00	710.00	1
7	955.00	710.00	1000.00	680.00	1
8	1000.00	680.00	1290.00	680.00	3
9	1000.00	680.00	1070.00	653.00	1
10	.00	568.00	345.00	568.00	2
11	345.00	568.00	370.00	572.00	2
12	370.00	572.00	490.00	617.00	1
13	370.00	572.00	425.00	569.00	2
14	425.00	569.00	490.00	617.00	2
15	490.00	617.00	520.00	614.00	2
16	520.00	614.00	535.00	619.00	2
17	535.00	619.00	565.00	630.00	1
18	535.00	619.00	820.00	642.00	2
19	820.00	642.00	825.00	638.00	2
20	825.00	638.00	910.00	636.00	2
21	910.00	638.00	945.00	651.00	2
22	945.00	651.00	1065.00	651.00	2
23	1065.00	651.00	1210.00	656.00	1
24	.00	868.00	335.00	860.00	4
25	335.00	860.00	1210.00	856.00	4
26	335.00	850.00	870.00	844.00	4
27	870.00	844.00	1240.00	840.00	4
28	1240.00	840.00	1290.00	840.00	4

INITIAL SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	880.00	630.00
3	1000.00	580.00
4	1290.00	580.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1290.00	529.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X = 900.00 ft.
and X = 1100.00 ft.

At Which A Surface Extends Is Y =819.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	477.78	630.00
2	523.69	610.20
3	572.41	598.96
4	622.36	596.66
5	671.91	603.36
6	719.45	618.86
7	763.43	642.63
8	802.43	673.93
9	833.69	710.00

Circle Center At X = 610.1 ; Y = 873.7 and Radius, 277.3

*** 1.745 ***

Runs 2 through 10 ranged from 1.750 to 1.848

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	4-11-92
Time of Run:	1
Run By:	DMC
Input Data Filename:	4AADYC1.DAT
Output Filename:	4AADYC1.OUT

PROBLEM DESCRIPTION STAGE 4, SECTION A-A, ~~STATIC~~ Seismic

BOUNDARY COORDINATES

8 Top Boundaries
28 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	820.00	710.00	1
6	820.00	710.00	955.00	710.00	1
7	955.00	710.00	1000.00	680.00	1
8	1000.00	680.00	1290.00	680.00	3
9	1000.00	680.00	1070.00	653.00	1
10	.00	568.00	345.00	568.00	2
11	345.00	568.00	370.00	572.00	2
12	370.00	572.00	490.00	617.00	1
13	370.00	572.00	425.00	569.00	2
14	425.00	569.00	490.00	617.00	2
15	490.00	617.00	520.00	614.00	2
16	520.00	614.00	535.00	619.00	2
17	535.00	619.00	565.00	630.00	1
18	535.00	619.00	820.00	642.00	2
19	820.00	642.00	825.00	638.00	2
20	825.00	638.00	910.00	638.00	2
21	910.00	638.00	945.00	651.00	2
22	945.00	651.00	1065.00	651.00	2
23	1065.00	651.00	1290.00	653.00	1
24	.00	568.00	335.00	560.00	4
25	335.00	560.00	370.00	555.00	4
26	335.00	560.00	571.00	544.00	4
27	570.00	544.00	1240.00	540.00	4
28	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	580.00	630.00
3	1000.00	680.00
4	1290.00	680.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

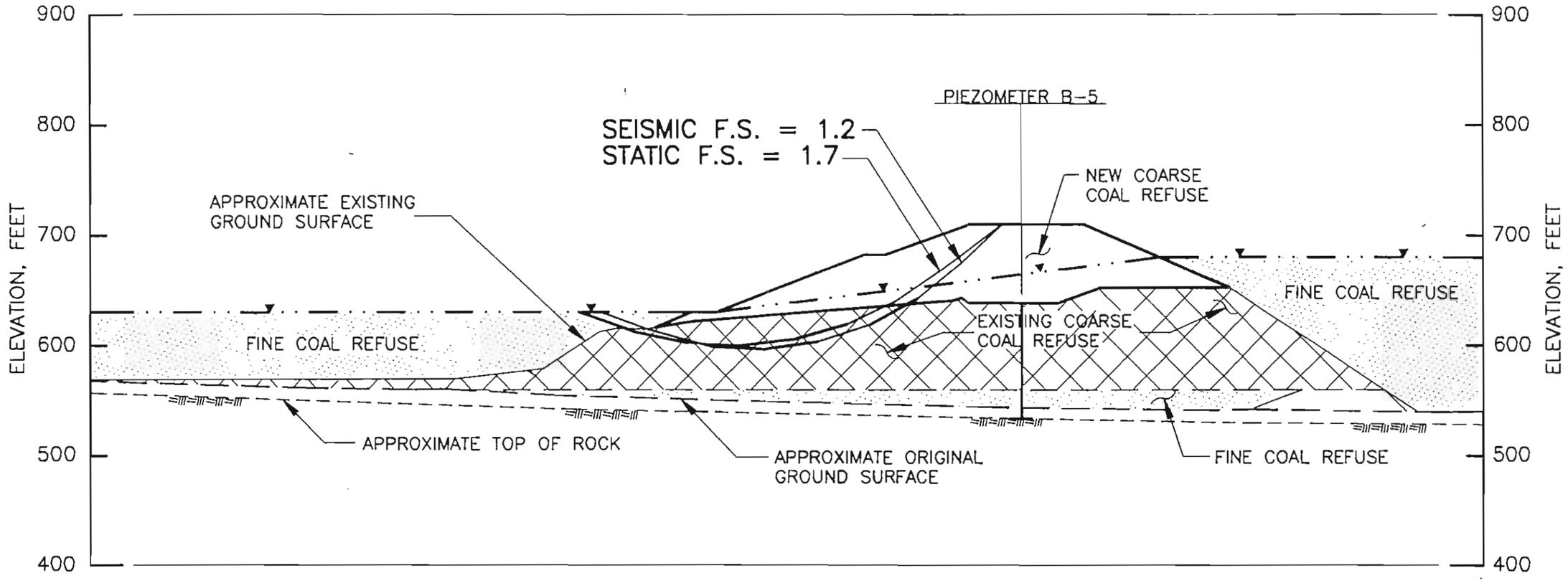
A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	588.00	870.00	630.00
2	870.00	630.00	1290.00	630.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.



STABILITY SECTION A_1-A_1, STAGE 4

SCALE
100 0 100 FEET

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

STABILITY SECTION A_1-A_1, STAGE 4
PREPARED FOR
U.S.STEEL MINING COMPANY, INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	MEL	05/14/92
CHECKED BY	DMC	6-5-92
APPROVED BY	RMN	6/9/92

EXHIBIT
DRAWING NO. 90-55-B3

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft. and X = 500.00 ft.

Each Surface Terminates Between X = 800.00 ft. and X = 900.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =529.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	455.55	630.00
2	502.26	612.16
3	551.22	602.01
4	601.17	599.81
5	650.83	605.63
6	698.93	619.32
7	744.21	640.51
8	785.53	668.57
9	821.81	703.07
10	827.10	710.00

Circle Center At X = 589.8 ; Y = 911.4 and Radius, 311.8

*** 1.224 ***

Runs 2 through 10 ranged from 1.226 to 1.249

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-10-91
Time of Run:	RUN 5
Run By:	DMC
Input Data Filename:	SAASTC1.DAT
Output Filename:	SAASTC5.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION A-A, STATIC

BOUNDARY COORDINATES

6 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	880.00	730.00	1
6	880.00	730.00	1290.00	730.00	1
7	1000.00	680.00	1290.00	680.00	3
8	1000.00	680.00	1070.00	653.00	1
9	.00	568.00	345.00	568.00	2
10	345.00	568.00	370.00	572.00	2
11	370.00	572.00	490.00	617.00	1
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	490.00	617.00	520.00	614.00	2
15	520.00	614.00	535.00	619.00	2
16	535.00	619.00	565.00	630.00	1
17	535.00	619.00	820.00	642.00	2
18	820.00	642.00	825.00	638.00	2
19	825.00	638.00	910.00	638.00	2
20	910.00	638.00	945.00	651.00	2
21	945.00	651.00	1065.00	651.00	2
22	1065.00	651.00	1210.00	556.00	2
23	.00	568.00	335.00	560.00	4
24	335.00	560.00	1210.00	556.00	4
25	335.00	560.00	870.00	544.00	4
26	870.00	544.00	1240.00	540.00	4
27	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	560.00	630.00
3	620.00	590.00
4	1015.00	557.00
5	1290.00	552.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1290.00	529.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 550.00 ft.
and X = 650.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =529.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	627.78	647.06
2	676.51	658.24
3	724.82	671.14
4	772.63	685.76
5	819.90	702.08
6	866.55	720.07
7	889.79	730.00

Circle Center At X = 339.1 ; Y = 2018.1 and Radius, 1401.1

*** 2.062 ***

(Runs 2 through 10 range from 2.144 to 2.254)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-10-91
Time of Run:	RUN 4
Run By:	DMC
Input Data Filename:	SAADYC1.DAT
Output Filename:	SAADYC4.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION A-A, DYNAMIC

BOUNDARY COORDINATES

6 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	880.00	730.00	1
6	880.00	730.00	1290.00	730.00	1
7	1000.00	680.00	1290.00	680.00	3
8	1000.00	680.00	1070.00	653.00	1
9	.00	568.00	345.00	568.00	2
10	345.00	568.00	370.00	572.00	2
11	370.00	572.00	490.00	617.00	1
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	490.00	617.00	520.00	614.00	2
15	520.00	614.00	535.00	619.00	2
16	535.00	619.00	565.00	630.00	1
17	535.00	619.00	820.00	642.00	2
18	820.00	642.00	825.00	638.00	2
19	825.00	638.00	910.00	638.00	2
20	910.00	638.00	945.00	651.00	2
21	945.00	651.00	1065.00	651.00	2
22	1065.00	651.00	1210.00	556.00	2
23	.00	568.00	335.00	560.00	4
24	335.00	560.00	1210.00	556.00	4
25	335.00	560.00	870.00	544.00	4
26	870.00	544.00	1240.00	540.00	4
27	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	560.00	630.00
3	620.00	590.00
4	1015.00	557.00
5	1290.00	552.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1290.00	529.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 550.00 ft.
and X = 650.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =529.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	627.78	647.06
2	676.51	658.24
3	724.82	671.14
4	772.63	685.76
5	819.90	702.08
6	866.55	720.07
7	889.79	730.00

Circle Center At X = 339.1 ; Y = 2018.1 and Radius, 1401.1

*** 1.518 ***

(Runs 2 through 10 ranged from 1.583 to 1.656)

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 2
Run By: DMC
Input Data Filename: SCCSTC1.DAT
Output Filename: SCCSTC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION C-C, STATIC

BOUNDARY COORDINATES

7 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	577.00	110.00	577.00	2
2	110.00	577.00	250.00	630.00	1
3	250.00	630.00	270.00	630.00	1
4	270.00	630.00	400.00	680.00	1
5	400.00	680.00	420.00	680.00	1
6	420.00	680.00	545.00	730.00	1
7	545.00	730.00	1615.00	730.00	1
8	1210.00	680.00	1615.00	680.00	3
9	1210.00	680.00	1255.00	660.00	1
10	110.00	577.00	190.00	580.00	2
11	190.00	580.00	370.00	580.00	2
12	370.00	580.00	430.00	585.00	2
13	430.00	585.00	460.00	580.00	3
14	460.00	580.00	530.00	577.00	3
15	530.00	577.00	725.00	574.00	3
16	725.00	574.00	745.00	562.00	3
17	745.00	562.00	930.00	562.00	2
18	930.00	562.00	950.00	579.00	3
19	950.00	579.00	970.00	590.00	2
20	970.00	590.00	1000.00	593.00	2
21	1000.00	593.00	1130.00	660.00	2
22	1130.00	660.00	1255.00	660.00	2
23	1255.00	660.00	1435.00	555.00	2
24	430.00	585.00	470.00	565.00	2
25	470.00	565.00	745.00	562.00	2
26	950.00	579.00	1305.00	580.00	3
27	930.00	562.00	1145.00	560.00	2
28	1145.00	560.00	1305.00	580.00	2
29	.00	555.00	720.00	558.00	4
30	720.00	558.00	905.00	556.00	4
31	905.00	556.00	1145.00	560.00	4
32	1145.00	560.00	1430.00	555.00	4
33	1430.00	555.00	1615.00	555.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	575.00
2	130.00	575.00
3	270.00	580.00
4	1105.00	588.00
5	1615.00	558.00

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 400.00 ft.
and X = 700.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	577.00
2	92.86	564.49
3	142.29	557.02
4	192.24	554.67
5	242.16	557.45
6	291.53	565.35
7	339.83	578.27
8	386.55	596.09
9	431.20	618.60
10	473.29	645.58
11	512.40	676.74
12	548.09	711.75
13	563.22	730.00

Circle Center At X = 190.1 ; Y = 1041.0 and Radius, 486.4

*** 1.937 ***

(Runs 2 through 10 ranged from 1.943 to 1.968)

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	5CCDYC1.DAT
Output Filename:	5CCDYC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION C-C, DYNAMIC

BOUNDARY COORDINATES

7 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	577.00	110.00	577.00	2
2	110.00	577.00	250.00	630.00	1
3	250.00	630.00	270.00	630.00	1
4	270.00	630.00	400.00	680.00	1
5	400.00	680.00	420.00	680.00	1
6	420.00	680.00	545.00	730.00	1
7	545.00	730.00	1615.00	730.00	1
8	1210.00	680.00	1615.00	680.00	3
9	1210.00	680.00	1255.00	660.00	1
10	110.00	577.00	190.00	580.00	2
11	190.00	580.00	370.00	580.00	2
12	370.00	580.00	430.00	585.00	2
13	430.00	585.00	460.00	580.00	3
14	460.00	580.00	530.00	577.00	3
15	530.00	577.00	725.00	574.00	3
16	725.00	574.00	745.00	562.00	3
17	745.00	562.00	930.00	562.00	2
18	930.00	562.00	950.00	579.00	3
19	950.00	579.00	970.00	590.00	2
20	970.00	590.00	1000.00	593.00	2
21	1000.00	593.00	1130.00	660.00	2
22	1130.00	660.00	1255.00	660.00	2
23	1255.00	660.00	1435.00	555.00	2
24	430.00	585.00	470.00	565.00	2
25	470.00	565.00	745.00	562.00	2
26	950.00	579.00	1305.00	580.00	3
27	930.00	562.00	1145.00	560.00	2
28	1145.00	560.00	1305.00	580.00	2
29	.00	555.00	720.00	558.00	4
30	720.00	558.00	905.00	556.00	4
31	905.00	556.00	1145.00	560.00	4
32	1145.00	560.00	1430.00	555.00	4
33	1430.00	555.00	1615.00	555.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	575.00
2	130.00	575.00
3	270.00	580.00
4	1105.00	588.00
5	1615.00	558.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 300.00 ft.
and X = 500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	577.00
2	92.23	562.28
3	141.86	556.18
4	191.78	558.91
5	240.45	570.37
6	286.35	590.20
7	328.04	617.79
8	364.24	652.29
9	378.50	671.73

Circle Center At X = 151.4 ; Y = 839.4 and Radius, 283.3

*** 1.420 ***

(Runs 2 through 10 ranged from 1.421 to 1.436)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
\PCSTABL5\CONCORD>A: or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 6
Run By: DMC
Input Data Filename: SDDSTC1.DAT
Output Filename: SDDSTC6.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION D-D, STATIC

BOUNDARY COORDINATES

11 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	574.00	145.00	602.00	2
2	145.00	602.00	265.00	614.00	2
3	265.00	614.00	315.00	636.00	2
4	315.00	636.00	340.00	632.00	2
5	340.00	632.00	380.00	632.00	2
6	380.00	632.00	420.00	656.00	2
7	420.00	656.00	440.00	656.00	2
8	440.00	656.00	510.00	681.00	1
9	510.00	681.00	530.00	681.00	1
10	530.00	681.00	670.00	730.00	1
11	670.00	730.00	1100.00	730.00	1
12	740.00	680.00	1100.00	680.00	3
13	740.00	680.00	780.00	658.00	1
14	440.00	656.00	590.00	658.00	2
15	590.00	658.00	780.00	658.00	2
16	780.00	658.00	1030.00	550.00	2
17	.00	560.00	1030.00	550.00	4
18	1030.00	550.00	1100.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	566.00
2	1100.00	557.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	550.00	615.00	547.00
2	615.00	547.00	1100.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 380.00 ft.
and X = 380.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 700.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =540.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	380.00	632.00
2	427.56	647.43
3	475.11	662.90
4	522.64	678.42
5	570.15	693.99
6	617.65	709.61
7	665.13	725.27
8	679.43	730.00

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.900 ***

(Runs 2 through 10 ranged from 1.901 to 2.012).

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-10-91
Time of Run:	RUN 3
Run By:	DMC
Input Data Filename:	5DDDYC1.DAT
Output Filename:	5DDDYC3.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION D-D, DYNAMIC

BOUNDARY COORDINATES

11 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	574.00	145.00	602.00	2
2	145.00	602.00	265.00	614.00	2
3	265.00	614.00	315.00	636.00	2
4	315.00	636.00	340.00	632.00	2
5	340.00	632.00	380.00	632.00	2
6	380.00	632.00	420.00	656.00	2
7	420.00	656.00	440.00	656.00	2
8	440.00	656.00	510.00	681.00	1
9	510.00	681.00	530.00	681.00	1
10	530.00	681.00	670.00	730.00	1
11	670.00	730.00	1100.00	730.00	1
12	740.00	680.00	1100.00	680.00	3
13	740.00	680.00	780.00	658.00	1
14	440.00	656.00	590.00	658.00	2
15	590.00	658.00	780.00	658.00	2
16	780.00	658.00	1030.00	550.00	2
17	.00	560.00	1030.00	550.00	4
18	1030.00	550.00	1100.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	566.00
2	1100.00	557.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	550.00	615.00	547.00
2	615.00	547.00	1100.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 400.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 700.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =540.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	388.89	637.33
2	437.32	649.78
3	485.44	663.34
4	533.24	678.01
5	580.69	693.78
6	627.76	710.65
7	674.42	728.61
8	677.81	730.00

Circle Center At X = -124.1 ; Y = 2734.5 and Radius, 2159.0

*** 1.488 ***

(Runs 2 through 10 ranged from 1.510 to 1.618)

PCSTABL5\CONCORD> TYPE SHHSTC2.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	SHHSTC1.DAT
Output Filename:	SHHSTC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION H-H, STATIC

BOUNDARY COORDINATES

16 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	425.00	180.00	440.00	4
2	180.00	440.00	270.00	480.00	2
3	270.00	480.00	340.00	500.00	2
4	340.00	500.00	360.00	500.00	2
5	360.00	500.00	430.00	530.00	2
6	430.00	530.00	460.00	533.00	2
7	460.00	533.00	570.00	580.00	1
8	570.00	580.00	590.00	580.00	1
9	590.00	580.00	710.00	630.00	1
10	710.00	630.00	730.00	630.00	1
11	730.00	630.00	840.00	680.00	1
12	840.00	680.00	860.00	680.00	1
13	860.00	680.00	890.00	690.00	1
14	890.00	690.00	930.00	690.00	1
15	930.00	690.00	1020.00	730.00	1
16	1020.00	730.00	1140.00	730.00	1
17	460.00	533.00	530.00	540.00	2
18	530.00	540.00	950.00	550.00	2
19	950.00	550.00	1140.00	572.00	2
20	180.00	440.00	290.00	450.00	4
21	290.00	450.00	560.00	500.00	4
22	560.00	500.00	640.00	520.00	4
23	640.00	520.00	753.00	527.00	4
24	753.00	527.00	860.00	520.00	4
25	860.00	520.00	985.00	490.00	4
26	985.00	490.00	1080.00	520.00	4
27	1080.00	520.00	1140.00	530.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	420.00
2	180.00	435.00
3	675.00	530.00
4	1140.00	550.00

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	415.00	290.00	440.00
2	290.00	440.00	560.00	490.00
3	560.00	490.00	640.00	510.00
4	640.00	510.00	860.00	510.00
5	860.00	510.00	983.00	480.00
6	982.00	480.00	1080.00	510.00
7	1080.00	510.00	1140.00	520.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 900.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =415.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.89	432.41
2	188.89	431.81
3	288.51	440.44
4	386.92	458.24
5	483.26	485.04
6	576.71	520.63
7	666.48	564.70
8	751.79	616.87
9	830.69	675.77

Circle Center At X = 145.4 ; Y = 1512.7 and Radius, 1081.8

*** 1.715 ***

(Runs 2 through 10 ranged from 1.717 to 1.733)

\PCSTABL5\CONCORD) TYPE 5HHDYC1.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	5HHDYC1.DAT
Output Filename:	5HHDYC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION H-H, DYNAMIC

BOUNDARY COORDINATES

16 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	425.00	180.00	440.00	4
2	180.00	440.00	270.00	480.00	2
3	270.00	480.00	340.00	500.00	2
4	340.00	500.00	360.00	500.00	2
5	360.00	500.00	430.00	530.00	2
6	430.00	530.00	460.00	533.00	2
7	460.00	533.00	570.00	580.00	1
8	570.00	580.00	590.00	580.00	1
9	590.00	580.00	710.00	630.00	1
10	710.00	630.00	730.00	630.00	1
11	730.00	630.00	840.00	680.00	1
12	840.00	680.00	860.00	680.00	1
13	860.00	680.00	890.00	690.00	1
14	890.00	690.00	930.00	690.00	1
15	930.00	690.00	1020.00	730.00	1
16	1020.00	730.00	1140.00	730.00	1
17	460.00	533.00	530.00	540.00	2
18	530.00	540.00	950.00	550.00	2
19	950.00	550.00	1140.00	572.00	2
20	180.00	440.00	290.00	450.00	4
21	290.00	450.00	560.00	500.00	4
22	560.00	500.00	640.00	520.00	4
23	640.00	520.00	753.00	527.00	4
24	753.00	527.00,	860.00	520.00	4
25	860.00	520.00	985.00	490.00	4
26	985.00	490.00	1080.00	520.00	4
27	1080.00	520.00	1140.00	530.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	420.00
2	180.00	435.00
3	675.00	530.00
4	1140.00	550.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	415.00	290.00	440.00
2	290.00	440.00	560.00	490.00
3	560.00	490.00	640.00	510.00
4	640.00	510.00	860.00	510.00
5	860.00	510.00	983.00	480.00
6	982.00	480.00	1080.00	510.00
7	1080.00	510.00	1140.00	520.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 900.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =415.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	434.26
2	211.11	433.47
3	310.57	443.87
4	408.24	465.33
5	502.90	497.57
6	593.35	540.20
7	678.48	592.68
8	726.12	630.00

Circle Center At X = 168.1 ; Y = 1325.3 and Radius, 892.8

*** 1.278 ***

(Runs 2 through 10 ranged from 1.278 to 1.287)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-31-91
Time of Run: RUN 1
Run By: DHC
Input Data Filename: 5IISTC1.DAT
Output Filename: 5IISTC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION I-1, STATIC

BOUNDARY COORDINATES

13 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	430.00	280.00	505.00	4
2	280.00	505.00	290.00	505.00	4
3	290.00	505.00	380.00	545.00	2
4	380.00	545.00	420.00	545.00	2
5	420.00	545.00	505.00	582.00	2
6	505.00	582.00	525.00	582.00	2
7	525.00	582.00	660.00	635.00	2
8	660.00	635.00	680.00	635.00	2
9	680.00	635.00	750.00	660.00	2
10	750.00	660.00	805.00	682.00	1
11	805.00	682.00	815.00	682.00	1
12	815.00	682.00	960.00	730.00	1
13	960.00	730.00	1100.00	730.00	1
14	750.00	660.00	1100.00	660.00	2
15	290.00	505.00	450.00	520.00	4
16	450.00	520.00	610.00	540.00	4
17	610.00	540.00	930.00	540.00	4
18	930.00	540.00	1040.00	527.00	4
19	1040.00	527.00	1100.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	425.00
2	280.00	500.00
3	610.00	445.00
4	1100.00	555.00

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	420.00	280.00	495.00
2	280.00	495.00	450.00	510.00
3	450.00	510.00	610.00	530.00
4	610.00	530.00	930.00	530.00
5	930.00	530.00	1040.00	515.00
6	1040.00	515.00	1100.00	530.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 250.00 ft.
and X = 250.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 750.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =420.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	250.00	496.96
2	348.51	514.19
3	445.20	539.69
4	539.39	573.28
5	630.40	614.72
6	666.48	635.00

Circle Center At X = 96.1 ; Y = 1667.4 and Radius, 1180.5

*** 1.762 ***

(Runs 2 through 10 ranged from 1.767 to 1.782)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-31-91
Time of Run: RUN 1
Run By: DMC
Input Data Filename: 5IIDYC1.DAT
Output Filename: 5IIDYC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION I-I, ~~STATIC~~ Seismic

BOUNDARY COORDINATES

13 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	430.00	280.00	505.00	4
2	280.00	505.00	290.00	505.00	4
3	290.00	505.00	380.00	545.00	2
4	380.00	545.00	420.00	545.00	2
5	420.00	545.00	505.00	582.00	2
6	505.00	582.00	525.00	582.00	2
7	525.00	582.00	660.00	635.00	2
8	660.00	635.00	680.00	635.00	2
9	680.00	635.00	750.00	660.00	2
10	750.00	660.00	805.00	682.00	1
11	805.00	682.00	815.00	682.00	1
12	815.00	682.00	960.00	730.00	1
13	960.00	730.00	1100.00	730.00	1
14	750.00	660.00	1100.00	660.00	2
15	290.00	505.00	450.00	520.00	4
16	450.00	520.00	610.00	540.00	4
17	610.00	540.00	930.00	540.00	4
18	930.00	540.00	1040.00	527.00	4
19	1040.00	527.00	1100.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	425.00
2	280.00	500.00
3	610.00	445.00
4	1100.00	555.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	420.00	280.00	495.00
2	280.00	495.00	450.00	510.00
3	450.00	510.00	610.00	530.00
4	610.00	530.00	930.00	530.00
5	930.00	530.00	1040.00	515.00
6	1040.00	515.00	1100.00	530.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 250.00 ft.
and X = 250.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 750.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =420.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	250.00	496.96
2	348.51	514.19
3	445.20	539.69
4	539.39	573.28
5	630.40	614.72
6	666.48	635.00

Circle Center At X = 96.1 ; Y = 1667.4 and Radius, 1180.5

*** 1.312 ***

(Runs 2 through 10 ranged from 1.315 to 1.325)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	SJJSTC1.DAT
Output Filename:	SJJSTC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION J-J, STATIC

BOUNDARY COORDINATES

19 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	20.00	395.00	30.00	390.00	4
2	30.00	390.00	65.00	400.00	4
3	65.00	400.00	160.00	450.00	4
4	160.00	450.00	165.00	460.00	4
5	165.00	460.00	235.00	480.00	4
6	235.00	480.00	280.00	490.00	4
7	280.00	490.00	310.00	500.00	4
8	310.00	500.00	520.00	520.00	4
9	520.00	520.00	555.00	530.00	2
10	555.00	530.00	660.00	550.00	2
11	660.00	550.00	720.00	570.00	2
12	720.00	570.00	760.00	580.00	2
13	760.00	580.00	825.00	590.00	2
14	825.00	590.00	1000.00	630.00	2
15	1000.00	630.00	1000.00	650.00	2
16	1000.00	650.00	1142.00	680.00	1
17	1142.00	680.00	1162.00	680.00	1
18	1162.00	680.00	1290.00	730.00	1
19	1290.00	730.00	1500.00	730.00	1
20	1000.00	630.00	1385.00	640.00	2
21	1385.00	640.00	1450.00	660.00	2
22	1450.00	660.00	1500.00	660.00	2
23	520.00	520.00	740.00	530.00	4
24	740.00	530.00	1345.00	530.00	4
25	1345.00	530.00	1500.00	545.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	30.00	390.00
2	520.00	520.00
3	740.00	540.00
4	1345.00	540.00
5	1500.00	555.00

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	65.00	390.00	170.00	450.00
2	170.00	450.00	310.00	490.00
3	310.00	490.00	520.00	510.00
4	520.00	510.00	740.00	520.00
5	740.00	520.00	1345.00	520.00
6	1345.00	520.00	1500.00	535.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 450.00 ft.
and X = 550.00 ft.

Each Surface Terminates Between X =1200.00 ft.
and X =1400.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =390.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	494.44	517.57
2	594.39	514.25
3	694.31	518.32
4	793.65	529.76
5	891.88	548.51
6	988.45	574.46
7	1082.85	607.47
8	1174.54	647.36
9	1263.04	693.92
10	1320.82	730.00

Circle Center At X = 589.3 ; Y = 1867.3 and Radius, 1353.1

*** 2.181 ***

(Runs 2 through 10 ranged from 2.184 to 2.188)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	SJJDYC1.DAT
Output Filename:	SJJDYC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION J-J, DYNAMIC

BOUNDARY COORDINATES

19 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	20.00	395.00	30.00	390.00	4
2	30.00	390.00	65.00	400.00	4
3	65.00	400.00	160.00	450.00	4
4	160.00	450.00	165.00	460.00	4
5	165.00	460.00	235.00	480.00	4
6	235.00	480.00	280.00	490.00	4
7	280.00	490.00	310.00	500.00	4
8	310.00	500.00	520.00	520.00	4
9	520.00	520.00	555.00	530.00	2
10	555.00	530.00	660.00	550.00	2
11	660.00	550.00	720.00	570.00	2
12	720.00	570.00	760.00	580.00	2
13	760.00	580.00	825.00	590.00	2
14	825.00	590.00	1000.00	630.00	2
15	1000.00	630.00	1000.00	650.00	2
16	1000.00	650.00	1142.00	680.00	1
17	1142.00	680.00	1162.00	680.00	1
18	1162.00	680.00	1290.00	730.00	1
19	1290.00	730.00	1500.00	730.00	1
20	1000.00	630.00	1385.00	640.00	2
21	1385.00	640.00	1450.00	660.00	2
22	1450.00	660.00	1500.00	660.00	2
23	520.00	520.00	740.00	530.00	4
24	740.00	530.00	1345.00	530.00	4
25	1345.00	530.00	1500.00	545.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	30.00	390.00
2	520.00	520.00
3	740.00	540.00
4	1345.00	540.00
5	1500.00	555.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	65.00	390.00	170.00	450.00
2	170.00	450.00	310.00	490.00
3	310.00	490.00	520.00	510.00
4	520.00	510.00	740.00	520.00
5	740.00	520.00	1345.00	520.00
6	1345.00	520.00	1500.00	535.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 400.00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X =1200.00 ft.
and X =1400.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =390.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	455.56	513.86
2	555.53	511.62
3	655.43	516.17
4	754.78	527.50
5	853.14	545.54
6	950.05	570.23
7	1045.05	601.44
8	1137.72	639.03
9	1227.62	682.83
10	1309.75	730.00

Circle Center At X = 538.5 ; Y = 1983.1 and Radius, 1471.5

*** 1.537 ***

(Runs 2 through 10 ranged from 1.538 to 1.541)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 3
Run By:	DMC
Input Data Filename:	5KKSTC1.DAT
Output Filename:	5KKSTC3.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION K-K, STATIC

BOUNDARY COORDINATES

7 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	560.00	125.00	565.00	4
2	125.00	565.00	260.00	615.00	1
3	260.00	615.00	280.00	615.00	1
4	280.00	615.00	350.00	640.00	1
5	350.00	640.00	400.00	640.00	1
6	400.00	640.00	425.00	632.00	1
7	425.00	632.00	570.00	632.00	3
8	425.00	632.00	570.00	575.00	1
9	125.00	565.00	200.00	570.00	4
10	200.00	570.00	420.00	575.00	4
11	420.00	575.00	465.00	575.00	4
12	465.00	575.00	468.00	568.00	4
13	492.00	568.00	495.00	575.00	4
14	495.00	575.00	570.00	575.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	555.00
2	200.00	568.00
3	320.00	570.00
4	360.00	590.00
5	375.00	610.00
6	425.00	632.00
7	570.00	632.00

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	552.00	200.00	562.00
2	200.00	562.00	420.00	567.00
3	420.00	567.00	468.00	568.00
4	468.00	568.00	470.00	565.00
5	470.00	565.00	490.00	565.00
6	490.00	565.00	492.00	568.00
7	492.00	568.00	570.00	568.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 50.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 250.00 ft.
and X = 350.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =552.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.78	566.03
2	152.38	570.46
3	176.56	576.84
4	200.15	585.11
5	223.00	595.24
6	244.98	607.16
7	253.12	612.45

Circle Center At X = 84.5 ; Y = 877.0 and Radius, 314.0

*** 1.792 ***

(Runs 2 through 10 ranged from 1.872 to 1.884)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	SKKDYC1.DAT
Output Filename:	SKKDYC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION K-K, ~~STATIC~~ Seismic

BOUNDARY COORDINATES

7 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	560.00	125.00	565.00	4
2	125.00	565.00	260.00	615.00	1
3	260.00	615.00	280.00	615.00	1
4	280.00	615.00	350.00	640.00	1
5	350.00	640.00	400.00	640.00	1
6	400.00	640.00	425.00	632.00	1
7	425.00	632.00	570.00	632.00	3
8	425.00	632.00	570.00	575.00	1
9	125.00	565.00	200.00	570.00	4
10	200.00	570.00	420.00	575.00	4
11	420.00	575.00	465.00	575.00	4
12	465.00	575.00	468.00	568.00	4
13	492.00	568.00	495.00	575.00	4
14	495.00	575.00	570.00	575.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	555.00
2	200.00	568.00
3	320.00	570.00
4	360.00	590.00
5	375.00	610.00
6	425.00	632.00
7	570.00	632.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	552.00	200.00	562.00
2	200.00	562.00	420.00	567.00
3	420.00	567.00	468.00	568.00
4	468.00	568.00	470.00	565.00
5	470.00	565.00	490.00	565.00
6	490.00	565.00	492.00	568.00
7	492.00	568.00	570.00	568.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 50.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 250.00 ft.
and X = 350.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =552.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.78	566.03
2	152.38	570.46
3	176.56	576.84
4	200.15	585.11
5	223.00	595.24
6	244.98	607.16
7	253.12	612.45

Circle Center At X = 84.5 ; Y = 877.0 and Radius, 314.0

*** 1.361 ***

(Runs 2 through 10 ranged from 1.409 to 1.413)

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND3BST.DAT
Output Filename:	POND3BST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 1, STATIC CASE

BOUNDARY COORDINATES

5 Top Boundaries
9 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	33.00	514.00	3
2	33.00	514.00	171.00	560.00	1
3	171.00	560.00	185.00	560.00	1
4	185.00	560.00	244.00	540.00	1
5	244.00	540.00	337.00	560.00	3
6	33.00	514.00	160.00	528.00	3
7	160.00	528.00	171.00	517.00	3
8	184.00	517.00	198.00	533.00	3
9	198.00	533.00	245.00	540.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	497.00
2	216.00	550.00
3	320.00	550.00
4	337.00	554.00

1

Searching Routine Will Be Limited To An Area Defined By 5 Boundaries Of Which The First 5 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	497.00	171.00	517.00
2	171.00	517.00	173.00	515.00
3	173.00	515.00	181.00	515.00
4	181.00	515.00	184.00	518.00
5	184.00	518.00	337.00	547.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 160.00 ft.
and X = 190.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =497.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	513.64
2	54.24	507.52
3	79.21	506.35
4	103.92	510.17
5	127.37	518.84
6	148.62	532.01
7	166.82	549.14
8	174.50	560.00

*** 1.768 ***

Runs 2 through 10 ranged from 1.773 to 1.791

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND3BDY.DAT
Output Filename:	POND3BDY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 1, SEISMIC CASE

BOUNDARY COORDINATES

5 Top Boundaries
9 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	33.00	514.00	3
2	33.00	514.00	171.00	560.00	1
3	171.00	560.00	185.00	560.00	1
4	185.00	560.00	244.00	540.00	1
5	244.00	540.00	337.00	560.00	3
6	33.00	514.00	160.00	528.00	3
7	160.00	528.00	171.00	517.00	3
8	184.00	517.00	198.00	533.00	3
9	198.00	533.00	245.00	540.00	3

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	497.00
2	216.00	550.00
3	320.00	550.00
4	337.00	554.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 5 Boundaries
Of Which The First 5 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	497.00	171.00	517.00
2	171.00	517.00	173.00	515.00
3	173.00	515.00	181.00	515.00
4	181.00	515.00	184.00	518.00
5	184.00	518.00	337.00	547.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 160.00 ft.
and X = 190.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =497.00 ft.

20.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	513.64
2	54.24	507.52
3	79.21	506.35
4	103.92	510.17
5	127.37	518.84
6	148.62	532.01
7	166.82	549.14
8	174.50	560.00

*** 1.302 ***

Runs 2 through 10 ranged from 1.306 to 1.319

** PCSTABL5 **

by

Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-12-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	POND1ST.DAT
Output Filename:	POND1ST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 2, Static

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	89.00	529.00	3
2	89.00	529.00	125.00	540.00	1
3	125.00	540.00	145.00	540.00	1
4	145.00	540.00	165.00	534.00	1
5	165.00	534.00	204.00	520.00	3
6	204.00	520.00	231.00	520.00	4
7	231.00	520.00	357.00	561.00	3
8	89.00	529.00	117.00	531.00	3
9	117.00	531.00	130.00	520.00	3
10	139.00	520.00	151.00	533.00	3
11	151.00	533.00	164.00	534.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	500.00
2	158.00	536.00
3	295.00	536.00
4	357.00	555.00

1

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries
Of Which The First 9 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	500.00	111.00	520.00
2	111.00	520.00	130.00	520.00
3	130.00	520.00	132.00	518.00
4	132.00	518.00	138.00	518.00
5	138.00	518.00	139.00	520.00
6	139.00	520.00	204.00	520.00
7	204.00	520.00	231.00	520.00
8	231.00	520.00	263.00	520.00
9	263.00	520.00	357.00	551.00

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = .00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 100.00 ft.
and X = 150.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =500.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	519.49
2	69.32	521.96
3	93.79	527.11
4	117.55	534.87
5	129.90	540.00

*** 2.445 ***

Runs 2 through 10 ranged from 2.480 to 2.573

** PCSTABL5 **

By

Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-11-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND1DY.DAT
Output Filename:	POND1DY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 2, SEISMIC CASE

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	89.00	529.00	3
2	89.00	529.00	125.00	540.00	1
3	125.00	540.00	145.00	540.00	1
4	145.00	540.00	165.00	534.00	1
5	165.00	534.00	204.00	520.00	3
6	204.00	520.00	231.00	520.00	4
7	231.00	520.00	357.00	561.00	3
8	89.00	529.00	117.00	531.00	3
9	117.00	531.00	130.00	520.00	3
10	139.00	520.00	151.00	533.00	3
11	151.00	533.00	164.00	534.00	3

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	500.00
2	158.00	536.00
3	295.00	536.00
4	357.00	555.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries
Of Which The First 9 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	500.00	111.00	520.00
2	111.00	520.00	130.00	520.00
3	130.00	520.00	132.00	518.00
4	132.00	518.00	138.00	518.00
5	138.00	518.00	139.00	520.00
6	139.00	520.00	204.00	520.00
7	204.00	520.00	231.00	520.00
8	231.00	520.00	263.00	520.00
9	263.00	520.00	357.00	551.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 100.00 ft.
and X = 150.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =500.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	519.49
2	69.32	521.96
3	93.79	527.11
4	117.55	534.87
5	128.90	540.00

*** 1.710 ***

Runs 2 through 10 ranged from 1.721 to 1.761

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	POND2ST.DAT
Output Filename:	POND2ST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 3, STATIC CASE

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	497.00	38.00	500.00	3
2	38.00	500.00	144.00	540.00	1
3	144.00	540.00	161.00	540.00	1
4	161.00	540.00	228.00	520.00	1
5	228.00	520.00	260.00	520.00	1
6	260.00	520.00	439.00	540.00	3
7	439.00	540.00	490.00	560.00	3
8	38.00	500.00	138.00	508.00	3
9	138.00	508.00	149.00	498.00	3
10	158.00	498.00	170.00	511.00	3
11	170.00	511.00	260.00	520.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	486.00
2	36.00	489.00
3	188.00	533.50
4	435.00	533.50
5	490.00	552.00

1

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	486.00	149.00	498.00
2	149.00	498.00	151.00	496.00
3	151.00	496.00	157.00	496.00
4	157.00	496.00	158.00	498.00
5	158.00	498.00	456.00	531.00
6	456.00	531.00	490.00	544.00

1

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 130.00 ft.
and X = 160.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =486.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.67	499.11
2	50.81	492.60
3	75.81	492.54
4	99.97	498.94
5	121.67	511.35
6	139.44	528.95
7	145.90	540.00

*** 1.678 ***

Runs 2 through 10 ranged from 1.689 to 1.711

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	POND2DY.DAT
Output Filename:	POND2DY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 3, SEISMIC CASE

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	497.00	38.00	500.00	3
2	38.00	500.00	144.00	540.00	1
3	144.00	540.00	161.00	540.00	1
4	161.00	540.00	228.00	520.00	1
5	228.00	520.00	260.00	520.00	1
6	260.00	520.00	439.00	540.00	3
7	439.00	540.00	490.00	560.00	3
8	38.00	500.00	138.00	508.00	3
9	138.00	508.00	149.00	498.00	3
10	158.00	498.00	170.00	511.00	3
11	170.00	511.00	260.00	520.00	3

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	486.00
2	36.00	489.00
3	188.00	533.50
4	435.00	533.50
5	490.00	552.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	486.00	149.00	498.00
2	149.00	498.00	151.00	496.00
3	151.00	496.00	157.00	496.00
4	157.00	496.00	158.00	498.00
5	158.00	498.00	456.00	531.00
6	456.00	531.00	490.00	544.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 130.00 ft.
and X = 160.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =486.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.67	499.11
2	50.81	492.60
3	75.81	492.54
4	99.97	498.94
5	121.67	511.35
6	139.44	528.95
7	145.90	540.00

*** 1.267 ***

Runs 2 through 10 ranged from 1.270 to 1.286

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 3
Run By:	DMC
Input Data Filename:	POND3AST.DAT
Output Filename:	POND3AST.OUT

PROBLEM DESCRIPTION SEDIMENT POND H, STATIC CASE

BOUNDARY COORDINATES

8 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	588.00	36.00	600.00	2
2	36.00	600.00	91.00	620.00	1
3	91.00	620.00	113.00	620.00	1
4	113.00	620.00	135.00	610.00	1
5	135.00	610.00	165.00	600.00	2
6	165.00	600.00	176.00	600.00	2
7	176.00	600.00	284.00	638.00	2
8	284.00	638.00	312.00	640.00	2
9	36.00	600.00	89.00	606.00	2
10	89.00	606.00	93.00	600.00	2
11	93.00	600.00	105.00	600.00	2
12	105.00	600.00	113.00	609.00	2
13	113.00	609.00	135.00	611.00	2

1

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 3 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	569.00
2	120.00	615.00
3	312.00	615.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 10.00 ft.
and X = 30.00 ft.

Each Surface Terminates Between X = 90.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.22	592.07
2	37.15	593.98
3	61.11	601.12
4	83.01	613.17
5	90.77	619.91

*** 1.720 ***

Runs 2 through 10 ranged from 1.723 to 1.766

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND3ADY.DAT
Output Filename:	POND3ADY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 4, SEISMIC CASE

BOUNDARY COORDINATES

8 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	588.00	36.00	600.00	2
2	36.00	600.00	91.00	620.00	1
3	91.00	620.00	113.00	620.00	1
4	113.00	620.00	135.00	610.00	1
5	135.00	610.00	165.00	600.00	2
6	165.00	600.00	176.00	600.00	2
7	176.00	600.00	284.00	638.00	2
8	284.00	638.00	312.00	640.00	2
9	36.00	600.00	89.00	606.00	2
10	89.00	606.00	93.00	600.00	2
11	93.00	600.00	105.00	600.00	2
12	105.00	600.00	113.00	609.00	2
13	113.00	609.00	135.00	611.00	2

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 3 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	569.00
2	120.00	615.00
3	312.00	615.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 10.00 ft.
and X = 30.00 ft.

Each Surface Terminates Between X = 90.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.22	592.07
2	37.15	593.98
3	61.11	601.12
4	83.01	613.17
5	90.77	619.91

*** 1.299 ***

Runs 2 through 10 ranged from 1.299 to 1.333

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: [illegible] DATE: 4-25-92 CHKD BY: [illegible] DATE: 5/6/92

PROJECT NAME: [illegible]

PROJECT NO. [illegible] SHEET 1 OF 1

DESCRIPTION [illegible]

The purpose of this calculation is to determine if there is enough extra freeboard in the areas underlain by fines to contain the impoundment [illegible]. In order to be conservative, we assume total loss of strength of the fines during a [illegible]. The greatest thickness of buried fines encountered during the exploration was 17 ft (Boring B-20). Therefore the crest of the impoundment [illegible] 17 ft above the maximum level of fines in each stage.

Stage 1

Crest Elev = 675

Max. Fine Elev = 658

675 - 658 = 17 ≥ 17 ft ok (No Free board)

Stage 2

Crest Elev. = 690

Max. Fine Elev. = 667

690 - 667 = 23 ft ≥ 17 ft ok

Stage 3

Crest Elev. = 710

Max Fine Elev = 678

710 - 678 = 32 ft ≥ 17 ft ok

Revised

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DAC DATE: 5-5-91 CHKD BY: RMW DATE: 6/11/91

PROJECT NAME: Conard

PROJECT NO. 89-55-27 SHEET 1 OF 1

DESCRIPTION Liquefaction Calculations for Existing Impoundment

The purpose of this calculation is to determine if there is enough extra freeboard in the areas underlain by fines to contain the impoundment if liquefaction did occur. In order to be conservative, we will assume total disappearance of the fines during a liquefaction event. The greatest thickness of buried fines encountered during the exploration program was 20 ft. Therefore, the crest of the impoundment (underlain by fines) will always be at least 20 ft above the maximum level of fines in each stage.

Stage 1

Crest Elev = 675

Max. Fine Elev = 653

675 - 653 = 22 > 20 ft ok

Stage 2

Crest Elev. = 690

Max. Fine Elev. = 665

690 - 665 = 25 ft > 20 ft ok

Stage 3

Crest Elev. = 710

Max Fine Elev = 679

710 - 679 = 31 ft ok

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/23/91 CHKD BY: SHP DATE: 6-10-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 1 OF 3
DESCRIPTION DEEP MINE PERCENT COAL RECOVERY

CALCULATE PERCENT RECOVERY/EXTRACTION IN DEEP MINE AREAS UNDER DISPOSAL AREA*
(*-USING CONCORD DEEP MINE MAPS)

SEAM MINED: PRATT SEAM, POTTSVILLE FORMATION
ELEVATIONS: NORTH AREA OF SITE - 40 FEET BELOW MSL.
SOUTH AREA OF SITE - 90 FEET BELOW MSL.

PERCENT RECOVERY/EXTRACTION IN NORTH AREA BELOW DIKE IMPOUNDMENT EMBANKMENT:

- IN THIS AREA THE COAL WAS NOT MINED WITHIN APPROXIMATELY 600 FEET OF THE PREPARATION PLANT, AND ONLY PANELS 150' TO 300' WIDE WERE MINED UNDER THE DIKE IMPOUNDMENT AREA, LEAVING 200' TO 300' WIDE UNMINED PANELS.

PERCENT RECOVERY IN MINED PANEL
PANEL WIDTH = 292'
AVERAGE ENTRY WIDTH = 25'
NUMBER OF ENTRIES = 4
NUMBER OF PILLARS = 3

$$\text{PILLAR WIDTH} = \frac{292' - 4\ \text{ENTRIES}(25')}{3\ \text{PILLARS}} = 64\ \text{FEET}$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SHP DATE: 6-10-91
PROJECT NAME: US STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 2 OF 3
DESCRIPTION DEEP MINE PERCENT COAL RECOVERY

PANEL LENGTH = 1700'
AVERAGE CROSSCUT WIDTH = 25'
NUMBER OF CROSSCUTS = 18
NUMBER OF PILLARS = 19

$$\text{PILLAR LENGTH} = \frac{1700' - 18 \text{ CROSSCUTS}(25')}{19 \text{ PILLARS}} = 65.7 \text{ FEET}$$

USE 66 FEET

$$\text{PERCENT RECOVERY IN MINED PANEL} = 1 - \frac{(64')(66')}{(64'+25')(66'+25')} = 48\%$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SAP DATE: 6-10-91
PROJECT NAME: US STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 3 OF 3
DESCRIPTION DEEP MINE PERCENT COAL RECOVERY

PERCENT RECOVERY/EXTRACTION IN SOUTHERN AREA BELOW MAIN EMBANKMENT AREA AND EXISTING IMPOUNDMENT

ALONG 1440 FOOT WIDTH OF MINED AREA, THERE ARE 18 ENTRIES (AVERAGE 25') AND 17 PILLARS

$$\text{PILLAR WIDTH} = \frac{1440' - 18 \text{ ENTRIES } (25')}{17} = 58.2'$$

USE 58 FEET

ALONG A 900 FOOT LENGTH OF MINED AREA, THERE ARE 10 CROSSCUTS (AVERAGE 25') AND 10 PILLARS

$$\text{PILLAR LENGTH} = \frac{900 - 10 \text{ CROSSCUTS } (25')}{10} = 65 \text{ FEET}$$

$$\text{PERCENT RECOVERY IN SOUTH AREA} = 1 - \frac{(58')(65')}{(58'+25')(65'+25')} = 49.5\%$$

USE 50%

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SAP DATE: 6-10-91

PROJECT NAME: U.S STEEL - CONCORD

PROJECT NO. 90-55-27 SHEET 1 OF 19

DESCRIPTION SUBSIDENCE CALCULATIONS

SUBSIDENCE EVALUATION
CONCORD REFUSE DISPOSAL AREA
U.S. STEEL MINING COMPANY, INC
HUEYTOWN, ALABAMA

OBJECTIVE: EVALUATE POTENTIAL SUBSIDENCE IMPACTS ON REFUSE DISPOSAL AREA

PART 1 - REVIEW EXISTING CONDITIONS

PART 2 - EVALUATE SINKHOLE SUBSIDENCE

PART 3 - EVALUATE TROUGH SUBSIDENCE

PART 4 - DETERMINE MAXIMUM PROFILE CHANGE

PART 5 - DETERMINE MAXIMUM STRAIN DUE TO MAXIMUM PROFILE CHANGE

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 2 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 1 - REVIEW OF EXISTING CONDITIONS

COAL SEAM THICKNESS - THE PRATT COAL SEAM IS THE ONLY SEAM KNOWN TO HAVE BEEN MINED BELOW THIS SITE. MINING ON THIS SEAM IN THE VICINITY OF THIS SITE HAS BEEN COMPLETED.

*AVERAGE SEAM THICKNESS = 7 FEET

*SEAM ELEVATION: 40 FEET BELOW MSL (NORTH SIDE)
90 FEET BELOW MSL (SOUTH SIDE)

(* PER MINE MAPS AND MINING RECORDS)

OVERBURDEN CONDITIONS

A COMPARISON OF TOPOGRAPHIC, GEOLOGIC AND DISPOSAL AREA MAPS INDICATE THE OVERBURDEN THICKNESS RANGES FROM APPROX. 620 FEET AT THE NORTH END OF THE SITE TO 670 FEET AT THE SOUTH END OF THE SITE.

MINING UNDER THE DIKE IMPOUNDMENT AREA AT THE NORTH WEST CORNER OF THE SITE WAS LIMITED TO 150' TO 300' WIDE PANELS, LEAVING 200' TO 300' WIDE UNMINED PANELS. THE AREAS BELOW THE COAL PREPARATION PLANT, AND AREAS WITHIN 600' WERE NOT MINED. PERCENT RECOVERY/EXTRACTION WITHIN THE MINED PANELS WAS ESTIMATED TO BE 48%.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: US STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 3 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

OVERBURDEN CONDITIONS (CONT.)

MINING UNDER THE MAIN DISPOSAL AREA AND EXISTING IMPOUNDMENT WAS GENERALLY BY ROOM AND PILLAR MINING. PERCENT COAL RECOVERY IN THESE AREAS WERE ESTIMATED TO BE 50%. NO AREAS UNDER THE EXISTING IMPOUNDMENT ARE INDICATED BY THE MINE MAPS TO HAVE BEEN RETREAT MINED (PILLARS MINED).

PART 2 - EVALUATE SINKHOLE SUBSIDENCE

SINKHOLE SUBSIDENCE IS COMMONLY ASSOCIATED WITH GOB FORMATION FROM ROOF COLLAPSE OR PILLAR FAILURE, BASED UPON KNOWLEDGE OF HISTORICAL OCCURRENCES, SEAM AND OVERBURDEN CONDITIONS THE POTENTIAL FOR SINKHOLE OCCURRENCE CAN BE ESTIMATED.

ESTIMATION OF GOB ZONE

a) ESTIMATE OF GOB ZONE BASED ON EMPIRICAL FACTORS (RULE OF THUMB) INDICATES GOB ZONE FORMATION AT TWO TO EIGHT TIMES THE EXTRACTED COAL SEAM THICKNESS.

- USING EIGHT TIMES SEAM HEIGHT,
GOB ZONE = 8 x 7 FEET = 56 FEET

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: JAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 4 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 2 (CONTINUED)

b) ESTIMATE GOB ZONE USING GOB HEIGHT FORMULA OF JONES AND KOHLI, (1985) SUBSIDENCE ENGINEERING, WVU INSTITUTE OF TECHNOLOGY, MONTGOMERY, WEST VIRGINIA.

$$\text{GOB HEIGHT} = \frac{100\,H}{4.7H + 19} \pm 2.2$$

WHERE H IS IN METERS

PRATT SEAM $H = 7$ FEET $= \frac{7 \text{ FEET}}{3.28 \text{ FT/METERS}} = 2.13$ METERS

$$\text{GOB HEIGHT} = \frac{100\,(2.13\,m)}{4.7\,(2.13\,m) + 19} \pm 2.2$$

$$= 7.3 \pm 2.2 \text{ METERS}$$

USE 9.5 METERS = 31.3 FEET $\approx$ 31 FEET

CONCLUSION

TO MAINTAIN A REASONABLE MARGIN OF SAFTEY USE ESTIMATE OF GOB FORMATION BY EMPIRICAL METHOD (56 FEET) AND A FACTOR OF SAFTEY OF OF 2, WHICH YEILDS A VALUE OF 112 FEET. BASED UPON EXISTING SINKHOLE SUBSIDENCE THEORIES, IT IS CONCLUDED THAT SINKHOLE SUBSIDENCE OCCURRENCES IS HIGHLY UNLIKELY AT THIS SITE DUE TO THE LARGE OVERBURDEN THICKNESS.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/25/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 5 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 3 - EVALUATION OF TROUGH SUBSIDENCE

DETERMINE THE HEIGHT OF THE POTENTIAL FRACTURED ZONE ABOVE THE DEEP MINE.

a) EMPIRICAL ESTIMATE

EMPIRICAL ESTIMATES OF FRACTURED ZONES ASSUME FRACTURED ZONE MAY EXTEND 20 TO 40 TIMES THE EXTRACTED COAL HEIGHT: (7 FEET)

FRACTURED ZONE = 20 X 7 FEET = 140 FEET
" " = 40 X 7 FEET = 280 FEET

b) FRACTURED ZONE FORMULA, JONES AND KOHLI (1985)

$$\text{FRACTURED ZONE FORMULA} = \frac{100\,H}{1.6\,H + 3.6} \pm 5.6$$

WHERE H IS IN METERS

$$\text{SEAM HEIGHT } H = 7 \text{ FEET} = \frac{7 \text{ FEET}}{3.28 \text{ FT/M}} = 2.13 \text{ METERS}$$

$$\text{FRACTURED ZONE} = \frac{100\,(2.13\text{m})}{1.6\,(2.13\text{m}) + 3.6\text{m}} \pm 5.6\text{m}$$

$$= 30.4 \pm 5.6\text{m} = 24.8 \rightarrow 36.0\text{m}$$

$$= 81.3 \longrightarrow 118.1 \text{ FEET}$$

CONCLUSION: SUBSIDENCE WILL NOT CAUSE OVERBURDEN TO RUBBELIZE (GOB) TO THE SURFACE AND THE FRACTURE ZONE WILL NOT REACH THE SURFACE IN THE AREA OF THE REFUSE DISPOSAL FACILITY.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 6 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 4 - DETERMINE POST MINING PROFILE CHANGE

FROM WARDELL (1969) FOR ROOM AND PILLAR MINING AREAS, MAXIMUM POSSIBLE SUBSIDENCE, S_M, CAN BE EXPRESSED AS: $S_M = ta$

WHERE S_M = MAXIMUM POSSIBLE SUBSIDENCE

t = AVERAGE VOID HEIGHT

a = SUBSIDENCE COEFFICIENT REPRESENTING THE PERCENT OF MAXIMUM SUBSIDENCE AS A FUNCTION OF DEPTH, RATIO OF EXTRACTION, PILLAR LOADING AND HEIGHT TO WIDTH RATIO OF PILLARS.

FOR AREA 1, NORTHWEST PORTION OF SITE (DIKE AREA)

$t = H$ = VOID HEIGHT = 7 FEET

R = EXTRACTION RATIO = 48%
W = PILLAR WIDTH = 64 FEET
D = DEPTH = 620 FEET
S = ROOM WIDTH = 25 FEET
L_{MAX} = PILLAR LOAD = $\frac{D}{1-R}$ (FROM WARDELL, 1969)

FROM FIGURE 2, (WARDELL 1969)

WHERE $L_{MAX} \times \frac{H}{W} = \left(\frac{D}{1-R}\right)\left(\frac{H}{W}\right) = 130$

$a = 0.065$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMN DATE: 6/6/91 CHKD BY: SAP DATE: 6-10-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 7 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

CALCULATE MAXIMUM SUBSIDENCE

$S_M = t\,a$ WHERE $t = 7$ FEET
$a = 0.065$

$S_M = (7')(0.065)$
$= 0.46$ FEET $= 0.14$ METERS

USING NCB METHOD, REF: PENG, S. 1985
COAL MINE GROUND CONTROL
WILEY & SONS, N.Y.

DEVELOP SUBSIDENCE PROFILE

1. Subsidence % as s/s	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
2. Subsidence (S max)	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.07	0.10	0.13	0.14
3. Subsidence (d/h)	0.94	0.47	0.33	0.28	0.23	0.20	0.17	0.15	0.12	0.08	0.00
4. Distance (d meters)	177.66	88.83	62.37	52.92	43.47	37.80	32.13	28.35	22.68	15.12	0.00
5. Subsidence (s feet)	0.00	0.00	0.00	0.01	0.03	0.07	0.14	0.23	0.33	0.41	0.46
6. Distance (d feet)	582.72	291.36	204.57	173.58	142.58	123.98	105.39	92.99	74.39	49.59	0.00

1. PERCENT OF MAX. SUBSIDENCE = S/S %
2. SUBSIDENCE (METERS) = S_{MAX} X S/S = 0.14m x S/S
3. DISTANCE d/h FROM TABLE 13.4.2, PENG, S. 1986.
4. DISTANCE d (METER) = d/h x h = d/h X 189 METERS
5. SUBSIDENCE = S (FEET)
6. DISTANCE = d (FEET)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: VIS. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 8 OF 19
DESCRIPTION SUBSIDENCE CALC's

FOR AREA 2, MAIN DISPOSAL AREA (EXISTING AREA)
ROOM AND PILLAR MINING AREA

ASSUME $t = H =$ VOID HEIGHT = 7 FEET
$R =$ EXTRACTION RATIO = 50%
$W =$ PILLAR WIDTH = 58 FEET
$D =$ DEPTH = 670 FEET
$S =$ ROOM WIDTH = 25 FEET
L_{MAX} = PILLAR LOAD = $\frac{D}{1-R}$ (FROM WARDELL 1969)

FROM FIGURE 2, (WARDELL, 1969)
WHERE $L_{MAX} \times \frac{H}{W} = \left(\frac{D}{1-R}\right)\left(\frac{H}{W}\right) = 161.$

USE

$a = 0.085$

CALCULATE MAXIMUM SUBSIDENCE FOR AREA 2,

$S_{MAX} = t\,a$ WHERE $t = 7$ FEET
$a = 0.085$

$S_{MAX} = (7')(0.085) = 0.595$ FEET $= 0.18$ METER

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91

PROJECT NAME: U.S. STEEL - CONCORD

PROJECT NO. 90-55-27 SHEET 9 OF 19

DESCRIPTION SUBSIDENCE CALC's

DEVELOP SUBSIDENCE PROFILE; USING NCB METHOD (REF: PENG, S., 1985)

1. Subsidence % as s/s	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
2. Subsidence (S max)	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.09	0.13	0.16	0.18
3. Subsidence (d/h)	1.70	1.09	0.99	0.94	0.90	0.86	0.82	0.78	0.73	0.65	0.16
4. Distance (d meters)	346.80	222.36	201.96	191.76	183.60	175.44	167.28	159.12	148.92	132.60	32.64
5. Subsidence (s feet)	0.00	0.00	0.00	0.01	0.04	0.09	0.18	0.30	0.43	0.53	0.59
6. Distance (d feet)	1137.50	729.34	662.43	628.97	602.21	575.44	548.68	521.91	488.46	434.93	107.06

1. PERCENT OF MAXIMUM SUBSIDENCE - s/s_0
2. SUBSIDENCE (METERS) = $S_{MAX} \times s/s = 0.18 \times s/s$
3. DISTANCE d/h FROM TABLE 13.4.2 (PENG, S. 1985) *
4. DISTANCE d (METERS) - $d/h \times h = d/h \times 204$ METERS
5. SUBSIDENCE - S (FEET)
6. DISTANCE - d (FEET)

* W - WIDTH OF MINED AREA = 1400 FEET
h - depth of mined seam = 670 feet

$$w/h = \frac{1400'}{670} = 2.08$$ USE 2.0 IN TABLE 13.4.4

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL – CONCORD
PROJECT NO. 90-55-27 SHEET 10 OF 19
DESCRIPTION SUBSIDENCE CALC's

CALCULATE MAXIMUM POTENTIAL SUBSIDENCE FOR AREA 3, EAST SIDE OF MAIN DISPOSAL AREA WHERE PILLAR EXTRACTION OCCURED

ASSUME W = WIDTH OF MINED AREA = 1000 FEET
m = VOID HEIGHT = 7 FEET = 2.13 METERS
h = DEPTH OF MINING = 670 FEET

USING NCB METHOD (PENG, S., 1985)

$S/m = 0.89$ FROM FIGURE 13.4.2

$S = 0.89\ (2.13) = 1.89$ METERS $= 6.22$ FEET

$W/h = \frac{1000'}{670'} = 1.49$ USE 1.5

DEVELOP SUBSIDENCE PROFILE:

1. Subsidence % as s/s	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
2. Subsidence (S max)	0.00	0.00	0.01	0.03	0.11	0.29	0.57	0.95	1.36	1.70	1.89
3. Subsidence (d/h)	1.50	0.90	0.80	0.74	0.70	0.66	0.62	0.58	0.53	0.45	0.05
4. Distance (d meters)	306.00	183.60	163.20	150.96	142.80	134.64	126.48	118.32	108.12	91.80	10.20
5. Subsidence (s feet)	0.00	0.00	0.02	0.11	0.37	0.94	1.87	3.12	4.46	5.58	6.20
6. Distance (d feet)	1003.68	602.21	535.30	495.15	468.38	441.62	414.85	388.09	354.63	301.10	33.46

1. PERCENT OF MAXIMUM SUBSIDENCE – s/s %
2. SUBSIDENCE (METERS) – $S_{MAX} \times s/s = 2.13 \times s/s$
3. DISTANCE d/h FROM TABLE 13.4.2 (PENG, S., 1985)
4. DISTANCE d (METERS) = $d/h \times h = d/h \times 204$
5. SUBSIDENCE (FEET)
6. DISTANCE (FEET)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: DML DATE: 6-13-91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 11 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 5 - DETERMINE MAXIMUM STRAIN DUE TO TROUGH SUBSIDENCE (REF. PENG, S., 1985 FIGURE 13.4.4)

$$E_{MAX} = K_3 \left(\frac{S}{h}\right)$$

FOR AREA 1, NORTHWEST AREA, (DIKE IMPOUNDMENT)

WHERE K_3 = CONSTANT FROM FIG 13.4.4, DEPENDING ON PANEL WIDTH, W, AND EXTRACTED SEAM DEPTH, h.

S = MAXIMUM SETTLEMENT DUE TO SUBSIDENCE.

$W/h = 300'/620' = 0.48$

FROM FIG. 13.4.4, $K_3 = +1.4$ (EXTENSION)
-0.63 (COMPRESSION)

MAXIMUM TENSILE STRAIN

$$E_+ = 1.4\left(\frac{0.46}{620}\right) = +0.001\ FT/FT$$

MAXIMUM COMPRESSIVE STRAIN

$$E_- = -0.63\left(\frac{0.46}{620}\right) = -0.00046\ FT/FT$$

USING NCB METHOD, DEVELOP STRAIN PROFILE

e/E	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
Strain, E x 10^{-3}	0.00	0.04	0.19	0.48	0.80	1.00	0.80	0.00	- 0.02	- 0.09	- 0.22	- 0.37	- 0.46	- 0.37	- 0.22	- 0.09	- 0.02	- 0.00
Distance, % h (ft)	0.94	0.60	0.51	0.43	0.38	0.31	0.27	0.20	0.18	0.15	0.12	0.08	0.01	0.00	0.00	0.00	0.00	0.00
Distance (ft)	630	402	342	288	255	208	181	134	121	101	80	54	7	0	0	0	0	0

e/E - PERCENT OF STRAIN FROM CENTER OF MINED AREA
STRAIN - STRAIN AT DISTANCE h FROM CENTER OF MINED AREA
h - DISTANCE FROM CENTER OF MINED AREA

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: DML DATE: 6-13-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55.27 SHEET 12 OF 19
DESCRIPTION SUBSIDENCE CALC's

FOR AREA 2, MAIN DISPOSAL AREA

DETERMINE MAXIMUM STRAIN

$$E_{MAX} = K_3 \left(\frac{S}{h}\right)$$

WHERE K_3 = STRAIN CONSTANT = +0.65 FROM 13.4.4 (PENG, S, 1985)
-0.5

S = MAX. SUBSIDENCE = 0.59 FEET

h = DEPTH = 670 FEET

$W/h = \frac{1400'}{670} = 2.08$ USE 2.0 IN TABLE 13.4.4

MAXIMUM TENSILE STRAIN

$$E+ = 0.65\left(\frac{0.59'}{670}\right) = +0.00057 \text{ FT/FT}$$

MAXIMUM COMPRESSIVE STRAIN

$$E- = -0.5\left(\frac{0.375}{670}\right) = -0.00046 \text{ FT/FT}$$

USING NCB METHOD, DEVELOP STRAIN PROFILE TABLE 13.4.4

e/E	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
Strain, E x 10^{-4}	0.00	0.22	1.09	2.74	4.56	5.70	4.56	0.00	-0.18	-0.90	-2.26	-3.76	-4.70	-3.76	-2.26	-0.90	-0.18	0.00
Distance, % h (ft)	1.70	1.28	1.17	1.11	1.05	1.00	0.96	0.86	0.84	0.81	0.78	0.75	0.69	0.60	0.53	0.47	0.40	0.20
Distance (ft)	1139	794	725	688	651	620	595	533	521	502	484	465	428	372	329	291	248	124

e/E = PERCENT OF STRAIN FROM CENTER OF MINED AREA

STRAIN - STRAIN AT DISTANCE h FROM CENTER OF MINED AREA

h - DISTANCE FROM CENTER OF MINED AREA.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: DNL DATE: 6-13-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 13 OF 19
DESCRIPTION SUBSIDENCE CALC's

FOR AREA 3, EAST SIDE OF MAIN DISPOSAL AREA
(PILLAR EXTRACTION AREA)

DETERMINE MAXIMUM STRAIN

WHERE K_3 = STRAIN CONSTANT = +0.65
= -0.5

S = MAX SUBSIDENCE = 6.2 FEET

h = DEPTH = 670 FEET

$W/h = \frac{1000'}{670'} = 1.49$, USE 1.5 IN TABLE 13.4.4

MAXIMUM TENSILE STRAIN

$E+ = 0.65\left(\frac{6.2'}{670'}\right) = +0.006$ FT/FT

MAXIMUM COMPRESSIVE STRAIN

$E- = -0.5\left(\frac{6.2'}{670}\right) = -0.0046$ FT/FT

USING NCB METHOD, DEVELOP STRAIN PROFILE TABLE 13.4.4

e/E	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
Strain, E x 10	0.00	0.23	1.15	2.88	4.80	6.00	4.80	0.00	-0.18	-0.88	-2.21	-3.68	-4.60	-3.68	-2.21	-0.88	-0.18	0.00
Distance, % h (ft)	1.50	1.08	0.97	0.91	0.85	0.80	0.76	0.66	0.63	0.61	0.58	0.55	0.49	0.40	0.33	0.27	0.20	0.03
Distance (ft)	1005	724	650	610	570	536	509	442	422	409	389	369	328	268	221	181	134	20

e/E - PERCENT OF STRAIN FROM CENTER OF MINED AREA
STRAIN - STRAIN AT DISTANCE h FROM CENTER OF MINED AREA
h - DISTANCE FROM CENTER OF MINED AREA

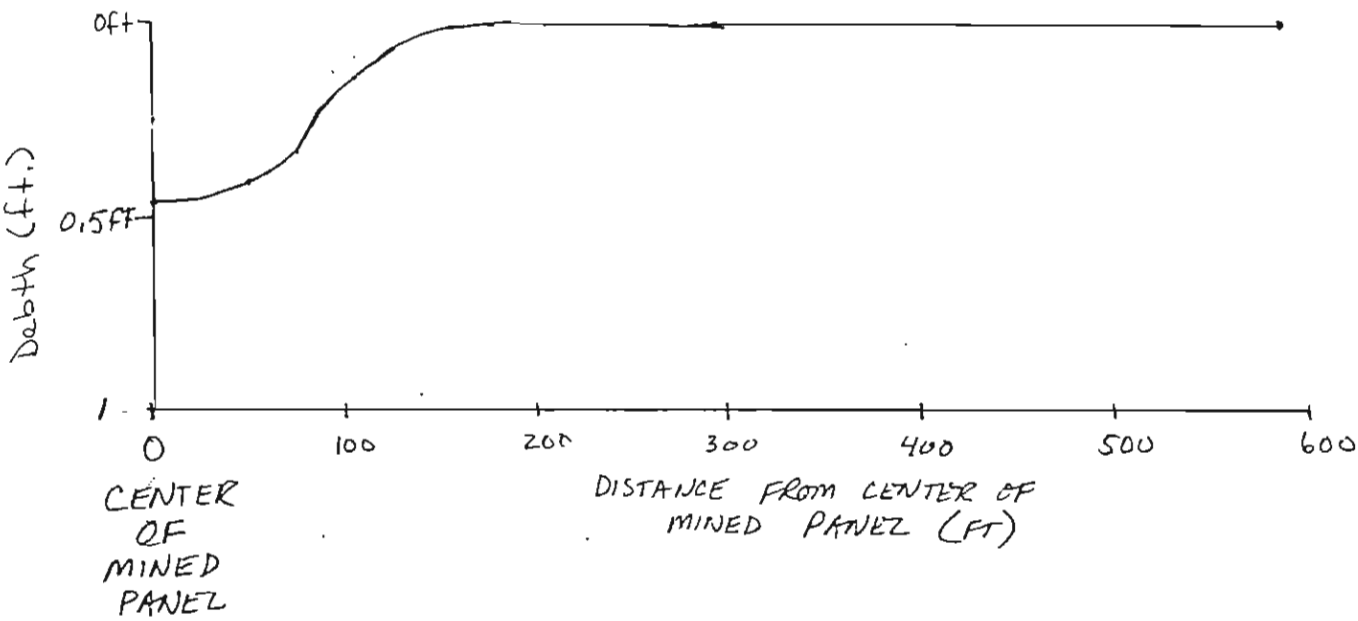
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: U.S. Steel - Concord

PROJECT NO. 90-55-27 SHEET 14 OF 19

DESCRIPTION SUBSIDENCE PROFILE



AREA 1 MINING ON the PRATT Seam

U.S. Steel - Concord Refuse Disposal Area

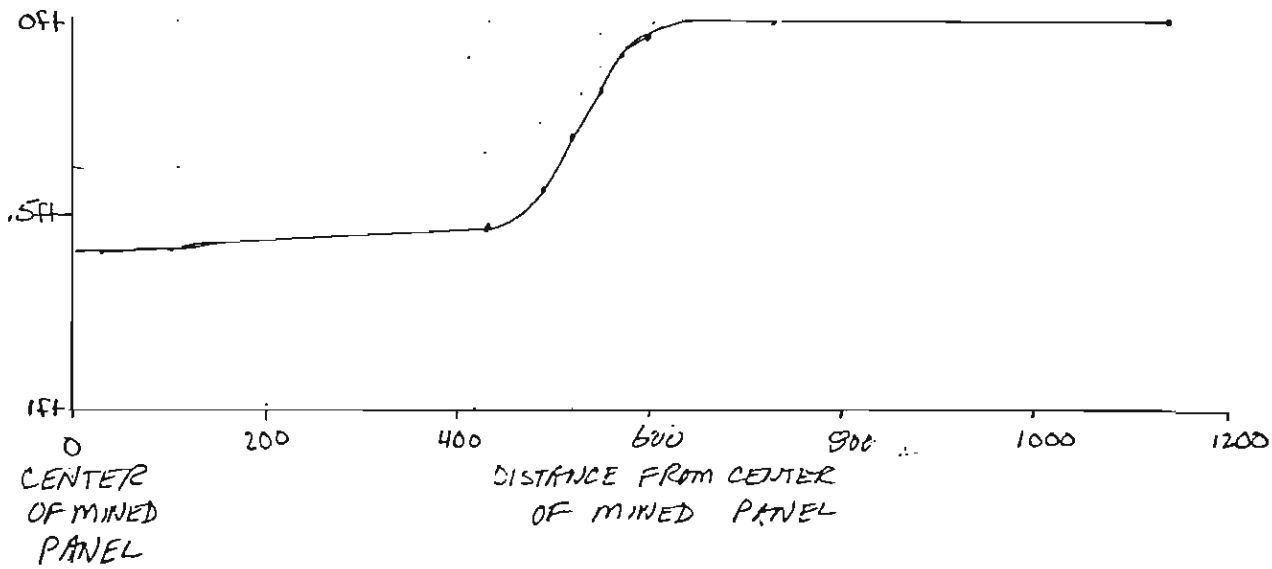
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: U.S. Steel - Concord

PROJECT NO. 90-55-27 SHEET 15 OF 19

DESCRIPTION Area 2 mining on the Pratt Seam SUBSIDENCE PROFILE



Area 2 mining on the Pratt Seam
US Steel - Concord Refuse Disposal Area

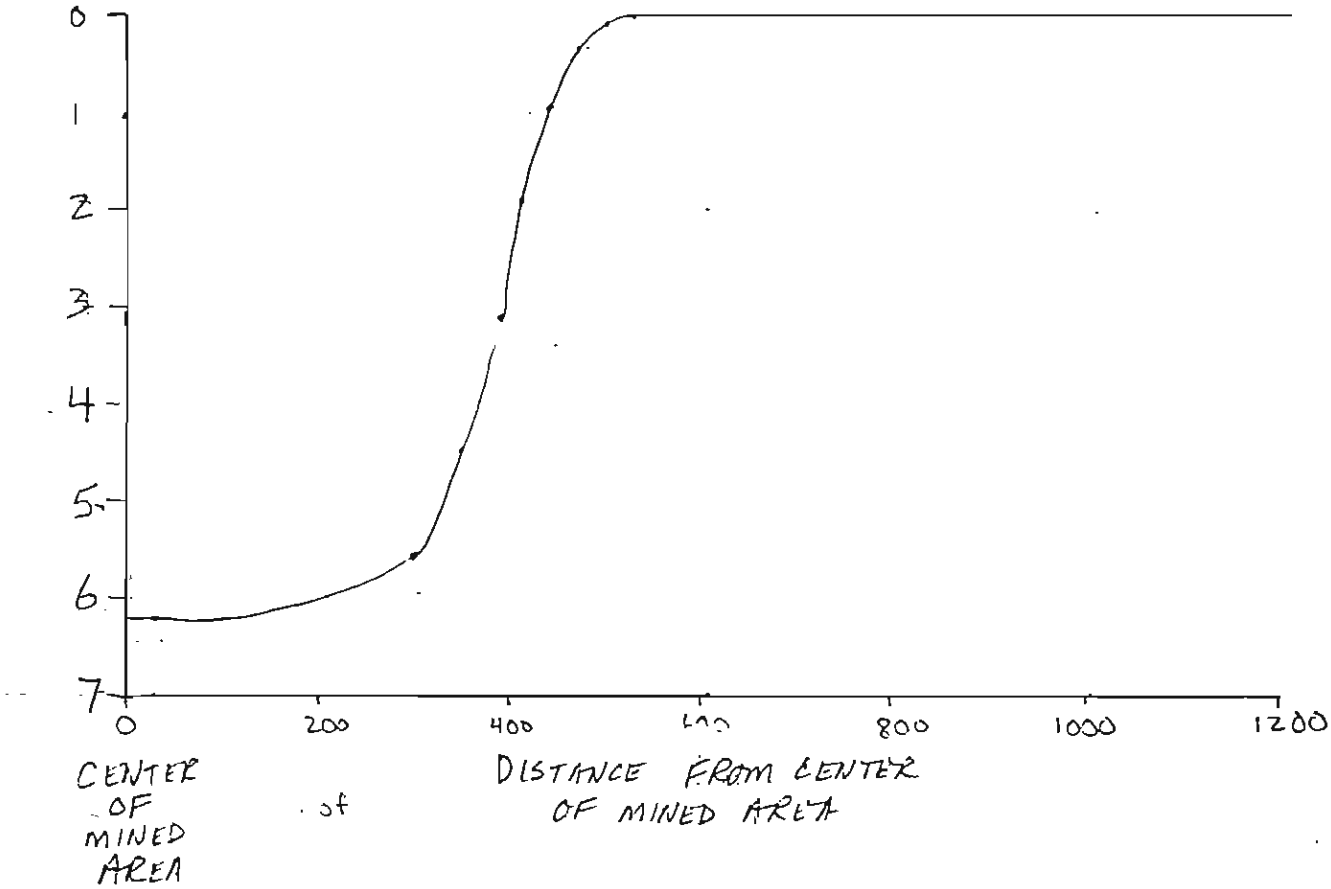
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/13/91

PROJECT NAME: US Steel - CONCORD

PROJECT NO. 90-55-27 SHEET 16 OF 19

DESCRIPTION SUBSIDENCE PROFILE



Area 3 mining on the Concord Seam
Us Steel - Concord Refuse disposal Area

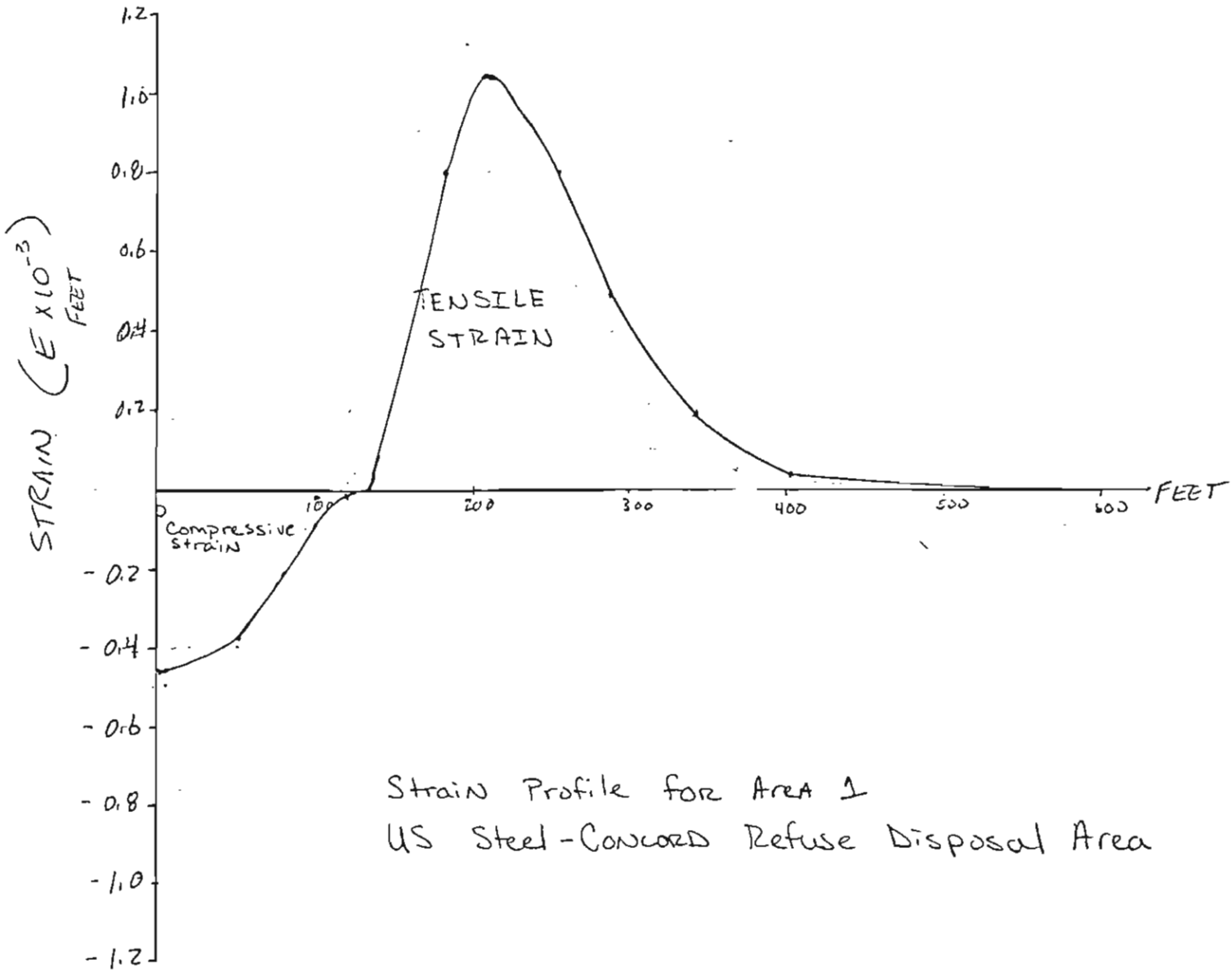
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: US. Steel - Concord

PROJECT NO. 90-55-27 SHEET 17 OF 19

DESCRIPTION US Steel-Concord Refuse Disposal Area. Strain Profile for Area 1



Strain Profile for Area 1
US Steel-Concord Refuse Disposal Area

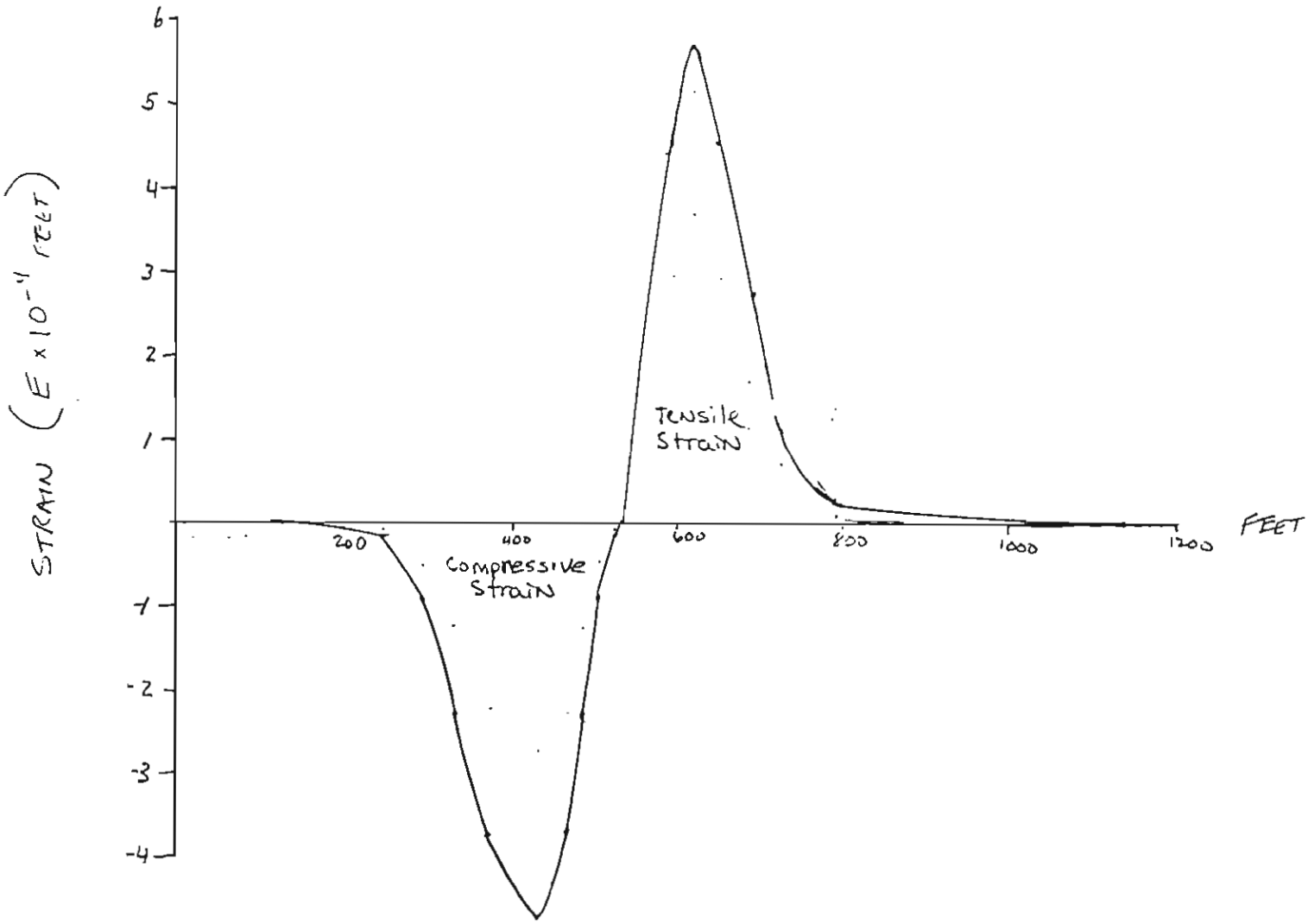
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: US Steel Concord

PROJECT NO. 90-55-27 SHEET 18 OF 19

DESCRIPTION US Steel - Concord Refuse Disposal Area. Strain Profile for Area 2



STRAIN PROFILE FOR AREA 2

U.S. STEEL CONCORD REFUSE DISPOSAL AREA

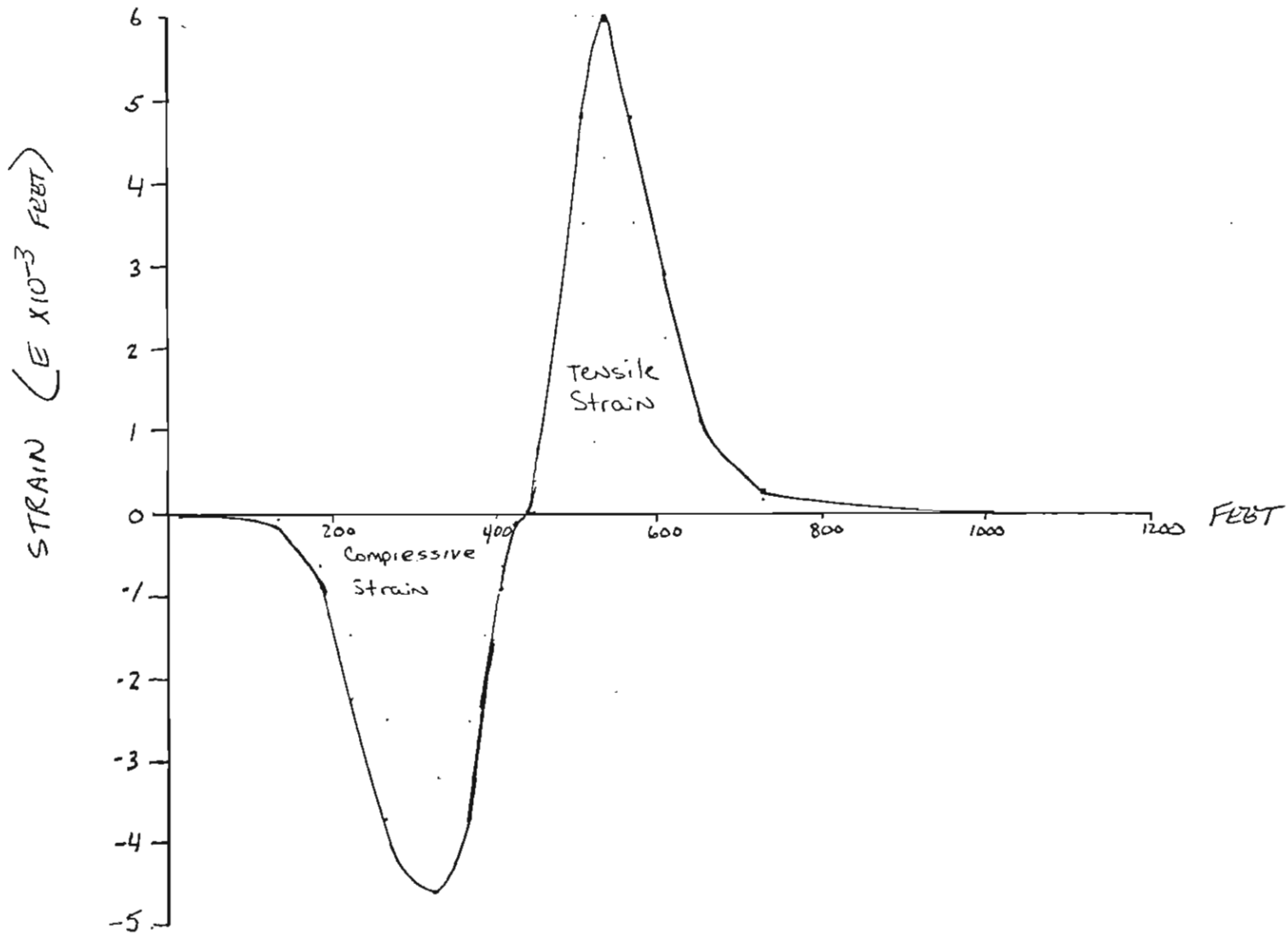
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: US Steel Concord

PROJECT NO. 90-55-27 SHEET 19 OF 19

DESCRIPTION US Steel Refuse Disposal Area Strain profile for Area 3



STRAIN PROFILE FOR AREA 3

U.S. STEEL - CONCORD REFUSE DISPOSAL AREA

APPENDIX D

FIELD AND LABORATORY TESTING RESULTS

APPENDIX D

FIELD AND LABORATORY TESTING RESULTS
PROPOSED REFUSE DISPOSAL PLAN
CONCORD REFUSE DISPOSAL AREA
U.S. STEEL MINING CO.

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PERMEABILITY TESTS	D-39
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CONSOLIDATED UNDRAINED TRIAXIAL TESTS	D-44

PROJECT: U.S. STEEL - CONCORD BY: DMC DATE: 4-8-91

PROJECT NO.: 90-55-27 CHK: DATE:

DESCRIPTION: Adjusted In-place Density Data

Test No.	Measured Dry Unit Wt (pcf)	Measured Water Cont.	Moist Unit Wt(pcf)	Adj.Water Cont.	Adj Dry Unit Wt (pcf)	Descrption
1	127.5	6.7	136.0	6.7	127.5	Natural Soil
2	134.6	4.6	140.9	4.6	134.7	Natural Soil
3	109.8	12.2	123.2	12.2	109.8	Natural Soil
4	90	29.3	116.4	29.3	90.0	Natural Soil
5	105.5	12.2	118.5	3.7	114.3	Fresh Coarse
6	109	12.5	122.6	3.8	118.2	Fresh Coarse
7	110.9	9.1	121.0	2.7	117.8	Fresh Coarse
8	101.6	11.4	113.2	3.4	109.5	Fresh Coarse
9	104	10.6	115.5	3.2	111.9	Fresh Coarse
10	108	9.1	117.8	2.7	114.7	Fresh Coarse
11	47.4	68.4	79.8	60.9	49.6	Fines
12	54.8	56	85.5	49.8	57.1	Fines
13	54.9	45.5	79.9	40.5	56.9	Fines
14	105.4	9.1	115.0	6.1	108.4	Decomp Coarse
15	118.4	9.7	129.9	6.5	122.0	Decomp Coarse
16	99.7	12.4	112.0	8.308	103.4	Decomp Coarse

PROJECT: U.S. STEEL - CONCORD BY: DMC DATE: 3-25-91

PROJECT NO.: 90-55-27 CHK: DATE:

DESCRIPTION: In-place Density Test Adjustment Factor Calculation

In-place Sample No.	Water Content (%)	Field Sample No.	Water Content (%)	% of In-place	Description
5	12.9	BS-6	3	0.23	Coarse
7	10.1	B-14, S-1	3.7	0.37	Coarse
12	30.7	BS-8	23.5	0.77	Fine
13	25	BS-9	25.5	1.02	Fine
15	11.6	BS-3	7.8	0.67	Decomp. Coarse

Adjustment Factors:

Coarse	0.30
Fine	0.89
Decomp. Coarse	0.67

GROUND ENGINEERING AND TESTING SERVICE, INC.
4764 FIRST AVE SOUTH
BIRMINGHAM, ALABAMA

REPORT OF FIELD DENSITY TESTS

PROJECT NAME: CONCORD MINE JOB NUMBER: B6122-001

CLIENT: ALMES AND ASSOCIATES INC DATE: 03-27-1991

TEST NO	TEST DATE	DRY #/CF	WATER (%)	WET DENSITY #/CF	APPROXIMATE LOCATION OF THE FIELD DENSITY TESTS	DEPTH ELEV.
1	02/05	127.5	6.7	136.0	BORING NO. 16	0
2	02/05	134.6	4.6	140.9	BORING NO. 2	0
3	02/05	109.8	12.2	123.2	BORING NO. 15	0
4	02/05	90	29.3	116.4	BORING NO. 3	0
5	02/05	105.5	12.2	118.5	E SIDE OF POND	0
6	02/05	109	12.5	122.6	E SIDE OF POND	0
7	02/05	110.9	9.1	121.0	S END OF POND	0
8	02/05	101.6	11.4	113.2	W SIDE OF POND	0
9	02/05	104	10.6	115.5	W SIDE OF POND	0
10	02/05	108	9.1	117.8	N END OF POND	0
11	02/05	47.4	68.4	79.8	IN SIDE OF POND N END	0
12	02/05	54.8	56	85.5	OLD POND N END (B-6)	0
13	02/05	54.9	45.5	79.9	OLD POND SOUTH W END	0
14	02/05	105.4	9.1	115.0	SOUTHERN AREA	0
15	02/05	118.4	9.7	129.9	SOUTHERN AREA	0
16	02/05	99.7	12.4	112.0	SOUTHERN AREA	0

RESPECTFULLY SUBMITTED

Johnny F. Canzuela

GROUND ENGINEERING & TESTING SERVICE, INC.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304) 255-0491
R.D. #1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

WATER CONTENT

BY: MWS DATE: 3/7/91 CHKD BY: RLF DATE: 3/7/91

PROJECT NAME: U. S. STEEL-CONCORD

PROJECT NUMBER: 90-55-27 SHEET 1 OF 1

DESCRIPTION

SAMPLE NUMBER	BS-1	BS-1	BS-2	BS-2	BS-3	BS-3	
DEPTH	-	-	-	-	-	-	
TARE NUMBER	32	15	40	100	8	42	
WT. TARE+WS, GM.	244.55	246.03	174.82	188.24	213.47	207.66	
WT. TARE+DS, GM.	200.14	202.83	160.47	174.55	204.98	199.78	
W, %	39.9	41.0	19.8	19.5	7.9	7.7	
COMMENTS							
	AVG.= 40.5%		AVG.= 19.7%		AVG.= 7.8%		

SAMPLE NUMBER	BS-5	BS-5	BS-7	BS-7			
DEPTH	-	-	-	-			
TARE NUMBER	15	54	54	92			
WT. TARE+WS, GM.	245.43	247.85	250.65	227.10			
WT. TARE+DS, GM.	240.16	242.83	246.28	223.46			
W, %	3.7	3.6	3.0	3.0			
COMMENTS							
	AVG.= 3.7%		AVG.= 3.0%				

SAMPLE NUMBER							
DEPTH							
TARE NUMBER							
WT. TARE+WS, GM.							
WT. TARE+DS, GM.							
W, %							
COMMENTS							

SAMPLE NUMBER							
DEPTH							
TARE NUMBER							
WT. TARE+WS, GM.							
WT. TARE+DS, GM.							
W, %							
COMMENTS							

NOTES:

BS-1: FINE COAL REFUSE
BS-2: FINE COAL REFUSE
BS-3: WEATHERED COARSE COAL REFUSE
BS-5: FRESH COARSE COAL REFUSE
BS-7: COARSE COAL REFUSE

Geotechnics

MOISTURE CONTENT DETERMINATION

Client	ALMES & ASSOC.	Tested By	TO	Date	3-8-91
Client Project	US STEEL CONCORD	Checked By	JCM	Date	3-19-91
Project No.	91033				

MOISTURE CONTENT

Boring No.	BS-6	BS-8	BS-9
Sample No.	NA	NA	NA
Depth	NA	NA	NA
Tare Number	806	683	1004
Wt. Tare & WS(gm.)	1013.00	613.60	646.70
Wt. Tare & DS(gm.)	986.45	518.00	537.53
Wt. Water(gm.)	26.55	95.60	109.17
Wt. Tare(gm.)	103.67	110.72	109.75
Wt. DS(gm.)	882.78	407.28	427.78
Moisture Content(%)	3.0	23.5	25.5

Geotechnics

MOISTURE CONTENT DETERMINATION

Client	ALMES & ASSOC.	Tested By	TO	Date	3-14-91
Client Project	US STEEL CONCORD	Checked By	gw	Date	3.27.91
Project No.	91033-01				

MOISTURE CONTENT

Boring No.	BS-1	BS-2
Sample No.	NA	NA
Depth	NA	NA
Tare Number	K15	674
Wt. Tare & WS(gm.)	212.75	348.06
Wt. Tare & DS(gm.)	177.46	298.45
Wt. Water(gm.)	35.29	49.61
Wt. Tare(gm.)	74.37	74.94
Wt. DS(gm.)	103.09	223.51
Moisture Content(%)	34.2	22.2

geotechnics

WASH SIEVE ANALYSIS

Client	ALMES & ASSOC.	Tested By	TO Date 3-14-91
Client Project	US STEEL CONCORD	Checked By	SW Date 3-28-91
Project No.	91033-01		
Boring No.	BS-1		
Depth(ft.)	NA		
Sample No.	NA		
Visual Description	BLACK FINE COAL REFUSE		

Wt. of Total Sample(dry)	623.93gm.
Wt. of +#200 Sample	187.68gm.
Wt. of -#200 Sample	436.25gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
3"	75.00	0.00	0.0	0.0	100.00
1 1/2"	37.50	0.00	0.0	0.0	100.00
3/4"	19.00	0.00	0.0	0.0	100.00
3/8"	9.50	0.00	0.0	0.0	100.00
#4	4.75	0.00	0.0	0.0	100.00
#10	2.00	0.50	0.1	0.1	99.92
#20	0.85	1.44	0.2	0.3	99.69
#40	0.425	16.68	2.7	3.0	97.02
#60	0.250	36.60	5.9	8.9	91.15
#140	0.106	100.22	16.1	24.9	75.09
#200	0.075	32.24	5.2	30.1	69.92
Pan	-	436.25	69.9	100.0	-

Water Content	
Tare No.	680
Wgt. Tare + WS.	974.45
Wgt. Tare + DS.	733.16
Wgt. Tare	109.23
Wgt. Of Water	241.29
Wgt. Of DS.	623.93
% Water	38.7

Geotechnics

HYDROMETER ANALYSIS

Client	ALMES & ASSOC.	Tested By TO	Date 3-18-91
Client Project	US STEEL CONCORD	Checked By [illegible]	Date 3-28-91
Project No.	91033-01		
Boring No.	BS-1		
Depth(ft.)	NA		
Sample No.	NA		

Soil Sample Weight

Container No.	811		
Wt. Contain. & Dry Soil	172.04gm.	K Factor	0.02538
Wt. Contain.	104.68gm.	Composite Correction	7.49
Wt. Dispers.	5.00gm.	a Factor	1.24
Wt. Dry Soil	62.36gm.	% Finer Than No. 200	0.699

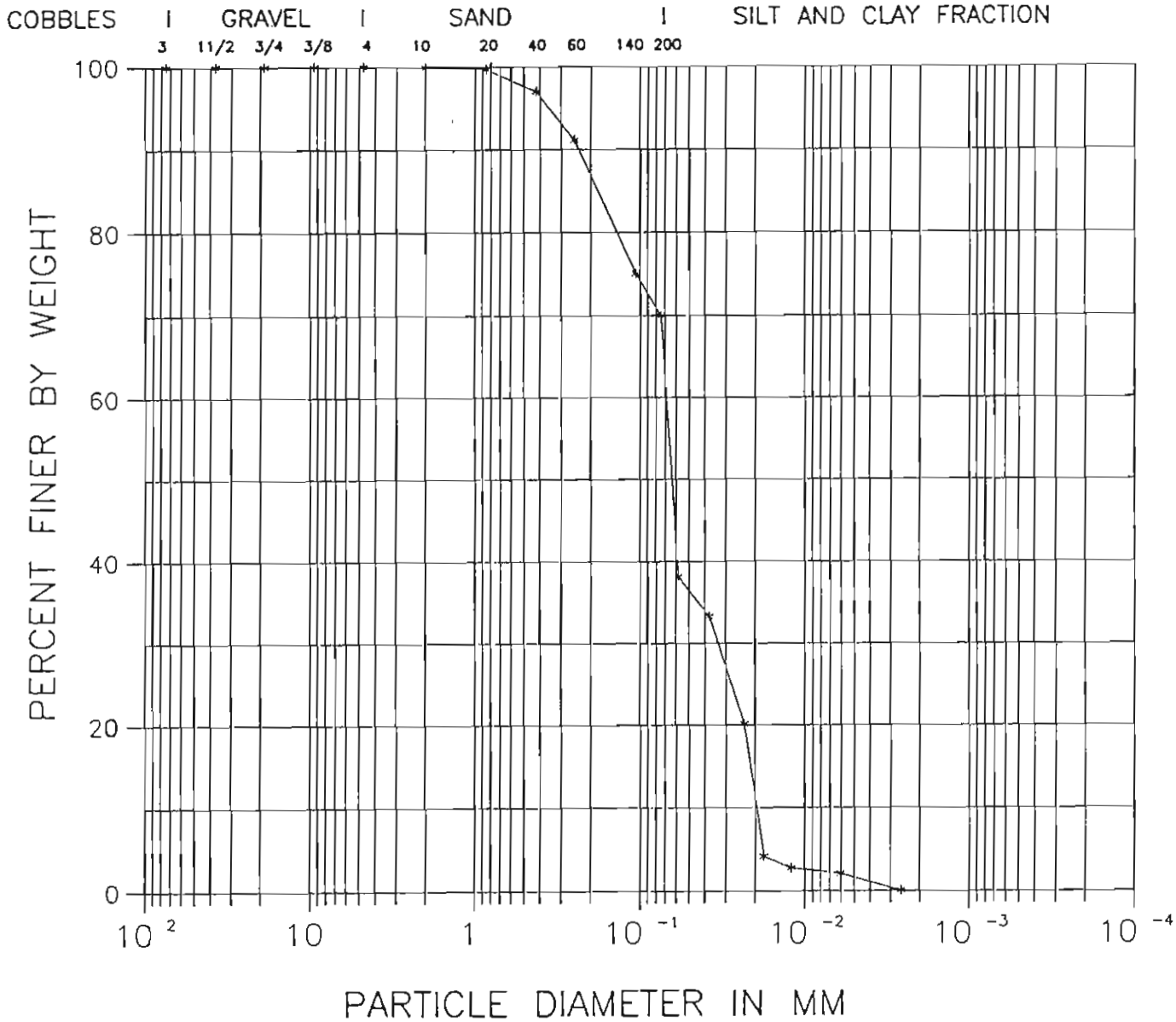
Temperature C	20.5
Specific Gravity	1.47
	Measured

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
0.25	42.5	42.5	35.0	69.4	0.1550	48.5
0.50	42.0	42.0	34.5	68.4	0.1101	47.8
1	38.0	38.0	30.5	60.5	0.0805	42.3
2	35.0	35.0	27.5	54.5	0.0583	38.1
2		35.0	27.5	54.5	0.0583	38.1
5		31.5	24.0	47.6	0.0379	33.3
15		22.0	14.5	28.8	0.0233	20.1
30		10.5	3.0	6.0	0.0177	4.2
65		9.5	2.0	4.0	0.0121	2.8
258		9.0	1.5	3.0	0.0061	2.1
1440		7.5	0.0	0.0	0.0026	0.0

CLIENT: ALMES & ASSOC.
PROJECT NO. 91033-01
DEPTH: NA
DESCRIPTION: BLACK FINE COAL REFUSE
USCS CLASSIFICATION: NA

CLIENT PROJECT: US STEEL CONCORD
BORING NO. BS-1
SAMPLE NO. NA

SIEVE ANALYSIS HYDROMETER



geotechnics

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
P.O. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3810

SIEVE ANALYSIS

PROJECT U. S. STEEL-CONCORD
PROJECT NO. 90-55-27
BORING NO. -
DEPTH -
SAMPLE BS-1

TESTED BY DSM DATE 03-04-91
CHKD BY RLF DATE 3/11/91

WT. OF TOTAL SAMPLE = 530.86
WT. OF +200 SAMPLE = 157.95
WT. OF -200 SAMPLE = 372.91

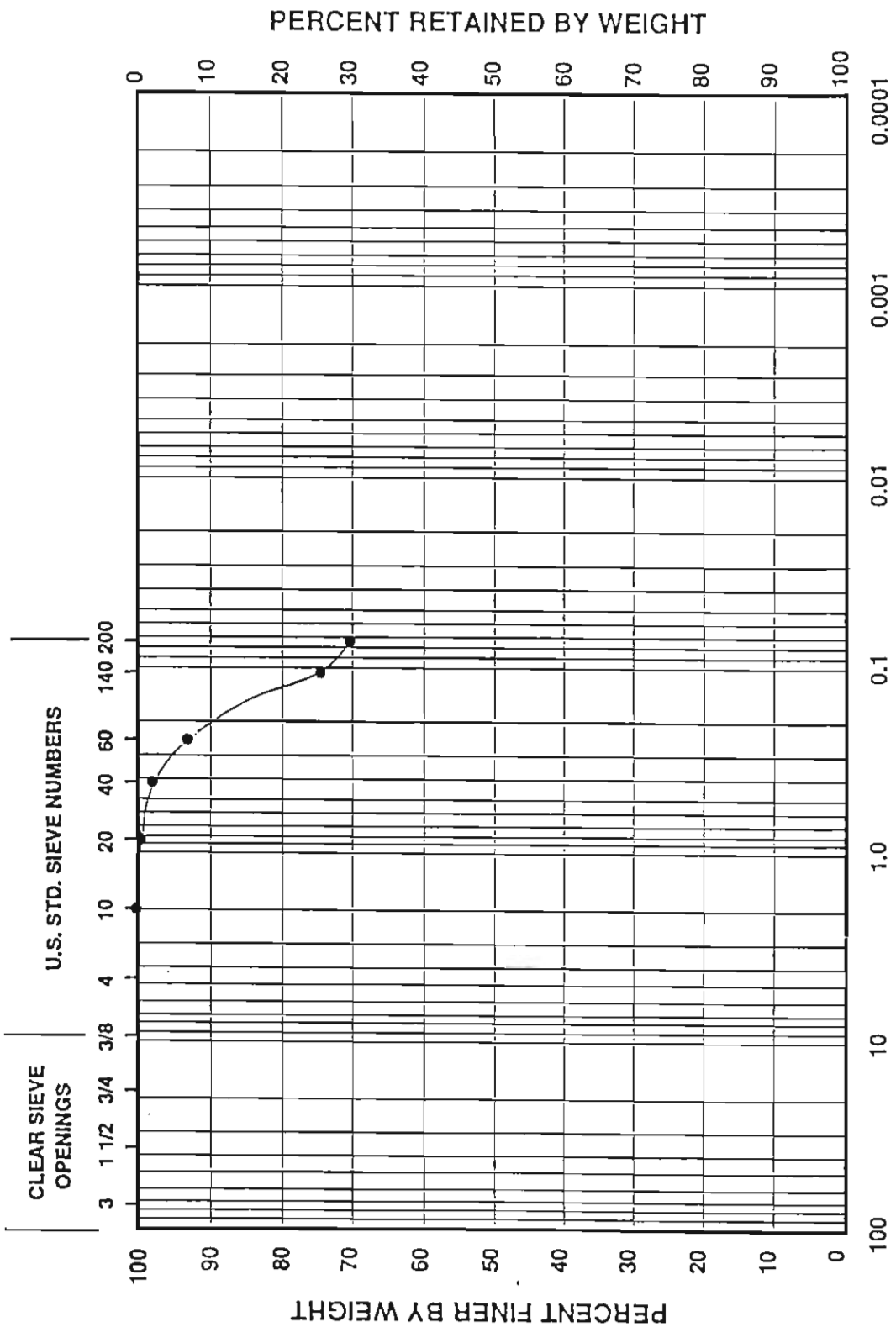
SPECIFIC GRAVITY N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	545.10	545.10	0.00	0.00	0.00	100.00
1.5	38.10	532.30	532.30	0.00	0.00	0.00	100.00
0.75	19.05	536.50	536.50	0.00	0.00	0.00	100.00
0.375	9.50	522.10	522.10	0.00	0.00	0.00	100.00
No. 4	4.75	540.60	540.60	0.00	0.00	0.00	100.00
No. 10	2.00	538.90	538.90	0.00	0.00	0.00	100.00
No. 20	0.85	416.08	416.43	0.35	0.07	0.07	99.93
No. 40	0.425	363.79	374.96	11.17	2.10	2.17	97.83
No. 60	0.25	368.05	396.04	27.99	5.27	7.44	92.56
No. 140	0.106	348.02	441.81	93.79	17.67	25.11	74.89
No. 200	0.075	281.54	306.19	24.65	4.64	29.75	70.25
PAN				372.91	70.25	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: WS 3/11/91

GRAIN SIZE ANALYSIS



BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL.	P.L	WC, %
—	BS - 1	Fine coal refuse	ML - OL			40.5

COBBLES | GRAVEL: COARSE, FINE | SAND: COARSE, MEDIUM, FINE | SILT AND CLAY: SILT FRACTION, CLAY FRACTION

Geotechnics

WASH SIEVE ANALYSIS

Client	ALMES & ASSOC.		Tested By	TO	Date 3-14-91
Client Project	US STEEL CONCORD		Checked By	SW	Date 3-28-91
Project No.	91033-01				
Boring No.	BS-2				
Depth(ft.)	NA				
Sample No.	NA				
Visual Description	BLACK FINE TO MEDIUM CAOL REFUSE				

Wt. of Total Sample(dry)	613.31gm.
Wt. of +#200 Sample	413.61gm.
Wt. of -#200 Sample	199.70gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
3"	75.00	0.00	0.0	0.0	100.00
1 1/2"	37.50	0.00	0.0	0.0	100.00
3/4"	19.00	0.00	0.0	0.0	100.00
3/8"	9.50	0.00	0.0	0.0	100.00
#4	4.75	0.00	0.0	0.0	100.00
#10	2.00	0.76	0.1	0.1	99.88
#20	0.85	8.12	1.3	1.4	98.55
#40	0.425	72.06	11.7	13.2	86.80
#60	0.250	123.70	20.2	33.4	66.63
#140	0.106	172.22	28.1	61.4	38.55
#200	0.075	36.75	6.0	67.4	32.56
Pan	-	199.70	32.6	100.0	-

Water Content	
Tare No.	1020
Wgt. Tare + WS.	864.56
Wgt. Tare + DS.	717.54
Wgt. Tare	104.23
Wgt. Of Water	147.02
Wgt. Of DS.	613.31
% Water	24.0

Geotechnics

HYDROMETER ANALYSIS

Client	ALMES & ASSOC.	Tested By TO	Date 3-18-91
Client Project	US STEEL CONCORD	Checked By SW	Date 3-28-91
Project No.	91033-01		
Boring No.	BS-2		
Depth(ft.)	NA		
Sample No.	NA		

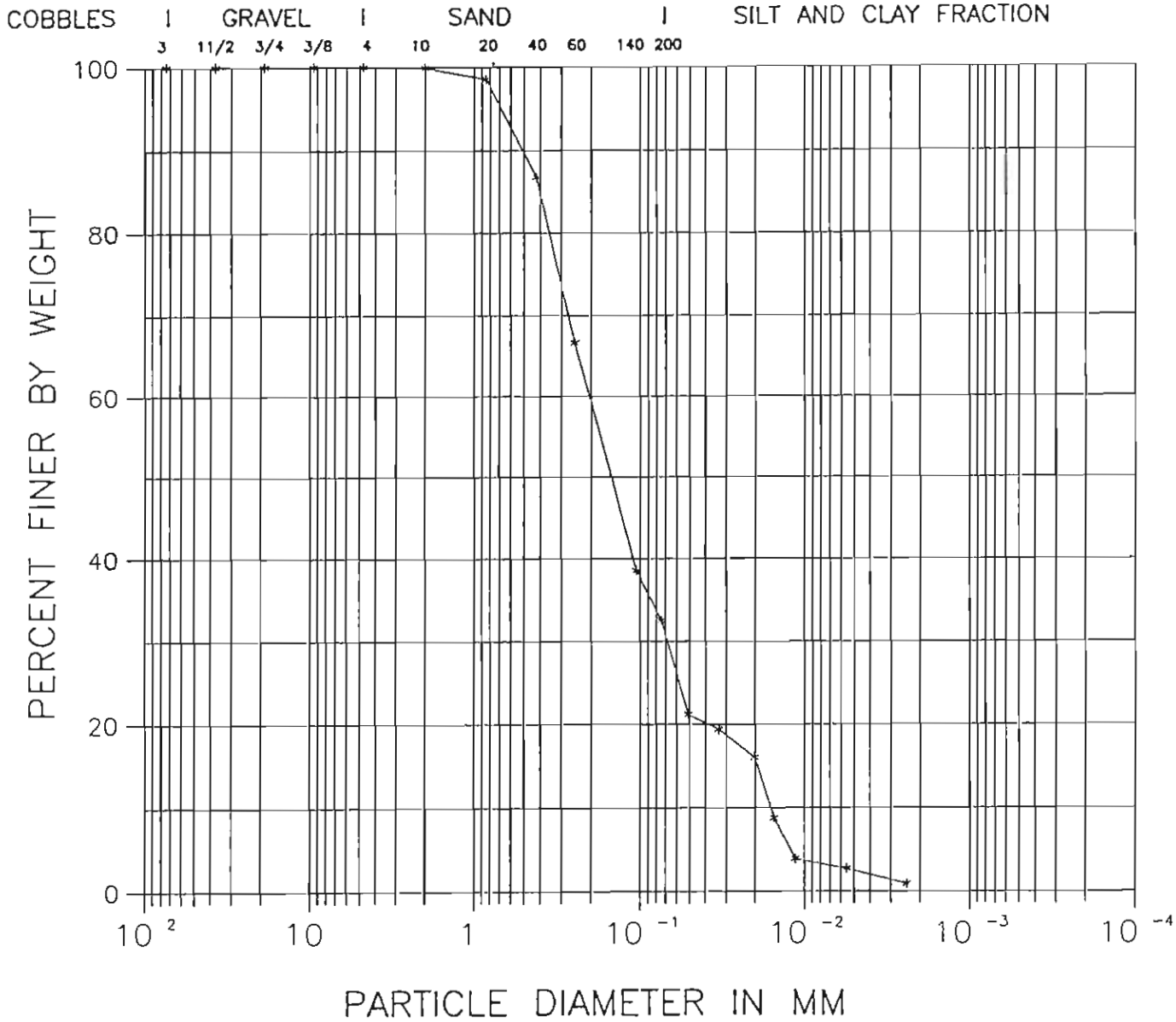
Soil Sample Weight			
Container No.	800		
Wt. Contain. & Dry Soil	175.29gm.	K Factor	0.02368
Wt. Contain.	104.55gm.	Composite Correction	7.49
Wt. Dispers.	5.00gm.	a Factor	1.22
Wt. Dry Soil	65.74gm.	% Finer Than No. 200	0.326

Temperature C	20.5
Specific Gravity	1.54
	Measured

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
0.25	44.0	44.5	37.0	68.8	0.1421	22.4
0.50	43.5	44.0	36.5	67.9	0.1009	22.1
1	42.0	42.5	35.0	65.1	0.0723	21.2
2	41.0	41.5	34.0	63.2	0.0516	20.6
2		42.5	35.0	65.1	0.0511	21.2
5		39.5	32.0	59.5	0.0332	19.4
15		34.0	26.5	49.3	0.0200	16.0
30		22.0	14.5	27.0	0.0154	8.8
60		14.0	6.5	12.1	0.0114	3.9
256		12.0	4.5	8.4	0.0056	2.7
1440		9.0	1.5	2.8	0.0024	0.9

CLIENT: ALMES & ASSOC. CLIENT PROJECT: US STEEL CONCORD
PROJECT NO. 91033-01 BORING NO. BS-2
DEPTH: NA SAMPLE NO. NA
DESCRIPTION: BLACK FINE TO MEDIUM COAL REFUSE
USCS CLASSIFICATION: NA

SIEVE ANALYSIS HYDROMETER



Geotechnics

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
R.D. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3610

SIEVE ANALYSIS

PROJECT U. S. STEEL-CONCORD
PROJECT NO. 90-55-27
BORING NO. -
DEPTH -
SAMPLE BS-2

TESTED BY DSM DATE 03-04-91
CHKD BY RLF DATE 3/11/91

SPECIFIC GRAVITY N.A.

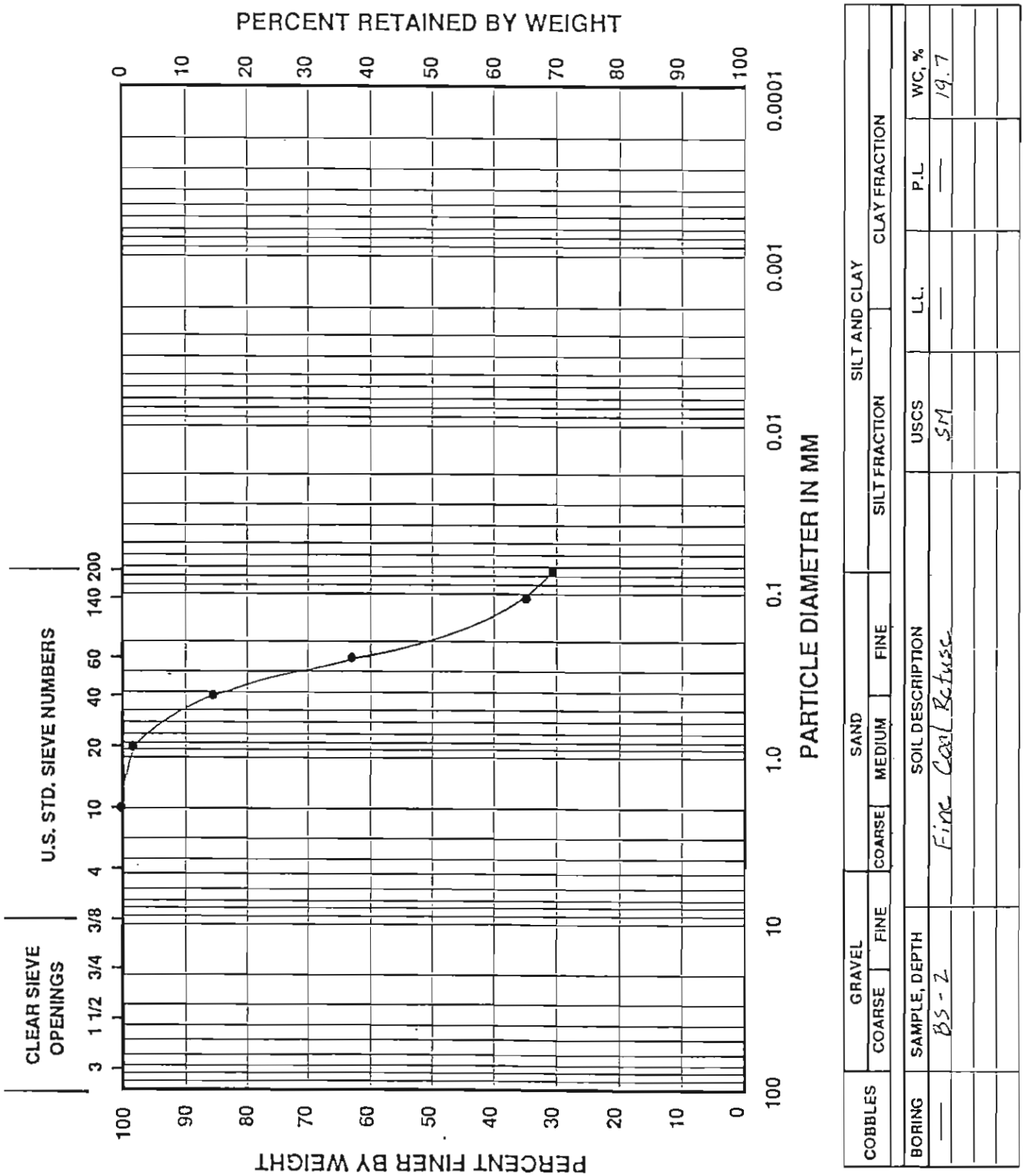
WT. OF TOTAL SAMPLE = 521.01
WT. OF +200 SAMPLE = 361.46
WT. OF -200 SAMPLE = 159.55

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	545.10	545.10	0.00	0.00	0.00	100.00
1.5	38.10	532.30	532.30	0.00	0.00	0.00	100.00
0.75	19.05	536.50	536.50	0.00	0.00	0.00	100.00
0.375	9.50	522.10	522.10	0.00	0.00	0.00	100.00
No. 4	4.75	540.60	540.60	0.00	0.00	0.00	100.00
No. 10	2.00	538.90	538.90	0.00	0.00	0.00	100.00
No. 20	0.85	416.10	422.79	6.69	1.28	1.28	98.72
No. 40	0.425	363.78	430.47	66.69	12.80	14.08	85.92
No. 60	0.25	368.04	489.25	121.21	23.26	37.35	62.65
No. 140	0.106	348.03	490.76	142.73	27.39	64.74	35.26
No. 200	0.075	281.54	305.67	24.13	4.63	69.37	30.63
PAN				159.55	30.62	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: MS 3/11/91

GRAIN SIZE ANALYSIS



BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL.	P.L	WC, %
—	BS-2	Fine Coal Between	SM	—	—	19.7

COBBLES | GRAVEL (COARSE, FINE) | SAND (COARSE, MEDIUM, FINE) | SILT AND CLAY (SILT FRACTION, CLAY FRACTION)

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
R.D. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3610

SIEVE ANALYSIS

	US.STEEL-CONCORD	TESTED BY	D.C.	DATE	03-11-91
PROJECT NO.	90-55-27	CHKD BY	RLF	DATE	3/11/91
BORING NO.	-				
DEPTH	-				
SAMPLE	BS-3				

WT. OF TOTAL SAMPLE = 3031.75
WT. OF +200 SAMPLE = 2891.77
WT. OF -200 SAMPLE = 139.98

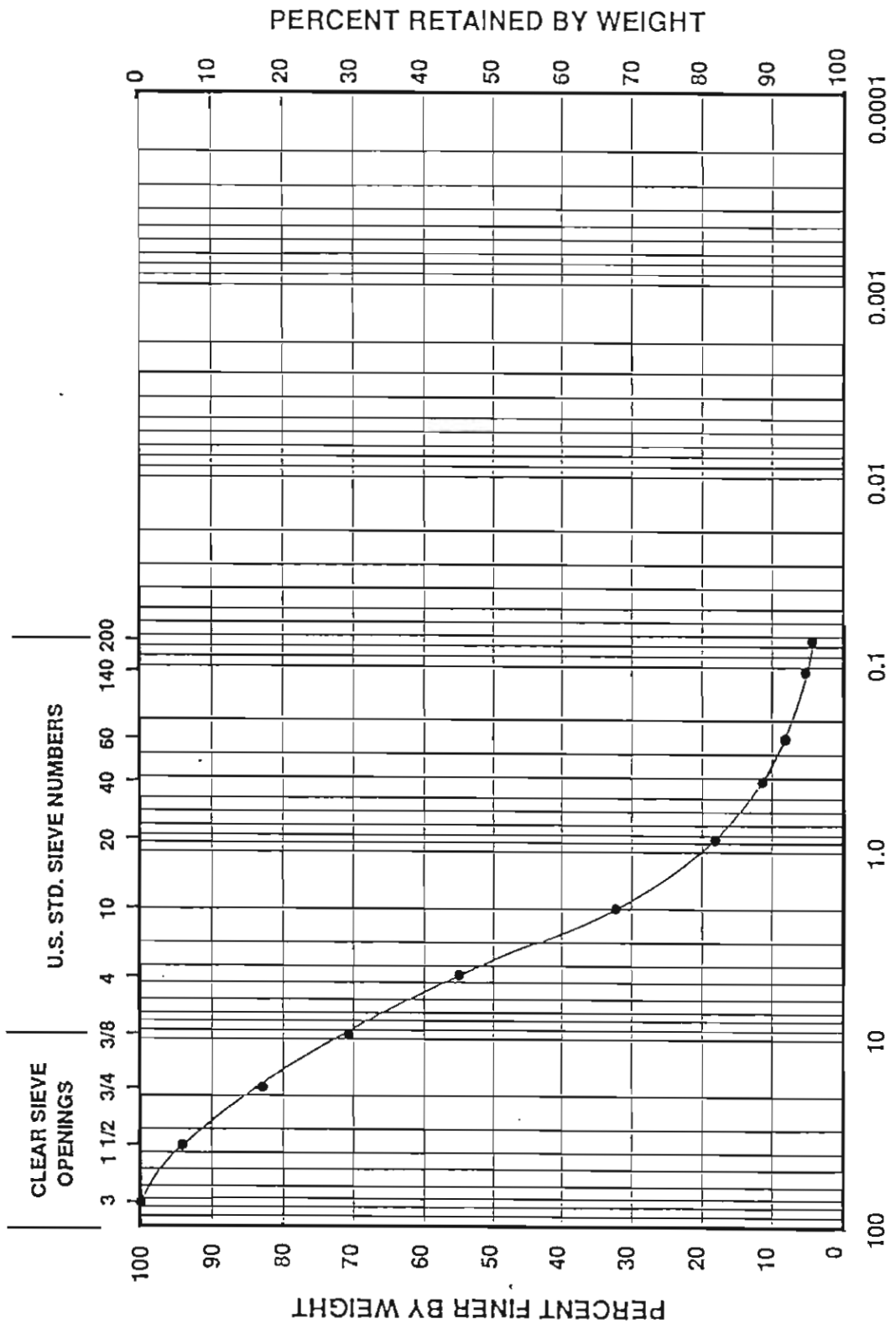
SPECIFIC GRAVITY N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	527.02	527.02	0.00	0.00	0.00	100.00
1.5	38.10	572.06	761.27	189.21	6.24	6.24	93.76
0.75	19.05	580.47	907.30	326.83	10.78	17.02	82.98
0.375	9.50	545.28	922.74	377.46	12.45	29.47	70.53
No. 4	4.75	504.44	960.93	456.49	15.06	44.53	55.47
No. 10	2.00	466.16	1159.70	693.54	22.88	67.40	32.60
No. 20	0.85	416.09	850.77	434.68	14.34	81.74	18.26
No. 40	0.425	363.77	568.17	204.40	6.74	88.48	11.52
No. 60	0.25	368.03	466.96	98.93	3.26	91.75	8.25
No. 140	0.106	348.07	439.63	91.56	3.02	94.77	5.23
No. 200	0.075	281.57	300.24	18.67	0.62	95.38	4.62
PAN				139.98	4.62	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: MS 3/11/91

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY					
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION				

BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL	P.L	WC, %
—	BS-3	Weathered coarse coal refuse	SW	—	—	7.8

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
P.O. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3810

SIEVE ANALYSIS

PROJECT: US.STEEL CONCORD
PROJECT NO.: 90-55-27
BORING NO.: -
DEPTH: -
SAMPLE: BS-5

TESTED BY: D.C. DATE: 03-11-91
CHKD BY: RLF DATE: 3/11/91

WT. OF TOTAL SAMPLE = 4866.65
WT. OF +200 SAMPLE = 4819.65
WT. OF -200 SAMPLE = 47.00

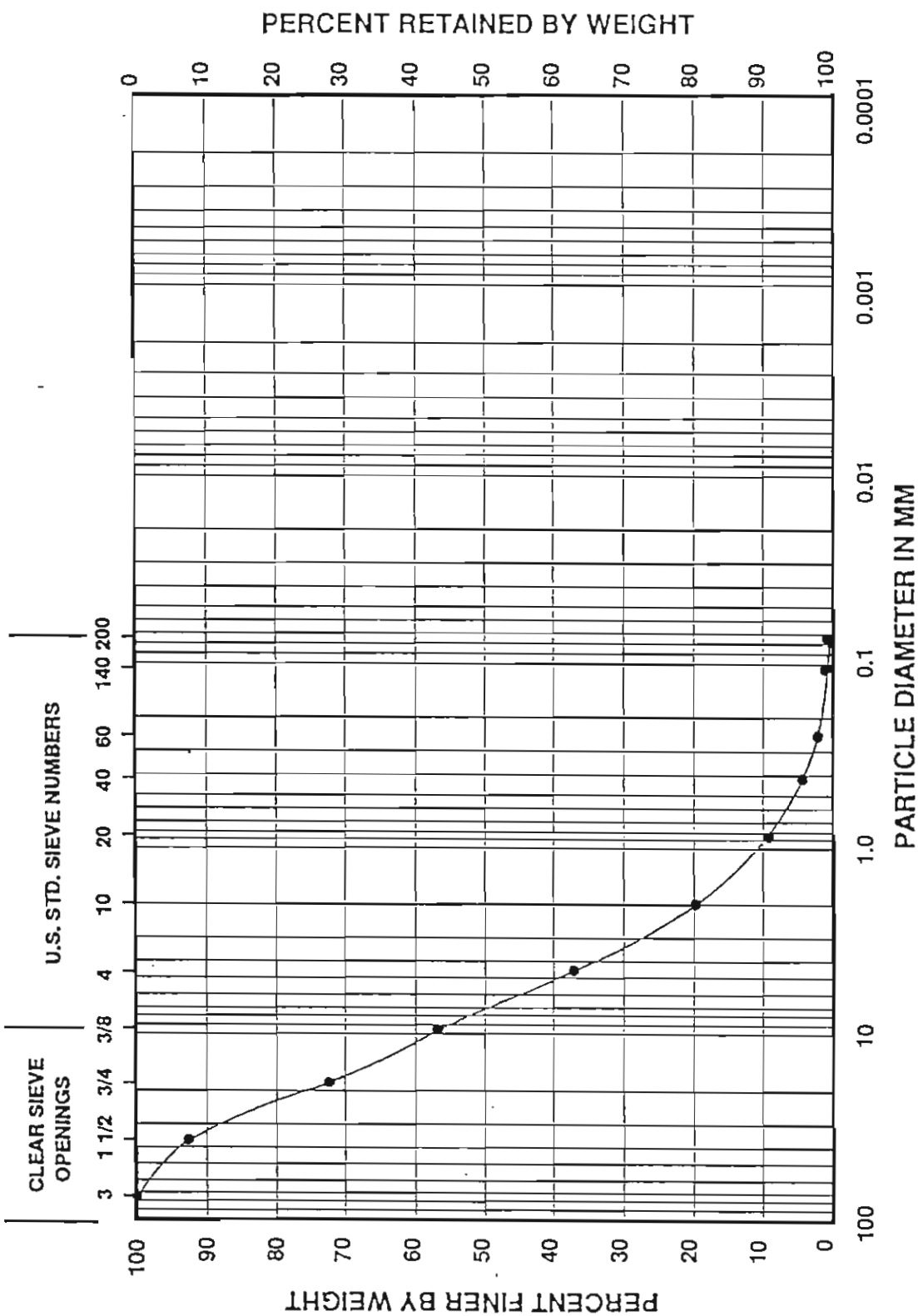
SPECIFIC GRAVITY: N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	527.01	527.01	0.00	0.00	0.00	100.00
1.5	38.10	572.05	906.58	334.53	6.87	6.87	93.13
0.75	19.05	580.50	1567.90	987.40	20.29	27.16	72.84
0.375	9.50	545.26	1330.00	784.74	16.12	43.29	56.71
No. 4	4.75	504.55	1442.90	938.35	19.28	62.57	37.43
No. 10	2.00	466.17	1327.00	860.83	17.69	80.26	19.74
No. 20	0.85	416.10	906.20	490.10	10.07	90.33	9.67
No. 40	0.425	363.83	609.66	245.83	5.05	95.38	4.62
No. 60	0.25	368.09	471.62	103.53	2.13	97.51	2.49
No. 140	0.106	348.04	414.32	66.28	1.36	98.87	1.13
No. 200	0.075	281.57	289.63	8.06	0.17	99.03	0.97
PAN				47.00	0.97	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: WS 3/11/91

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY					
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION				

BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL.	P.L.	WC, %
—	B5-5	Coarse coal refuse	GM	—	—	3.7

Geotechnics

SPECIFIC GRAVITY DETERMINATION

Client	ALMES & ASSOC.	Tested By	BS	Date	3-15-91
Client Project	US STEEL CONCORD	Checked By	[signature]	Date	3.27.91
Project No.	91033-01				
Boring No.	BS-1				
Depth (ft.)	NA				
Sample No.	NA				

Soil Description BLACK FINE COAL REFUSE

Determination No.	1	2
Bottle No.	A	C
Wgt. Bottle+Soil+Water (gms.)	691.26	691.25
Temperature (c)	28.10	27.90
Wgt. Bottle + Water (gms.)	670.75	670.29
Tare No.	502	1024
Wgt. of Tare + Dry Soil (gms.)	173.46	167.68
Wgt. of Tare (gms.)	108.89	103.02
Wgt. of Dry Soil (gms.)	64.57	64.66
Specific Gravity of Soil At T.	1.466	1.480
Specific Gravity of Water at T.	0.9962	0.9963
Conversion Factor For Temp. T	0.9980	0.9981
Specific Gravity of Soil at 20 c.	1.460	1.474

Avg. Specific Gravity 1.47

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 2/28/91 CHKD BY: RLF DATE: 3/11/91
PROJECT NAME: U. S. STEEL - CONCORD
PROJECT NO.: 90-55-27
SAMPLE DESCRIPTION: BS-1

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	689.26	675.78		
TEMPERATURE, T, °C	26.0	26.0		
WT. PYCNOMETER+WATER W2, gm.	658.52	649.61		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	258.61	234.44		
WT. PYCNOMETER, gm.	160.90	151.98		
WT. DRY SAMPLE, Ws,	97.71	82.46		
Ws-W1+W2, gm.	66.97	56.29		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	1.46	1.46		
CONVERSION FACTOR FOR TEMP. T, K	0.9986	0.9986		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	1.46	1.46		
AVG. SPECIFIC GRAVITY	1.46			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS: _____

REF: ASTM D 854

Geotechnics

SPECIFIC GRAVITY DETERMINATION

Client	ALMES & ASSOC.	Tested By	TO	Date	3-14-91
Client Project	US STEEL CONCORD	Checked By	SW	Date	3-27-91
Project No.	91033-01				
Boring No.	BS-2				
Depth (ft.)	NA				
Sample No.	NA				

Soil Description BLACK FINE COAL REFUSE

Determination No.	1	2
Bottle No.	A	C
Wgt. Bottle+Soil+Water (gms.)	687.76	689.90
Temperature (c)	24.80	25.30
Wgt. Bottle + Water (gms.)	671.19	670.65
Tare No.	K7	200
Wgt. of Tare + Dry Soil (gms.)	153.28	163.37
Wgt. of Tare (gms.)	106.85	107.88
Wgt. of Dry Soil (gms.)	46.43	55.49
Specific Gravity of Soil At T.	1.555	1.531
Specific Gravity of Water at T.	0.9971	0.9970
Conversion Factor For Temp. T	0.9989	0.9988
Specific Gravity of Soil at 20 c.	1.550	1.527

Avg. Specific Gravity 1.54

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 2/28/91 CHKD BY: RLF DATE: 3/11/91
PROJECT NAME: U. S. STEEL - CONCORD
PROJECT NO.: 90-55-27
SAMPLE DESCRIPTION: BS-2

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	681.52	670.01		
TEMPERATURE, T, °C	26.0	26.0		
WT. PYCNOMETER+WATER W2, gm.	658.52	649.61		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	241.06	237.37		
WT. PYCNOMETER, gm.	160.60	151.70		
WT. DRY SAMPLE, Ws,	80.46	85.67		
Ws-W1+W2, gm.	57.46	65.27		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	1.40	1.31		
CONVERSION FACTOR FOR TEMP. T, K	0.9986	0.9986		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	1.40	1.31		
AVG. SPECIFIC GRAVITY	1.35			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS:

REF: ASTM D 854

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
P.O. 01 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/11/91
PROJECT NAME: U. S. STEEL - CONCORD
PROJECT NO.: 90-55-27
SAMPLE DESCRIPTION: BS-3

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	726.30	721.43		
TEMPERATURE, T, °C	30.0	30.0		
WT. PYCNOMETER+WATER W2, gm.	658.03	649.12		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	297.66	294.76		
WT. PYCNOMETER, gm.	160.61	151.72		
WT. DRY SAMPLE, Ws,	137.05	143.04		
Ws-W1+W2, gm.	68.78	70.73		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	1.99	2.02		
CONVERSION FACTOR FOR TEMP. T, K	0.9974	0.9974		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	1.99	2.02		
AVG. SPECIFIC GRAVITY	2.00			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS: _____

REF: ASTM D 854

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

+3/4 SPECIFIC GRAVITY

BY: DC DATE: 3/14/91 CHKD BY: RLF DATE: 3/15/91

PROJECT NAME: U. S. STEEL-CONCORD

PROJECT NUMBER: 90-55-27

SAMPLE DESCRIPTION: BS-3

WEIGHT OF DRY SAMPLE & PAN	933.21	gms
WEIGHT OF PAN	118.27	gms
WEIGHT OF OVEN-DRIED SAMPLE (A)	814.94	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE & PAN	945.99	gms
WEIGHT OF PAN	118.27	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE (B)	827.72	gms
WEIGHT OF SATURATED SAMPLE IN WATER & BASKET	2481.00	gms
WEIGHT OF BASKET IN WATER	1990.00	gms
WEIGHT OF SATURATED SAMPLE IN WATER (C)	491.00	gms
SPECIFIC GRAVITY OF SAMPLE A/(B-C)	**2.42**	

REMARKS:

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/11/91
PROJECT NAME: U. S. STEEL - CONCORD
PROJECT NO.: 90-55-27
SAMPLE DESCRIPTION: BS-5

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	728.26	738.78		
TEMPERATURE, T, °C	31.0	31.0		
WT. PYCNOMETER+WATER W2, gm.	657.90	648.99		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	287.83	315.28		
WT. PYCNOMETER, gm.	163.23	153.65		
WT. DRY SAMPLE, Ws,	124.60	161.63		
Ws-W1+W2, gm.	54.24	71.84		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	2.30	2.25		
CONVERSION FACTOR FOR TEMP. T, K	0.9971	0.9971		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	2.29	2.24		
AVG. SPECIFIC GRAVITY	**2.27**			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS:

REF: ASTM D 854

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

+3/4 SPECIFIC GRAVITY

BY: DC DATE: 3/14/91 CHKD BY: RLF DATE: 3/15/91

PROJECT NAME: U. S. STEEL-CONCORD

PROJECT NUMBER: 90-55-27

SAMPLE DESCRIPTION: BS-5

WEIGHT OF DRY SAMPLE & PAN	1012.00	gms
WEIGHT OF PAN	120.60	gms
WEIGHT OF OVEN-DRIED SAMPLE (A)	891.40	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE & PAN	1027.89	gms
WEIGHT OF PAN	120.60	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE (B)	907.29	gms
WEIGHT OF SATURATED SAMPLE IN WATER & BASKET	2534.00	gms
WEIGHT OF BASKET IN WATER	1985.00	gms
WEIGHT OF SATURATED SAMPLE IN WATER (C)	549.00	gms
SPECIFIC GRAVITY OF SAMPLE A/(B-C)	**2.49**	

REMARKS:

Geotechnics

ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	TO	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033-01				
Boring No.	BS-1				
Depth(ft.)	NA				
Sample No.	NA				
Soil Description	NON PLASTIC (-40)				

LIQUID LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	
NO. OF BLOWS	

PLASTIC LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	NON PLASTIC
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D. #1 BOX 250 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY RD

ATTERBERG LIMITS TESTS

PROJECT NAME: U.S. STEEL-CONCORD TESTED BY: RLF DATE: 3/13/91

PROJECT NUMBER: 90-55-27

SAMPLE: BS-1 CHECKED BY: MS DATE: 3/15/91

SOIL DESCRIPTION: FINE COAL REFUSE

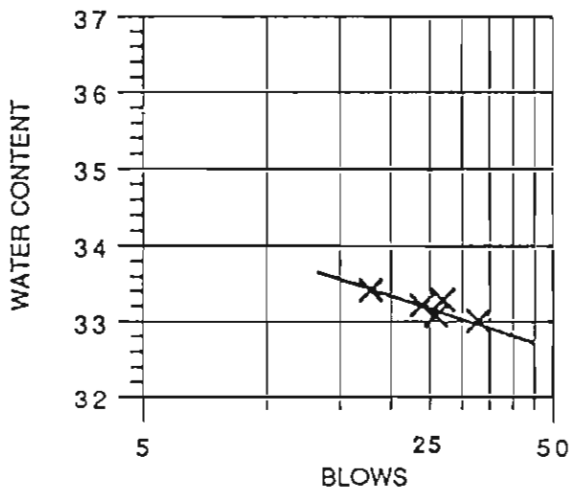
LIQUID LIMIT

DETERMINATION NO.	1	2	3	4	5
TARE NO.	226	27	99	44	29
WT. OF TARE + WET SOIL, gms	118.89	108.51	114.70	108.40	107.20
WT. OF TARE + DRY SOIL, gms	115.87	106.19	111.98	106.28	105.19
WATER CONTENT	33.4	33.0	33.2	33.1	33.3
NO. OF BLOWS	18	33	24	26	27

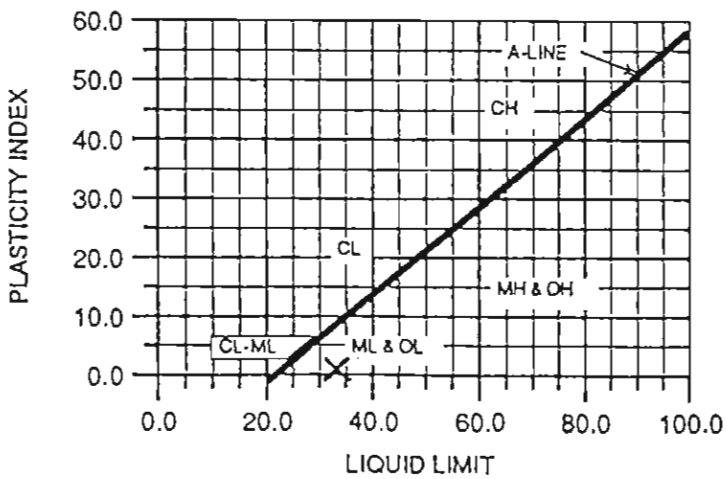
PLASTIC LIMIT

DETERMINATION NO.	1	2	3
TARE NO.	1	54	92
WT. OF TARE + WET SOIL, gms	100.90	103.25	101.97
WT. OF TARE + DRY SOIL, gms	100.73	103.05	101.66
WATER CONTENT	30.4	33.9	32.6
AVERAGE WATER CONTENT	32.3		

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS	
LIQUID LIMIT	33.2
PLASTIC LIMIT	32.3
PLASTICITY INDEX	0.9
NATURAL WATER CONTENT	40.5
USCS SYMBOL	ML&OL

Geotechnics

ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	TM	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033-01				
Boring No.	BS-2				
Depth(ft.)	NA				
Sample No.	NA				
Soil Description	NON PLASTIC (-40)				

LIQUID LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	
NO. OF BLOWS	

PLASTIC LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	NON PLASTIC
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	

Geotechnics

ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	TM	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033				
Boring No.	B-20				
Depth(ft.)	27.6'-27.8'				
Sample No.	ST-2				
Soil Description	NON PLASTIC (-40)				

LIQUID LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	
NO. OF BLOWS	

PLASTIC LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	NON PLASTIC
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	

Geotechnics

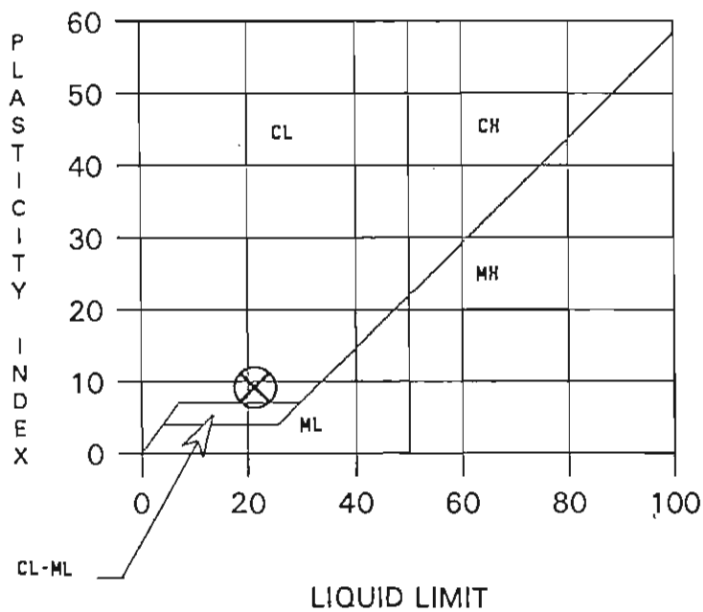
ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	SW	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033				
Boring No.	B-3A				
Depth(ft.)	3.5'-3.7'				
Sample No.	ST-1				
Soil Description	BROWN LEAN CLAY (-40)				

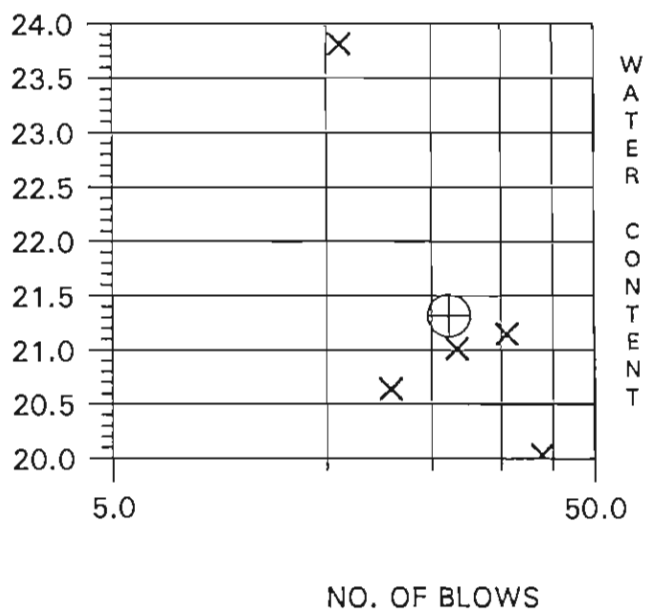
LIQUID LIMIT					
Tare Number	1310	89	456	778	667
Wt. Tare & WS(gm.)	109.35	107.38	105.47	40.11	41.57
Wt. Tare & DS(gm.)	108.23	105.98	104.43	38.68	40.12
Wt. Water(gm.)	1.12	1.40	1.04	1.43	1.45
Wt. Tare(gm.)	102.64	99.36	99.48	31.75	34.03
Wt. DS(gm.)	5.59	6.62	4.95	6.93	6.09
NO. OF BLOWS	39	33	26	19	15
Moisture Content(%)	20.0	21.1	21.0	20.6	23.8

PLASTIC LIMIT					
Tare Number	771	770	755	Summary	
Wt. Tare & WS(gm.)	39.05	42.62	38.14	Liquid Limit %	21
Wt. Tare & DS(gm.)	38.32	41.93	37.40	Plastic Limit %	12
Wt. Water(gm.)	0.73	0.69	0.74	Plasticity Index	9
Wt. Tare(gm.)	32.37	36.02	31.44	USCS Symbol	CL
Wt. DS(gm.)	5.95	5.91	5.96		
Moisture Content(%)	12.3	11.7	12.4		

PLASTICITY CHART



FLOW CURVE



MOISTURE-DENSITY RELATIONSHIP

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

118 HARPER PARK, STE. J BECKLEY, WV 25801 (304)255-0491
R.D. #1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/15/91

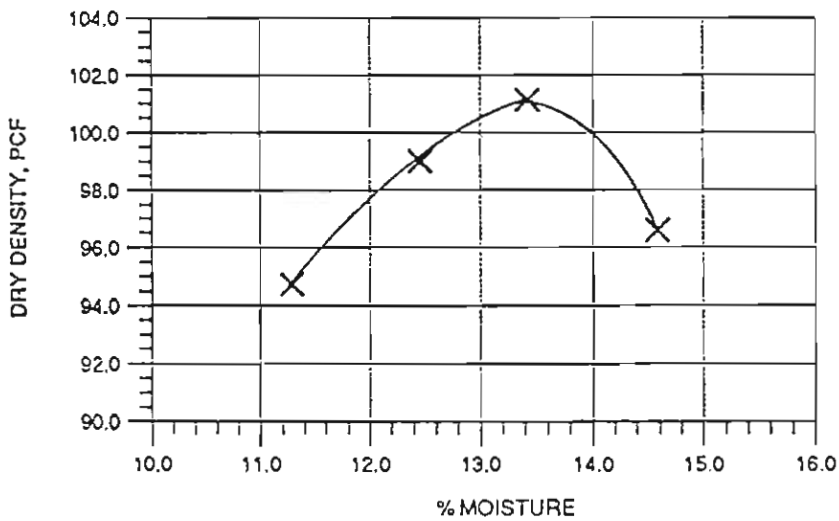
PROJECT NAME: US. STEEL-CONCORD

PROJECT NO.: 90-55-27 SHEET 1 OF 1

POINT NO.	PT. 1		PT. 2		PT. 3		PT. 4			
WT. MOLD+WS, GM	10577		10440		10262		10462			
WT. MOLD, GM	6675		6675		6675		6675			
WT. WS, GM	3902		3765		3587		3787			
VOL. MOLD, CU. FT.	0.075		0.075		0.075		0.075			
WT. WS, LBS	8.602		8.300		7.908		8.349			
WET DENSITY, PCF	114.7		110.7		105.4		111.3			
TARE NO.	100	92	48	96	24	29	24	29		
WT. TARE+WS, GM	247.33	264.47	207.99	219.03	239.76	247.35	242.10	222.10		
WT. TARE+DS, GM	230.15	245.37	193.91	204.32	224.04	232.81	226.38	207.56		
% MOISTURE	13.4		14.6		11.3		12.5			
DRY DENSITY, PCF	101.1		96.6		94.7		99.0			

SAMPLE DESCRIPTION

WEATHERED COARSE
COAL REFUSE
SAMPLE NO. BS-3



MAX. DRY DENSITY 101.1 PCF

OPTIMUM MOISTURE 13.4 %

METHOD	MATERIAL SIZE	MOLD SIZE	BLOWS
A	ALL PASSING #4	4" DIA.	25
B	ALL PASSING #4	6" DIA.	56
C	ALL PASSING 3/4"	6" DIA.	56
D	ALL PASSING 3/4"	6" DIA.	56
E	ALL PASSING 1 1/2"	6" DIA.	56

DESIGNATION USED: STD

METHOD USED: E

DESIGNATION	HAM/DROP	LAYER
STANDARD	5.5#/12"	3
MODIFIED	10#/18"	5

NOTES:

MOISTURE-DENSITY RELATIONSHIP

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

118 HARPER PARK STE. J, BECKLEY, WV 25801, (304)255-0491
R.D. #1 BOX 520, PLEASANT VALLEY ROAD, TRAFFORD, PA 15085, (412)744-3610

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/15/91

PROJECT NAME: US. STEEL-CONCORD

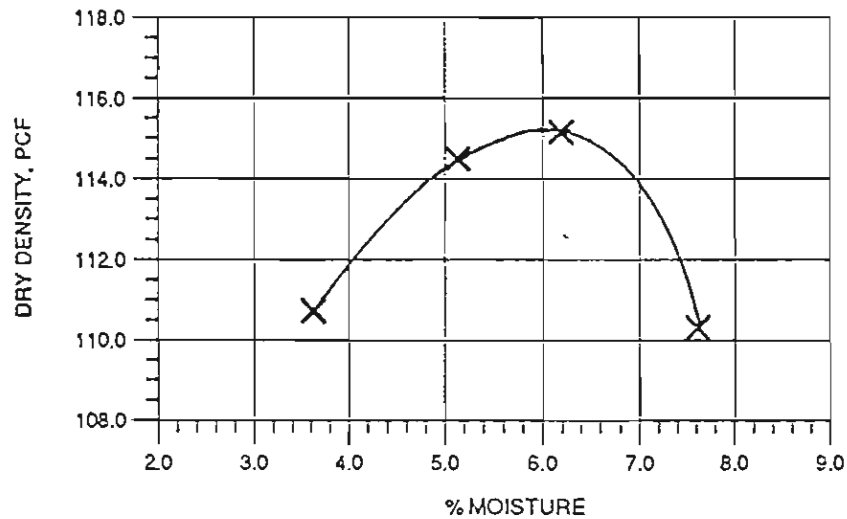
PROJECT NO.: 90-55-27 SHEET 1 OF 1

POINT NO.	PT. 1		PT. 2		PT. 3		PT. 4			
WT. MOLD+WS, GM	10579		10770		10835		10714			
WT. MOLD, GM	6675		6675		6675		6675			
WT. WS, GM	3904		4095		4160		4039			
VOL. MOLD, CU. FT.	0.075		0.075		0.075		0.075			
WT. WS, LBS	8.607		9.028		9.171		8.904			
WET DENSITY, PCF	114.8		120.4		122.3		118.7			
TARE NO.	15	54	10	65	5	20	1	131		
WT. TARE+WS, GM	245.43	247.85	259.43	214.07	280.79	275.07	239.97	275.80		
WT. TARE+DS, GM	240.16	242.83	251.70	208.01	270.33	264.62	230.84	262.80		
% MOISTURE	3.6		5.1		6.2		7.6			
DRY DENSITY, PCF	110.7		114.5		115.1		110.3			

SAMPLE DESCRIPTION

FRESH COARSE COAL REFUSE

SAMPLE NO. BS-5



MAX. DRY DENSITY 115.1 PCF

OPTIMUM MOISTURE 6.2 %

METHOD	MATERIAL SIZE	MOLD SIZE	BLOWS
A	ALL PASSING #4	4" DIA.	25
B	ALL PASSING #4	6" DIA.	56
C	ALL PASSING 3/4"	6" DIA.	56
D	ALL PASSING 3/4"	6" DIA.	56
E	ALL PASSING 1 1/2"	6" DIA.	56

DESIGNATION USED: STD

METHOD USED: E

DESIGNATION	HAM/DROP	LAYER
STANDARD	5.5#/12"	3
MODIFIED	10#/18"	5

NOTES:

Geotechnics

MOISTURE-DENSITY RELATIONSHIP

Client	ALMES & ASSOC.	Tested By	JP/SW	DATE	04-02-91
Client Project	US STEEL CONCORD	Checked By	JCM	DATE	4-4-91
Project No.	91033-02				
Boring No.	BS-6	Test Type			STANDARD
Depth (ft.)	NA	Wt. of Mold (gm.)			6431
Sample No.	NA	Mold Volume (cm^3)			2124

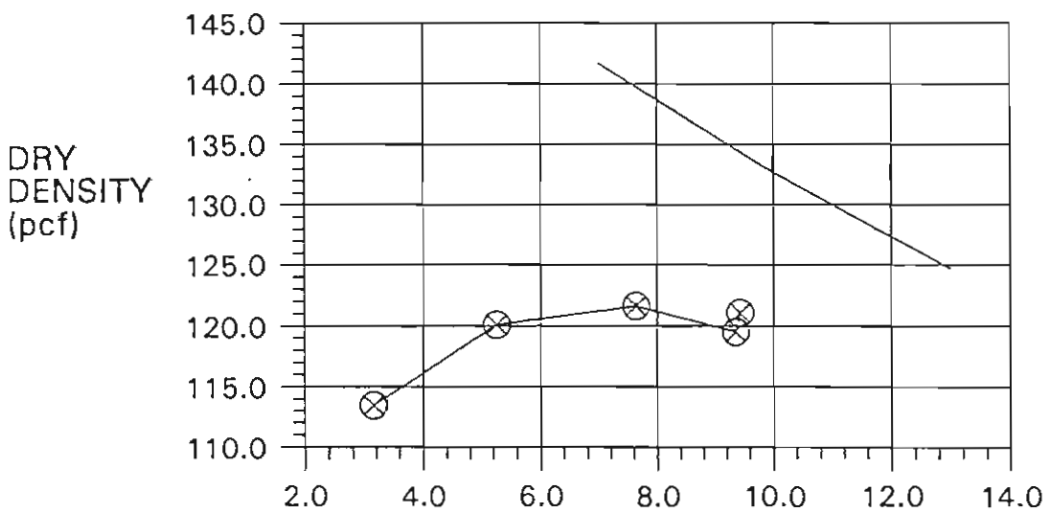
Description: COAL REFUSE

WET DENSITY

Wt. Mold & WS(gm.)	10415	10734	10887	10880	10940
Wt. Mold(gm.)	6431	6431	6431	6431	6431
Wt. WS(gm.)	3984	4303	4456	4449	4509
Mold Volume(cm^3)	2124	2124	2124	2124	2124
Wet Density(gm./cm^3)	1.88	2.03	2.10	2.09	2.12
Wet Density(pcf)	117.04	126.42	130.91	130.71	132.47

WATER CONTENT

Tare Number	728	9	781	782	785
Wt. Tare & WS(gm.)	383.43	393.31	468.70	667.40	575.50
Wt. Tare & DS(gm.)	374.36	377.38	441.50	617.60	533.30
Wt. Water(gm.)	9.07	15.93	27.20	49.80	42.20
Wt. Tare(gm.)	86.67	74.59	85.27	85.66	85.93
Wt. DS(gm.)	287.69	302.79	356.23	531.94	447.37
Moisture Content(%)	3.15	5.26	7.64	9.36	9.43
Dry Density(pcf)	113.47	120.10	121.62	119.52	121.05



Specific Gravity
2.70
ASSUMED

Zero Air Voids

Moisture Content (%)	Dry Unit Weight (pcf)
7.00	141.70
10.00	132.66
13.00	124.71

Geotechnics

PERMEABILITY TEST

Client	ALMES & ASSOC.	Tested By JCM Date	4-4-91
Client Project	US STEEL CONCORD	Checked By MM Date	4-12-91
Project No.	91033-02		
Boring No.	BS-6	Specific Gravity	2.70
Depth(ft.)	NA		ASSUMED
Sample No.	NA		

SOIL DESCRIPTION COAL REFUSE (REMOLDED)

	BEFORE TEST	AFTER TEST
MOISTURE CONTENT		
Tare Number	718	8
Wt. Tare & WS(gm.)	206.56	708.50
Wt. Tare & DS(gm.)	194.87	654.00
Wt. Water(gm.)	11.69	54.50
Wt. Tare(gm.)	35.56	74.44
Wt. DS(gm.)	159.31	579.56
Moisture Content(%)	7.3	9.4
UNIT WEIGHT		
Wt. Tube & WS.(gms.)	1129.10	NA
Wt. Of Tube(gms.)	269.80	NA
Wt. Of WS.(gms.)	859.30	875.84
Length 1 (in.)	3.98	3.96
Length 2 (in.)	3.98	3.98
Length 3 (in.)	3.98	3.96
Top Diameter (in.)	2.89	3.00
Middle Diameter (in.)	2.89	2.99
Bottom Diameter (in.)	2.89	3.00
Average Length (in)	3.98	3.97
Average Area (in.)	6.56	7.05
Sample Volume(cc.)	428.45	458.23
Unit Wet Wt.(gms/cc)	2.006	1.911
Unit Wet Wt.(pcf.)	125.2	119.3
Unit Dry Wt.(pcf.)	116.6	109.0
Unit Dry Wt.(gms/cc)	1.869	1.747
Intial Void Ratio,e	0.445	0.545

Geotechnics

PERMEABILITY TEST

Client	ALMES & ASSOC.	Tested By JCM Date	4-4-91
Client Project	US STEEL CONCORD	Checked By MM Date	4-12-91
Project No.	91033-02		
Boring No.	BS-6	Specific Gravity	2.70
Depth(ft.)	NA		ASSUMED
Sample No.	NA		

Pressures		Final Sample Dimensions	
Top Cap (psi)	25.0	Sample Length (in.)	3.97
Bottom Cap (psi)	30.0	Sample Diameter (in.)	3.00
Cell (psi)	35.0	Sample Area (in.^2)	7.05
Total Head (cm)	351.5		

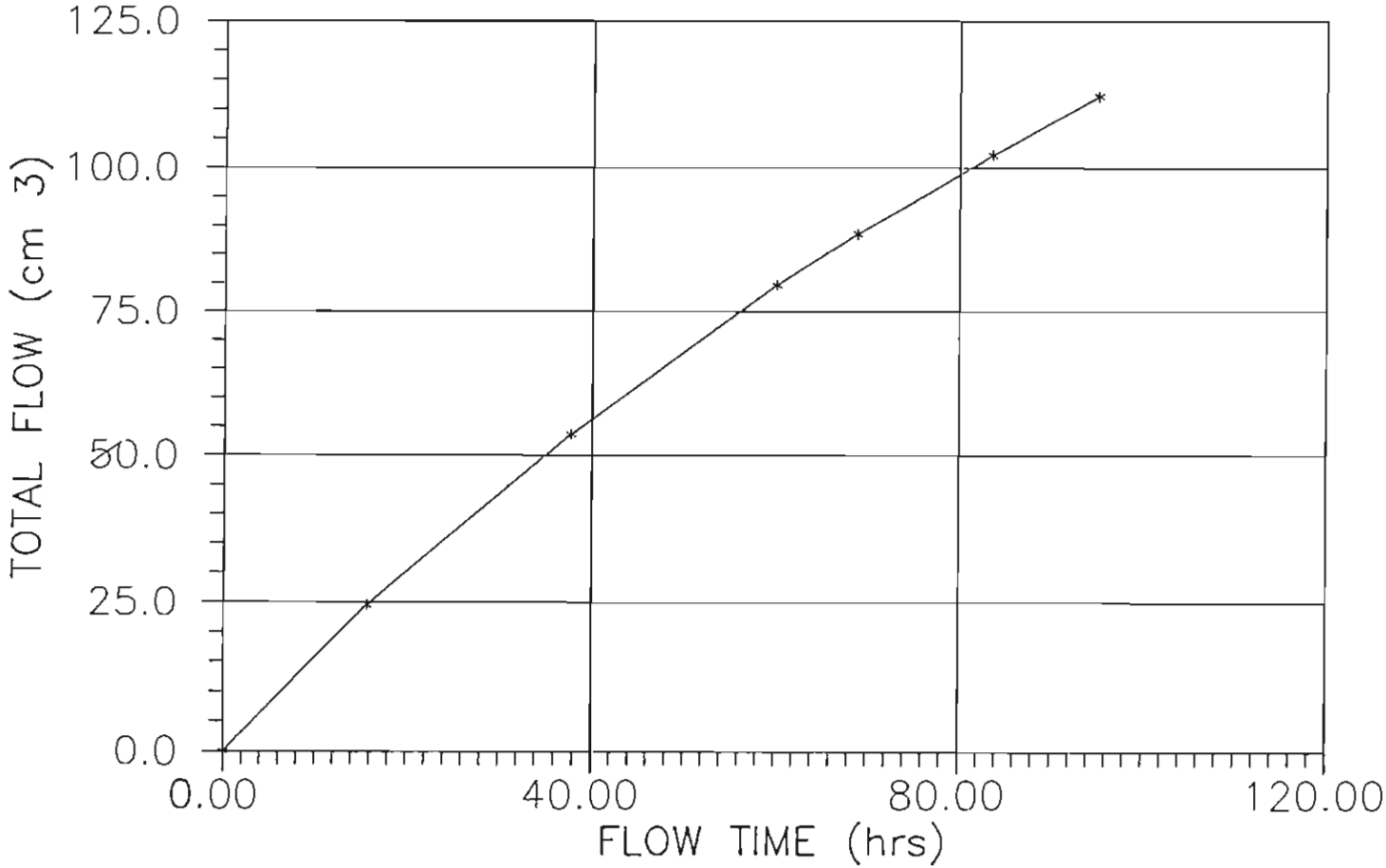
B PARAMETER 97%

TIME 1	60.17	hrs.	PERMEABILITY	1.63e-007	CM/SEC
TOTAL FLOW 1	79.6	cm^3	AVG. TEST TEMP	23.2	CELSIUS
TIME 2	95.17	hrs.	PERMEABILITY	1.51e-007	CM/SEC
TOTAL FLOW 2	112.2	cm^3	CORRECTED TO	20.0	CELSIUS

DATE	TIME		ELAPSE TIME	BURETTE READINGS		TOTAL FLOW	FLOW 0 RUN 1 STOP
				INITIAL	FINAL		
dy-mon-yr	hr	min	hrs	cm^3		cm^3	
5-APR-1991	18	50	0.00	31.5	31.5	0.0	0
6-APR-1991	10	35	15.75	56.1	0.0	24.5	0
7-APR-1991	8	35	37.75	29.0	29.0	53.6	1
7-APR-1991	9	35	37.75	29.0	29.0	53.6	0
8-APR-1991	8	0	60.17	55.1	55.1	79.6	0
8-APR-1991	16	45	68.92	64.1	64.1	88.6	0
9-APR-1991	7	25	83.58	77.6	77.6	102.1	0
9-APR-1991	19	0	95.17	87.6	87.6	112.2	0

Client ALMES & ASSOC. Boring No. BS-6
Client Project US STEEL CONCORD Sample No. NA
Project No. 91033-02 Depth (ft.) NA
Soil Description: COAL REFUSE (REMOLDED)

PERMEABILITY TEST
PERMEABILITY = 1.51E-07 CM/SEC

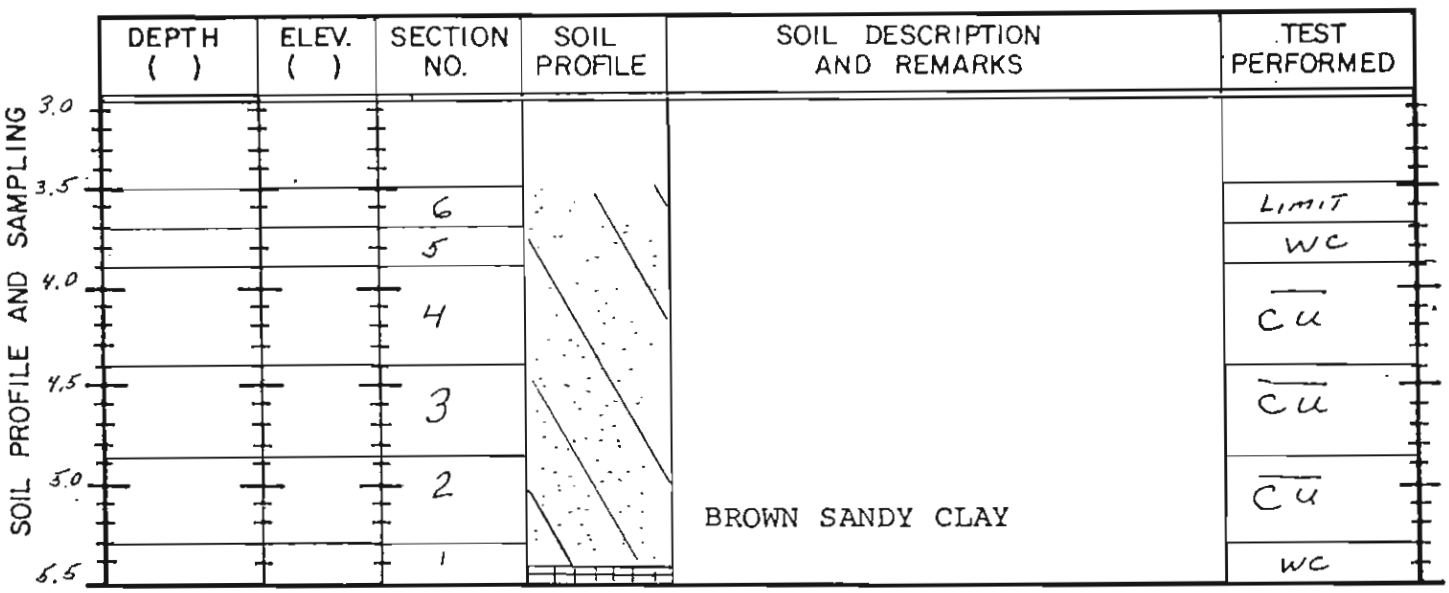


Geotechnics

Geotechnics

SHELBY TUBE UNIT WEIGHT

Client	ALMES & ASSOC.	Boring No.	B-3A
Client Project	US STEEL CONCORD	Depth Pushed	3'-5.5'
Project No.	91033	Shelby Tube No.	ST-1
Tested By	JCM 3-11-91	Tube Recovery	2.5'
Checked By	DB 3/20/91		



NOTE: WHEN FULL RECOVERY IS NOT ACHIEVED, SOIL ELEVATION CAN NOT BE ACCURATELY DEFINED

INDICATE EACH CUT OF THE TUBE WITH AN ARROW ——►

INDICATE EACH SOIL CUT (AFTER EXTRUDING) BY A BROKEN LINE- - - - - -

INDICATE DIVIDING LINE BETWEEN SOIL TYPES BY A SOLID LINE ————

INDICATE WAX BY CROSS-HATCHING ▦

INDICATE SOIL TYPES BY STANDARD SYMBOLS

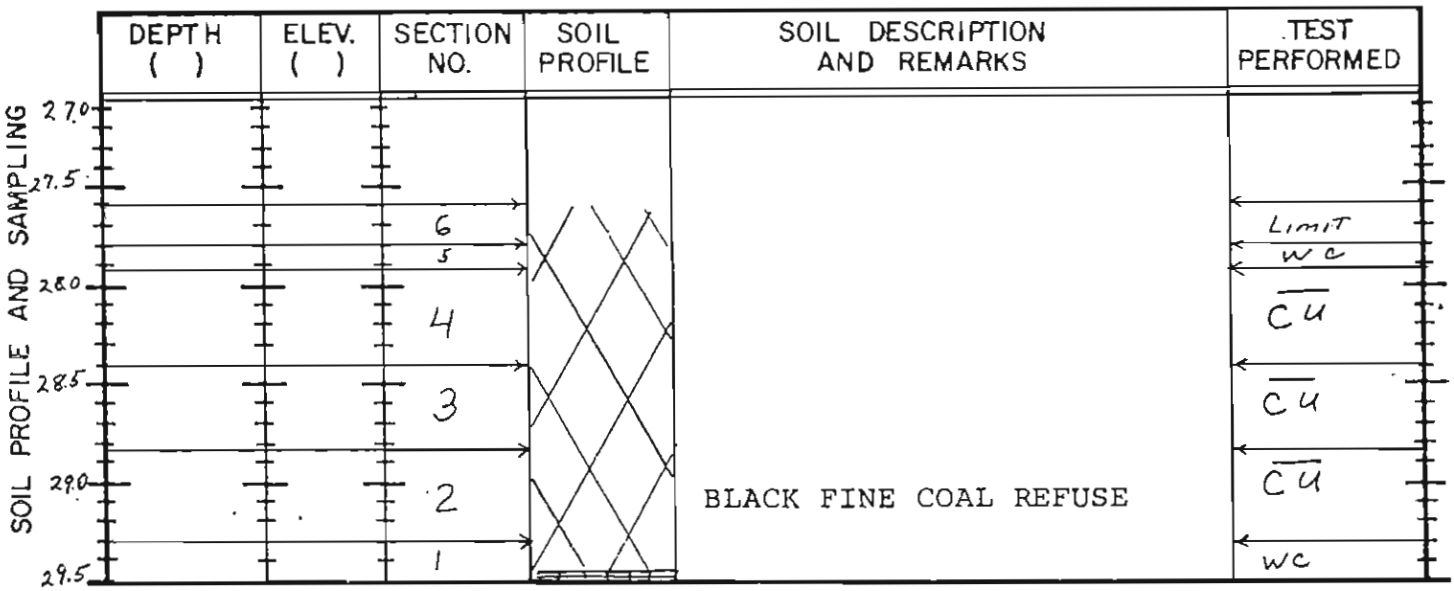
MOISTURE CONTENT					
Section Number	1	2	3	4	5
Tare Number	602				829
Wt. Tare & WS(gm.)	192.04				205.54
Wt. Tare & DS(gm.)	170.59				180.94
Wt. Tare(gm.)	37.29				31.61
Moisture Content(%)	16.1				16.5

UNIT WEIGHT			
Wt. Tube & WS.(gms.)	1601.70	1575.10	1619.50
Wt. Of Tube(gms.)	398.74	379.25	388.71
Wt. Of WS.(gms.)	1202.96	1195.85	1230.79
Length 1 (in.)	5.52	5.40	5.50
Length 2 (in.)	5.51	5.39	5.50
Length 3 (in.)	5.55	5.42	5.49
Top Diameter (in.)	2.86	2.87	2.88
Middle Diameter (in.)	2.88	2.86	2.86
Bottom Diameter (in.)	2.88	2.88	2.88
Sample Volume (cc)	586.27	572.31	582.87
Moisture Content(%)	16.1	16.1	16.5
Unit Wet Wt.(gms/cc)	2.05	2.09	2.11
Unit Wet Wt.(pcf.)	128.04	130.39	131.76
Unit Dry Wt.(pcf.)	90.42	92.08	93.05
Unit Dry Wt.(gms/cc)	1.45	1.48	1.49

Geotechnics

SHELBY TUBE UNIT WEIGHT

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth Pushed	27'-29.5'
Project No.	91033	Shelby Tube No.	ST-2
Tested By	JCM 3-7-91	Tube Recovery	2.5'
Checked By	DB 3/20/91		



NOTE: WHEN FULL RECOVERY IS NOT ACHIEVED, SOIL ELEVATION CAN NOT BE ACCURATELY DEFINED

INDICATE EACH CUT OF THE TUBE WITH AN ARROW ⟶

INDICATE EACH SOIL CUT (AFTER EXTRUDING) BY A BROKEN LINE- - - - - -

INDICATE DIVIDING LINE BETWEEN SOIL TYPES BY A SOLID LINE ——————

INDICATE WAX BY CROSS-HATCHING ▦▦▦▦▦

INDICATE SOIL TYPES BY STANDARD SYMBOLS

MOISTURE CONTENT					
Section Number	1	2	3	4	5
Tare Number	654				808
Wt. Tare & WS(gm.)	174.51				121.68
Wt. Tare & DS(gm.)	133.99				109.72
Wt. Tare(gm.)	36.54				36.52
Moisture Content(%)	41.6				16.3

UNIT WEIGHT			
Wt. Tube & WS.(gms.)	1071.80	1051.00	1039.40
Wt. Of Tube(gms.)	381.20	383.36	390.05
Wt. Of WS.(gms.)	690.60	667.64	649.35
Length 1 (in.)	5.40	5.40	5.51
Length 2 (in.)	5.43	5.41	5.54
Length 3 (in.)	5.42	5.41	5.51
Top Diameter (in.)	2.87	2.87	2.87
Middle Diameter (in.)	2.88	2.87	2.87
Bottom Diameter (in.)	2.89	2.87	2.87
Sample Volume (cc)	578.14	573.47	585.45
Moisture Content(%)	41.6	41.6	41.6
Unit Wet Wt.(gms/cc)	1.19	1.16	1.11
Unit Wet Wt.(pcf.)	74.54	72.65	69.21
Unit Dry Wt.(pcf.)	52.64	51.30	48.88
Unit Dry Wt.(gms/cc)	0.84	0.82	0.78

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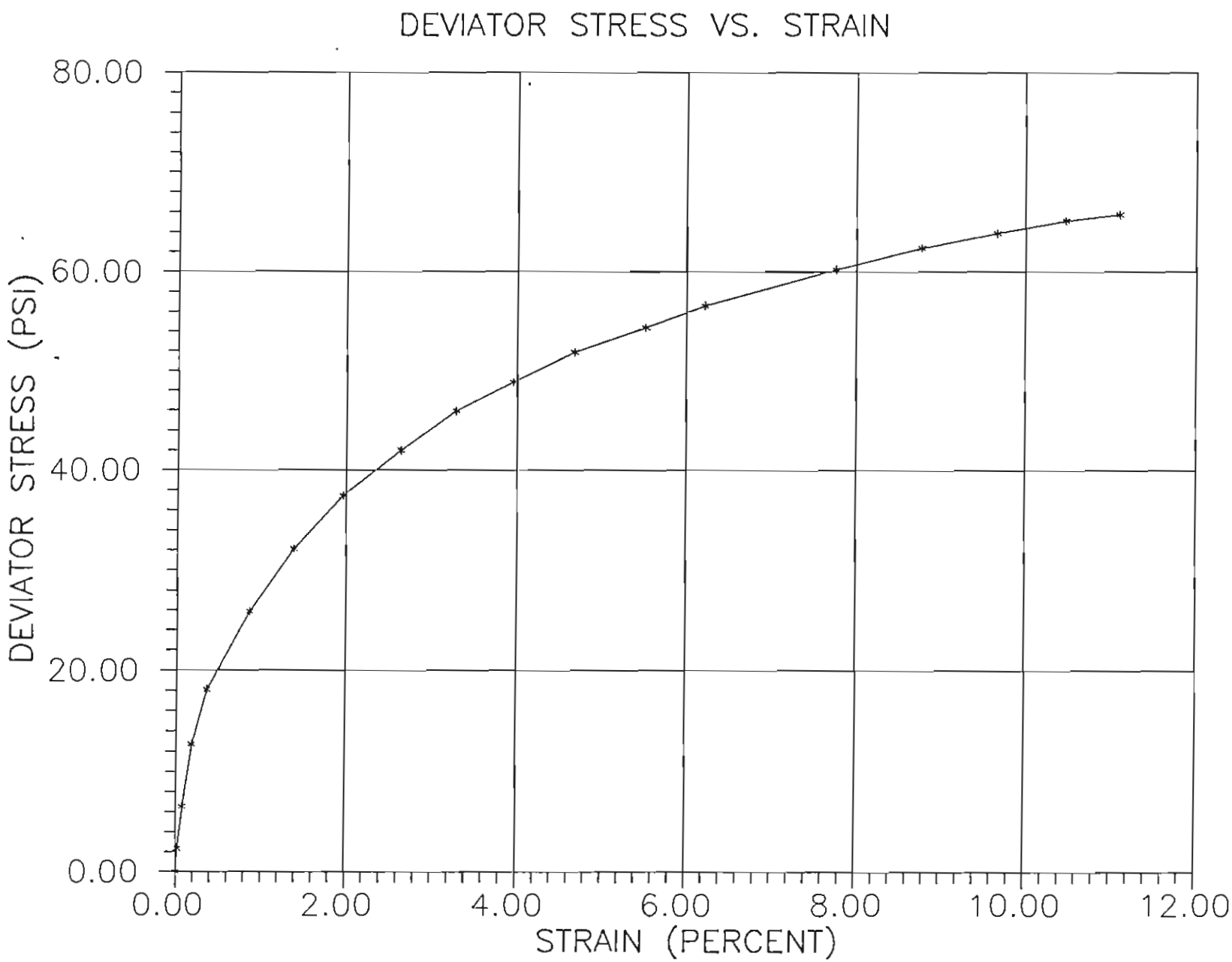
CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

CLIENT	ALMES & ASSOC.	BORING NO.	BS-6
CLIENTS JOB	US STEEL CONCORD	SAMPLE NO.	NA
PROJECT	91033-02		
TESTED BY	JCM 4-4-91		
CHECKED BY	mm 4-12-91		

SAMPLE CONDITION SUMMARY

TEST NO:	T1	T2	T3
DEPTH (ft):	NA	NA	NA
DEF. RATE (in/min):	0.002	0.002	0.002
BACK PRESSURE (psi):	39.7	39.3	39.4
CONSOLIDATION TIME (days):	1.0	1.0	1.0
INITIAL STATE (w%):	7.3	7.3	7.3
TOTAL UNIT WEIGHT (pcf):	125.1	125.0	124.1
DRY UNIT WEIGHT (pcf):	116.6	116.5	115.7
FINAL STATE (w%):	9.6	9.1	9.1

CLIENT: ALMES & ASSOC. BORING NO. BS-6
CLIENTS JOB:US STEEL CONCORD SAMPLE NO. NA
PROJECT NO. 91033-02 DEPTH: NA TEST 1
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	BS-6
Client Project	US STEEL CONCORD	Depth(ft.)	NA
Project No.	91033-02	Sample No.	NA
Tested By	JCM 4-4-91	Stage No.	1
Checked By	MM 4-12-91	Test No.	1

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	59.60	INITIAL SAMPLE LENGTH	5.57
BACK PRESSURE	39.70	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	36.03
EFF. CONS. PRESS	19.90	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	22.50
RESPONSE (%)	97	FINAL CHANGE	2.50
		VOL. AFTER CONS.	35.88
		LENGTH AFTER CONS.	5.57
		AREA AFTER CONS.	6.45

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
13.00	0	39.70
28.00	1	40.40
55.00	4	42.20
95.00	10	45.10
130.00	20	48.00
181.00	48	50.30
223.00	77	50.00
259.00	109	49.00
291.00	147	47.70
319.00	183	46.50
341.00	220	45.50
364.00	260	44.40
384.00	307	43.20
402.00	346	42.40
434.00	432	41.10
454.00	488	40.30
469.00	538	39.50
482.00	583	39.00
490.00	618	38.60

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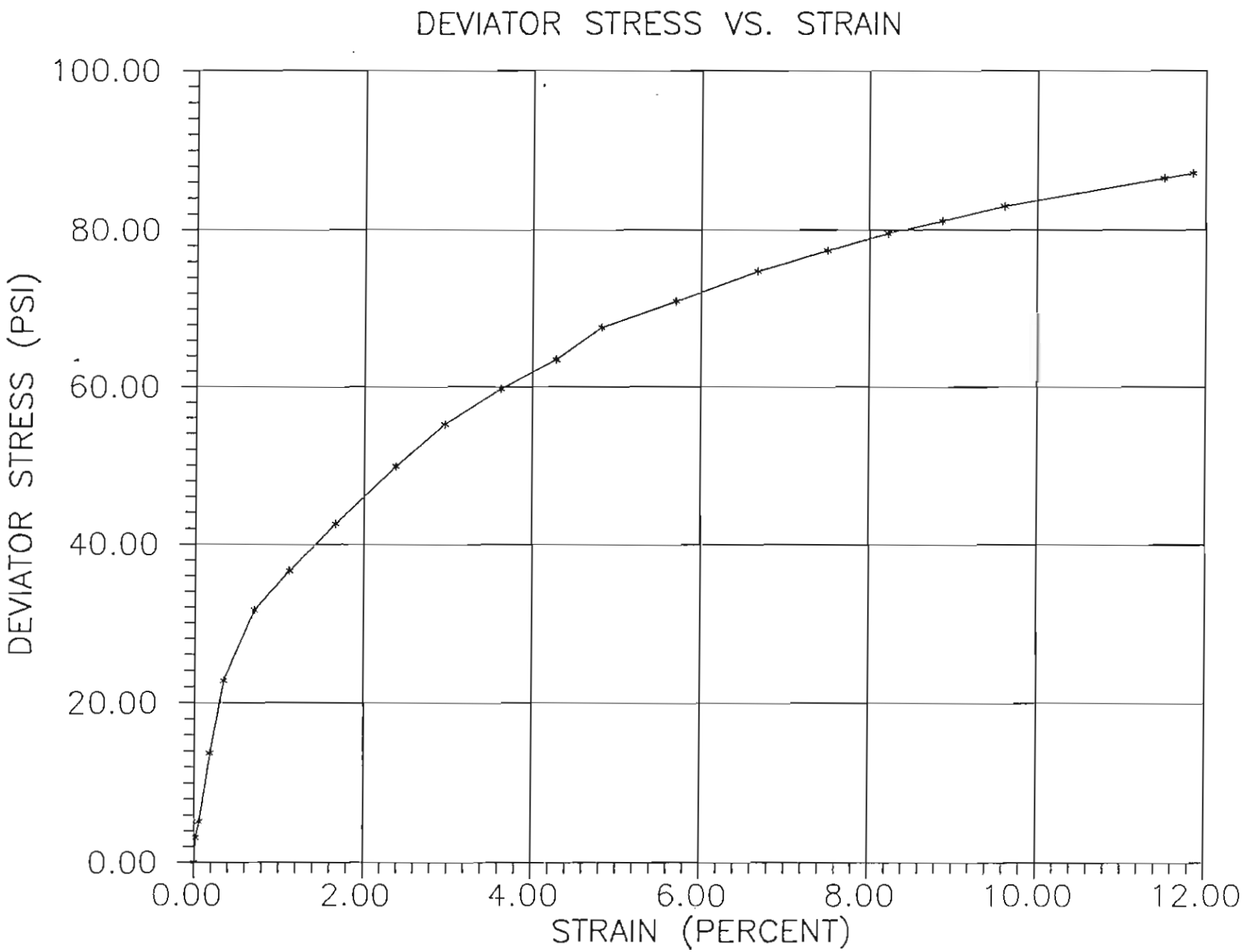
Test No. 1
Boring No. BS-6
Depth(ft.) NA
Sample No. NA

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	2.33	0.70	21.53	19.20	1.12	0.31	20.36	1.16
0.07	6.51	2.50	23.91	17.40	1.37	0.40	20.66	3.26
0.18	12.70	5.40	27.20	14.50	1.88	0.44	20.85	6.35
0.36	18.08	8.30	29.68	11.60	2.56	0.47	20.64	9.04
0.86	25.84	10.60	35.14	9.30	3.78	0.42	22.22	12.92
1.38	32.13	10.30	41.73	9.60	4.35	0.33	25.66	16.06
1.96	37.41	9.30	48.01	10.60	4.53	0.26	29.31	18.71
2.64	41.99	8.00	53.89	11.90	4.53	0.20	32.89	20.99
3.29	45.91	6.80	59.01	13.10	4.50	0.15	36.05	22.95
3.95	48.87	5.80	62.97	14.10	4.47	0.12	38.53	24.43
4.67	51.90	4.70	67.10	15.20	4.41	0.09	41.15	25.95
5.52	54.38	3.50	70.78	16.40	4.32	0.07	43.59	27.19
6.22	56.59	2.70	73.79	17.20	4.29	0.05	45.50	28.30
7.76	60.24	1.40	78.74	18.50	4.26	0.02	48.62	30.12
8.77	62.41	0.60	81.71	19.30	4.23	0.01	50.51	31.21
9.67	63.90	-0.20	84.00	20.10	4.18	-0.00	52.05	31.95
10.48	65.13	-0.70	85.73	20.60	4.16	-0.01	53.17	32.57
11.10	65.78	-1.10	86.78	21.00	4.13	-0.02	53.89	32.89

CLIENT: ALMES & ASSOC. BORING NO. BS-6
CLIENTS JOB:US STEEL CONCORD SAMPLE NO. NA
PROJECT NO. 91033-02 DEPTH: NA TEST 2
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	BS-6
Client Project	US STEEL CONCORD	Depth(ft.)	NA
Project No.	91033-02	Sample No.	NA
Tested By	JCM 4-4-91	Stage No.	1
Checked By	MM 4-12-91	Test No.	2

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	79.10	INITIAL SAMPLE LENGTH	5.57
BACK PRESSURE	39.30	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	36.03
EFF. CONS. PRESS	39.80	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	16.70
RESPONSE (%)	97	FINAL CHANGE	8.30
		VOL. AFTER CONS.	35.52
		LENGTH AFTER CONS.	5.55
		AREA AFTER CONS.	6.40

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
12.00	0	39.30
32.00	1	40.20
45.00	3	41.00
100.00	10	46.70
158.00	19	54.80
216.00	39	63.40
249.00	62	66.30
289.00	92	66.80
339.00	132	65.80
376.00	164	64.60
409.00	201	63.30
437.00	237	61.90
467.00	267	60.50
494.00	316	59.10
525.00	370	57.80
548.00	416	56.60
567.00	456	55.80
582.00	492	55.10
600.00	533	54.20
638.00	638	52.60
645.00	657	52.40

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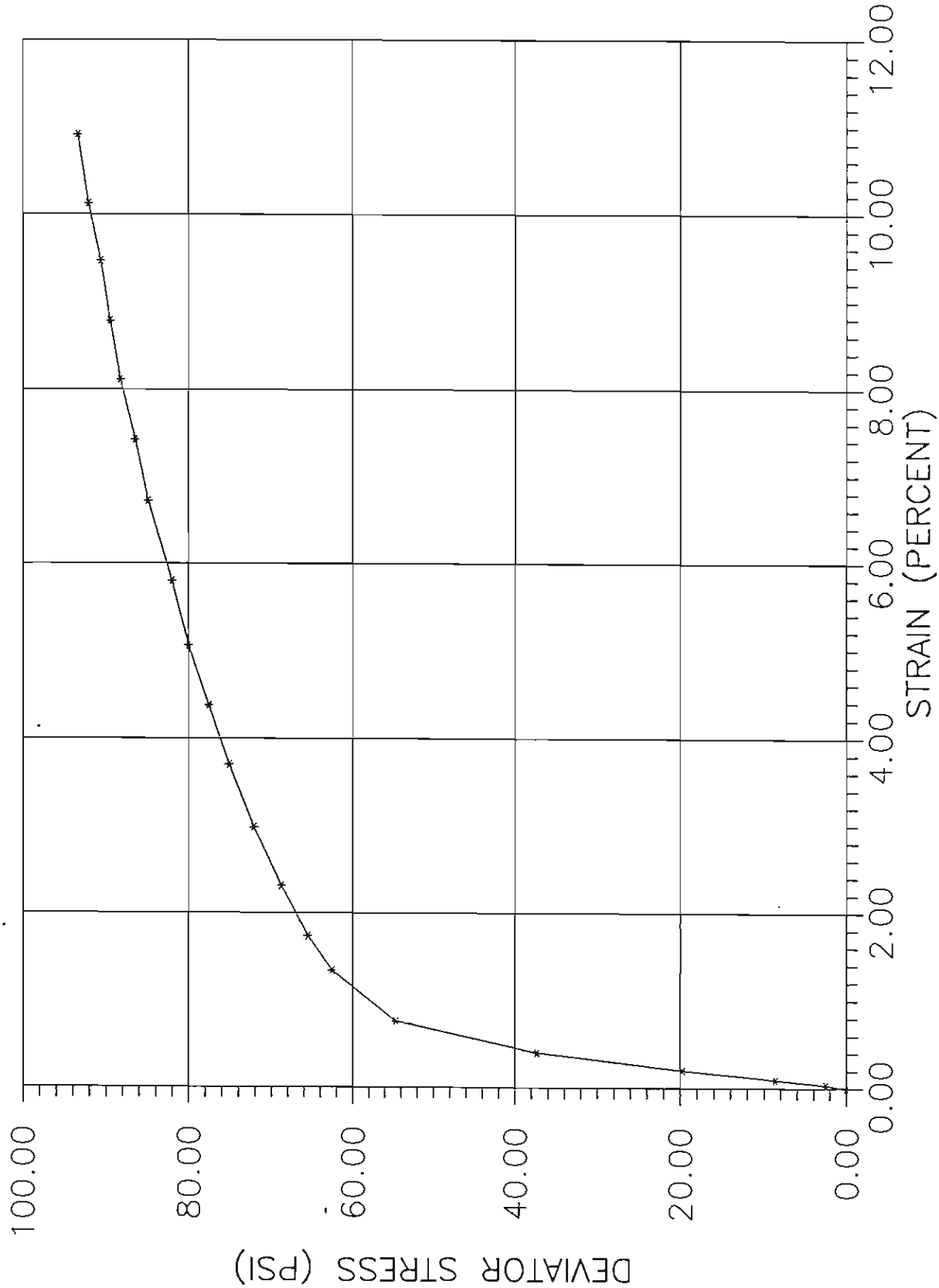
Test No. 2
Boring No. BS-6
Depth(ft.) NA
Sample No. NA

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	3.12	0.90	42.02	38.90	1.08	0.30	40.46	1.56
0.05	5.15	1.70	43.25	38.10	1.14	0.34	40.68	2.58
0.18	13.72	7.40	46.12	32.40	1.42	0.56	39.26	6.86
0.34	22.72	15.50	47.02	24.30	1.94	0.70	35.66	11.36
0.70	31.63	24.10	47.33	15.70	3.01	0.79	31.52	15.82
1.12	36.60	27.00	49.40	12.80	3.86	0.76	31.10	18.30
1.66	42.54	27.50	54.84	12.30	4.46	0.67	33.57	21.27
2.38	49.85	26.50	63.15	13.30	4.75	0.55	38.22	24.92
2.96	55.16	25.30	69.66	14.50	4.80	0.47	42.08	27.58
3.62	59.75	24.00	75.55	15.80	4.78	0.41	45.67	29.87
4.27	63.53	22.60	80.73	17.20	4.69	0.37	48.97	31.77
4.81	67.63	21.20	86.23	18.60	4.64	0.32	52.42	33.82
5.70	70.98	19.80	90.98	20.00	4.55	0.29	55.49	35.49
6.67	74.76	18.50	96.06	21.30	4.51	0.26	58.68	37.38
7.50	77.42	17.30	99.92	22.50	4.44	0.23	61.21	38.71
8.22	79.54	16.50	102.84	23.30	4.41	0.21	63.07	39.77
8.87	81.11	15.80	105.11	24.00	4.38	0.20	64.56	40.56
9.61	83.00	14.90	107.90	24.90	4.33	0.19	66.40	41.50
11.50	86.51	13.30	113.01	26.50	4.26	0.16	69.75	43.25
11.84	87.14	13.10	113.84	26.70	4.26	0.15	70.27	43.57

Geotechnics

CLIENT: ALMES & ASSOC. BORING NO. BS-6
CLIENTS JOB:US STEEL CONCORD SAMPLE NO. NA
PROJECT NO. 91033-02 DEPTH: NA TEST 3
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	BS-6
Client Project	US STEEL CONCORD	Depth(ft.)	NA
Project No.	91033-02	Sample No.	NA
Tested By	JCM 4-4-91	Stage No.	1
Checked By	TMM 4-12-91	Test No.	3

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	119.30	INITIAL SAMPLE LENGTH	5.57
BACK PRESSURE	39.40	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	36.03
EFF. CONS. PRESS	79.90	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	12.60
RESPONSE (%)	98	FINAL CHANGE	12.40
		VOL. AFTER CONS.	35.27
		LENGTH AFTER CONS.	5.53
		AREA AFTER CONS.	6.37

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
25.00	0	39.40
41.00	2	40.50
80.00	5	42.90
151.00	11	49.90
264.00	22	65.70
376.00	42	83.70
429.00	74	93.10
450.00	96	95.00
474.00	128	95.70
499.00	165	95.50
522.00	205	94.90
542.00	242	94.20
562.00	280	93.30
580.00	321	93.00
605.00	372	92.00
620.00	411	91.40
637.00	449	90.60
650.00	486	90.00
663.00	524	89.30
678.00	560	88.70
693.00	604	88.90

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Test No. 3
Boring No. BS-6
Depth(ft.) NA
Sample No. NA

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.04	2.51	1.10	81.31	78.80	1.03	0.45	80.05	1.25
0.09	8.62	3.50	85.02	76.40	1.11	0.41	80.71	4.31
0.20	19.73	10.50	89.13	69.40	1.28	0.54	79.26	9.86
0.40	37.35	26.30	90.95	53.60	1.70	0.72	72.27	18.67
0.76	54.65	44.30	90.25	35.60	2.54	0.83	62.93	27.33
1.34	62.54	53.70	88.74	26.20	3.39	0.88	57.47	31.27
1.73	65.52	55.60	89.82	24.30	3.70	0.87	57.06	32.76
2.31	68.82	56.30	92.42	23.60	3.92	0.83	58.01	34.41
2.98	72.15	56.10	95.95	23.80	4.03	0.79	59.88	36.08
3.70	75.09	55.50	99.49	24.40	4.08	0.75	61.94	37.54
4.37	77.57	54.80	102.67	25.10	4.09	0.72	63.88	38.78
5.06	79.99	53.90	105.99	26.00	4.08	0.69	66.00	40.00
5.80	82.03	53.60	108.33	26.30	4.12	0.67	67.31	41.01
6.72	84.88	52.60	112.18	27.30	4.11	0.63	69.74	42.44
7.43	86.42	52.00	114.32	27.90	4.10	0.61	71.11	43.21
8.11	88.23	51.20	116.93	28.70	4.07	0.59	72.82	44.12
8.78	89.45	50.60	118.75	29.30	4.05	0.58	74.02	44.72
9.47	90.62	49.90	120.62	30.00	4.02	0.56	75.31	45.31
10.12	92.09	49.30	122.69	30.60	4.01	0.55	76.64	46.04
10.91	93.37	49.50	123.77	30.40	4.07	0.54	77.08	46.68

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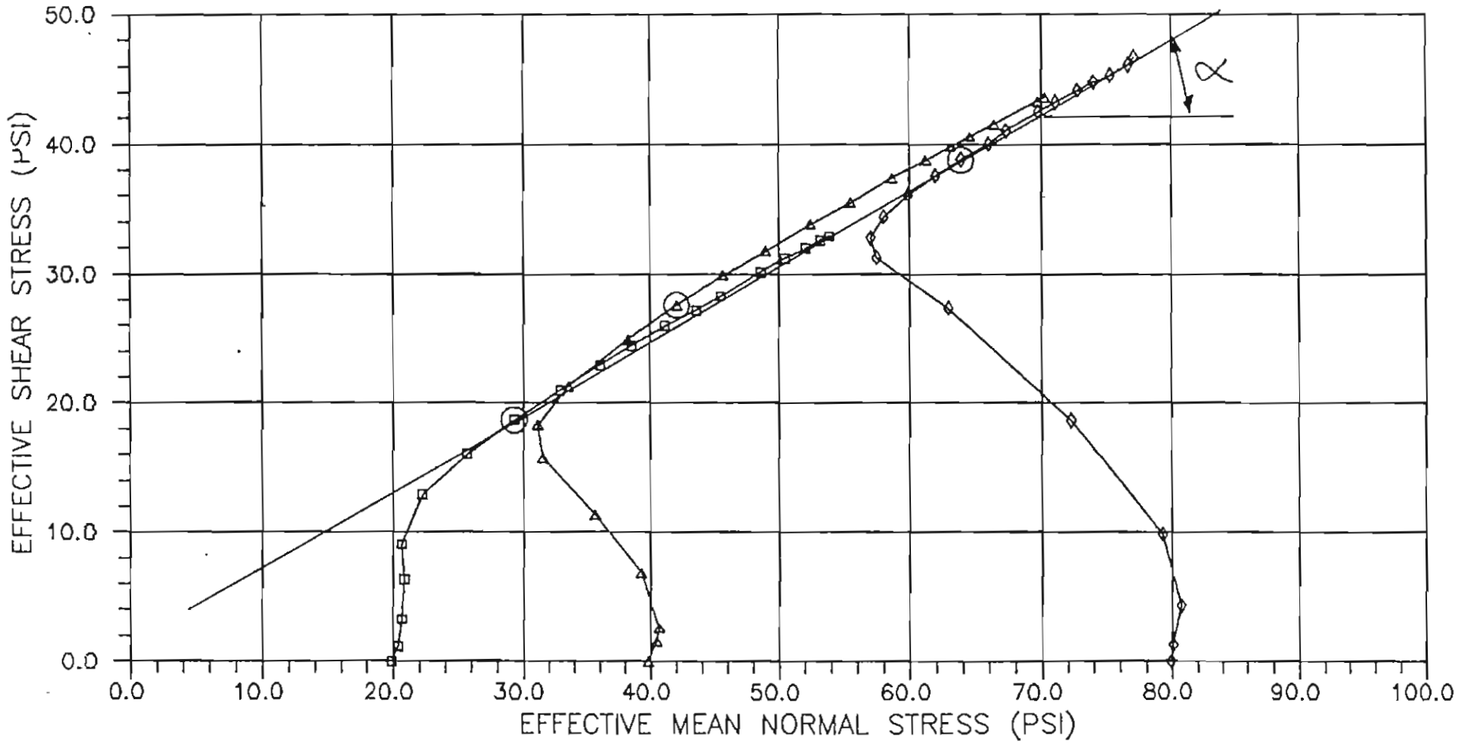
CLIENT: ALMES & ASSOC.
CLIENT PROJECT: US STEEL CONCORD
PROJECT NO. 91033
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)

BORING NO. BS-6
SAMPLE NO. NA
DEPTH (ft.) NA

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS



$$\sin \Phi = \tan \alpha$$
α = 30.14 DEGREES
Φ = 35.49 DEGREES

$$C = \frac{a}{\cos \Phi}$$

C = 0 PSI

EFFECTIVE STRESS FAILURE ENVELOPE
TEST NO. 1
TEST NO. 2
TEST NO. 3

Geotechnics

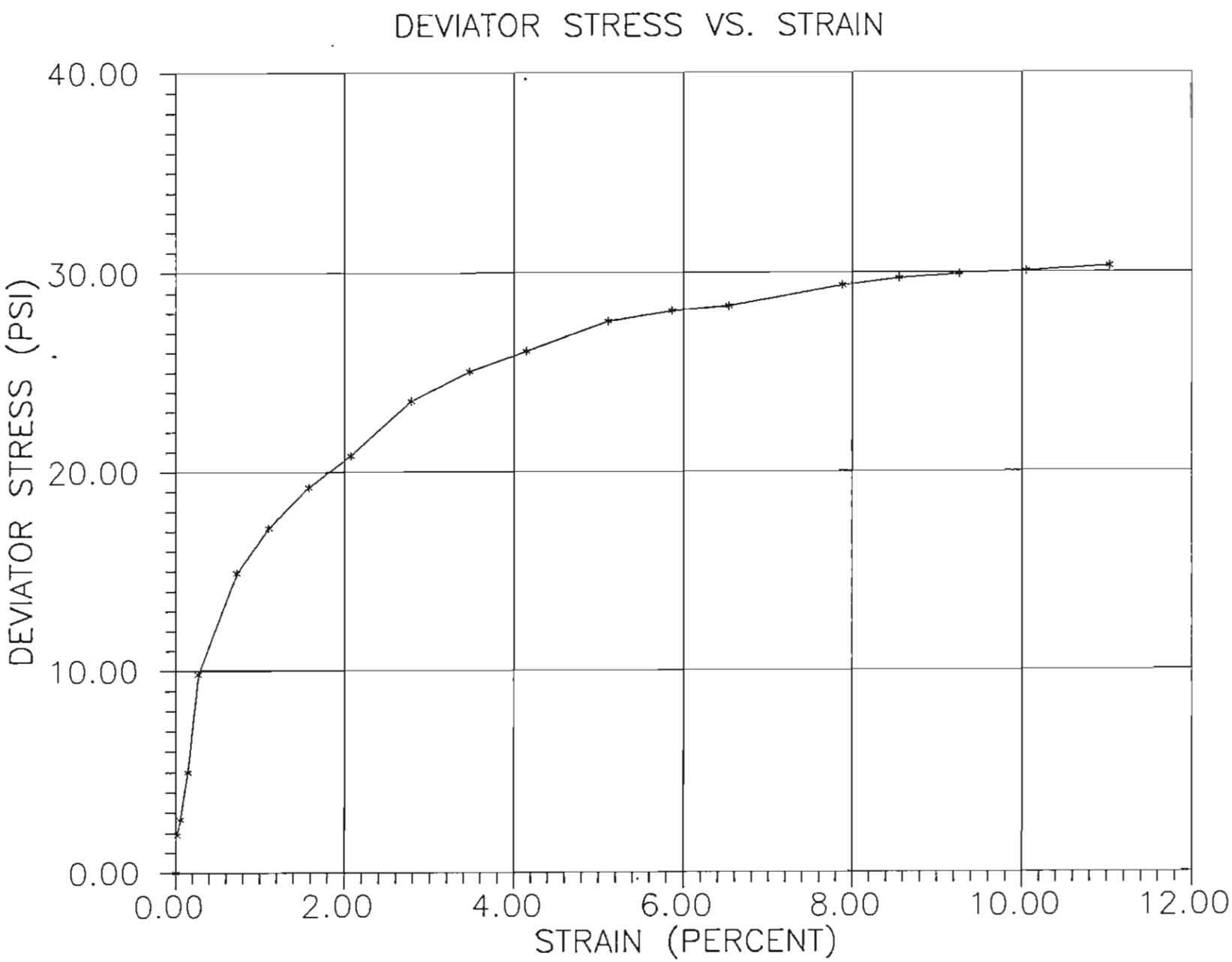
CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

CLIENT	ALMES & ASSOC.	BORING NO.	B 3A
CLIENTS JOB	US STEEL CONCORD	SAMPLE NO.	ST-1
PROJECT	91033		
TESTED BY	JCM 3-11-91		
CHECKED BY	DB 3/20/91		

SAMPLE CONDITION SUMMARY

TEST NO:	T4	T5	T6
DEPTH (ft):	4.8'-5.3	4.4'-4.8'	3.9'-4.4
DEF. RATE (in/min):	0.002	0.002	0.002
BACK PRESSURE (psi):	34.9	39.1	35.2
CONSOLIDATION TIME (days):	1.0	1.0	1.0
INITIAL STATE (w%):	16.1	16.1	16.5
TOTAL UNIT WEIGHT (pcf):	128.0	130.4	131.8
DRY UNIT WEIGHT (pcf):	110.3	112.3	113.1
FINAL STATE (w%):	18.4	15.7	13.9

CLIENT: ALMES & ASSOC. BORING NO. B 3A
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-1 SEC 2
PROJECT NO. 91033 DEPTH:4.8'-5.3'TEST NO. 4
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B 3A
Client Project	US STEEL CONCORD	Depth(ft.)	4.8'-5.3'
Project No.	91033	Sample No.	ST-1 SEC 2
Tested By	JCM 3-11-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	4

PRESSURES (psi)	
CELL PRESSURE	54.30
BACK PRESSURE	34.90
EFF. CONS. PRESS	19.40
PORE PRESSURE RESPONSE (%)	97

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.53
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.78

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	39.90
FINAL CHANGE	10.10
VOL. AFTER CONS.	35.16
LENGTH AFTER CONS.	5.49
AREA AFTER CONS.	6.40

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
10.00	0	34.90
22.00	1	35.50
27.00	3	35.80
42.00	8	36.80
73.00	15	40.00
106.00	40	46.00
121.00	61	47.50
135.00	87	48.10
146.00	114	48.20
165.00	153	47.90
176.00	191	47.50
184.00	228	47.00
196.00	281	46.30
201.00	322	45.90
204.00	359	45.50
214.00	433	45.10
218.00	470	45.00
221.00	509	44.80
224.00	552	44.70
228.00	606	44.50

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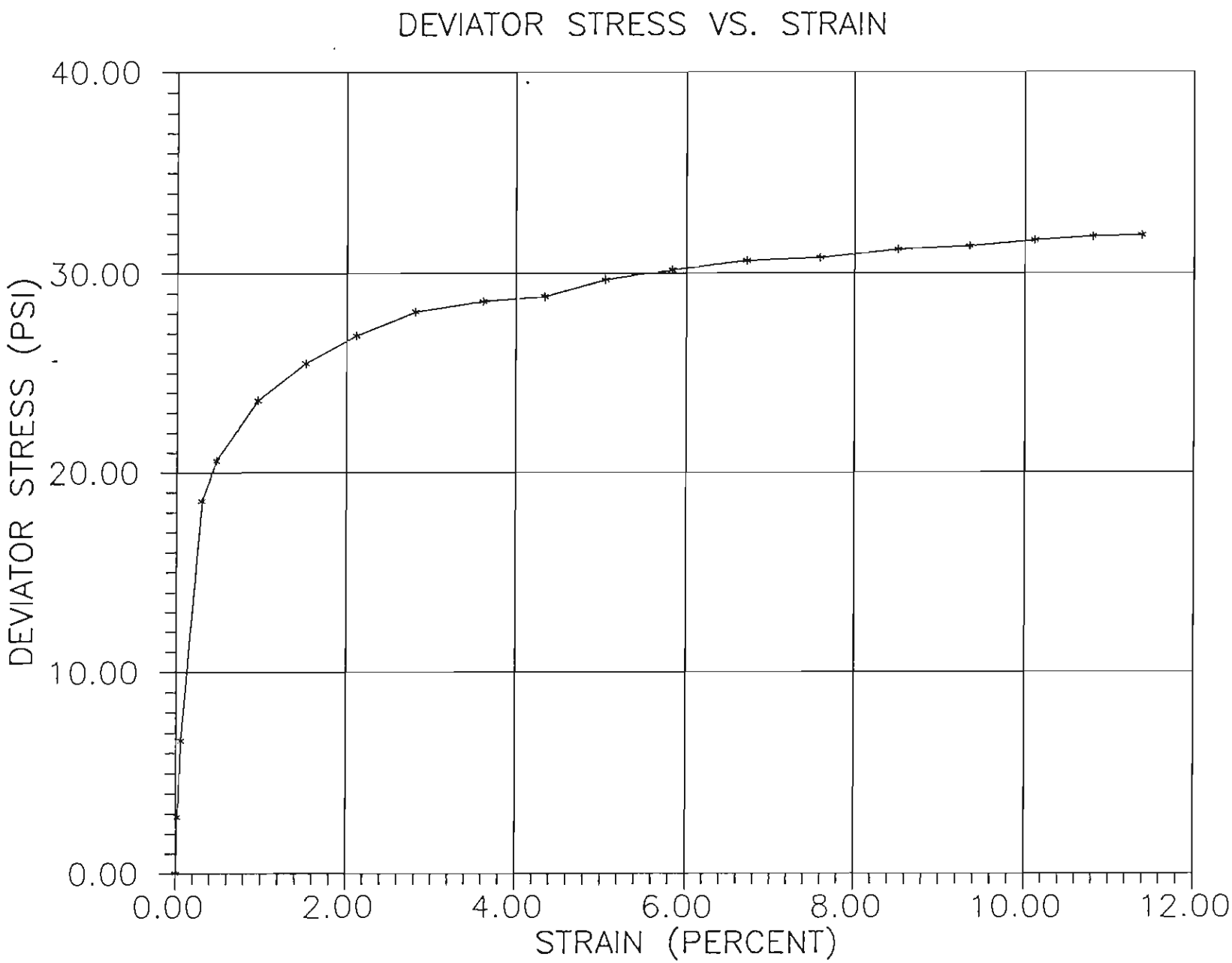
Test No. 4
Boring No. B 3A
Depth(ft.) 4.8′-5.3′
Sample No. ST-1 SEC 2

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	1.87	0.60	20.67	18.80	1.10	0.33	19.74	0.94
0.05	2.66	0.90	21.16	18.50	1.14	0.35	19.83	1.33
0.15	4.99	1.90	22.49	17.50	1.29	0.39	20.00	2.50
0.27	9.82	5.10	24.12	14.30	1.69	0.54	19.21	4.91
0.73	14.89	11.10	23.19	8.30	2.79	0.77	15.75	7.45
1.11	17.15	12.60	23.95	6.80	3.52	0.76	15.38	8.58
1.58	19.23	13.20	25.43	6.20	4.10	0.71	15.81	9.61
2.07	20.81	13.30	26.91	6.10	4.41	0.66	16.51	10.41
2.78	23.55	13.00	29.95	6.40	4.68	0.57	18.17	11.77
3.48	25.04	12.60	31.84	6.80	4.68	0.52	19.32	12.52
4.15	26.06	12.10	33.36	7.30	4.57	0.48	20.33	13.03
5.11	27.58	11.40	35.58	8.00	4.45	0.43	21.79	13.79
5.86	28.10	11.00	36.50	8.40	4.35	0.40	22.45	14.05
6.53	28.34	10.60	37.14	8.80	4.22	0.39	22.97	14.17
7.88	29.37	10.20	38.57	9.20	4.19	0.36	23.88	14.68
8.55	29.72	10.10	39.02	9.30	4.20	0.35	24.16	14.86
9.26	29.92	9.90	39.42	9.50	4.15	0.34	24.46	14.96
10.05	30.08	9.80	39.68	9.60	4.13	0.34	24.64	15.04
11.03	30.31	9.60	40.11	9.80	4.09	0.33	24.96	15.16

CLIENT: ALMES & ASSOC. BORING NO. B 3A
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-1 SEC 3
PROJECT NO. 91033 DEPTH:4.4'-4.8'TEST NO. 5
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B 3A
Client Project	US STEEL CONCORD	Depth(ft.)	4.4'-4.8'
Project No.	91033	Sample No.	ST-1 SEC 3
Tested By	JCM 3-11-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	5

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	79.30	INITIAL SAMPLE LENGTH	5.40
BACK PRESSURE	39.10	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	34.92
EFF. CONS. PRESS	40.20	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	7.80
RESPONSE (%)	100	FINAL CHANGE	17.20
		VOL. AFTER CONS.	33.88
		LENGTH AFTER CONS.	5.35
		AREA AFTER CONS.	6.33

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
15.00	0	39.10
33.00	1	40.00
57.00	3	41.60
133.00	16	51.70
146.00	25	56.60
166.00	51	63.20
179.00	81	66.10
189.00	113	67.30
198.00	150	67.70
203.00	193	67.80
206.00	232	67.80
213.00	270	67.60
218.00	312	67.40
223.00	359	67.20
226.00	406	66.90
231.00	455	66.80
234.00	500	66.70
238.00	541	66.50
241.00	578	66.40
243.00	609	66.30

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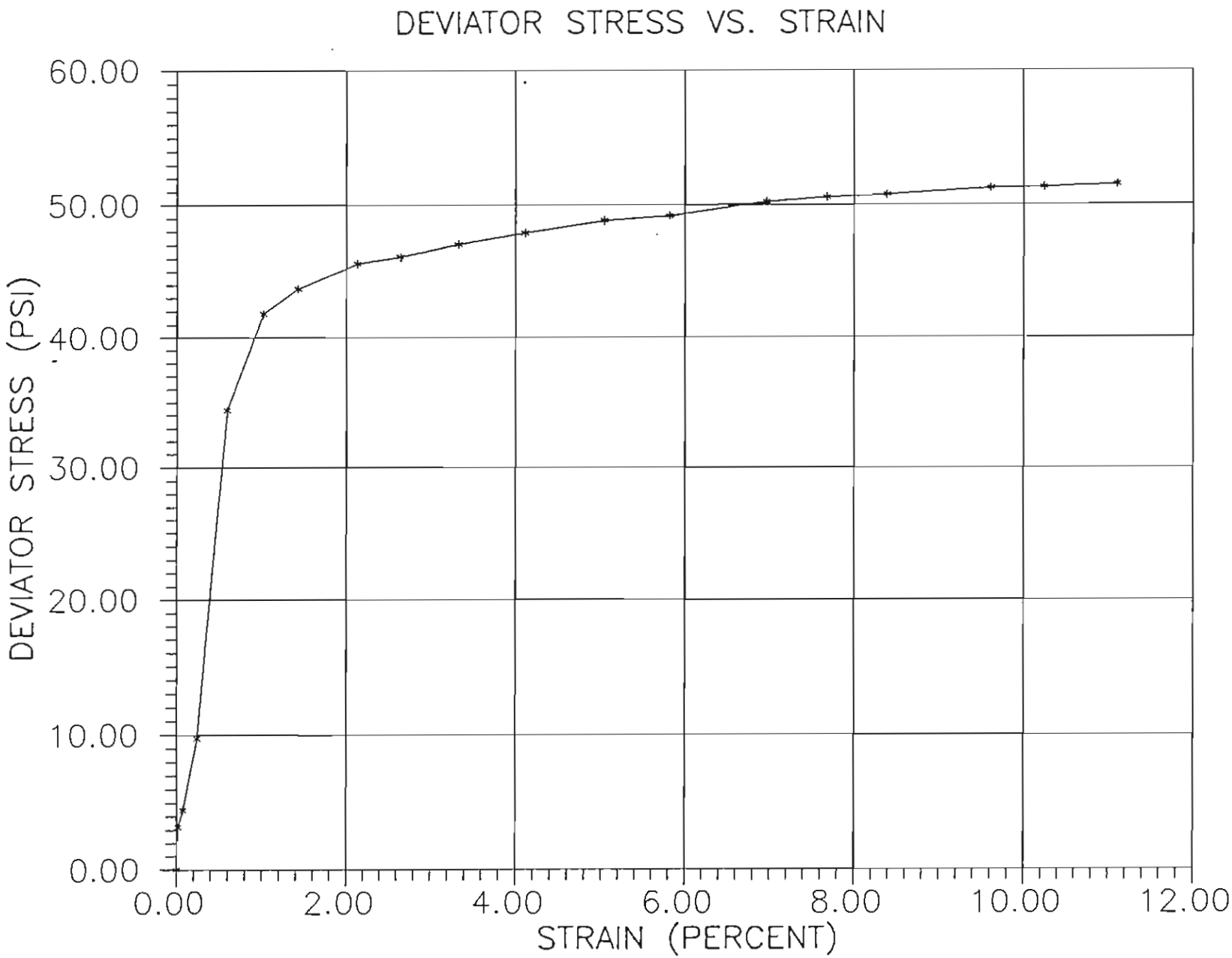
Test No. 5
Boring No. B 3A
Depth(ft.) 4.4'-4.8'
Sample No. ST-1 SEC 3

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	2.84	0.90	42.14	39.30	1.07	0.32	40.72	1.42
0.06	6.63	2.50	44.33	37.70	1.18	0.38	41.01	3.31
0.30	18.57	12.60	46.17	27.60	1.67	0.68	36.89	9.29
0.47	20.59	17.50	43.29	22.70	1.91	0.85	32.99	10.29
0.95	23.61	24.10	39.71	16.10	2.47	1.02	27.91	11.81
1.51	25.50	27.00	38.70	13.20	2.93	1.06	25.95	12.75
2.11	26.89	28.20	38.89	12.00	3.24	1.05	25.45	13.45
2.80	28.08	28.60	39.68	11.60	3.42	1.02	25.64	14.04
3.61	28.61	28.70	40.11	11.50	3.49	1.00	25.81	14.31
4.34	28.85	28.70	40.35	11.50	3.51	0.99	25.92	14.42
5.05	29.68	28.50	41.38	11.70	3.54	0.96	26.54	14.84
5.83	30.18	28.30	42.08	11.90	3.54	0.94	26.99	15.09
6.71	30.63	28.10	42.73	12.10	3.53	0.92	27.42	15.32
7.59	30.78	27.80	43.18	12.40	3.48	0.90	27.79	15.39
8.51	31.20	27.70	43.70	12.50	3.50	0.89	28.10	15.60
9.35	31.34	27.60	43.94	12.60	3.49	0.88	28.27	15.67
10.12	31.65	27.40	44.45	12.80	3.47	0.87	28.62	15.82
10.81	31.82	27.30	44.72	12.90	3.47	0.86	28.81	15.91
11.39	31.90	27.20	44.90	13.00	3.45	0.85	28.95	15.95

CLIENT: ALMES & ASSOC. BORING NO. B 3A
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-1 SEC 4
PROJECT NO. 91033 DEPTH:3.9'-4.4'TEST NO. 6
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B 3A
Client Project	US STEEL CONCORD	Depth(ft.)	3.9'-4.4'
Project No.	91033	Sample No.	ST-1 SEC 4
Tested By	JCM 3-11-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	6

PRESSURES (psi)	
CELL PRESSURE	115.20
BACK PRESSURE	35.20
EFF. CONS. PRESS	80.00
PORE PRESSURE RESPONSE (%)	98

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.49
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.57

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	19.60
FINAL CHANGE	30.40
VOL. AFTER CONS.	33.71
LENGTH AFTER CONS.	5.40
AREA AFTER CONS.	6.24

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
20.00	0	35.20
40.00	1	36.20
48.00	4	36.60
81.00	13	38.60
236.00	32	62.80
284.00	55	80.50
297.00	77	87.50
311.00	115	91.70
316.00	143	93.00
324.00	180	93.90
332.00	222	94.20
341.00	272	94.20
346.00	314	94.10
357.00	376	93.90
362.00	415	93.70
366.00	453	93.60
374.00	519	93.30
377.00	553	93.20
382.00	600	93.00

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Test No. 6
Boring No. B 3A
Depth(ft.) 3.9'-4.4'
Sample No. ST-1 SEC 4

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	3.20	1.00	82.20	79.00	1.04	0.32	80.60	1.60
0.07	4.48	1.40	83.08	78.60	1.06	0.32	80.84	2.24
0.24	9.74	3.40	86.34	76.60	1.13	0.36	81.47	4.87
0.59	34.38	27.60	86.78	52.40	1.66	0.82	69.59	17.19
1.02	41.85	45.30	76.55	34.70	2.21	1.10	55.62	20.92
1.43	43.73	52.30	71.43	27.70	2.58	1.22	49.56	21.86
2.13	45.61	56.50	69.11	23.50	2.94	1.26	46.30	22.80
2.65	46.14	57.80	68.34	22.20	3.08	1.28	45.27	23.07
3.33	47.06	58.70	68.36	21.30	3.21	1.27	44.83	23.53
4.11	47.91	59.00	68.91	21.00	3.28	1.26	44.95	23.95
5.04	48.81	59.00	69.81	21.00	3.32	1.23	45.41	24.41
5.82	49.17	58.90	70.27	21.10	3.33	1.22	45.68	24.58
6.96	50.21	58.70	71.51	21.30	3.36	1.19	46.40	25.10
7.69	50.56	58.50	72.06	21.50	3.35	1.18	46.78	25.28
8.39	50.76	58.40	72.36	21.60	3.35	1.17	46.98	25.38
9.61	51.24	58.10	73.14	21.90	3.34	1.16	47.52	25.62
10.24	51.31	58.00	73.31	22.00	3.33	1.15	47.66	25.66
11.11	51.53	57.80	73.73	22.20	3.32	1.14	47.96	25.76

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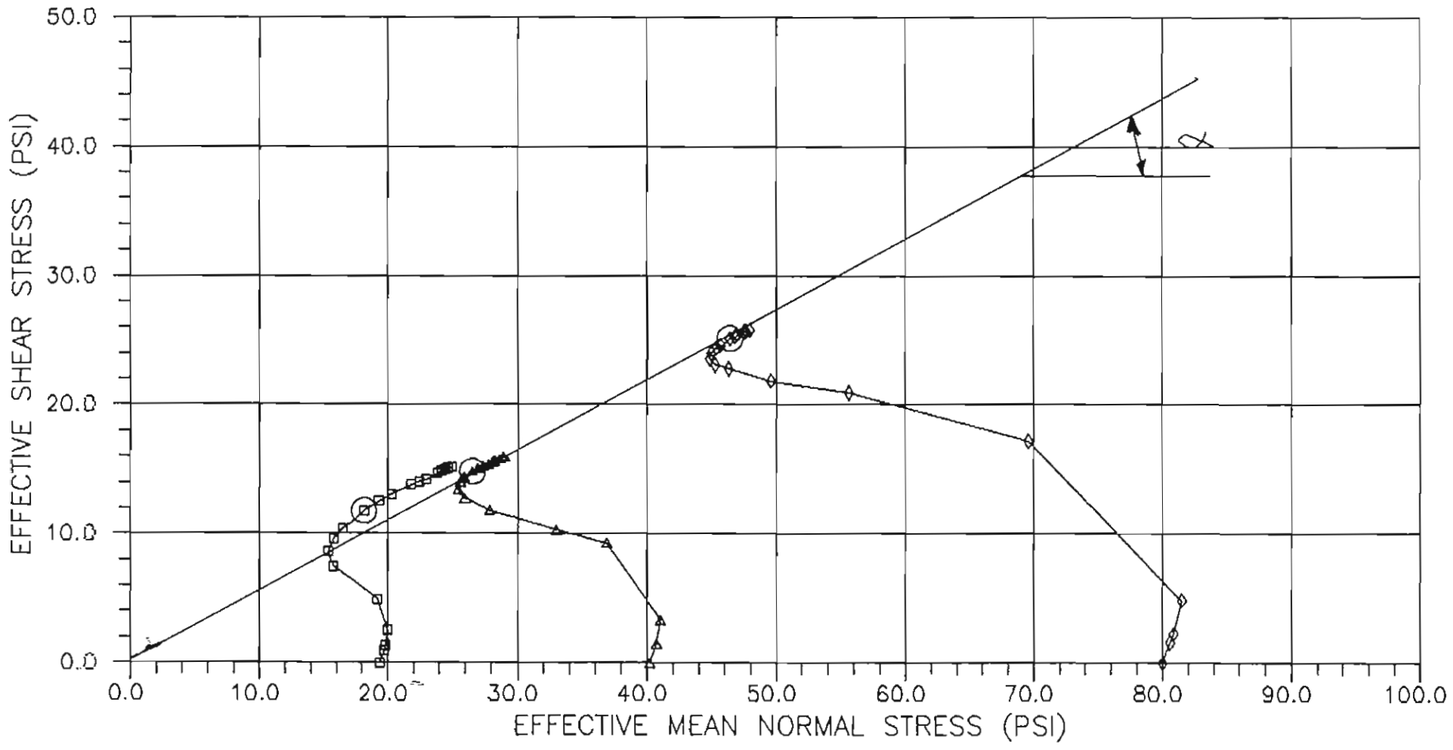
CLIENT: ALMES & ASSOC. BORING NO. B-3A
CLIENT PROJECT:US STEEL CONCORD SAMPLE NO. ST-1
PROJECT NO. 91033 DEPTH (ft.) 3.0'-5.5'
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS



SIN Φ = TAN α
α =27.32 DEGREES
Φ =31.11 DEGREES

$$C = \frac{\rightarrow\rightarrow 0 \rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow}{\cos \Phi}$$

C = 0 PSI

EFFECTIVE STRESS FAILURE ENVELOPE
TEST NO. 4
TEST NO. 5
TEST NO. 6

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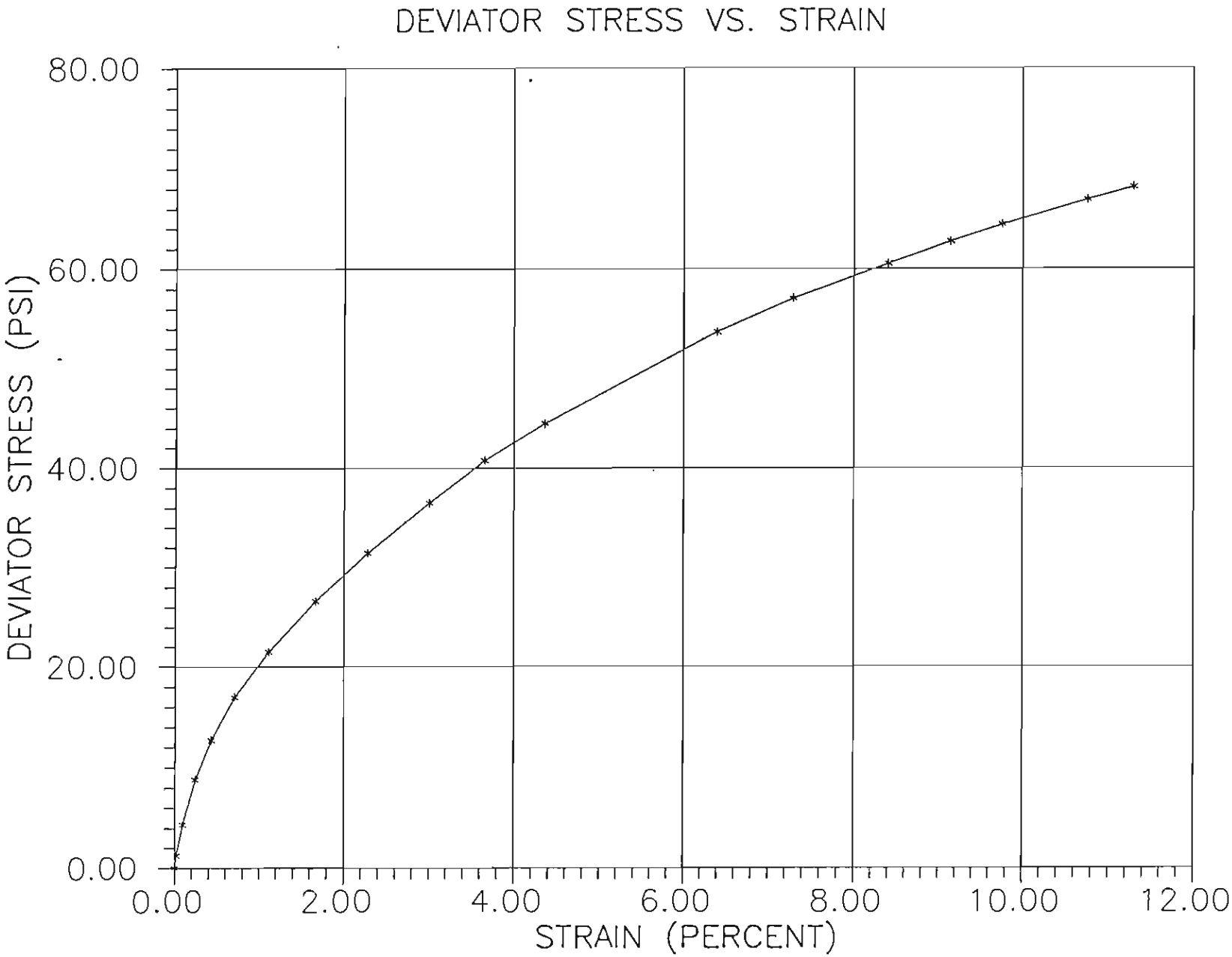
CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

CLIENT	ALMES & ASSOC.	BORING NO.	B-20
CLIENTS JOB	US STEEL CONCORD	SAMPLE NO.	ST-2
PROJECT	91033		
TESTED BY	JCM 3-7-91		
CHECKED BY	DB 3/20/91		

SAMPLE CONDITION SUMMARY

TEST NO:	T1	T2	T3
DEPTH (ft):	28.4-28.9	28.9-29.3	27.9-28.
DEF. RATE (in/min):	0.002	0.002	0.002
BACK PRESSURE (psi):	30.0	30.0	29.8
CONSOLIDATION TIME (days):	1.0	1.0	1.0
INITIAL STATE (w%):	41.6	41.6	41.6
TOTAL UNIT WEIGHT (pcf):	72.6	74.5	69.2
DRY UNIT WEIGHT (pcf):	51.3	52.6	48.9
FINAL STATE (w%):	40.6	39.0	40.2

CLIENT: ALMES & ASSOC. BORING NO. B-20
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-2 SEC 3
PROJECT NO. 91033 DEPTH:28.4'-28.9' TEST NO. 1
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth(ft.)	28.4'-28.9'
Project No.	91033	Sample No.	ST-2 SEC 3
Tested By	JCM 3-7-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	1

PRESSURES (psi)	
CELL PRESSURE	50.10
BACK PRESSURE	30.00
EFF. CONS. PRESS	20.10
PORE PRESSURE RESPONSE (%)	99

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.41
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.00

VOLUME CHANGE	
INT. BURRETE RDG.	25.00
FINAL BURETTE RDG.	19.70
FINAL CHANGE	5.30
VOL. AFTER CONS.	34.67
LENGTH AFTER CONS.	5.39
AREA AFTER CONS.	6.43

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
17.00	0	30.00
25.00	1	30.70
45.00	5	32.40
74.00	13	35.50
99.00	23	38.10
127.00	38	40.10
157.00	60	41.10
191.00	90	41.10
224.00	123	40.50
259.00	162	39.50
289.00	197	38.50
316.00	235	37.40
386.00	345	34.70
413.00	393	33.60
442.00	453	32.50
461.00	493	31.70
476.00	526	31.10
499.00	580	30.20
511.00	609	29.60

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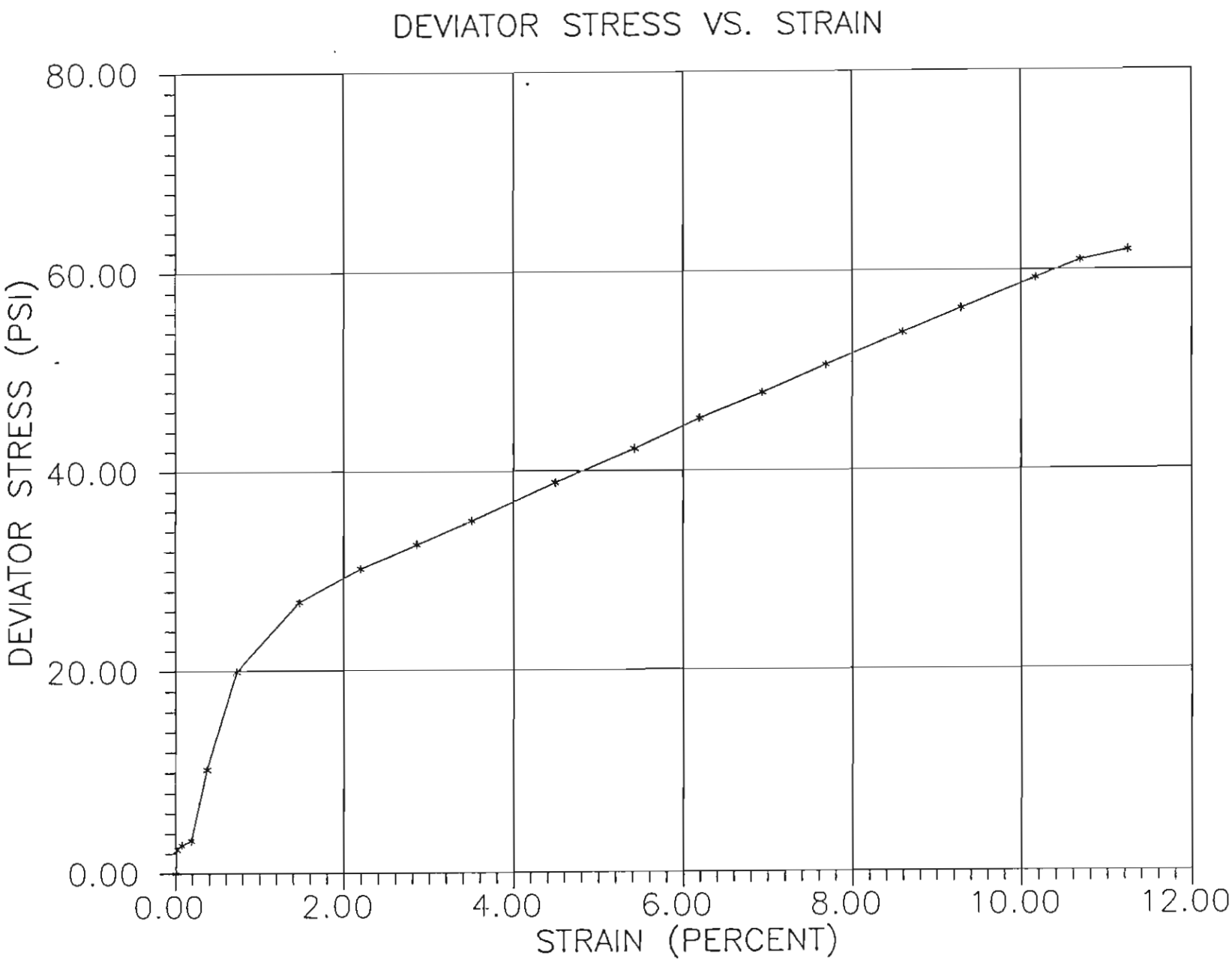
Test No. 1
Boring No. B-20
Depth(ft.) 28.4'-28.9'
Sample No. ST-2 SEC 3

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	1.24	0.70	20.64	19.40	1.06	0.57	20.02	0.62
0.09	4.35	2.40	22.05	17.70	1.25	0.56	19.87	2.17
0.24	8.84	5.50	23.44	14.60	1.61	0.63	19.02	4.42
0.43	12.69	8.10	24.69	12.00	2.06	0.64	18.35	6.35
0.70	16.98	10.10	26.98	10.00	2.70	0.60	18.49	8.49
1.11	21.52	11.10	30.52	9.00	3.39	0.52	19.76	10.76
1.67	26.60	11.10	35.60	9.00	3.96	0.42	22.30	13.30
2.28	31.45	10.50	41.05	9.60	4.28	0.34	25.32	15.72
3.01	36.49	9.50	47.09	10.60	4.44	0.26	28.85	18.25
3.65	40.74	8.50	52.34	11.60	4.51	0.21	31.97	20.37
4.36	44.46	7.40	57.16	12.70	4.50	0.17	34.93	22.23
6.40	53.70	4.70	69.10	15.40	4.49	0.09	42.25	26.85
7.29	57.08	3.60	73.58	16.50	4.46	0.06	45.04	28.54
8.40	60.52	2.50	78.12	17.60	4.44	0.04	47.86	30.26
9.15	62.71	1.70	81.11	18.40	4.41	0.03	49.76	31.36
9.76	64.40	1.10	83.40	19.00	4.39	0.02	51.20	32.20
10.76	66.87	0.20	86.77	19.90	4.36	0.00	53.34	33.44
11.30	68.12	-0.40	88.62	20.50	4.32	-0.01	54.56	34.06

CLIENT: ALMES & ASSOC. BORING NO. B-20
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-2 SEC 2
PROJECT NO. 91033 DEPTH:28.9'-29.3' TEST NO. 2
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth(ft.)	28.9'-29.3'
Project No.	91033	Sample No.	ST-2 SEC 2
Tested By	JCM 3-7-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	2

PRESSURES (psi)	
CELL PRESSURE	70.30
BACK PRESSURE	30.00
EFF. CONS. PRESS	40.30
PORE PRESSURE RESPONSE (%)	98

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.42
INITIAL SAMPLE DIAMETER	2.88
INITIAL SAMPLE AREA(in^2)	6.51
INITIAL SAMPLE VOL. (in^3)	35.28

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	31.40
FINAL CHANGE	18.60
VOL. AFTER CONS.	34.15
LENGTH AFTER CONS.	5.36
AREA AFTER CONS.	6.37

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
17.00	0	30.00
32.00	1	30.90
35.00	4	31.20
38.00	10	31.50
83.00	20	36.00
145.00	39	45.50
191.00	79	53.50
214.00	118	55.80
231.00	153	56.60
248.00	188	56.70
276.00	241	56.40
301.00	291	55.80
324.00	332	55.30
344.00	372	54.60
366.00	412	53.90
392.00	461	53.00
412.00	498	52.40
437.00	545	51.40
452.00	573	50.90
462.00	603	50.30

Geotechnics

Test No. 2
Boring No. B-20
Depth(ft.) 28.9'-29.3'
Sample No. ST-2 SEC 2

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	2.35	0.90	41.75	39.40	1.06	0.39	40.58	1.18
0.07	2.82	1.20	41.92	39.10	1.07	0.43	40.51	1.41
0.19	3.29	1.50	42.09	38.80	1.08	0.47	40.44	1.64
0.37	10.32	6.00	44.62	34.30	1.30	0.59	39.46	5.16
0.73	19.94	15.50	44.74	24.80	1.80	0.79	34.77	9.97
1.47	26.91	23.50	43.71	16.80	2.60	0.89	30.25	13.45
2.20	30.24	25.80	44.74	14.50	3.09	0.87	29.62	15.12
2.86	32.63	26.60	46.33	13.70	3.38	0.83	30.01	16.31
3.51	34.98	26.70	48.58	13.60	3.57	0.78	31.09	17.49
4.50	38.82	26.40	52.72	13.90	3.79	0.69	33.31	19.41
5.43	42.15	25.80	56.65	14.50	3.91	0.62	35.58	21.08
6.20	45.20	25.30	60.20	15.00	4.01	0.57	37.60	22.60
6.94	47.76	24.60	63.46	15.70	4.04	0.53	39.58	23.88
7.69	50.56	23.90	66.96	16.40	4.08	0.48	41.68	25.28
8.60	53.79	23.00	71.09	17.30	4.11	0.44	44.20	26.90
9.29	56.23	22.40	74.13	17.90	4.14	0.41	46.02	28.12
10.17	59.21	21.40	78.11	18.90	4.13	0.37	48.51	29.61
10.69	60.97	20.90	80.37	19.40	4.14	0.35	49.89	30.49
11.25	61.98	20.30	81.98	20.00	4.10	0.33	50.99	30.99

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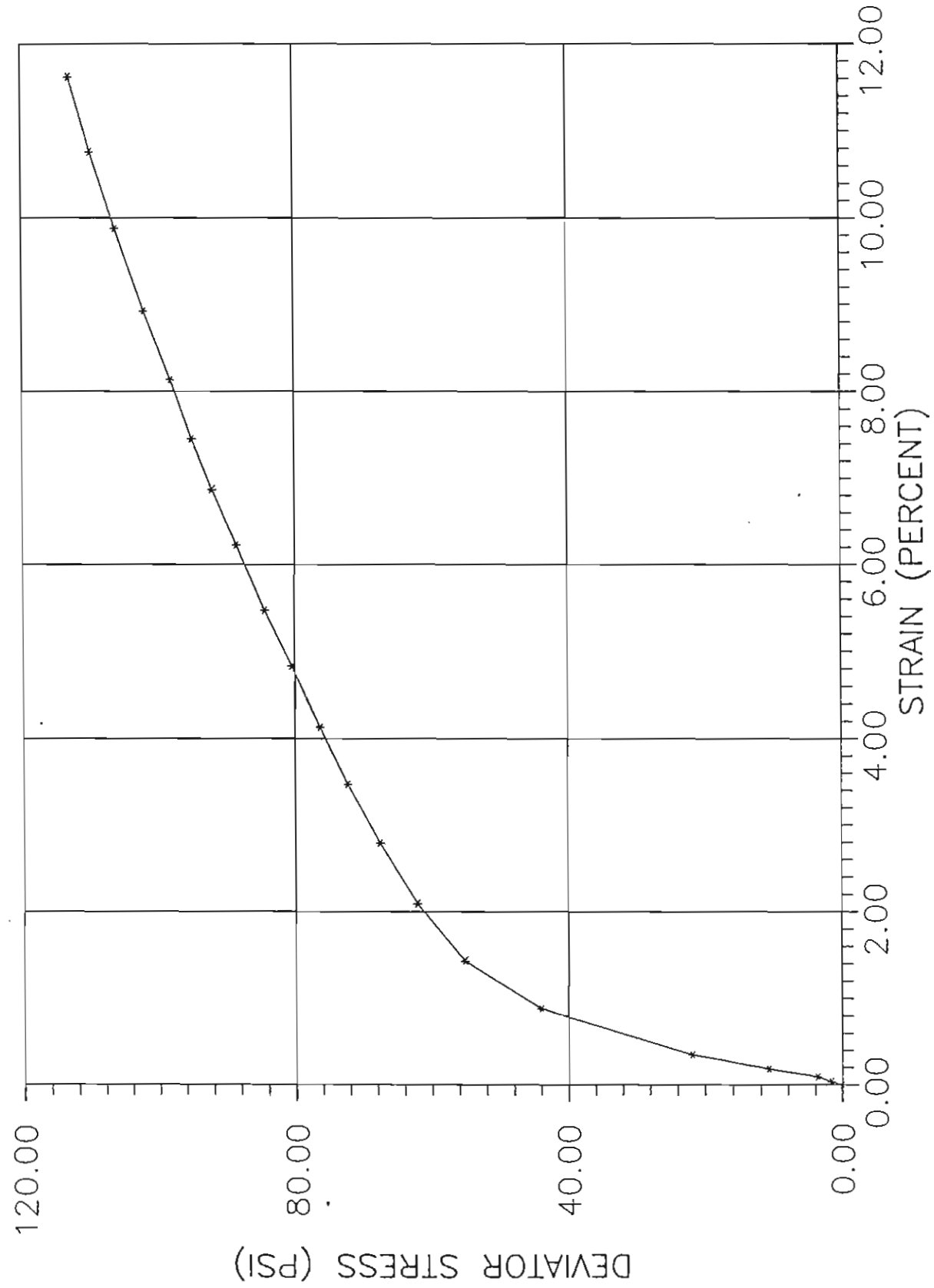
CLIENT: ALMES & ASSOC. BORING NO. B-20
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-2 SEC 4
PROJECT NO. 91033 DEPTH:27.9'-28.4' TEST NO. 3
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)



Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth(ft.)	27.9'-28.4'
Project No.	91033	Sample No.	ST-2 SEC 4
Tested By	JCM 3-7-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	3

PRESSURES (psi)	
CELL PRESSURE	110.70
BACK PRESSURE	29.80
EFF. CONS. PRESS	80.90
PORE PRESSURE RESPONSE (%)	97

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.52
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.73

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	27.40
FINAL CHANGE	22.60
VOL. AFTER CONS.	34.35
LENGTH AFTER CONS.	5.45
AREA AFTER CONS.	6.30

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
20.00	0	29.80
30.00	2	30.40
43.00	5	31.30
88.00	10	35.00
158.00	19	42.60
300.00	48	63.10
373.00	78	74.10
420.00	114	80.10
458.00	152	82.50
492.00	189	83.20
522.00	225	83.50
553.00	263	83.20
583.00	298	82.50
615.00	339	81.90
643.00	374	81.20
667.00	406	80.40
693.00	443	79.60
726.00	486	78.60
763.00	538	77.30
796.00	586	76.10
826.00	633	75.00

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Test No. 3
Boring No. B-20
Depth(ft.) 27.9'-28.4'
Sample No. ST-2 SEC 4

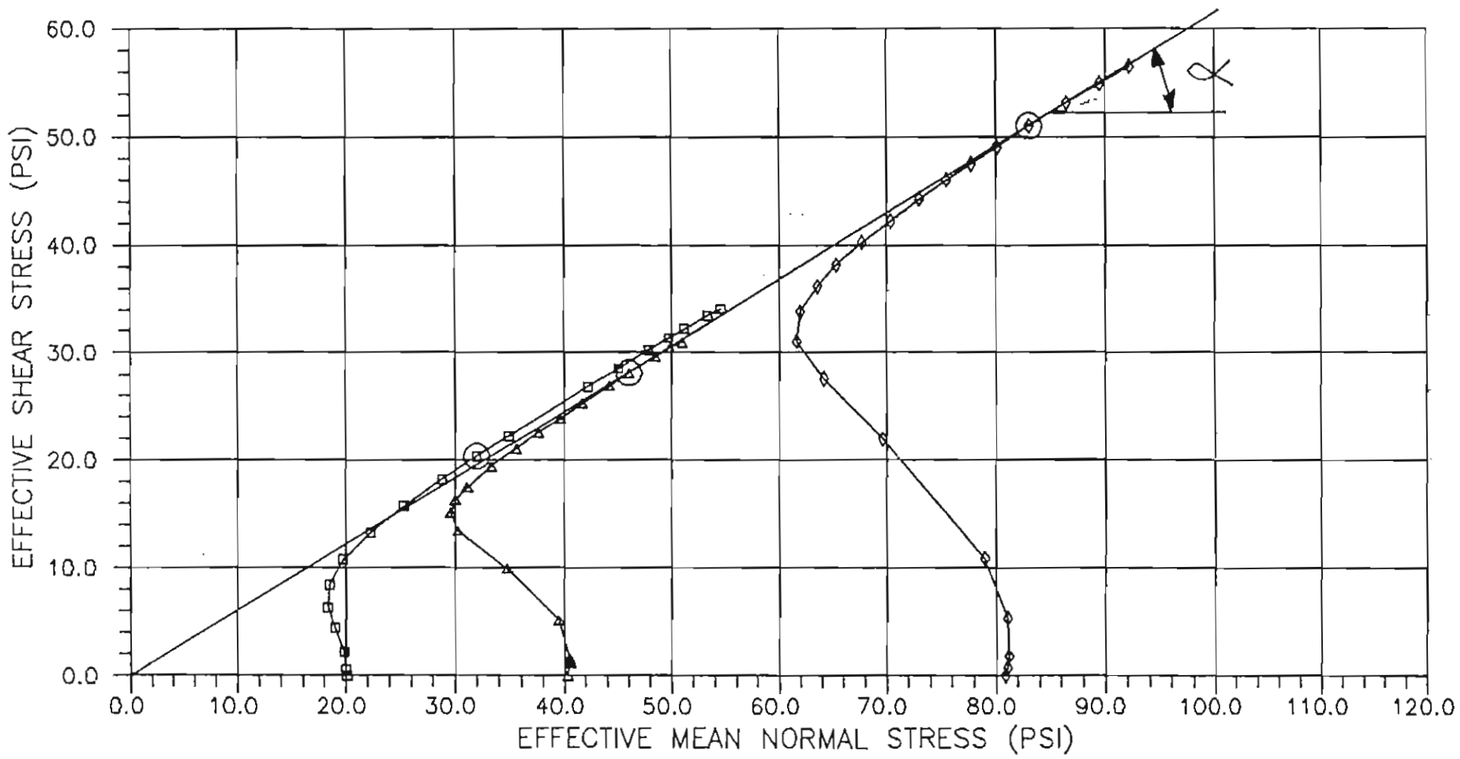
STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.04	1.59	0.60	81.89	80.30	1.02	0.39	81.09	0.79
0.09	3.64	1.50	83.04	79.40	1.05	0.42	81.22	1.82
0.18	10.77	5.20	86.47	75.70	1.14	0.50	81.08	5.38
0.35	21.81	12.80	89.91	68.10	1.32	0.61	79.01	10.91
0.88	44.02	33.30	91.62	47.60	1.92	0.78	69.61	22.01
1.43	55.19	44.30	91.79	36.60	2.51	0.83	64.19	27.59
2.09	62.11	50.30	92.71	30.60	3.03	0.83	61.66	31.06
2.79	67.53	52.70	95.73	28.20	3.39	0.80	61.97	33.77
3.47	72.26	53.40	99.76	27.50	3.63	0.76	63.63	36.13
4.13	76.33	53.70	103.53	27.20	3.81	0.73	65.37	38.17
4.83	80.46	53.40	107.96	27.50	3.93	0.68	67.73	40.23
5.47	84.41	52.70	112.61	28.20	3.99	0.64	70.40	42.20
6.22	88.50	52.10	117.30	28.80	4.07	0.61	73.05	44.25
6.87	92.03	51.40	121.53	29.50	4.12	0.58	75.51	46.01
7.45	94.97	50.60	125.27	30.30	4.13	0.55	77.78	47.48
8.13	98.06	49.80	129.16	31.10	4.15	0.52	80.13	49.03
8.92	101.99	48.80	134.09	32.10	4.18	0.49	83.09	50.99
9.88	106.21	47.50	139.61	33.40	4.18	0.46	86.50	53.10
10.76	109.84	46.30	144.44	34.60	4.17	0.43	89.52	54.92
11.62	112.98	45.20	148.68	35.70	4.16	0.41	92.19	56.49

Geotechnics

CLIENT: ALMES & ASSOC.
CLIENT PROJECT:US STEEL CONCORD
PROJECT NO. 91033
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)

BORING NO. B-20
SAMPLE NO. ST-2
DEPTH (ft.) 27.0'-29.5'

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS



$$\sin \Phi = \tan \alpha$$

α = 31.43 DEGREES

Φ = 37.66 DEGREES

$$C = \frac{a}{\cos \Phi}$$

C = 0 PSI

EFFECTIVE STRESS FAILURE ENVELOPE
TEST NO. 1
TEST NO. 2
TEST NO. 3

APPENDIX E

SLOPE SHAFT SEAL DETAILS

DRAWINGS

Loaned
to
Chris Lewis
10/18/91

U.S. Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer, AL 35023

Southern Division

March 25, 1992

Mr. Richard G. Almes
Almes & Associates, Inc.
RD #1 Box 520
Pleasant Valley Road
Trafford, PA 15085

Re: MSHA Review of "Proposed Coal Refuse Disposal Area Expansion Plan, Concord Coal Refuse Disposal Facility"

Dear Mr. Almes:

Please find attached a copy of the subject received by this office on March 20, 1992. As per my conversation with R. V. Hidalgo, please review the subject and prepare the necessary responses such that the proposed plan can be approved by MSHA. Should you have any questions, please contact the undersigned or Mr. Hidalgo. Because of the delay in MSHA's review and correspondence, prompt action is essential.

Sincerely,

C. R. Bickerton
Division Manager
Engineering & Operating Services

CRB/psc

Attachment

cc: R. V. Hidalgo

Received 3/20/92

U. S. Department of Labor

Mine Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225-0367

January 29, 1992 Report No. D7544-W3291

MEMORANDUM FOR JOSEPH J. GARCIA
District Manager, District 7
Coal Mine Safety and Health
Barbourville, Kentucky

THROUGH: JOHN L. ODELL
Chief, Mine Waste and
Construction Division
Denver Safety and Health
Technology Center

FROM: WADE E. COOPER, P.E.
Civil Engineer, Mine Waste and
Construction Division

SUBJECT: Revised Plan Review Concord Mine Coal Refuse Disposal Facility, ID No. 1211-AL07-00093-01, Concord, Jefferson County, Alabama, U.S. Steel Mining Company, Inc., Mine ID No. 01-00329

The report titled "Proposed Coal Refuse Disposal Area Expansion Plan, Concord Coal Refuse Disposal Facility" by Messrs. Randy M. Wood, CPG, and Richard G. Almes, P.E., both of Almes & Associates Inc., and dated September 1991, has been reviewed as requested in a memorandum from Mr. William H. Meadows, Subdistrict Manager, dated October 2, 1991. The reviewed report was transmitted to your office under a cover letter from Mr. Larry King, U.S. Steel Mining Co., Inc., dated September 13, 1991. The letter requested an expeditious review and interim approval of the plan's Stage 1. Unfortunately, the plan cannot be recommended for approval until the following comments have been adequately addressed:

1. Many stages of the embankment, most noticably on the diked embankment, do not contain a structural zone which requires compaction to 95 percent standard Proctor maximum dry density using 1-ft. lift thicknesses. Structural zones should be provided to assure stability of the embankment and uniformity of permeability through at least the structural zone.

2. The plan has specified field density test frequencies of one per 5,000 cubic yards and 10,000 cubic yards, respectively, for the structural zone and nonstructural zone. No frequency was provided for the "100 percent compaction zone." No specifications were presented for the frequency of standard Proctor tests. The plan should contain minimum testing frequency specifications as

provided in Procedure Instruction Letter No. I90-II-7[1], dated 12/31/90. In addition, the specifications should specify that the placement of lifts shall progress parallel with the longitudinal axis of the embankment in continuous nearly horizontal lifts with each lift extending its full length and width prior to the placement of subsequent lifts.

3. There are many disagreements between the text and the drawings concerning the maximum fine refuse elevation at the end of each stage and substage. It is apparent that a table which specifies the maximum fine refuse elevation for every stage and substage is needed in the plan. The elevations reported in the text and new table should be in agreement with the drawings. The elevations must correspond with the required water storage capacities of the impoundments. In addition, some type of gauging mechanism should be provided to allow quick determination of the surface elevation of the fines to ascertain whether sufficient storage capacity for the design storms is available.

4. The designers have calculated the 72-hour Probable Maximum Precipitation (PMP) rainfall amount by multiplying the 6-hour PMP rainfall amount by a factor of 1.47. This results in a 72-hour PMP rainfall amount of 45.7 inches. The 6-hour PMP rainfall amount was determined from HMR No. 51[2]. It is unknown how the factor of 1.47 was determined, however, HMR 51 shows on figure 22, page 52, the all-season 72-hour PMP rainfall amount for this site to be approximately 50 inches. Therefore, it appears that the PMP rainfall estimates and required storage capacities are underestimated by almost 10 percent. It is also apparent that the designers do not have sufficient storage capacity with 3 ft of freeboard for the 2 PMP design storms in all proposed stages for the existing impoundment.

5. Table 3 of the plan indicates a fine refuse disposal capacity of 13.3 years and a coarse refuse disposal capacity of 19.9 years. Where is the fine refuse to be disposed during the 6.6 years difference in capacity?

---

[1] Mine Safety & Health Administration, Procedure Instruction Letter No. I90-II-7, Impounding Structures Safety Design Procedures: Frequency of Moisture-Density Testing to Verify Compliance with Compaction Specifications, 12/31/90.

[2] National Weather Service, Probable Maximum Precipitation Estimates, U.S. East of the 103rd Meridian, Hydrometeorological Report No. 51, 1978.

6. The design should include provisions for safely handling the design storm during closure of both the existing impoundment (Stage 4) and the proposed dike embankment.

7. It must be understood that the abandonment plan submitted in the plan represents only the general provisions for abandonment as required by Title 30 CFR §77.216-2(a)(16), and that a final abandonment plan shall be submitted to and approval obtained from the District Manager prior to abandonment as required by 30 CFR §77.216-5.

8. As required by 30 CFR §77.216-2(a)(17), the plan must be certified by a registered engineer that the design is in accordance with current, prudent engineering practices for the maximum volume of water, sediment, or slurry which can be impounded therein.

9. In assessing liquefaction, the designers have used maximum fines elevations (Appendix C, page 266) which are considerably lower than the maximum fines elevations presented on the drawings and in the text of the main body of the report. Thus, the designers conclusion that there is sufficient freeboard under normal operating conditions in the unlikely event of fine liquefaction is not substantiated by their calculations.

10. The plan has not provided stability analyses for the worst case phreatic surface within the portion of the embankment shared by both fine refuse disposal ponds (i.e., Section A_1-A_2). This worst case phreatic surface appears to occur at the beginning of Stage 4, when the disposal of coarse refuse on top of the fine refuse in the existing impoundment begins. Stability analyses for this condition should be provided.

11. The drawings should illustrate the location and extent of the piezometers in the facility. In addition, a table of maximum allowable piezometer readings for each piezometer during each stage should be provided. These maximum allowable piezometer readings should correspond with the phreatic surfaces used in the stability analyses.

12. U.S. Steel Drawings 4854-1-1 and M226 were not included in Appendix E of our copy. These should be submitted for review.

The reviewed submittal includes the design of four sediment ponds which do not require, according to the Company, plan approval because they are less than 20-ft high and have a storage volume capacity less than 20 acre-ft. The District or Subdistrict Office should verify in the field that these structures will not present a downstream hazard. In the event they do present a downstream hazard, plans for their design, construction, and maintenance should be submitted to the District Manager as required by §77.216(a)(3) and §77.216(b). The design plans for these sediment

ponds were not reviewed because they apparently do not require plan approval.

If there are any questions concerning this review, please contact me at FTS 554-5434 or (303)231-5434.

cc: M. Nichols
J. Mulhern
W. Meadows
R. Bethard
~~W. Common~~
B. Owens

U.S. Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer, AL 35023

Southern Division

CRB

USM™

September 13, 1991

Mr. Joseph Garcia
District Manager, District 7
MINE SAFETY & HEALTH ADMINISTRATION
P.O. Box 572
Barbourville, KY 40906

Subject: U.S. Steel Mining Co., Inc.
Refuse Disposal Expansion Plan
Concord Refuse Disposal Facility
Hueytown, Alabama
(MSHA No. 0100329)
(ASMRC No. P-3233-01-93-P)

Dear Mr. Garcia:

Included herewith is a proposed detailed plan for expansion of the subject disposal facility. This facility is used by our Concord Preparation Plant for refuse disposal purposes.

Currently, the disposal facility is approaching capacity limits imposed by our existing permit. Therefore, we are requesting an expeditious review and interim approval of the plan's Stage 1 (the total plan includes five (5) Stages). Stage 1 will increase the capacity limits of our existing impoundment and allow us to continue operations while the complete plan is reviewed by the various state and federal agencies.

If there are any questions or you would like to meet to discuss the plan, please contact Mr. Chuck Bickerton, Division Manager - Engineering and Operating Services, at (205) 497-3612. Again, we would very much appreciate your review and approval of the interim Stage 1 at the earliest opportunity - our current disposal limits will be reached in a few short months.

Sincerely,

Larry King (LPS)

Larry King

LK/psc

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

September 12, 1991

Project No. 90-55-27

Mr. C. R. Bickerton
Manager - Engineering and Operating Services
U.S. STEEL MINING CO., INC.
1500 Concord Mine Road
Hueytown, AL 35023

Transmittal
Report
Proposed Coal Refuse Disposal Area Expansion Plan
Concord Coal Refuse Disposal Facility
U.S. Steel Mining Company, Inc.
Hueytown Alabama

Dear Mr. Bickerton:

Enclosed find five copies of the subject report. The original and two copies are for submittal to the Alabama Mine Safety and Health Administration. The remaining two copies are for U.S. Steel Mining Company, Inc. If you require any additional copies, please let us know.

We trust that the enclosed report will fulfill the submittal requirements. If you have any questions regarding this transmittal, please do not hesitate to contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood
Randy M. Wood
Project Manager

RMW:pkm
Enclosures

R.D.#1, BOX 520, PLEASANT VALLEY ROAD, TRAFFORD, PA 15085 TELEPHONE: 412/744-3610 FAX: 412/744-3631

U.S. Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer, AL 35023

Southern Division

March 25, 1992

Mr. Richard G. Almes
Almes & Associates, Inc.
RD #1 Box 520
Pleasant Valley Road
Trafford, PA 15085

Re: MSHA Review of "Proposed Coal Refuse Disposal Area Expansion Plan, Concord Coal Refuse Disposal Facility"

Dear Mr. Almes:

Please find attached a copy of the subject received by this office on March 20, 1992. As per my conversation with R. V. Hidalgo, please review the subject and prepare the necessary responses such that the proposed plan can be approved by MSHA. Should you have any questions, please contact the undersigned or Mr. Hidalgo. Because of the delay in MSHA's review and correspondence, prompt action is essential.

Sincerely,

C. R. Bickerton
Division Manager
Engineering & Operating Services

CRB/psc

Attachment

cc: R. V. Hidalgo

Received 3/20/92

U. S. Department of Labor

Mine Safety and Health Administration
P. O. Box 25367
Denver, Colorado 80225-0367

January 29, 1992 Report No. D7544-W3291

MEMORANDUM FOR JOSEPH J. GARCIA
District Manager, District 7
Coal Mine Safety and Health
Barbourville, Kentucky

THROUGH: JOHN L. ODELL
Chief, Mine Waste and
Construction Division
Denver Safety and Health
Technology Center

FROM: WADE E. COOPER, P.E.
Civil Engineer, Mine Waste and
Construction Division

SUBJECT: Revised Plan Review Concord Mine Coal Refuse Disposal Facility, ID No. 1211-AL07-00093-01, Concord, Jefferson County, Alabama, U.S. Steel Mining Company, Inc., Mine ID No. 01-00329

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2. The plan has specified field density test frequencies of one per 5,000 cubic yards and 10,000 cubic yards, respectively, for the structural zone and nonstructural zone. No frequency was provided for the "100 percent compaction zone." No specifications were presented for the frequency of standard Proctor tests. The plan should contain minimum testing frequency specifications as

provided in Procedure Instruction Letter No. I90-II-7[1], dated 12/31/90. In addition, the specifications should specify that the placement of lifts shall progress parallel with the longitudinal axis of the embankment in continuous nearly horizontal lifts with each lift extending its full length and width prior to the placement of subsequent lifts.

3. There are many disagreements between the text and the drawings concerning the maximum fine refuse elevation at the end of each stage and substage. It is apparent that a table which specifies the maximum fine refuse elevation for every stage and substage is needed in the plan. The elevations reported in the text and new table should be in agreement with the drawings. The elevations must correspond with the required water storage capacities of the impoundments. In addition, some type of gauging mechanism should be provided to allow quick determination of the surface elevation of the fines to ascertain whether sufficient storage capacity for the design storms is available.

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6. The design should include provisions for safely handling the design storm during closure of both the existing impoundment (Stage 4) and the proposed dike embankment.

7. It must be understood that the abandonment plan submitted in the plan represents only the general provisions for abandonment as required by Title 30 CFR §77.216-2(a)(16), and that a final abandonment plan shall be submitted to and approval obtained from the District Manager prior to abandonment as required by 30 CFR §77.216-5.

8. As required by 30 CFR §77.216-2(a)(17), the plan must be certified by a registered engineer that the design is in accordance with current, prudent engineering practices for the maximum volume of water, sediment, or slurry which can be impounded therein.

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11. The drawings should illustrate the location and extent of the piezometers in the facility. In addition, a table of maximum allowable piezometer readings for each piezometer during each stage should be provided. These maximum allowable piezometer readings should correspond with the phreatic surfaces used in the stability analyses.

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The reviewed submittal includes the design of four sediment ponds which do not require, according to the Company, plan approval because they are less than 20-ft high and have a storage volume capacity less than 20 acre-ft. The District or Subdistrict Office should verify in the field that these structures will not present a downstream hazard. In the event they do present a downstream hazard, plans for their design, construction, and maintenance should be submitted to the District Manager as required by §77.216(a)(3) and §77.216(b). The design plans for these sediment

ponds were not reviewed because they apparently do not require plan approval.

If there are any questions concerning this review, please contact me at FTS 554-5434 or (303)231-5434.

cc: M. Nichols
J. Mulhern
W. Meadows
R. Bethard
~~W. Gannich~~
B. Owens

U S Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer AL 35023

Southern Division

CRB

USM™

September 13, 1991

Mr. Joseph Garcia
District Manager, District 7
MINE SAFETY & HEALTH ADMINISTRATION
P.O. Box 572
Barbourville, KY 40906

Subject: U.S. Steel Mining Co., Inc.
Refuse Disposal Expansion Plan
Concord Refuse Disposal Facility
Hueytown, Alabama
(MSHA No. 0100329)
(ASMRC No. P-3233-01-93-P)

Dear Mr. Garcia:

Included herewith is a proposed detailed plan for expansion of the subject disposal facility. This facility is used by our Concord Preparation Plant for refuse disposal purposes.

Currently, the disposal facility is approaching capacity limits imposed by our existing permit. Therefore, we are requesting an expeditious review and interim approval of the plan's Stage 1 (the total plan includes five (5) Stages). Stage 1 will increase the capacity limits of our existing impoundment and allow us to continue operations while the complete plan is reviewed by the various state and federal agencies.

If there are any questions or you would like to meet to discuss the plan, please contact Mr. Chuck Bickerton, Division Manager - Engineering and Operating Services, at (205) 497-3612. Again, we would very much appreciate your review and approval of the interim Stage 1 at the earliest opportunity - our current disposal limits will be reached in a few short months.

Sincerely,

Larry King (LRB)

Larry King

LK/psc

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

September 12, 1991

Project No. 90-55-27

Mr. C. R. Bickerton
Manager - Engineering and Operating Services
U.S. STEEL MINING CO., INC.
1500 Concord Mine Road
Hueytown, AL 35023

Transmittal
Report
Proposed Coal Refuse Disposal Area Expansion Plan
Concord Coal Refuse Disposal Facility
U.S. Steel Mining Company, Inc.
Hueytown Alabama

Dear Mr. Bickerton:

Enclosed find five copies of the subject report. The original and two copies are for submittal to the Alabama Mine Safety and Health Administration. The remaining two copies are for U.S. Steel Mining Company, Inc. If you require any additional copies, please let us know.

We trust that the enclosed report will fulfill the submittal requirements. If you have any questions regarding this transmittal, please do not hesitate to contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood
Randy M. Wood
Project Manager

RMW:pkm
Enclosures

R.D.#1, BOX 520, PLEASANT VALLEY ROAD, TRAFFORD, PA 15085 TELEPHONE: 412/744-3610 FAX: 412/744-3631

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

R.D. #1, BOX 520, PLEASANT VALLEY ROAD, TRAFFORD PA 15085
TELEPHONE: 412/744-3610 FAX: 412/744-3631

June 10, 1992

Project No.: P90-55-27

Mr. C. Bickerton
Manager - Engineering and Operating Services
U.S. STEEL MINING COMPANY, INC.
1500 Concord Mine Road
Bessemer, AL 35023

MSHA Response Letter
Proposed Coal Refuse Disposal Area Expansion Plan
Concord Coal Refuse Disposal Facility
U.S. Steel Mining Company, Inc.
Hueytown, Alabama

Dear Mr. Bickerton:

This letter contains responses to review comments received from Mr. Wade Cooper of the Mine Safety and Health Administration (MSHA), Denver, Colorado (see attached MSHA letter). A response has been prepared for each of the MSHA comments referencing any revisions to the report or additional information or calculations provided in response to the comments.

1. The entire diked embankment is to be constructed as a structural zone requiring compaction to 95 percent of Standard Proctor maximum dry density using 1-foot lifts as specified in Section 2.4 of the Guideline Technical Specifications (Specifications) and noted on Drawing No. 90-55-E112. The core of the starter dike (Stage 2D) will be constructed to a density equal to or greater than 100 percent of the Standard Proctor maximum dry density. The drawings have been revised to delineate all structural zones with a cross hatch pattern.

2. As requested, Section 2.4 of the Specifications regarding coarse coal refuse placement and construction has been revised to include minimum field and laboratory testing frequencies which meet the minimum requirements of MSHA Procedure Instruction Letter No. I90-II-7. Field density testing frequencies have been included for 100 percent compaction zones and structural fill zones. In addition, Section 2.4.3 of the Specifications has been revised to require placement of coarse refuse lifts parallel to the longitudinal axis of the embankment.

3. The maximum fine refuse elevations projected at the end of each stage and substage has been reviewed and revised, as necessary, to provide the required storm storage capacities. A table has been prepared to show the maximum allowable fine refuse level relative to the stages of embankment construction and is included in the design report as Table 4. Section 7.1 of the Specifications has been revised to require the installation of a gauging staff in each of the impoundments. The gauging staffs will be marked in 1-foot increments so that the level of fines and/or impounded water can be quickly determined.

4. The 72-hour probable maximum precipitation (PMP) rainfall amount has been reviewed and the PMP has been revised to be 50 inches based on HMR 51,[1] Figure 2, Page 52. The actual PMP rainfall amount for this site appears to be slightly less than 50 inches, therefore, estimates of the probable maximum flood (PMF) storm storage requirements are conservative. The required storm storage capacity for the existing impoundment has been revised and the maximum fine refuse level in each stage of the proposed expansion has been adjusted to provide the required 2 PMP storage with a minimum 3 feet of freeboard.

5. The design capacity of the existing site given the existing conditions and physical constraints of the site is 13.4 years of fine refuse disposal capacity and 19.9 years of coarse refuse disposal capacity. Additional disposal volume for coarse refuse is available on top of the proposed Stage 5, however, designs for this capacity were not included due to a projected mine life of less than 20 years. Due to site constraints, fine refuse disposal capacity appears to be limited to the volumes and areas as indicated in this expansion plan. Additional site life may be gained as a result of improvements in the preparation plant process. However, at this time, it appears that fine refuse disposal operations beyond the projected capacity of this disposal plan will have to be located on areas outside the limits of this plan.

6. Fine refuse disposal will continue in the existing impoundment until the fines level reaches Elevation 678 during Stage 4 of the proposed plan. At this point, closure of the main impoundment will begin. Closure of the impoundment will be accomplished by backfilling the impoundment with coarse coal refuse. Backfilling of the impoundment will proceed generally from south to north in 100-foot wide increments, with each completed area sloped to drain away from the impoundment area. Sections 7.4 and 7.6 of the design report have been revised to describe the general procedure for impoundment closure. Additionally, the Specifications have been revised to include general procedures and criteria for closure of impoundments. However, since the actual configuration and elevations of the refuse disposal area may vary, the final abandonment plan would be evaluated at least two years prior to closure using actual refuse production rates and the existing site conditions and embankment configuration. A final closure plan would be prepared and submitted to MSHA for approval at that time.

7. The abandonment plan as revised and submitted in the design report and Specifications are intended to be general abandonment plans, as required by the regulations. Prior to closure of the impoundments and the facility, a final abandonment plan will be submitted to MSHA for approval. These closure/abandonment plans will be based on actual configuration and conditions of the refuse impoundments and disposal areas at the time of closure.

8. In accordance with 30 CFR §77.216-2(a)(17), the proposed expansion plan design has been certified, signed and sealed by a registered Professional Engineer.

9. Because of the limited extent and thickness of fine coal refuse under the existing impoundment embankment at the Concord facility, and the long-term consolidation that has occurred, it is our opinion that the liquefaction potential of the fines is very low and unlikely to occur. In

---

[1] National Weather Service, Probable Maximum Precipitation Estimates, U.S. East of the 103rd Meridian, Hydrometeorological Report No. 51, 1978.

any case, the proposed expansion of the existing impoundment embankment has been designed with additional height in order to maintain the embankment integrity should liquefaction of the fines occur. The calculations included with the report used to determine the excess embankment height required to maintain the integrity of the impoundment have been revised using the maximum fine elevations for each stage and a fines thickness based on drilling information. The embankment will contain the impoundment during any stage in the unlikely event of total liquefaction of the fines. With the increased embankment height, all stages of the embankment maintain the required 3 feet of freeboard, in the unlikely event of settlement equal to the total thickness of fines. The exception is during Stage 1 where the embankment height, above maximum fines level, is equal to the fines thickness. However, because the storage volume created from the embankment construction in Stage 1 outpaces the fines production and due to the localized nature of the fines, maximum settlement from liquefaction would not affect the impoundment capacity.

10. A stability analysis was performed on Section A_1-A_1 (Drawing No. 90-55-E105) at the beginning of Stage 4 as requested. The worst case phreatic surface was used, assuming maximum fine refuse disposal levels in both impoundments and a phreatic surface directly connecting them. The results of stability analysis for this section meet the MSHA stability requirements in both the static and seismic cases. The phreatic surface used in this section is very conservative because it does not take into account the effects of the underdrain that will be installed beneath the embankment, and the observed phreatic surfaces which are typically much lower in elevation.

11. As requested, all staging plans have been revised to show the location of the piezometers at the facility. In addition, a table presenting maximum allowable water elevations (Table 5) relative to each piezometer and stage has been included in the report. The maximum allowable water elevations presented in the table were based on the phreatic surfaces used in the stability analyses. In piezometers that had no direct correlation to stability cross-sections, maximum allowable water elevations were projected from the nearest stability analysis cross-section.

12. U.S. Steel Drawings 4854-1-1 and M226, which were inadvertently omitted from the design report, are included in Appendix E.

The Design Report, Specifications, and drawings have been revised to reflect the above discussed modifications, clarifications, and additional information. Copies of the revised Design Report, Specifications, drawings, and revised calculations are enclosed. These revised documents should be inserted into the three ring binders containing the original design report submitted in September 1991, in place of the original documents as appropriate. In the case of the new calculations, they should be inserted into the calculation brief according to the page numbers. A set of revised reduced size drawings has been provided for replacement of these originally submitted. A full size set of revised drawings is also enclosed.

We trust that the above responses to the MSHA review and the enclosed revised Design Report and Specifications will fulfill the submittal requirements. If you have any questions regarding the above information, please do not hesitate to contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood, C.P.G.
Project Manager

Richard G. Almes, P.E.
Principal Engineer

RMW:pkm
Enclosure

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

P.O. #1, BOX 520 PLEASANT VALLEY ROAD, TRAFFORD, PA 15085
TELEPHONE 412/744-3640 FAX 412/744-3534

June 10, 1992

Project No.: P90-55-27

Mr. C. Bickerton
Manager - Engineering and Operating Services
U.S. STEEL MINING COMPANY, INC.
1500 Concord Mine Road
Bessemer, AL 35023

MSHA Response Letter
Proposed Coal Refuse Disposal Area Expansion Plan
Concord Coal Refuse Disposal Facility
U.S. Steel Mining Company, Inc.
Hueytown, Alabama

Dear Mr. Bickerton:

This letter contains responses to review comments received from Mr. Wade Cooper of the Mine Safety and Health Administration (MSHA), Denver, Colorado (see attached MSHA letter). A response has been prepared for each of the MSHA comments referencing any revisions to the report or additional information or calculations provided in response to the comments.

1. The entire diked embankment is to be constructed as a structural zone requiring compaction to 95 percent of Standard Proctor maximum dry density using 1-foot lifts as specified in Section 2.4 of the Guideline Technical Specifications (Specifications) and noted on Drawing No. 90-55-E112. The core of the starter dike (Stage 2D) will be constructed to a density equal to or greater than 100 percent of the Standard Proctor maximum dry density. The drawings have been revised to delineate all structural zones with a cross hatch pattern.

2. As requested, Section 2.4 of the Specifications regarding coarse coal refuse placement and construction has been revised to include minimum field and laboratory testing frequencies which meet the minimum requirements of MSHA Procedure Instruction Letter No. 190-II-7. Field density testing frequencies have been included for 100 percent compaction zones and structural fill zones. In addition, Section 2.4.3 of the Specifications has been revised to require placement of coarse refuse lifts parallel to the longitudinal axis of the embankment.

3. The maximum fine refuse elevations projected at the end of each stage and substage has been reviewed and revised, as necessary, to provide the required storm storage capacities. A table has been prepared to show the maximum allowable fine refuse level relative to the stages of embankment construction and is included in the design report as Table 4. Section 7.1 of the Specifications has been revised to require the installation of a gauging staff in each of the impoundments. The gauging staffs will be marked in 1-foot increments so that the level of fines and/or impounded water can be quickly determined.

4. The 72-hour probable maximum precipitation (PMP) rainfall amount has been reviewed and the PMP has been revised to be 50 inches based on HMR 51,[1] Figure 2, Page 52. The actual PMP rainfall amount for this site appears to be slightly less than 50 inches, therefore, estimates of the probable maximum flood (PMF) storm storage requirements are conservative. The required storm storage capacity for the existing impoundment has been revised and the maximum fine refuse level in each stage of the proposed expansion has been adjusted to provide the required 2 PMP storage with a minimum 3 feet of freeboard.

5. The design capacity of the existing site given the existing conditions and physical constraints of the site is 13.4 years of fine refuse disposal capacity and 19.9 years of coarse refuse disposal capacity. Additional disposal volume for coarse refuse is available on top of the proposed Stage 5, however, designs for this capacity were not included due to a projected mine life of less than 20 years. Due to site constraints, fine refuse disposal capacity appears to be limited to the volumes and areas as indicated in this expansion plan. Additional site life may be gained as a result of improvements in the preparation plant process. However, at this time, it appears that fine refuse disposal operations beyond the projected capacity of this disposal plan will have to be located on areas outside the limits of this plan.

6. Fine refuse disposal will continue in the existing impoundment until the fines level reaches Elevation 678 during Stage 4 of the proposed plan. At this point, closure of the main impoundment will begin. Closure of the impoundment will be accomplished by backfilling the impoundment with coarse coal refuse. Backfilling of the impoundment will proceed generally from south to north in 100-foot wide increments, with each completed area sloped to drain away from the impoundment area. Sections 7.4 and 7.6 of the design report have been revised to describe the general procedure for impoundment closure. Additionally, the Specifications have been revised to include general procedures and criteria for closure of impoundments. However, since the actual configuration and elevations of the refuse disposal area may vary, the final abandonment plan would be evaluated at least two years prior to closure using actual refuse production rates and the existing site conditions and embankment configuration. A final closure plan would be prepared and submitted to MSHA for approval at that time.

7. The abandonment plan as revised and submitted in the design report and Specifications are intended to be general abandonment plans, as required by the regulations. Prior to closure of the impoundments and the facility, a final abandonment plan will be submitted to MSHA for approval. These closure/abandonment plans will be based on actual configuration and conditions of the refuse impoundments and disposal areas at the time of closure.

8. In accordance with 30 CFR §77.216-2(a)(17), the proposed expansion plan design has been certified, signed and sealed by a registered Professional Engineer.

9. Because of the limited extent and thickness of fine coal refuse under the existing impoundment embankment at the Concord facility, and the long-term consolidation that has occurred, it is our opinion that the liquefaction potential of the fines is very low and unlikely to occur. In

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[1] National Weather Service, Probable Maximum Precipitation Estimates, U.S. East of the 103rd Meridian, Hydrometeorological Report No. 51, 1978.

any case, the proposed expansion of the existing impoundment embankment has been designed with additional height in order to maintain the embankment integrity should liquefaction of the fines occur. The calculations included with the report used to determine the excess embankment height required to maintain the integrity of the impoundment have been revised using the maximum fine elevations for each stage and a fines thickness based on drilling information. The embankment will contain the impoundment during any stage in the unlikely event of total liquefaction of the fines. With the increased embankment height, all stages of the embankment maintain the required 3 feet of freeboard, in the unlikely event of settlement equal to the total thickness of fines. The exception is during Stage 1 where the embankment height, above maximum fines level, is equal to the fines thickness. However, because the storage volume created from the embankment construction in Stage 1 outpaces the fines production and due to the localized nature of the fines, maximum settlement from liquefaction would not affect the impoundment capacity.

10. A stability analysis was performed on Section A_1-A_1 (Drawing No. 90-55-E105) at the beginning of Stage 4 as requested. The worst case phreatic surface was used, assuming maximum fine refuse disposal levels in both impoundments and a phreatic surface directly connecting them. The results of stability analysis for this section meet the MSHA stability requirements in both the static and seismic cases. The phreatic surface used in this section is very conservative because it does not take into account the effects of the underdrain that will be installed beneath the embankment, and the observed phreatic surfaces which are typically much lower in elevation.

11. As requested, all staging plans have been revised to show the location of the piezometers at the facility. In addition, a table presenting maximum allowable water elevations (Table 5) relative to each piezometer and stage has been included in the report. The maximum allowable water elevations presented in the table were based on the phreatic surfaces used in the stability analyses. In piezometers that had no direct correlation to stability cross-sections, maximum allowable water elevations were projected from the nearest stability analysis cross-section.

12. U.S. Steel Drawings 4854-1-1 and M226, which were inadvertently omitted from the design report, are included in Appendix E.

The Design Report, Specifications, and drawings have been revised to reflect the above discussed modifications, clarifications, and additional information. Copies of the revised Design Report, Specifications, drawings, and revised calculations are enclosed. These revised documents should be inserted into the three ring binders containing the original design report submitted in September 1991, in place of the original documents as appropriate. In the case of the new calculations, they should be inserted into the calculation brief according to the page numbers. A set of revised reduced size drawings has been provided for replacement of these originally submitted. A full size set of revised drawings is also enclosed.

We trust that the above responses to the MSHA review and the enclosed revised Design Report and Specifications will fulfill the submittal requirements. If you have any questions regarding the above information, please do not hesitate to contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood, C.P.G.
Project Manager

Richard G. Almes, P.E.
Principal Engineer

RMW:pkm
Enclosure

MSHA APPROVAL
RECOMMENDATION LETTER

U.S. Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer, AL 35023

Southern Division

USM™

September 18, 1992

Mr. Randy Wood
Almes & Associates, Inc.
RD #1 Box 520
Pleasant Valley Road
Trafford, PA 15085

Re: Proposed Coal Refuse Disposal Area Expansion Plan
Concord Prep Plant, U.S. Steel Mining Co., Inc.
MSHA Approval Recommendation Letter

Dear Randy:

Attached is a copy of the subject. Please review to develop your thoughts on the impacts of the recommendations so we can discuss. Call when you are prepared.

Sincerely,

C. R. Bickerton
Manager, Engineering & Operating Services

CRB/psc

Attachment

U.S. Department of Labor

Mine Safety and Health Administration
135 Gemini Circle, Suite 213
Birmingham, Alabama 35209-5842

September 15, 1992

Mr. C. R. Bickerton
Chief Engineer
U. S. Steel Mining Company, Inc.
Concord Mine, ID. No. 01-00329
P. O. Box 2200
Bessemer, AL 35021-2200

Dear Mr. Bickerton:

Attached please find the approval recommendation for your plan for Coal Refuse Facility 1211-AL07-00093-01. The review which was conducted by Wade Cooper of the Denver Safety and Health Technology Center is provided for your information and action. Please advise Ron Bethard, Mining Engineer, of this office of actions concerning the revisions required by the attached approval recommendation letter.

Very truly yours,

William H. Meadows
Subdistrict Manager
Birmingham, Alabama Subdistrict

cc:
W.C Cannon
J. Early
File

IMPLTR.USX01RA

U. S. Department of Labor

Mine Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225–0367

September 11, 1992 Report No. D7738-W3409

MEMORANDUM FOR JOSEPH J. GARCIA
District Manager, District 7
Coal Mine Safety and Health
Barbourville, Kentucky

THROUGH: JOHN L. ODELL
Chief, Mine Waste and
Construction Division
Denver Safety and Health
Technology Center

FROM: WADE E. COOPER, P.E.
Civil Engineer, Mine Waste
and Construction Division

SUBJECT: Revised Plan Review Concord Mine Coal Refuse Disposal Facility, ID No. 1211-AL07-00093-01, Concord, Jefferson County, Alabama, U.S. Steel Mining Co., Inc., Concord Mine, Mine ID No. 01-00329

As requested in a memorandum dated June 17, 1992, from Mr. Ronald C. Bethard, Mining Engineer, Birmingham, AL, Subdistrict Office; through Mr. William H. Meadows, Subdistrict Manager; and your office; a review of the subject revised plan has been completed. The revised plan is in response to comments raised in Report No. D7544-W3291 dated January 29, 1992. The reviewed information consisted of a revised complete set of drawings, and revised pages for insertion and replacement in the original design plan submitted September 13, 1991. Also included was a four page letter dated June 10, 1992, from Almes & Associates, Inc., to Mr. C. Bickerton, U.S. Steel Mining Co., Inc., addressing the comments of our report. The revised plan is recommended for approval provided the Company and its designers agree to and make the plan revisions noted in the comments below.

Should you have any questions concerning this review, please contact me at (303)231-5434.

COMMENTS

The following comments reference the same comment numbers used in Report No. D7544-W3291.

1. Accepted.

2. Accepted with the following revision:

In Appendix A, on pages A-9 and A-10, the following statement is provided, "In cases where a record of consistent test results is established, or in cases involving low-hazard dams, less frequent testing may be acceptable if justification is provided." The reviewer believes these statements should be deleted from the plan because they allow the operator or designer to change the frequency of quality control testing based on only their judgement. The operator should not be allowed to change the frequency of quality control testing without the District Manager's approval. Their approval may be obtained by submitting the record of consistent test results and a modification request to the District Manager. The modification request should specifically request approval of a specified change in the control testing frequency for the subject dam.

3. Accepted with the following revisions:

Section 7.2.4 of the main section indicates the maximum fine refuse surface elevation for the proposed embankment at the end of Stage 2D will be 589 feet. This is in disagreement with the elevation of 591 feet reported in table 4 and on the drawings. Although both elevations will provide adequate storage, they should be consistent (i.e., 591 feet) to avoid confusion.

Stage 5B, which concerns raising of the pile from elevation 690 to 730 feet, should contain some stipulation that the surface of the pile will be sloped during construction at some minimum grade, such as 2 percent, to allow surface water to drain away from the pile. This drainage provision is currently required only when reaching the final elevation of 730 feet (see section 7.5.2).

4. Accepted.

5. Accepted.

6. Accepted with the following revision:

Page 2 of the Almes letter indicates that the final abandonment plan will be prepared and submitted to MSHA at least two years prior to closure. Meanwhile, the plan in section 7.6 indicates that the abandonment plan will be evaluated at least five years prior to abandonment. These should be consistent, and the plans for abandonment should be sent to the MSHA District Manager for approval preferably at least two years prior to <u>beginning</u> the abandonment plan construction.

7. Accepted.

8. Accepted.

9. Accepted.

10. Accepted.

11. Accepted.

12. Accepted.

Section 2.6.2 of Appendix A allows the rock cobble drain to contain rock cobbles and boulders larger than 6 inches provided smaller stones are placed adjacent to the filter cloth. The reviewer believes a maximum particle size of approximately 12 inches or less should be stipulated to prevent tearing of the filter cloth during rock placement and assist in preventing piping in the event a hole in the filter cloth occurs. These specifications should also clarify that the rock cobbles and boulders used in the drains will be placed with no dropping (zero drop height). The filter cloth should also be protected from ultra-violet radiation prior to placement in the drains.

The table of contents for Appendix A needs to be revised to reflect the correct page numbers.

cc: M. Nichols
J. Mulhern
W. Cannon
B. Owens
W. Meadows
R. Bethard

U.S. Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer, AL 35023

Southern Division

USM™

September 18, 1992

Mr. Randy Wood
Almes & Associates, Inc.
RD #1 Box 520
Pleasant Valley Road
Trafford, PA 15085

Re: Proposed Coal Refuse Disposal Area Expansion Plan
Concord Prep Plant, U.S. Steel Mining Co., Inc.
MSHA Approval Recommendation Letter

Dear Randy:

Attached is a copy of the subject. Please review to develop your thoughts on the impacts of the recommendations so we can discuss. Call when you are prepared.

Sincerely,

C. R. Bickerton
Manager, Engineering & Operating Services

CRB/psc

Attachment

U.S. Department of Labor

Mine Safety and Health Administration
135 Gemini Circle, Suite 213
Birmingham, Alabama 35209-5842

September 15, 1992

Mr. C. R. Bickerton
Chief Engineer
U. S. Steel Mining Company, Inc.
Concord Mine, ID. No. 01-00329
P. O. Box 2200
Bessemer, AL 35021-2200

Dear Mr. Bickerton:

Attached please find the approval recommendation for your plan for Coal Refuse Facility 1211-AL07-00093-01. The review which was conducted by Wade Cooper of the Denver Safety and Health Technology Center is provided for your information and action. Please advise Ron Bethard, Mining Engineer, of this office of actions concerning the revisions required by the attached approval recommendation letter.

Very truly yours,

William H. Meadows
Subdistrict Manager
Birmingham, Alabama Subdistrict

cc:
W.C Cannon
J. Early
File

IMPLTR.USX01RA

U. S. Department of Labor

Mine Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225-0367

September 11, 1992 Report No. D7738-W3409

MEMORANDUM FOR JOSEPH J. GARCIA
District Manager, District 7
Coal Mine Safety and Health
Barbourville, Kentucky

THROUGH: JOHN L. ODELL
Chief, Mine Waste and
Construction Division
Denver Safety and Health
Technology Center

FROM: WADE E. COOPER, P.E.
Civil Engineer, Mine Waste
and Construction Division

SUBJECT: Revised Plan Review Concord Mine Coal Refuse Disposal Facility, ID No. 1211-AL07-00093-01, Concord, Jefferson County, Alabama, U.S. Steel Mining Co., Inc., Concord Mine, Mine ID No. 01-00329

As requested in a memorandum dated June 17, 1992, from Mr. Ronald C. Bethard, Mining Engineer, Birmingham, AL, Subdistrict Office; through Mr. William H. Meadows, Subdistrict Manager; and your office; a review of the subject revised plan has been completed. The revised plan is in response to comments raised in Report No. D7544-W3291 dated January 29, 1992. The reviewed information consisted of a revised complete set of drawings, and revised pages for insertion and replacement in the original design plan submitted September 13, 1991. Also included was a four page letter dated June 10, 1992, from Almes & Associates, Inc., to Mr. C. Bickerton, U.S. Steel Mining Co., Inc., addressing the comments of our report. The revised plan is recommended for approval provided the Company and its designers agree to and make the plan revisions noted in the comments below.

Should you have any questions concerning this review, please contact me at (303)231-5434.

COMMENTS

The following comments reference the same comment numbers used in Report No. D7544-W3291.

1. Accepted.

2. Accepted with the following revision:

In Appendix A, on pages A-9 and A-10, the following statement is provided, "In cases where a record of consistent test results is established, or in cases involving low-hazard dams, less frequent testing may be acceptable if justification is provided." The reviewer believes these statements should be deleted from the plan because they allow the operator or designer to change the frequency of quality control testing based on only their judgement. The operator should not be allowed to change the frequency of quality control testing without the District Manager's approval. Their approval may be obtained by submitting the record of consistent test results and a modification request to the District Manager. The modification request should specifically request approval of a specified change in the control testing frequency for the subject dam.

3. Accepted with the following revisions:

Section 7.2.4 of the main section indicates the maximum fine refuse surface elevation for the proposed embankment at the end of Stage 2D will be 589 feet. This is in disagreement with the elevation of 591 feet reported in table 4 and on the drawings. Although both elevations will provide adequate storage, they should be consistent (i.e., 591 feet) to avoid confusion.

Stage 5B, which concerns raising of the pile from elevation 690 to 730 feet, should contain some stipulation that the surface of the pile will be sloped during construction at some minimum grade, such as 2 percent, to allow surface water to drain away from the pile. This drainage provision is currently required only when reaching the final elevation of 730 feet (see section 7.5.2).

4. Accepted.

5. Accepted.

6. Accepted with the following revision:

Page 2 of the Almes letter indicates that the final abandonment plan will be prepared and submitted to MSHA at least two years prior to closure. Meanwhile, the plan in section 7.6 indicates that the abandonment plan will be evaluated at least five years prior to abandonment. These should be consistent, and the plans for abandonment should be sent to the MSHA District Manager for approval preferably at least two years prior to <u>beginning</u> the abandonment plan construction.

7. Accepted.

8. Accepted.

9. Accepted.

10. Accepted.

11. Accepted.

12. Accepted.

Section 2.6.2 of Appendix A allows the rock cobble drain to contain rock cobbles and boulders larger than 6 inches provided smaller stones are placed adjacent to the filter cloth. The reviewer believes a maximum particle size of approximately 12 inches or less should be stipulated to prevent tearing of the filter cloth during rock placement and assist in preventing piping in the event a hole in the filter cloth occurs. These specifications should also clarify that the rock cobbles and boulders used in the drains will be placed with no dropping (zero drop height). The filter cloth should also be protected from ultra-violet radiation prior to placement in the drains.

The table of contents for Appendix A needs to be revised to reflect the correct page numbers.

cc: M. Nichols
J. Mulhern
W. Cannon
B. Owens
W. Meadows
R. Bethard

RESPONSE TO MS DAN
APPR. RECOM. LETTER

U.S. Steel Mining Co., Inc.
1500 Concord Mine Road
Bessemer, AL 35023

Southern Division

October 12, 1992

Mr. Joseph Garcia
District Manager, District 7
MINE SAFETY & HEALTH ADMINISTRATION
P.O. Box 572
Barbourville, KY 40906

Subject: U.S. Steel Mining Co., Inc.
Refuse Disposal Expansion Plan
Concord Refuse Disposal Facility
Hueytown, Alabama
(MSHA No. 01-00329)
(ASMRC No. P-3233-01-93-P)

Dear Mr. Garcia:

Attached please find the revisions required by the approval recommendation letter from Wade E. Cooper dated September 11, 1992. U.S. Steel Mining Co., Inc. and the facility designer - Almes and Associates, Inc. - have fully complied with the recommended revisions.

Sincerely

C. R. Bickerton
Manager of Engineering &
Operating Services

CRB/psc

Attachment

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

R.D. #1, BOX 520, PLEASANT VALLEY ROAD, TRAFFORD, PA 15085
TELEPHONE: 412/744-3610 FAX: 412/744-3631

October 8, 1992

Project No.: P90-55-27

Mr. C. R. Bickerton
Manager - Engineering and Operating Services
U.S. STEEL MINING COMPANY, INC.
1500 Concord Mine Road
Bessemer, AL 35023

Report Revisions
Expansion of Slurry Impoundment
and Refuse Disposal Area
USM Specification No. 481-7241
Concord Refuse Disposal Area
U.S. Steel Mining Company, Inc.
Hueytown, Alabama

Dear Mr. Bickerton:

As requested by your letter of September 18, 1992, Almes & Associates, Inc., Consulting Engineers (ALMES) has reviewed the Mine Safety and Health Administration (MSHA) approval recommendation letter dated September 11, 1992 (attached). In response to the comments and recommendations contained in the subject MSHA letter, the following revisions to the proposed expansion plan for the Concord Coal Refuse Disposal Area are submitted.

1. As requested by Item 2 of the MSHA letter, Section 2.4.4 of the Guideline Technical Specifications (page A-9) has been revised to delete the sentence related to "less frequent" compaction testing requirements. Should U.S. Steel Mining Company, Inc. (USM) find a lesser compaction testing frequency appropriate for the subject project, a request for a modification to the compaction testing frequency will be submitted to the District Manager of MSHA for approval.

2. Section 7.2.4 of the design report (page 16) has been revised to show a maximum fine refuse elevation of 591 feet for Stage 2D of the proposed embankment.

   As requested, Section 7.5.2 of the design report (page 19) has been revised to include a statement that during the construction of Stage 5B the top surface of the disposal area will be sloped to promote drainage away from the disposal area.

3. As discussed in Section 7.6 of the design report (page 19), the final abandonment plan will be based on an evaluation of the refuse disposal area operations, five years prior to abandonment, using current refuse production rates and the existing site conditions and embankment

configuration. The final abandonment plan will be developed and submitted to the MSHA District Manager for approval, approximately two years prior to beginning the abandonment plan construction. The referenced section of the report has been revised to include a statement to this affect.

4. Section 2.6.2 of Appendix A (page A-12), Guideline Technical Specifications, has been revised to limit the sandstone rock used in the construction of the underdrain to a maximum particle size of 12 inches.

   In addition, Section 2.6.4 has been revised to include the requirement that the rock cobbles be placed on the filter fabric with no dropping (zero drop height) to prevent damage to the filter cloth.

   A requirement that the filter cloth material be protected from ultra-violet radiation prior to installation in the underdrains has been included in Section 2.6.3 as requested.

5. The table of contents for Appendix A has been revised to reflect the page number changes.

Copies of the revised pages, as described above are enclosed with this letter. The revised pages should be inserted into the three ring binders containing the original design report submitted in September 1991 (revised June 1992) in place of the original or previously revised page as appropriate.

We trust that the above responses to the MSHA review comments and the enclosed revised pages for the Design Report and Specifications will fulfill the submittal requirements. If you have any questions regarding the above comments or revisions, please do not hesitate to contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

RMWood

Randy M. Wood, C.P.G.
Project Manager

RMW:jg
Enclosures

REPORT REVISIONS

REPORT
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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7.2.4 Stage 2D

Construction of the new fine refuse impoundment begins with the construction of a starter embankment during Stage 2D. During this stage, a dike is constructed to elevation 600 to form a new fine refuse impoundment area. The dike includes a highly compacted (100 percent Standard Proctor density) core and key trench. The new impoundment is capable of providing fine refuse disposal capacity to elevation 591 with one PMF of storm storage capacity plus 3 feet of freeboard. Storm dewatering capacity will be provided by a dedicated pump dewatering system. The pump dewatering system will have the capacity to evacuate the PMF from the impoundment in 10 days. Plans and cross-sections for the dike embankment are presented in Drawing Nos. 90-55-E103, 90-55-E107, 90-55-E111, and 90-55-E112. The pump dewatering system specifications are included in Appendix A, Guideline Technical Specifications.

7.3 STAGE 3

Stage 3 includes four substages of construction: Stage 3A raises the existing impoundment embankment to the final elevation of 690; Stage 3B continues the build up of the northern buttress area; Stage 3C continues with the construction of the dike impoundment embankment; and Stage 3D raises the southern end of the disposal area to elevation 660.

7.3.1 Stage 3A

Construction under Stage 3A will raise the main impoundment embankment to the final elevation of 690. At this elevation the impoundment provides an additional 2.7 years of fine refuse disposal capacity with a maximum fine refuse elevation of 678. At this stage the impoundment provides 2 PMF storm storage capacity and 3 feet of freeboard. A pump system to evacuate one PMF in 30 days will be maintained for the life of this impoundment.

7.3.2 Stage 3B

During Stage 3B, the northern area of the embankment will be raised to elevation 710 adjacent to the impoundment and elevation 690 in the northern part of this area, as shown on Drawing No. 90-55-E104.

7.5 STAGE 5

Stage 5, the final stage of the proposed expansion plan, contains two construction substages. These two substages, Stage 5A and Stage 5B, are located in the east and main area of the pile. During Stage 5 fine refuse disposal continues in the diked impoundment area.

7.5.1 Stage 5A

Coarse refuse disposal in the east portion of the disposal area to elevation 690, provides approximately four years of capacity. At the completion of this stage the main refuse disposal area should be at an average elevation of 690.

7.5.2 Stage 5B

Coarse refuse disposal will continue in the coarse refuse area for the remainder of the proposed expansion plan. During disposal operations, the disposal area will be sloped approximately 2 percent to promote drainage off the pile. Coarse refuse disposal capacity at elevation 730 provides approximately 20 years of site life. Additional capacity beyond 20 years is available by increasing the embankment elevation. Upon reaching the final elevation of the coarse refuse disposal area, the pile should be sloped to drain towards the perimeter of the area.

7.6 ABANDONMENT

Due to the potential for additional coarse refuse disposal capacity, the final abandonment plan should be evaluated at least five years prior to abandonment using actual refuse production rates and the existing site conditions and embankment configuration. Based on this evaluation, a final abandonment plan will be developed and submitted to the MSHA District Manager for approval approximately two years prior to beginning the abandonment plan construction. The pertinent construction items in the abandonment plan include:

- Fine Coal Refuse Cover - Coarse coal refuse will be placed in the impoundment to provide at least a 3-foot cover above the settled fine coal refuse.

- Impoundment Elimination - To eliminate the impounding capacity of the diked impoundment, an abandonment channel will be excavated through the embankment crest. The channel should be sized to convey the peak runoff from a 100-year, 24-hour recurrence interval storm event.

- Revegetation - All final surfaces will be vegetated by planting with appropriate vegetation in accordance with the revegetation plan specified in the surface mine permit.

The general criteria and sequence of closing and abandoning the impoundments is included in Section 2.5 of the Guideline Technical Specifications.

8.0 ENGINEERING ANALYSES

The disposal plan described herein was developed in accordance with prudent engineering principles and our understanding of current MSHA and Alabama Surface Mine Commission design criteria. In support of the plan, engineering analyses included slope stability of the embankment staging and the hydrologic and hydraulic studies for the impoundment and surface drainage structures. In addition, evaluations of potential affects on the structures from liquefaction of settled fine coal refuse and mine subsidence were performed. The calculations describing the design assumptions, methodology and results are included in Appendix C.

8.1 HYDROLOGIC AND HYDRAULIC ANALYSES

The existing fine refuse disposal impoundment will be raised in increments during Stages 1, 2, and 3 to provide needed disposal capacity and additional site life. Each stage is designed to be operated at a maximum fines level with sufficient capacity to store 2 PMF of storm events plus 3 feet of freeboard. Storm storage evacuation capability for 1 PMF (within 30 days) will be provided by a dedicated portable pump system.

The proposed new fine refuse impoundment is designed to store the runoff associated with the PMF storm event (extended to 72 hours) and a dedicated pump system is provided to evacuate at least 90 percent of the PMF in 10 days or less. The pump system will have a minimum pumping capacity of 2,400 gallons per minute. Specifications for the pump system are included in Appendix A - Guideline Technical Specifications.

The hydrologic characteristics of the impoundment's watershed areas are summarized below:

Existing Impoundment

Stage	Drainage Area Acres	Runoff Curve No.*	Six-Hour All Season PMP Inches	Total PMF Runoff in Million Cubic Feet
1	34.7	--	31	11.5
2	37.7	--	31	12.5
3	39.9	--	31	13.3

Proposed Impoundment

Stage	Drainage Area Acres	Runoff Curve No.*	Six-Hour All Season PMP Inches	Total PMF Runoff in Million Cubic Feet
2	21.8	--	31	3.61
3	24.8	--	31	4.11
4	35.0	--	31	4.62

*Since nearly all of the drainage area of each impoundment is the impoundment itself, it was assumed that all rainfall in the area would be runoff.

The surface drainage facilities, including bench gutters, haul road ditches and perimeter ditches, have been sized to convey the 100-year, 24-hour recurrence interval storm event. The computed peak discharges were based on procedures outlined by the U. S. Soil Conservation Service. All permanent facilities have been provided with appropriate protection to minimize the potential for channel erosion.

8.2 SLOPE STABILITY ANALYSES

Slope stability analyses were performed for several embankment configurations using PCSTABL5, a computerized version of the modified Bishop Method of Slices developed by Purdue University and the Indiana State Highway Commission. The critical potential failure surfaces, minimum factors of safety and material properties used in the analyses are presented on Drawing Nos. 90-55-E109 and 90-55-E110.

Slope stability was analyzed for both static and seismic (pseudo-static) loading conditions. For the seismic analyses, a horizontal acceleration of 0.1g was used. Since no upstream coarse coal refuse

APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2,000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed. Additional field density tests should be conducted any time there is a suspicion of the effectiveness of compaction. A supplementary Standard Proctor laboratory compaction test (ASTM D698) shall be performed for every 20 field density tests (approximately every 40,000 cubic yards).

Field tests shall be performed at random locations in the fill. Records of the test results, as well as the test locations, shall be kept at the mine.

Any time there is reason to suspect that the characteristics of the construction material have changed, reasons such as a change in preparation plant processing or unusual compaction test results, the material shall be further investigated. Grain-size compaction, shear-strength, and other tests shall be performed as warranted.

- Structural Zone - The coarse coal refuse material within the structural zone of the impounding embankments shall be compacted to a density greater than or equal to 95 percent of the maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction zone and structural zone. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2,000 cubic

2.6.2 Rock Cobbles - Competent durable sandstone rock of 3 to 6 inches in diameter with a maximum size of 12 inches shall be used. Limestone or other calcareous rock materials are not acceptable. Larger rock cobbles and boulders are acceptable provided smaller stones (3 to 6 inches) are placed adjacent to the filter cloth.

2.6.3 Filter Cloth - The filter cloth shall be "Supac 3.5NP", manufactured by Phillips Petroleum Company, or an approved equivalent. The filter cloth material must be protected from ultra-voilet radiation prior to installation.

2.6.4 Installation - Details of the rock underdrains are shown on Drawing No. 90-55-E114. The rock cobble drain is wrapped entirely in filter cloth with a minimum 2-foot overlap and totally enclosed in soil or coarse coal refuse, as shown on the detail. At the discharge point for the finger drains, a 6-inch plastic pipe shall be incorporated to make the transition to the perimeter surface ditch, as shown in the detail on Drawing No. 90-55-E115. The drains shall be constructed to the dimensions shown on Drawing No. 90-55-E115. To protect the filter cloth, smaller sandstone cobbles shall be placed between the cloth and the larger boulders. The rock cobbles should be placed on the filter fabric with no dropping (zero drop height) to prevent damage to the filter fabric. The rock drains shall be immediately covered with a minimum of 4 feet of loose coarse coal refuse after construction. This coarse refuse cover shall protect the filter fabric from UV light exposure and heavy equipment traffic. All underdrains shall be constructed with a minimum 2 percent slope.

2.7 PIEZOMETERS

Piezometers installed at the locations shown on the plans and in detail on Drawing No. 90-55-E114 must be maintained and monitored on a routine schedule. Details of the piezometer installations are shown on the boring logs in Appendix B. The piezometers shall be extended as required. Details for the piezometer extension procedure are shown on Drawing No. 90-55-E114.

2.8 HAUL ROAD CONSTRUCTION

During the embankment construction, existing haul roads shall be maintained, extended or relocated as shown on the drawings. The haul road shall have a maximum gradient of 10 percent. A minimum thickness of 3 feet below the haul road surfaces shall be a well-compacted material. The top 1 foot (minimum) shall consist of well-graded gravel or cobbles in order to provide a compacted surface which will not deteriorate during wet periods. The operator has the option of placing a stabilizing geotextile beneath the road base coarse material. The haul roads shall have proper drainage structures. Details of the haul road ditches are included on Drawing No. 90-55-E113.

3.0 IMPOUNDMENT DEWATERING SYSTEMS

3.1 GENERAL

During the initial stages of the proposed refuse disposal area expansion plan, the existing slurry impoundment shall be enlarged for fine refuse storage. The impoundment enlargement has been designed to provide two PMF of storm storage plus 3 feet of freeboard in addition to the fine refuse storage capacity. A dedicated portable pump system shall be used to evacuate storm storage should it become necessary. A proposed new slurry impoundment shall be constructed simultaneously with the expansion and abandonment of the existing impoundment. The new impoundment shall provide at least one PMF of storm storage plus 3 feet of freeboard above the maximum fine refuse level. A dedicated portable pump system shall serve to evacuate storm storage from this impoundment as well.

3.2 PUMP DEWATERING SYSTEM

A pump dewatering system shall be supplied for evacuation of storm storage from both slurry impoundments. A dedicated portable pump system with a minimum capacity of 2,400 gallons per minute shall be provided. The pump system must be powered by an internal combustion engine or a gas/diesel powered generator which is dedicated to the pump system. Fuel for the pump power system must be stored with the system in accordance with applicable local, state and federal regulations.

Upon initial installation of the pump dewatering system, the pump shall be operated for a sufficient length of time to insure proper operation of the system. The pump system shall be operated weekly and prior to a forecasted large storm event to insure proper operation. Records of initial pump operation test and weekly operation checks recording the time, date, duration and quantity/rate of pumpage shall be maintained.

This pump system shall be portable and capable of being relocated as necessary to accommodate refuse disposal operations through the life of the facility.

In the event of a major storm when both impoundments are active and storm evacuation is required, the pump system shall first be installed in the new impoundment. Once the new impoundment is pumped to it's required level, the pump shall immediately be installed in the existing impoundment. This arrangement should allow both impoundments to be dewatered within the required time frames.

4.0 SEDIMENT POND CONSTRUCTION

4.1 GENERAL

Four sediment ponds are required to meet erosion and sediment control requirements. The location of the four sediment ponds and associated collection ditch system are shown on Drawing No. 90-55-E116. The sediment pond embankments shall be constructed using compacted coarse refuse. The refuse shall be placed in accordance with refuse placement and compaction specifications contained in Section 2.4 for structural zones. Prior to sediment pond construction the pond and embankment areas shall be cleared and grubbed. The pond embankment shall be keyed a minimum of 2 feet into bedrock or 5 feet into non-bedrock foundation materials. The cutoff trench shall be a minimum of 8 feet wide with no flatter than 1H:1V (horizontal to vertical) side slopes. Each pond shall be equipped with a spillpipe principal spillway, sized to meet the settleable solids criteria. The spillpipe discharge point shall be protected with riprap. Each pond shall be constructed with an emergency spillway.

As shown on Drawing No. 90-55-E116, an emergency spillway shall be constructed for each of the sediment pond embankments to route the design storm runoff through the pond. Spillway sections and typical construction details are presented on Drawing No. 90-55-E117. The emergency spillway shall have side slopes of 2.5H:1V or flatter, depending on the

actual bedrock conditions. Where soil is encountered, the spillway side slope shall be 2H:1V and lined with erosion protection, as discussed in Section 4.2.

4.2 EROSION PROTECTION

Some areas of the sediment pond embankment may become susceptible to erosion damage because of the spillway construction, thus requiring erosion protection. The upstream portion of the embankment adjacent the spillway entrance shall be protected with a 3-foot thick layer of 12- to 24-inch diameter riprap. If adequate quality, the rock obtained from the spillway excavation may be used for this purpose.

In areas where any portion of the spillway channel is in natural soil, it shall be protected with a minimum 3-foot thick layer of 1-foot to 2-foot diameter hard, durable rock boulders. The soil shall be covered with a layer of Supac 3.5NP filter cloth (or approved equivalent) prior to placing the boulders. Large voids between the boulders shall be choked with smaller stones; however, sufficient void space for proper grout penetration shall be maintained. The boulders shall be grouted in accordance with Section 5.5.5 of these Specifications.

5.0 EMBANKMENT SURFACE DRAINAGE FACILITIES

5.1 GENERAL

During construction of the embankment, benches, bench gutters and perimeter ditches shall be constructed to control surface runoff and minimize erosion. The location of these facilities are shown on the stage drawings with details presented on Drawing No. 90-55-E113. All permanent ditches shall be lined with the erosion protection specified in the table on Drawing No. 90-55-E113 and discussed in these Specifications.

5.2 BENCHES AND BENCH GUTTERS

Benches shall slope at about 3 percent toward the bench gutter at their upstream edge and at about 1 percent toward the perimeter ditch or dropover ditch where the runoff will discharge. The direction of slope on the benches is shown on the drawings. All final gutters shall be lined with compacted soil and seeded to reduce erosion. At the abutments, the benches shall grade smoothly into the perimeter ditches to avoid abrupt changes in ditch alignment and slope.

LETTER FROM
MINE SAFETY AND HEALTH ADMINISTRATION

U. S. Department of Labor

Mine Safety and Health Administration
P O. Box 25367
Denver, Colorado 80225–0367

September 11, 1992 Report No. D7738-W3409

MEMORANDUM FOR JOSEPH J. GARCIA
District Manager, District 7
Coal Mine Safety and Health
Barbourville, Kentucky

THROUGH: JOHN L. ODELL JLO
Chief, Mine Waste and
Construction Division
Denver Safety and Health
Technology Center

FROM: WADE E. COOPER, P.E. Wade E. Cooper
Civil Engineer, Mine Waste
and Construction Division

SUBJECT: Revised Plan Review Concord Mine Coal Refuse Disposal Facility, ID No. 1211-AL07-00093-01, Concord, Jefferson County, Alabama, U.S. Steel Mining Co., Inc., Concord Mine, Mine ID No. 01-00329

As requested in a memorandum dated June 17, 1992, from Mr. Ronald C. Bethard, Mining Engineer, Birmingham, AL, Subdistrict Office; through Mr. William H. Meadows, Subdistrict Manager; and your office; a review of the subject revised plan has been completed. The revised plan is in response to comments raised in Report No. D7544-W3291 dated January 29, 1992. The reviewed information consisted of a revised complete set of drawings, and revised pages for insertion and replacement in the original design plan submitted September 13, 1991. Also included was a four page letter dated June 10, 1992, from Almes & Associates, Inc., to Mr. C. Bickerton, U.S. Steel Mining Co., Inc., addressing the comments of our report. The revised plan is recommended for approval provided the Company and its designers agree to and make the plan revisions noted in the comments below.

Should you have any questions concerning this review, please contact me at (303)231-5434.

COMMENTS

The following comments reference the same comment numbers used in Report No. D7544-W3291.

1. Accepted.

2. Accepted with the following revision:

In Appendix A, on pages A-9 and A-10, the following statement is provided, "In cases where a record of consistent test results is established, or in cases involving low-hazard dams, less frequent testing may be acceptable if justification is provided." The reviewer believes these statements should be deleted from the plan because they allow the operator or designer to change the frequency of quality control testing based on only their judgement. The operator should not be allowed to change the frequency of quality control testing without the District Manager's approval. Their approval may be obtained by submitting the record of consistent test results and a modification request to the District Manager. The modification request should specifically request approval of a specified change in the control testing frequency for the subject dam.

3. Accepted with the following revisions:

Section 7.2.4 of the main section indicates the maximum fine refuse surface elevation for the proposed embankment at the end of Stage 2D will be 589 feet. This is in disagreement with the elevation of 591 feet reported in table 4 and on the drawings. Although both elevations will provide adequate storage, they should be consistent (i.e., 591 feet) to avoid confusion.

Stage 5B, which concerns raising of the pile from elevation 690 to 730 feet, should contain some stipulation that the surface of the pile will be sloped during construction at some minimum grade, such as 2 percent, to allow surface water to drain away from the pile. This drainage provision is currently required only when reaching the final elevation of 730 feet (see section 7.5.2).

4. Accepted.

5. Accepted.

6. Accepted with the following revision:

Page 2 of the Almes letter indicates that the final abandonment plan will be prepared and submitted to MSHA at least two years prior to closure. Meanwhile, the plan in section 7.6 indicates that the abandonment plan will be evaluated at least five years prior to abandonment. These should be consistent, and the plans for abandonment should be sent to the MSHA District Manager for approval preferably at least two years prior to <u>beginning</u> the abandonment plan construction.

7. Accepted.

8. Accepted.

9. Accepted.

10. Accepted.

11. Accepted.

12. Accepted.

Section 2.6.2 of Appendix A allows the rock cobble drain to contain rock cobbles and boulders larger than 6 inches provided smaller stones are placed adjacent to the filter cloth. The reviewer believes a maximum particle size of approximately 12 inches or less should be stipulated to prevent tearing of the filter cloth during rock placement and assist in preventing piping in the event a hole in the filter cloth occurs. These specifications should also clarify that the rock cobbles and boulders used in the drains will be placed with no dropping (zero drop height). The filter cloth should also be protected from ultra-violet radiation prior to placement in the drains.

The table of contents for Appendix A needs to be revised to reflect the correct page numbers.

cc: M. Nichols
J. Mulhern
W. Cannon
B. Owens
W. Meadows
R. Bethard

MSHA APPROVAL

U. S. Department of Labor

Mine Safety and Health Administration
HC 66 Box 1762
Barbourville, KY 40906–9206
(606)546-5125

October 20, 1992

Mr. C. R. Bickerton, Chief Engineer
Concord Mine, ID No. 01-00329
U. S. Steel Mining Company, Inc.
PO Box 2200
Bessemer, AL 35021-2200

Dear Mr. Bickerton:

The plan for Concord Refuse Facility, Site ID No. 1211-AL7-0093-01, is approved. The review of the plan was conducted by Wade Cooper of the Denver Safety and Health Technology Center. Additional requested information was submitted on October 12, 1992, by you and your consultant, Almes & Associates, Inc.

Please advise Ron Bethard, Mining Engineer, of the Birmingham Subdistrict concerning the proposed construction schedule.

Very truly yours,

Edward Morgan
for Joseph J. Garcia
District Manager
District 7

IMPLTR.USX01AP

U.S. Department of Labor

Mine Safety and Health Administration
HC 66 Box 1762
Barbourville, KY 40906-9206

February 2, 1995

Mr. J. R. Nogosky, Manager of Safety
Concord Mine, ID No. 01-00329
U. S. Steel Mining Company, Inc.
PO Box 2200
Bessemer, Alabama 35021

Dear Mr. Nogosky:

This is in reference to your request to modify the plan for your Slurry Impoundment #3, Site ID No. 1211-AL7-00093-01, located near the coal washer.

This request is a response to comments raised in our Denver Technology Center, Report No. W3556, dated November 5, 1993. These comments were adequately addressed in your consultants modified plan of March 22, 1994.

This is to inform you that your request to modify the above plan, to be constructed and maintained in accordance with your plan and specifications, is hereby approved.

If you have any questions concerning the above action, please contact William Cannon or Harold Gibson at this office.

Very truly yours,

Joseph W. Pavlovich
District Manager
District 7

cc:
Birmingham Subdistrict w/copy of Denver Report No. 08118 - W3634
Hueytown FO
C. R. Bickerton
Files

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Four Triangle Drive, Suite 200, Export, PA 15632-9255
Telephone: (412) 327-5200

FACSIMILE TRANSMITTAL FORM

PITTSBURGH FAX NO.: (412) 327-5280

ALMES Services:

- Ash Handling/Management
- Coal Mining Permitting
- Coal Refuse Permitting and Design
- Construction Management
- Construction Monitoring and Construction Quality Assurance
- Dam Design
- Environmental Site Assessments
- Geotechnical Engineering
- Hydrogeologic/Groundwater Studies
- Industrial Waste Disposal Design
- Investigative Engineering
- Soil and Groundwater Remediation
- Solid Waste Landfill Design
- Storm Water Management
- Underground Storage Tanks
- Wetland Services

PROJECT NO.: P90-55-27

SHEET 1 **OF** 3

FAX NUMBER: 433-3518

TRANSMITTAL TO: Larry King

DATE: 1-22 96

SENT BY: Randy Wood

REMARKS:

Hard copy to follow in the mail.

CONFIDENTIALITY NOTICE:

The documents accompanying this telecopy transmission contain confidential information belonging to the sender which is legally privileged. The information is intended only for the use of the individual(s) or entity named above. If you are not the intended recipient, you are hereby notified that any disclosure, copying, distribution or the taking of any action in reliance on the contents of this faxed information is strictly prohibited. If you have received this telecopy in error, please immediately notify us by telephone at the number above to arrange for return of the original documents to us. Thank you.

Rev. 5/95

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

FOUR TRIANGLE DRIVE, SUITE 200, EXPORT, PA 15632-9255
PHONE: (412) 327-5200 FAX: (412) 327-5280

January 22, 1996

Project No.: P90-55-27

Mr. Larry King
U.S. STEEL MINING COMPANY, INC.
600 Grant Street
Pittsburgh, PA 15219

Underground Utilities Review
Starter Dike Stage 2D Embankment Construction
Concord Coal Refuse Disposal Area Expansion
Concord Coal Refuse Disposal Facility
U.S. Steel Mining Company, Inc.
Hueytown, Alabama

Dear Mr. King:

At your request and in accordance with our discussion of January 10, 1996, Almes & Associates, Inc., Consulting Engineers (ALMES) has reviewed the U.S. Steel Mining Company, Inc. (USM) map entitled "Oak Grove Systems, Location of Underground Utilities & Drainage Structures in Area of Proposal Concord Slurry Impoundment," dated December 15, 1995 showing the location of various underground utilities relative to the proposed new fine refuse slurry impoundment dike embankment. The purpose of this review was to provide an opinion as to the treatment that will be required for the removal and abandonment of the utilities located within the embankment foundation during the excavation of the cutoff trench and preparation of the subgrade for placement of the starter dike embankment material.

Based on our review of the subject map supplied by USM, it is our opinion that all underground utilities located within the foundation area of the proposed new fine refuse impoundment starter dike (Stage 1) should be removed. Removal of the utilities should be in accordance with the approved Concord Refuse Area expansion plan, Technical Specifications contained in Section 1.0 Site Preparation, Subsection 1.1 Clearing and Grubbing which calls for the removal of all buried utilities by excavation. Once these utilities are removed, the excavations should be filled to grade with suitable compacted backfill materials. Some of the soil materials excavated during removal of the utilities could possibly be used to backfill the excavations provided the specifications are followed. Soils materials must be placed to a compactive effort equivalent to at least 95 percent of the maximum dry density and between -2 and +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698). If coarse refuse materials are used, they must be placed to a minimum compactive effort of 100 percent of the maximum dry density and between -2 and +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698). Utilities located beneath the proposed Stage 2 and 3 of the embankment should be treated on a case by case basis, as follows. Utilities larger than 8 inches in diameter and any buried line which has contained or may contain explosive and/or

combustible materials must be removed and backfilled in accordance with the specifications as described above. Small diameter inactive buried utilities not presenting a settlement or potential piping/seepage path problem may remain in place as determined by the engineer certifying the embankment construction.

We trust that this report will fulfill the submittal requirements. If you have any questions regarding this transmittal, please do not hesitate to contact me.

Very truly yours,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood, C.P.G.
Project Manager

RMW/lmw:jg

AVATAR RESOURCE MANAGEMENT

11607 Giles Road
Woodstock, Alabama 35188
(205) 938-3400

November 7, 1994

Ron Osborne
U.S. Steel Mining Co., Inc.

Re: Concord Preparation Plant ASMC Revision
P-3233

Mr. Osborne:

As per instructions from Larry King, USSM, attached is a blank verification page for a revision to Alabama Surface Mining Commission permit P-3233 - Concord Preparation Plant. Please sign and have notarized in the appropriate blanks.

I understand from Mr. King that tomorrow (11-8-94) you will receive via overnight delivery from Almes & Associates Inc. copies of a report PROPOSED COAL DISPOSAL AREA EXPANSION PLAN. My instructions are to pick up copies of this plan and, together with some additional pages from this office, deliver the package to the ASMC in Jasper.

I will contact your office in the morning to make arrangements to pick up the appropriate material. If you have any questions please feel free to contact this office.

Thanks,

Greg Jones

Greg Jones
Avatar Resource Management

Encl.

Company Name: U.S. Steel Mining Co., Inc.

Mine Name: Concord Preparation Plant

P-3233

PART VI -- VERIFICATION OF PERMIT APPLICATION (771.27)

I, the undersigned operator and holder of an A.S.M.C. license do hereby submit this as my application for a permit to engage in surface coal mining operation and certify that the information in the application is true and correct to the best of my information and belief. This application is submitted in conformance with the rules and regulations of the Commission and it is agreed that any operations pursuant to the permit will be conducted in accordance with those rules and regulations. I further certify that I will keep the Commission advised of any change of facts as may pertain to the license information or this permit application.

U.S. Steel Mining Co., Inc License No. L-460
Licensee

By: Donald E. Osborne

STATE OF Alabama)
St. at Large COUNTY)

Before me, the undersigned authority, personally appeared Donald E. Osborne who being duly sworn upon oath, deposed and said, that he has read the foregoing application, that he is the responsible official of the applicant who executed the application, that the facts and matters contained therein are true and correct to the best of his information and belief, and that he executed the same for the purposes therein expressed.

Sworn to and subscribed before me, this 7th day of November 1994.

Brenda Stratton
Notary Public

My commission expires: 5-30-98

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Transmittal Form

To: **U. S. Steel Mining Company, Inc.**
Oak Grove Mine
8800 Oak Grove Mine Road
Adger, Al 35006

Project No.: P90-55-27

Date: November 7, 1994

If enclosures are not as noted, please inform us immediately.

Attention: Mr. Ron Osborne

We transmit:

- ■ Herewith
- ■ Under Separate Cover via (Drawings in Tube)

For Your:

- ☐ Approval
- ☐ Record
- ☐ Review & Comment
- ■ As Requested
- ■ Use

The Following:

- ■ Drawings
- ☐ Laboratory Data
- ☐ Specifications
- ☐ Field Data
- ■ Other

Copies	Date	No.	Description
2	9-91	--	Report, Proposed Coal Refuse Disposal Area Expansion Plan, Concord
			Coal Refuse Disposal Facility, U. S. Steel Mining Company, Inc.,
			Hueytown, Alabama
2	9-91	--	Concord Coal Refuse Disposal Facility Drawings (19 drawings per set)

Remarks: As requested by Mr. Larry King, enclosed please find two (2) copies of the above referenced report and drawings for your use. An additional three (3) copies will be sent to you via UPS ground service. Please note, USM needs to provide copies of the "Slope Shaft Seal Details" drawing for Appendix E. If you should have any questions, please call.

By: Randy M. Wood RMW 11/7/94

Copies To: Larry King (w/o enclosures)

520 Pleasant Valley Road, Trafford, PA 15085 Telephone: 412 / 744-3610 Fax: 412 / 744-3631
124 Philpott Lane, Beaver, WV 25813-9502 Telephone: 304 / 255-0491 Fax: 304 / 255-4232

ASMC USE ONLY

FEE: _____

BOND REQUIRED: _____

DATE APPROVED: _____

APPLICATION FOR PERMIT REVISION
Revision 4

NAME OF PERMITTEE: U.S. Steel Mining Co., Inc.

LIC. NO: L-460 COMPLETE PERMIT NO: P-3233-01-93-P EXPIRATION DATE OF PERMIT 2-28-98

MINE NAME: Concord Preparation Plant

NATURE OF PROPOSED REVISION:

NATURE OF REVISION 4

1. Add two sections of ancillary road (3 acres total).
2. Modify general drainage plan to add Ponds 014, 015, 016, 017, 018, access and drainage (no acreage change).
3. Modify existing coal processing waste dam and embankment.

IDENTIFY ANY CONDITIONS PLACED ON THIS PERMIT WHICH WOULD RELATE TO THE PROPOSED REVISION BEING REQUESTED:

ATTACH A DETAILED ESTIMATE OF EFFECT OF PROPOSED REVISION ON RECLAMATION COSTS.

NOTE: Upon review of this application, ASMC will notify the permitee of required information and of the necessity of public notice.

Applicant: U.S. Steel Mining Co., Inc.
Mine Name: Concord Preparation Plant
Permit Number: P-3233 R-4

STATE OF ALABAMA
SURFACE MINING COMMISSION

( ) Permit Application for a Surface Coal Mine
(xx) Permit Application for an Underground Coal Mine
( ) Permit Application for a Preparation Facility

PART I A. IDENTIFICATION

1. PERMIT APPLICANT
Name: U.S. Steel Mining Co., Inc.
Street Address: 1500 Concord Mine Road
City: Hueytown State: AL Zip: 35023
Mailing Address: same
City: State: Zip:
Telephone Number: (205) 497-3612
Social Security Number(Voluntary): ___-__-____
Employer Identification Number:
ASMC License#: L-

2. ENTITY OR PERSON RESPONSIBLE FOR PAYING ABANDONED MINE LAND RECLAMATION FEES
Name: same as 1 above
Street Address:
City: State: Zip:
Mailing Address:
City: State: Zip:
Telephone Number: (_____)___-_____
Social Security Number(Voluntary): ___-__-____
Employer Identification Number:
ASMC License#:

3. IDENTIFY THE OPERATOR FOR THIS MINE IF DIFFERENT FROM THE PERMITTEE
Name: Not Applicable
Street Address:
City: State: Zip:
Mailing Address:
City: State: Zip:
Telephone Number: (_____)___-_____
Social Security Number(Voluntary): ___-__-____
Employer Identification Number:
ASMC License#:

4. CONTACT PERSON FOR PERMIT REVIEW ISSUES AND CORRESPONDENCE
Name: Chuck Bickerton
Mailing Address: same as 1 above
City: State: Zip:
Telephone Number: (_____)___-_____

Applicant: U.S. Steel Mining Co., Inc.
Mine Name: Concord Preparation Plant
Permit Number: P-3233 R-4

PART I B. OWNERSHIP AND CONTROL

1. PERMIT APPLICANT OWNERSHIP AND CONTROL. At the time of filing of this application provide an update of all information contained in the applicant's license file or certify that the information contained in the license is accurate and complete. The updated information shall be submitted on Part I A through Part I F of the License application form. Check one of the following

☐ A license update is included

☐ Information contained in the license file is accurate and complete at the time of filing of this application. No update is included.

Following notification that the permit appears eligible for issuance, the applicant must certify that all information in this application and the license file pertaining to ownership and control, surface mining history and violation history is still valid or the applicant must submit the appropriate update information.

2. OPERATOR OWNERSHIP AND CONTROL. If someone other than the permittee has been identified as the operator under this permit, an update of the ownership and control information contained in the operator's license file must be provided or certify that the information contained in the license file is accurate and complete. The updated information shall be submitted on Part I A through Part I F of the License application form. Check one of the following:

☐ A license update is included

☐ Information contained in the license file is accurate and complete at the time of filing of this application. No update is included.

Following notification that the permit appears eligible for issuance, the applicant must certify that all information in this application and the license file pertaining to ownership and control, surface mining history and violation history is still valid or the applicant must submit the appropriate update information.

3. CONTROL OF MINING OPERATION THROUGH CONTROL OF COAL TO BE MINED. Provide the information below for any person or entity who owns or controls the coal to be mined under this permit and who, by lease, sublease, or other contract:

A. has the right to receive the coal after mining, or,

B. has the authority to determine the manner in which the operator or permittee conducts surface coal mining operations.

(USE ADDITIONAL SHEETS IN THE FORMAT BELOW IF NECESSARY)

Name: Not applicable.
Street Address: _____
City: _____ State: ____ Zip: _____
Mailing Address: _____
City: _____ State: ____ Zip: _____
Telephone Number: (____)-____-_____
Social Security Number: ___-___-_____ (Voluntary)
Employer Identification Number: _____
ASMC License#: _____

Applicant: U.S. Steel Mining Co., Inc.
Mine Name: Concord Preparation Plant
Permit Number: P-3233 R-4

PART I C. PROPERTY OWNERSHIP, INTERESTS AND RIGHTS

1. OWNERSHIP OF PROPERTY TO BE MINED AND RIGHT OF ENTRY.

INSTRUCTIONS: Show the property ownership boundaries of each parcel of land in the permit area on the permit map or an overlay of the same scale as the permit map. If the surface estate is severed from the mineral estate, show and describe the ownership of each estate separately. In the spaces below, identify:

1. Every current legal or equitable owner(s) of record (as found in a standard search of title) of the property;
2. The holders of record of any leasehold interest in the property; and,
3. Any purchaser of record under a real estate contract of the property.

Describe the basis of the applicant's legal right to enter and mine on all properties contained in the permit application. If the mineral estate has been severed from the surface estate, describe the basis of the legal right to enter and mine both the surface and mineral separately. Give the nature of such right (i.e. lease, deed, contract, etc.), where recorded, describe from whom, to whom, and the date executed,and whether that right is the subject of pending litigation.

USE ADDITIONAL SHEETS IN THE FORMAT BELOW AS NECESSARY

Legal description of property or permit map symbol: _____

Surface/Mineral/or Fee Simple (both): Fee Simple
Legal owner(s) of record: U.S. Stedel Mining Co., Inc.
Address: _____ City: _____ State: ___ Zip: 35134
Holders of leasehold interest: _____
Address: _____ City: _____ State: ___ Zip: _____
Purchasers under a real estate contract: _____
Address: _____ City: _____ State: ___ Zip: _____
Description of right to enter or mine:

Describe the type of document or conveyance which grants the right of entry, disturbance or mining. Indicate from whom the right was acquired and to whom the right was granted. If the grantor of the right is not the owner(s) of property, identify all grantors and grantees of the right beginning with the owner(s) and ending with the permit applicant.

Describe Right of Entry(If deed indicate where recorded):	Granted From:	Granted To:	Date Granted:	Litigation Pending? (Yes or No) If yes,explain.
Deed Recorded Jefferson Cnty. Courthouse Book 78 Page 559	Pratt Coal & Iron	U. S. Steel	12-28-1886	No

Applicant: U.S. Steel Mining Co., Inc.
Mine Name: Concord Preparation Plant
Permit Number: P-3233 R-4

PART I C. (CONTINUED)

2. OWNERSHIP OF SURFACE AND MINERAL LANDS CONTIGUOUS TO THE AREA TO BE MINED.
INSTRUCTIONS: Provide the information below for the owners of record of all surface and mineral properties contiguous to any part of the proposed permit area.

USE ADDITIONAL SHEETS AS NECESSARY IN THE FORMAT BELOW

PAGE 1 OF __

Name: same
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple)
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple):
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal or Fee Simple):
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple)
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple):
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple):
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple):
Type of Interest(Owner, Lease , or Other):

Name:
Address:
City: State: Zip:
Interest owned (Surface,Coal, or Fee Simple):
Type of Interest(Owner, Lease , or Other):

Applicant: U.S. Steel Mining Co., Inc.
Mine Name: Concord Preparation Plant
Permit Number: P-3233 R-4

PART I D. PERMIT AREA INFORMATION

1. Give the requested term of this permit: _____ years.

2. Give the legal description of the land upon which the applicant proposes to conduct surface coal mining operations. List each quarter-quarter section, section, township, range, and county.

Area added by Revision 4:
NW 1/4 Section 28; SE/SW, SW/SE Section 22; NE/NE, NW/NE Section 27, all in Township 18 South, Range 5 West, Jefferson County, Alabama

3. Give the acreage of the permit, each increment and the type of bonding.

a. Total permit acreage: 3 acres (added)

b. Give the acreage and type of bond for each mining increment:

Increment	Acres	Type Bond Proposed
1.	3	Certificate of Deposit
2.		Certificate of Deposit
3.		Certificate of Deposit
4.		Certificate of Deposit
5.		
6.		

c. Identify the increment(s) on which mining will initially begin upon issuance of this permit: Increments 1

4. Has any acreage in the proposed permit area been previously disturbed by mining? ( )YES (xx)NO

If yes, supply the following for any and all previously disturbed areas:

a. Show the boundaries of the previously disturbed area(s) on the permit map and identify with an appropriate symbol.

b. List, for each area, the permit number under which it was disturbed and the number of acres. Indicate the status of each permit as Unreleased, Grading released, or 100% released.(If no permit, indicate as such)

Permit	Acres	Status

c. For each area which has not been reclaimed or received a 100% release, indicate whether you intend to assume responsibility for reclamation of the area under this permit and its performance bond(s)

The applicant will assume all reclamation obligations for disturbances created under this permit.

5. Is disturbance to be conducted within 300 feet, measured horizontally, from an occupied dwelling? ( )YES (XX)NO.

If YES, attach a signed waiver from the owner of the dwelling indicating the minimum distance disturbance will be allowed by the owner

Applicant: U.S. Steel Mining Co., Inc.
Mine Name: Concord Preparation Plant
Permit Number: P-3233 R-4

PART I D. (CONTINUED)

6. Is disturbance proposed within 100 feet of a public road right-of-way or will a public road be closed or relocated? ( )YES (XX)NO.
If YES, enclose a copy of the approval granted by the government entity which has jurisdiction over the road. The approval must state the minimum distance disturbance will be allowed to the road or road right-of-way.

7. List all other licenses and permits required to conduct mining operations including, but not limited to, MSHA I.D. and NPDES. Give the identification or permit number , the name and address of the issuing authority, and the status or date of approval or issuance of each:

Permit	ID or Permit Number	Issuing Authority	Address	Status or date of issuance
MSHA ID		MSHA	228 W Val. Av. B'ham,AL 35209	12-19-89
NPDES	AL0061808	ADEM	1751 WLD Drive Mont.,AL 36130	1-29-91

8. Is the property in the permit covered by zoning or other land use restrictions? (X)YES ( )NO.
If yes, indicate the jurisdictional authority and zoning or landuse restriction for the entire permit area. If more than one zoning classification exists for the permit area, identify the boundaries of each on the permit map.

Jurisdictional Authority	Zoning Classification	Allows mining? Yes or No
Jefferson County	I-2	yes

9. Describe access to the proposed mine from a known point on the nearest public highway: From Warrior River Road in Hueytown proceed west to Concord Mine Road. Turn south - the facility is located at 1500 Concord Mine Road.

10. Did the applicant receive assistance from the Small Operator Assistance Program in preparing this application? ( )YES (XX)NO
If YES, list SOAP I.D. Number:

11. Submit a certificate of proof of Liability Insurance with this application.

PART I E. PUBLIC NOTICE AND AVAILABILITY FOR INSPECTION

12. Give the name of the approved public office in which a copy of this application will be filed for public inspection following notification of completeness:

13. Enclose a copy of the notice of filing of this application which will appear in a newspaper of general circulation in the vicinity of the mine and identify the name of the newspaper:

3. Attach a narrative explaining the construction modification, use, maintenance, and removal of the following facilities:

   a. Coal removal, handling, storage, cleaning and transportation structures and facilities;

   b. Spoil, coal processing waste and non-coal waste removal, handling, storage, transportation and disposal structures and facilities;

   c. Mine facilities; and

   d. Water pollution control facilities.

   Please see Attachment III-A-3

4. Describe the means to be used to maximize the use and conservation of coal reserves in the permit area.

   Not applicable

5. Describe measures to be taken to ensure that all debris, acid-forming and toxic-forming materials and materials constituting a fire hazard are disposed of in accordance with 816.89 and 816.103; include contingency plans to prevent sustained combustion of such material.

   DEBRIS AND MATERIALS CONSTITUTING A FIRE HAZARD will be disposed of off site in accordance with all applicable Federal, State and local rules and regulations. This debris and waste will be disposed of in government approved dumps or containers or by private contractors. This material will be disposed of timely to prevent large quantities of material from accumulating to prevent sustained combustion of the material. In case of combustion the burning material will be isolated and covered to put the fire out.

   ACID-FORMING AND TOXIC FORMING MATERIALS will be disposed of in the waste embankment adjacent to the slurry impoundment so that water will be treated by the existing acid water treatment system.

6. Give a description, including appropriate cross-sections and maps, of measures to be used to seal or manage mine openings, boreholes, wells and other openings within the proposed permit area.

Not applicable

7. Give a description of steps taken to comply with applicable water quality laws, regulations and health and safety standards.

All applicable laws of Alabama Department of Environmental Management (ADEM), Mine Safety and Health Administration (MSHA), and other relevant agencies will be complied with.

ADEM: All surface drainage from disturbed areas will be passed through and approved sediment pond and this drainage will be chemically treated as necessary to comply with effluent limitations set forth in an approved NPDES permit, to be obtained by the operator from ADEM. Upon issuance of relevant permits and approval of design plans by the ASMC, basins will be constructed under the supervision of and certified by a registered professional engineer. Upon completion and certification of the pond, the basins will be monitored and reported (including non compliance discharges) as set forth in the NPDES permit and as outlined in the hydrologic monitoring plan. Water samples will be analyzed by Avatar Resource Management or other qualified laboratory.

Treatment of effluent is not expected to be necessary. If Necessary, treatment will consist mainly of application of sodium hydroxide to raise pH and to aid in the precipitation of dissolved metals. For excess manganese, potassium permanganate may be applied as a supplement to the NaOH to oxidize the Mn and aid in its precipitation. If total suspended solids is in excess one of the commercially available flocculents may be applied. These chemicals will be applied at the inflow of the pond to ensure effective mixing.

MSHA: New employees will be given New Employee Training. Annual refresher training will be given to each employee. Blasting will be done only by a certified blaster and all precautions for safety will be implemented during blasting. Signs will be placed at entrances and all appropriate places signifying hazardous areas, Federal I.D. number, NPDES number, mine name,company name, etc.

DUST & NOISE: Samples will be taken according to appropriate federal and state regulations. Ear plugs, goggles, masks and other safety equipment will be issued to employees as needed.

B. Engineering Plans.

All cross sections, maps and plans related to operations, reclamation and structures must comply with Section 784.10. Plans,appropriate calculations and conclusions shall be presented in a clear and logical sequence and shall take into account all applicable factors necessary to evaluate the proposed plan or design.

1. Existing Structures. (784.12, 786.21)

(a) Describe each existing structure to be used, its location, current condition, approximate dates of construction and evidence (including relevant monitoring data) showing whether or not the structure meets the performance standards of Subchapter K or Subchapter B, whichever is more stringent, and demonstrate whether or not the use of the existing structures will pose a significant harm to the environment or public health or safety.

(b) If an existing structure requires modification or reconstruction to meet the performance standards, attach a compliance plan which includes design specifications, construction schedule, monitoring procedures, and evidence that the risk of harm to the environment or public health or safety is not significant during modification or reconstruction.

2. Ponds, impoundments, banks, dams and embankments. (784.25)

(a) Submit a general plan which complies with Section 784.25 (a)(1) for each proposed sedimentation pond, water impoundment, and coal processing waste bank, dam or embankment to be located within the proposed permit area. See attachemnt III-B-2(a)

(b) Submit detailed design plans which comply with Sections 784.25(a)(2)(3) and 817.46, for each sedimentation pond to be constructed on the increment you currently propose to mine. See Attachment III-B-2(b) If the sediment pond is to remain as a permanent water impoundment, design plans shall comply with Section 817.49.

(c) Submit detailed design plans which comply with Sections 784.25 (a) (2 & 3) and 817.49, for each temporary or permanent water impoundment to be constructed on the increment you currently propose to mine.

(d) Submit detailed design plans, which comply with Sections 784.25(a)(2&3) and 817.81-817.85, for each coal processing waste bank to be constructed on the increment you currently propose to mine.

(e) Submit detailed design plans which comply with Section 784.25 (a)(2 & 3) and 817.91-817.93 for each coal processing waste dam and embankment to be constructed on the increment which you currently propose to mine.

See attachment III-B-2(e)

3. Diversions (784.29, 817.43, 817.44)

Are diversions of overland flow or stream channel diversions proposed?
(X) Yes ( ) No
If yes, complete the following:

(a) Is the diversion to be permanent? ( ) Yes. ( ) No.

(b) Describe, in detail, the proposed diversion and include plans, maps and cross-sections which comply with 817.43 and 817.44.

(c) If diversions are temporary, enclose plans for removal including a timetable and plans for restoration of vegetation, channel characteristics, etc.

(d) Enclose approvals of other governmental agencies where required.

Please see Attachment III-B-3

5. Transportation Facilities

a. Describe the measures to be taken to ensure the interest of the public and landowners affected are protected if disturbance within 100 feet of the right-of-way of a public road is proposed.

b. Describe any unique design, feature, or structure which is necessary for the road to meet the performance standards of Subchapter K using any necessary maps, plans, or cross sections.

See attachment III-B-5 for plans for the ancilary roads added by this revision.

c. Describe, in detail, the measures to be taken during the construction, maintenance and use of transportation facilities to prevent damage to fish and wildlife and their habitat; public and private property; and erosion, siltation, and pollution of water.

Stream crossing structures and/or other drainage structures will be used to cross any stream or drainage course. The total amount of disturbance created during road construction and use will be minimized to the extent possible. No property will be disturbed unless absolutely necessary.

Sedimentation control will be installed as necessary to prohibit, to the extent possible, contribution of suspended solids to the runoff. These controls will include silt fencing,hay dikes and berms, ditches, cross drains, culverts, and others as necessary. All disturbed areas, except travel surfaces and flow lines of ditches, will be seeded and mulched as soon as possible after disturbance.

The roadway will be maintained to keep these protective measures in good working condition at all times.

U. S. Steel Mining Company, Inc.

Concord Preparation Plant

P-3233 Revision 4

ANCILLARY ROADS

SPECIFICATIONS FOR ANCILLARY ROADS

I. GENERAL CONSIDERATIONS

1. ROADS covered by these specifications are the roads added to this permit (P-3233) by Revision 4 as shown on the Permit Map. ROADS include the roadbed, shoulders, parking and side areas, approaches, and all structures and ditches.

2. PRIMARY ROADS are roads used for 1) transporting coal or spoil, 2) frequently used for access for 6 months or more or, 3) to be retained for an approved postmining land use.

3. ANCILLARY ROADS are all roads that are not primary roads, ramps and routes of travel within the immediate active mining area, or within spoil or coal mine waste disposal areas. The roads added by this revision are ancillary roads.

4. The operator will construct all roads so that each road will: be located, designed, constructed, used, maintained, and reclaimed to control or prevent erosion, siltation, and dust by means of vegetation, watering or chemical dust suppressants, or otherwise stabilizing exposed surface in accordance with current, prudent engineering practices; control or prevent damage to fish and wildlife or their habitats and environments; control or prevent additional contributions of suspended solids to surface runoff; neither cause nor contribute to violations of applicable water quality laws; refrain from seriously altering the normal flow of water in streambeds or drainage channels; prevent or control damage to public or private property; and use nonacid- and nontoxic-forming substances in base material and road surfacing.

II. DESIGN

1. Attached sheets show locations, widths, surface materials, typical drainage controls, and other appropriate details.

2. Roads shall be located to minimize sedimentation and flooding and on the most stable available surface

3. Ancillary roads, unless otherwise noted on detailed design sheets, are designed for use by passenger vehicles and occasional use by service vehicles for the life of the mine.

4. The center of all roads will be crowned to a minimum of ½" per foot (from center of road to edge of road) to direct runoff away from the road surface.

5. No roadway will impound water; adequate drainage structures will be provided. These structures will include ditches, low water crossings, ditch relief drains, culverts, cross drains and others. Should the roadway grade exceed 15%, cross drains, ditch relief drains and roadway drains will be place at minimum 300' intervals.

III. CONSTRUCTION

1. All roads will be constructed according to design plans approved by the regulatory authority.

2. The roadway will be cleared of all vegetation and topsoil will be removed and stockpiled for use in reclamation. A suitable sub grade elevation will be effected by (1) Excavation or (2) Placing and compacting suitable material in lifts. Base material will be placed and compacted, and road surfacing material added, according to the attached detailed design sheets.

3. Appropriate erosion control structures will be used during construction. These erosion control structures will include hay dikes, silt fencing, rock filters, rip rap, or others as necessary.

4. All areas disturbed by road building activities will be vegetated with an appropriate grass mixture (temporary and permanent grasses), mulched and otherwise protected from erosion as soon as possible after construction.

IV. MAINTENANCE

1. Roads will be maintained to function as designed.

2. Maintenance will include periodic grading and resurfacing the roadway. Ditches and drainage structures will be cleaned of any accumulated sediment or trash as necessary. Spot seeding will take place as needed to improve vegetative coverage. All erosion control structures will be kept in good working condition.

3. Damage from unforeseen circumstances (earthquakes, floods, etc.) will be repaired in a timely manner.

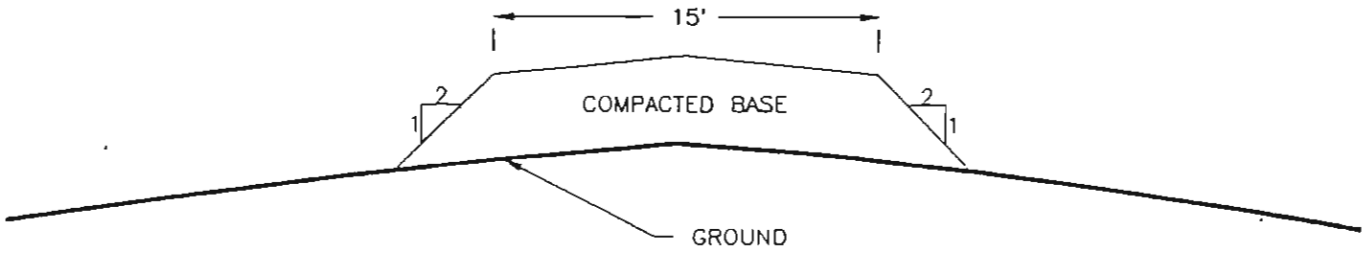
4. Maintenance on the low water crossing will include: maintaining the rip rap that surrounds the concrete pad on the banks of the stream to ensure that erosion does not occur upstream, above, or downstream of the crossing structure; ensuring that any cracks or other defects found in the concrete structure are repaired timely; maintaining the vegetation on the areas disturbed by construction; and routine maintenance of the roadway that adjoins the structure.

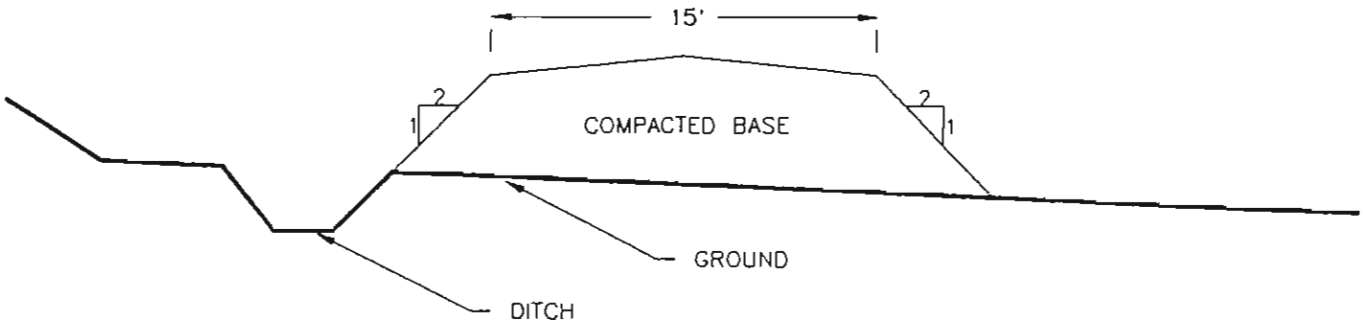
V. RECLAMATION

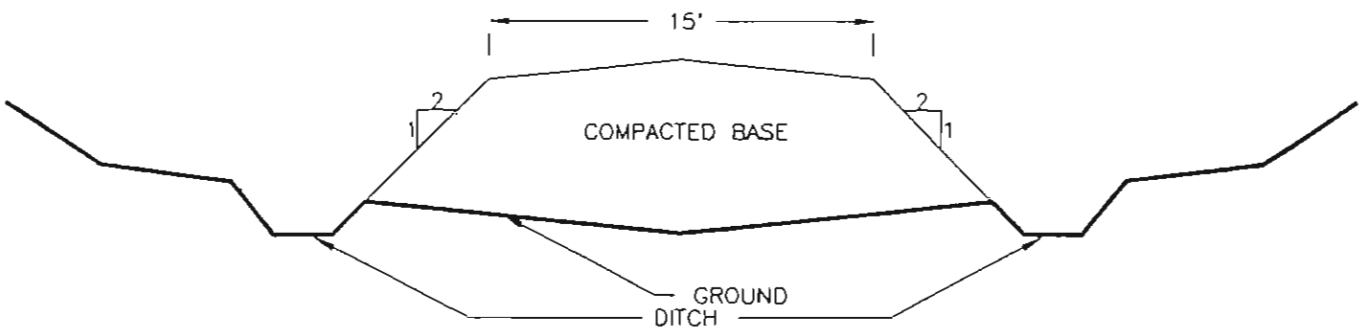
1. All roads and associated drainage structures will be removed and reclaimed when no longer needed.

2. The roadway will be plowed and ripped, with all surface material hauled to an appropriate on-site spoil area. Natural drains will be restored by removing drainage structures. The entire roadway and will be returned to its approximate original contours, with terraces installed as necessary to control erosion. Topsoil will be replaced and the area revegetated according to the approved reclamation plan.

ANCILLARY ROADS
TYPICAL SECTIONS







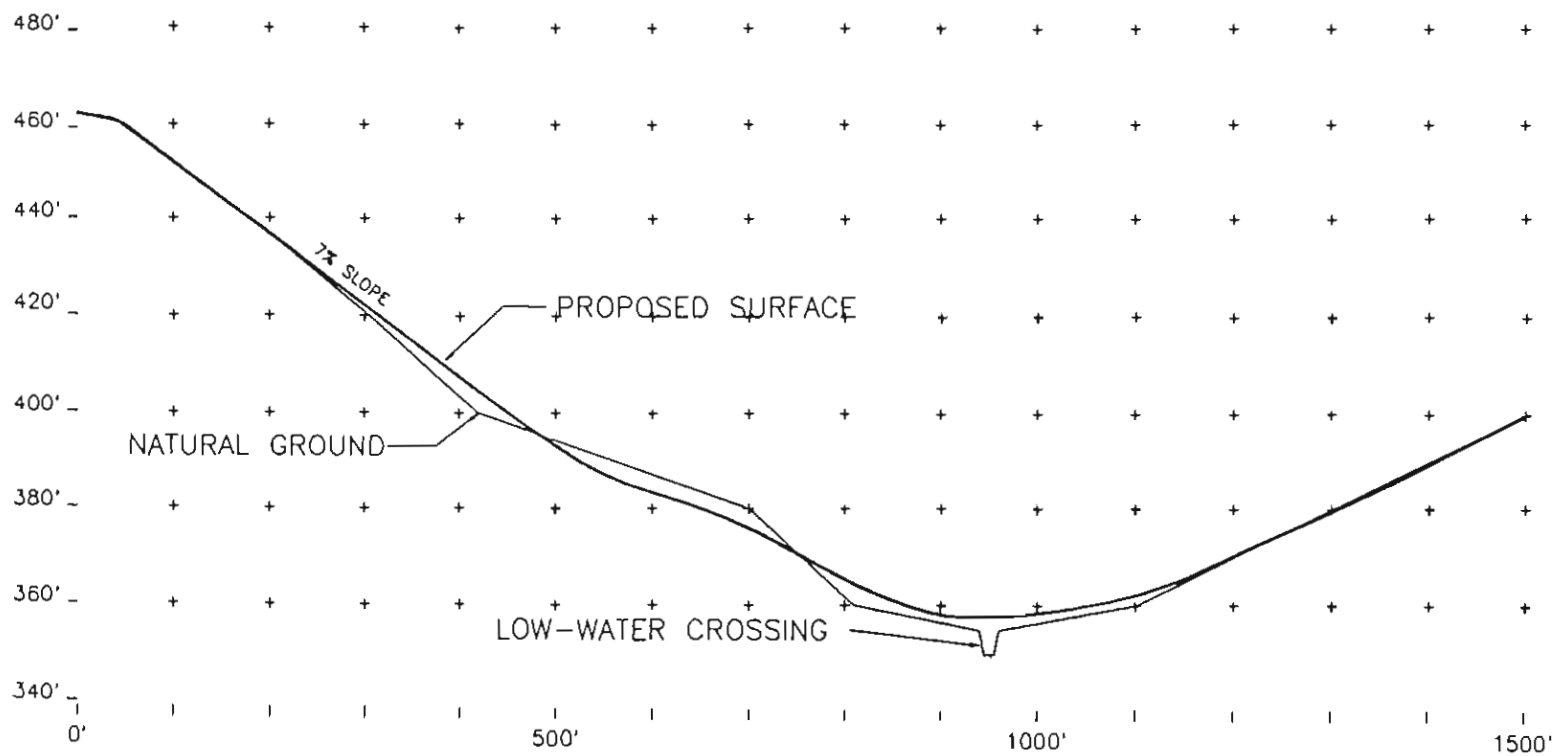
ROADS WILL BE SURFACED WITH 4" OF CRUSHED LIMESTONE.
DITCHES WILL BE CONSTRUCTED IN NON-ERODIBLE MATERIAL, OR
GRASS LINED, OR LINED WITH RIP RAP WHERE SLOPES EXCEED 10%.

P-3233 R-4

PREPARED 3-94 BY:
Avatar Resource Management
MINING/ENVIRONMENTAL ENGINEERING & GEOLOGY

ANCILLARY ROAD NEAR LOW WATER CROSSING

PROFILE – CENTER LINE OF ROAD



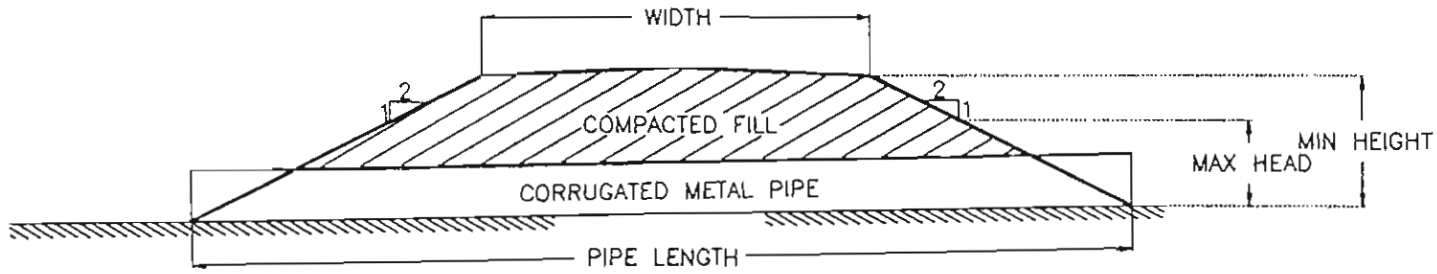
U.S. Steel Mining Co., Inc.

Concord Preparation Plant (P-3233)

PREPARED 4-94 BY:

Avatar Resource Management

P-3233 R-4
Culverts



CULVERT ID	DRAINAGE AREA (ac)	PEAK FLOW (cfs)	PIPE SIZE (in)	PIPE SLOPE (%)	PIPE LENGTH (ft)	MAX HEAD (ft)	MIN HEIGHT (ft)	WIDTH (ft)
C1	2	3	12	4	60	3	4	18
C2	3	4	12	4	60	3	4	18
LOW WATER CROSSING	2370	625	3 60"	2	40	8	7	20

P-3233 R-4 Culverts

PREPARED BY: 4-94

Avatar Resource Management

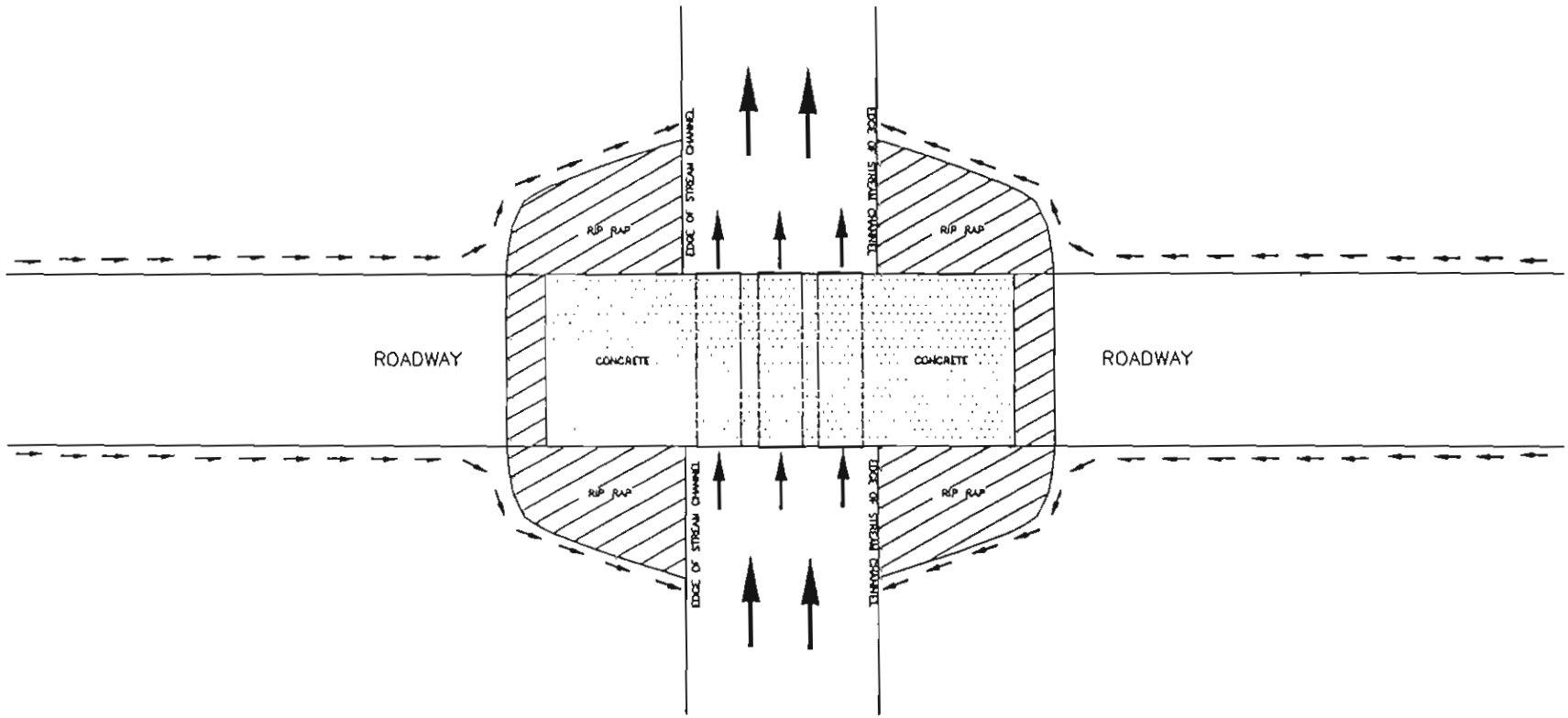
MINING/ENVIRONMENTAL ENGINEERING & GEOLOGY

LOW WATER CROSSING

SE/NW SECTION 28 TOWNSHIP 18 SOUTH RANGE 5 WEST

PLAN VIEW

1" =20'

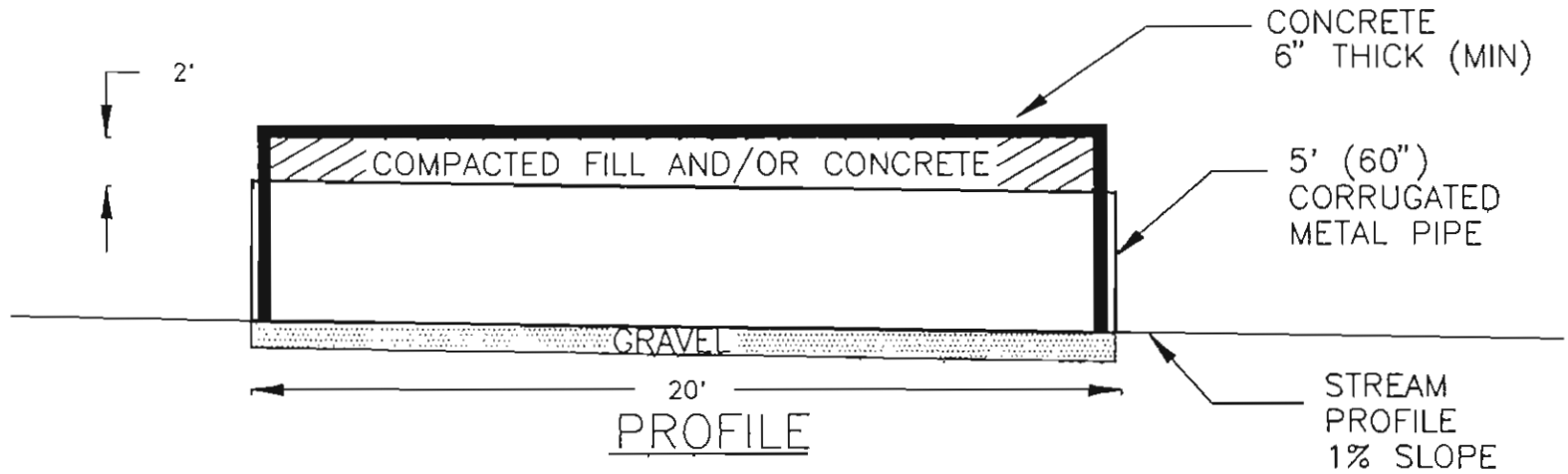


U.S. Steel Mining Co., Inc.
Concord Preparation Plant (P-3233)

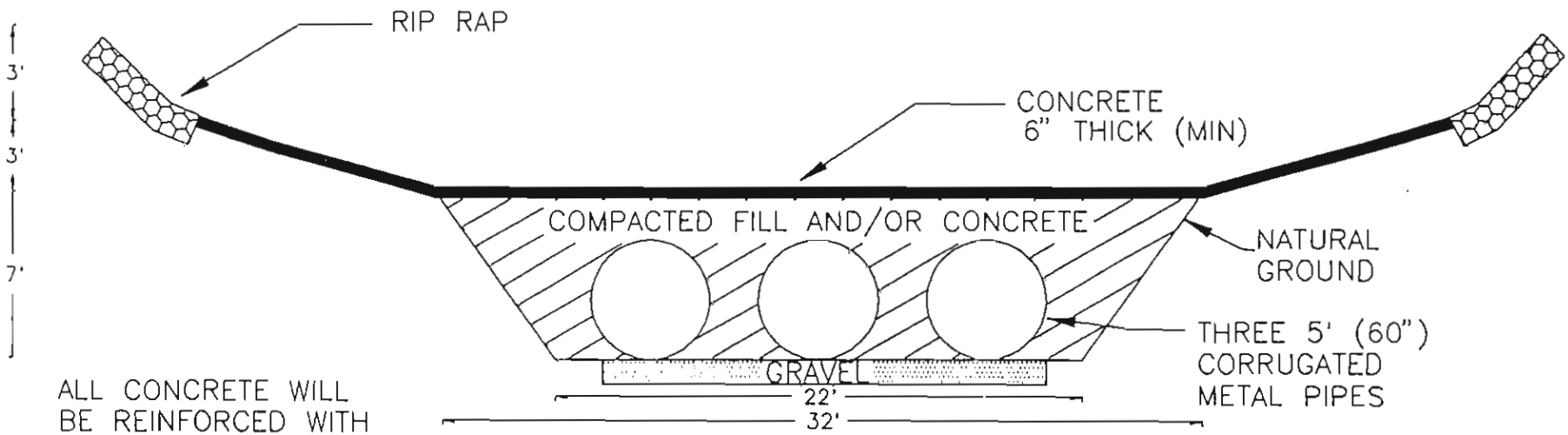
PREPARED BY:
Avatar Resource Management
MINING/ENVIRONMENTAL ENGINEERING & GEOLOGY

LOW WATER CROSSING

SE/NW SECTION 28 TOWNSHIP 18 SOUTH RANGE 5 WEST



PROFILE



ALL CONCRETE WILL BE REINFORCED WITH STANDARD REINFORCEMENT WIRE.

CROSS SECTION

U.S. Steel Mining Co., Inc.

Concord Preparation Plant (P-3233)

PREPARED 3-94 BY:

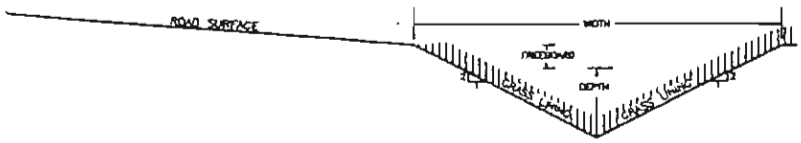
Avatar Resource Management

MINING/ENVIRONMENTAL ENGINEERING & GEOLOGY

ANCILLARY ROAD DITCHES
P-3233 REVISION 4

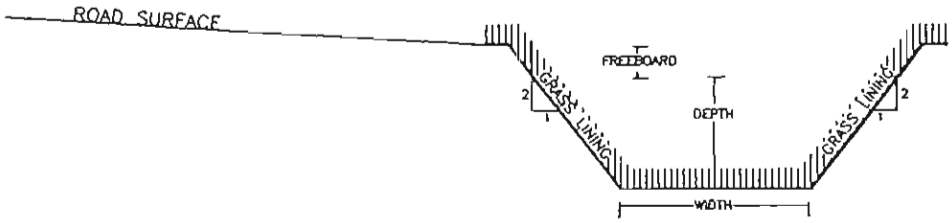
ALL DITCHES — MAX D.A. 4 AC. MAX FLOW 6 CFS

SLOPE RANGE (%)	CHANNEL DIMENSIONS (depth x width)	FREEBOARD (ft)	COMMENTS
1 – 5	1.7' X 4'	0.3'	DITCH WILL BE LINED WITH A GOOD STAND OF FESCUE AND BERMUDA.



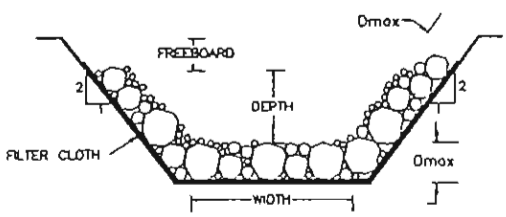
ALL DITCHES — MAX D.A. 4 ACRES MAX FLOW 6 CFS

SLOPE RANGE (%)	CHANNEL DIMENSIONS (depth x width)	FREEBOARD (ft)	COMMENTS
1 – 6	1.2' X 2'	0.3'	DITCH WILL BE LINED WITH A GOOD STAND OF FESCUE AND BERMUDA.



ALL DITCHES — MAC D.A. 4 ACRES MAX FLOW 6 CFS

SLOPE RANGE (%)	CHANNEL DIMENSIONS (depth x width)	FREEBOARD (ft)	COMMENTS
6 – 15	1.2' X 2'	0.3'	DITCH WILL BE LINED WITH GRADED DURABLE SANDSTONE OR LIMESTONE RIP RIP (CLASS II).



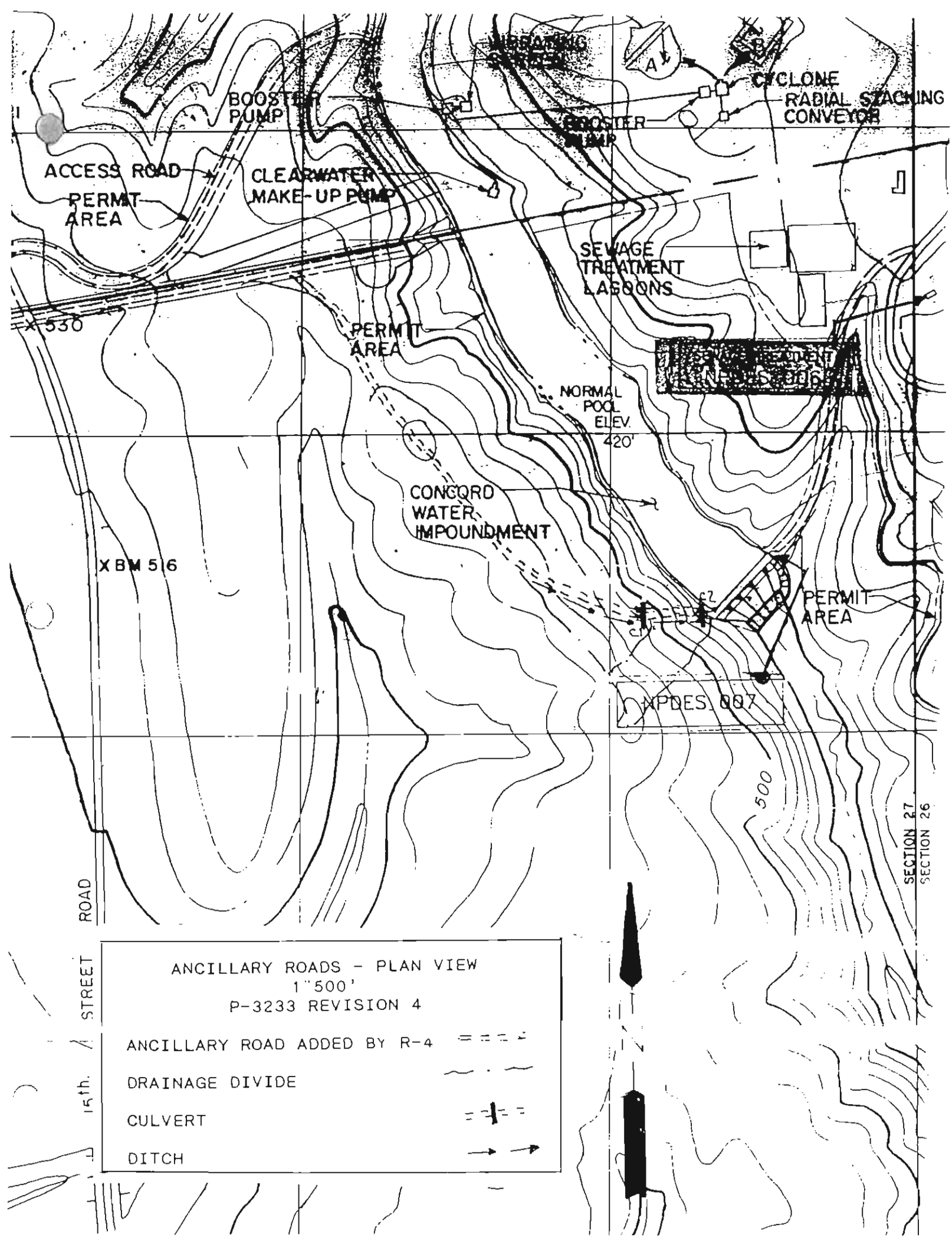
RIP RAP DESIGN SIZE:

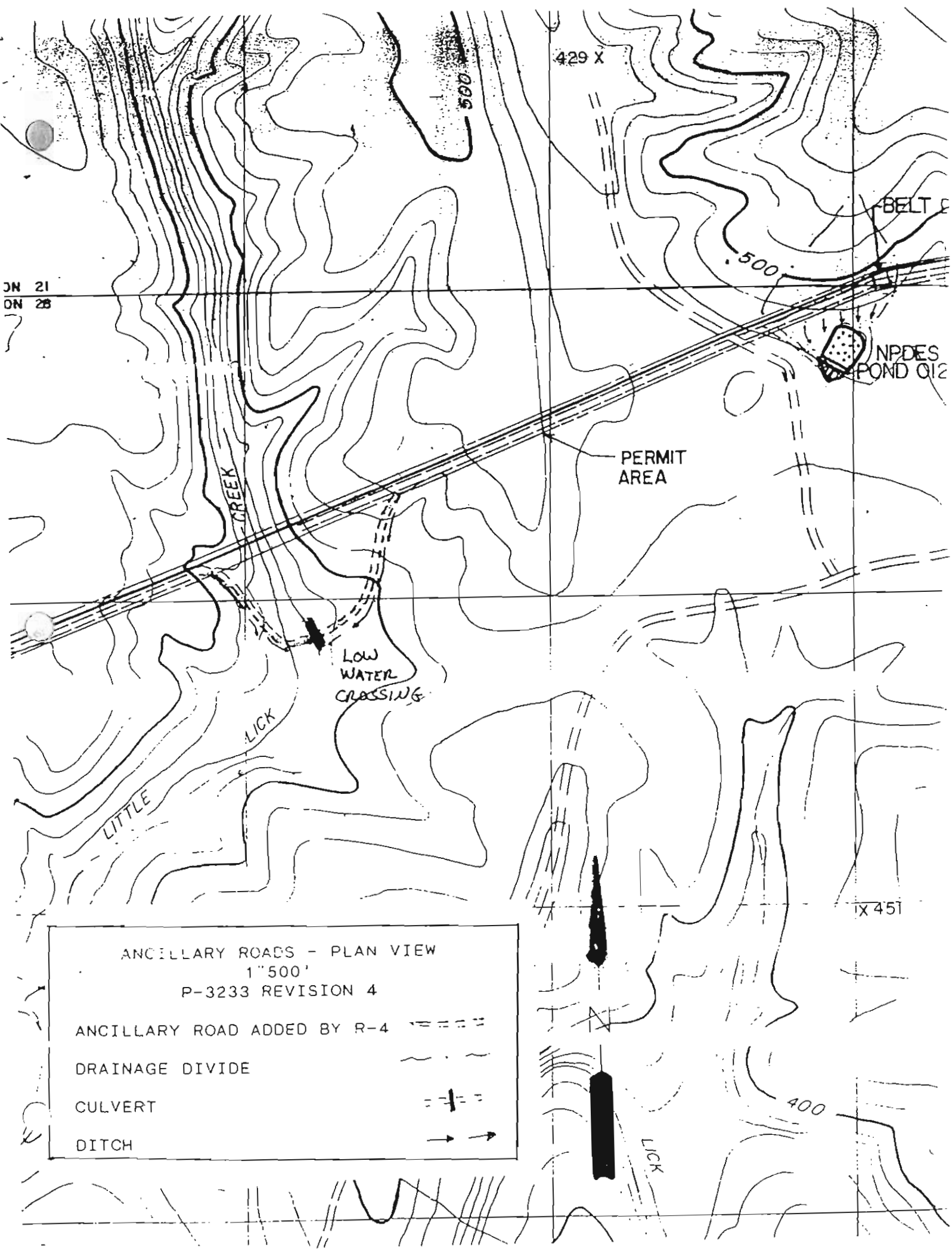
D_{10}	6"
D_{50}	12"
D_{max}	18"

RIP RAP WILL BE CLASS II GRADED RIP RAP, SANDSTONE OR LIMESTONE. ALL RIP RAP WILL BE UNDERLAIN BY FILTER CLOTH.

P-3233 R-4

PREPARED BY: 4-94
Avatar Resource Management
MINING/ENVIRONMENTAL ENGINEERING & GEOLOGY


BOOSTER PUMP
ACCESS ROAD
PERMIT AREA
CLEARWATER MAKE-UP PUMP
BOOSTER PUMP
CYCLONE
RADIAL STACKING CONVEYOR
SEWAGE TREATMENT LAGOONS
X 530
PERMIT AREA
NORMAL POOL ELEV. 420'
CONCORD WATER IMPOUNDMENT
X BM 516
PERMIT AREA
NPDES 007
500
ROAD
SECTION 27
SECTION 26
STREET
15th.
ANCILLARY ROADS - PLAN VIEW
1"500'
P-3233 REVISION 4
ANCILLARY ROAD ADDED BY R-4
DRAINAGE DIVIDE
CULVERT
DITCH


429 X
500
BELT
500
ON 21
ON 28
NPDES
POND 012
PERMIT
AREA
CREEK
LOW
WATER
CROSSING
LICK
LITTLE
X 451
400
LICK
ANCILLARY ROADS - PLAN VIEW
1"500'
P-3233 REVISION 4
ANCILLARY ROAD ADDED BY R-4
DRAINAGE DIVIDE
CULVERT
DITCH

ATTACHMENT III-A-3

Haul roads

Roads will be used for transportation of coal and refuse and for general transportation for service, supplies and equipment throughout the mine area. Haul roads will be constructed and maintained to facilitate efficient transportation.

'ROADS' are all roads used in surface coal mining and reclamation operations and coal exploration, including the roadbed, shoulders, parking and side areas, approaches, and all structures and ditches, except ramps and routes of travel within the immediate active mining area or within spoil or coal mine waste disposal areas, which are excluded.

PRIMARY ROADS are roads used for transporting coal or spoil, frequently used for access for 6 months or more, or are to be retained for an approved postmining land use.

ANCILLARY ROADS are all roads that are not primary roads, that are ramps and routes of travel within the immediate active mining area, or are within spoil or coal mine waste disposal areas.

Design plans for roads within this permit are given in Part III-B-6 of this application. The operator will construct all roads so that each road will: be located, designed, constructed, used, maintained, and reclaimed to control or prevent erosion, siltation, and dust by means of vegetation, watering or chemical dust suppressants, or otherwise stabilizing exposed surface in accordance with current, prudent engineering practices; control or prevent damage to fish and wildlife or their habitats and environments; control or prevent additional contributions of suspended solids to surface runoff; neither cause nor contribute to violations of applicable water quality laws; refrain from seriously altering the normal flow of water in streambeds or drainage channels; prevent or control damage to public or private property; and use nonacid- and nontoxic-forming substances in base material and road surfacing.

Roads will be constructed on ridges and away from drainage courses when possible. Where necessary to construct roads on slopes, the most stable available slopes are selected. All road locations are selected and roads will be constructed in such away as to minimize disturbance, prevent adverse effects to fish and wildlife, prevent downstream flooding, prevent impounding of water, limit the contribution of suspended solids to surface water runoff, and limit to the extent possible any adverse effects on the environment.

The roadway will be cleared of all vegetation and all topsoil will be removed and stockpiled for use in reclamation. A suitable sub grade elevation will be effected by (1) Excavation or (2) Placing and compacting suitable material in lifts. Appropriate erosion control structures will be constructed. These erosion control structures will include hay dikes, silt fencing, rock filters, rip rap, or others as necessary.

Roads will be modified or constructed to provide adequate drainage structures. These structures will include ditches, ditch relief drains, culverts, cross drains and others. Should the roadway grade exceed 15%, cross drains, ditch relief drains and roadway drains will be place at minimum 300' intervals. Structures will be placed in cut and fill embankment as necessary to prevent impounding of water and altering drainageways. No drainageway will be altered without specific approval from the Regulatory Authority. Drain outlets will be placed strategically to minimize erosion.

After suitable sub grade is reached and drainage structures are in place, the road will be surfaced with gravel, rock or other suitable material. This surface material will be placed in 3" -4" lifts and compacted until a surface and grade suitable for the anticipated volume and type of traffic is attained. No acid forming or toxic material will be used for sub grade or surfacing material. Cut and fill slopes and other areas will be seeded and mulched and grass established to help prevent erosion. Any necessary traffic control, warning or other signs will be placed well off the shoulder of the road.

Maintenance will include periodic grading and resurfacing the roadway. Ditches and drainage structures will be cleaned of any accumulated sediment or trash as necessary. Spot seeding will take place as needed to improve vegetative coverage and to control erosion.

All temporary roads will be removed when no longer needed. The roadway will be plowed and ripped, with all surface material hauled to an appropriate on-site spoil area. Natural drains will be restored by removing drainage structures. The entire roadway and will be returned to its approximate original contours, with terraces installed as necessary to control erosion. Topsoil will be replaced and the area revegetated detailed in Part IV (reclamation) of this application.

(b) Spoil Handling

Coal processing waste will be transported to the existing waste dam and embankment. This revision expands the capacity of the existing embankment and slurry pond. Runoff from the existing embankment and discharge from the existing slurry impoundment are treated by an in-placed acid water treatment system. Four additional sediment ponds (014, 015, 016, 017) are proposed to treat the runoff from the outslopes of the embankment. These ponds will be built prior to any construction in their drainage areas. Coarse refuse will be trucked to the disposal area via existing roads. The slurry will be pumped to the slurry pond via existing pipelines.

All handling and storage will take place on site and require no facilities other than the equipment which will move it to the storage area where it will be graded and reclaimed.

Non-coal Waste

Non-coal waste will be removed from the permit area and disposed of at appropriate disposal sites that meet Local, State and Federal laws and regulations.

(d) Water pollution control facilities will consist of sediment basins, berms and drainage ditches which will be constructed prior to mine operation in a particular increment. These facilities will be constructed using standard construction equipment according to designs presented in Part III-B of this application.

BERMS AND DRAINAGE DITCHES will be constructed as necessary to control drainage from disturbed areas and to direct this drainage to an approved sediment basin. These facilities will be inspected at least monthly. Any maintenance necessary will be performed using standard construction equipment in such a way as to minimize any adverse environmental impacts. Areas disturbed by maintenance will be hayed and seeded, and hay bales used, as necessary to control erosion. When no longer required, these facilities will be regraded, stabilized and vegetated so that the areas will conform to the approved post mining land use. No modification of the structures is anticipated.

SEDIMENT BASINS will be constructed according to design plans presented in Part III-B of this application. The locations of these ponds are shown on the permit map.

The pond area will be cleared of vegetation and the area of the dam will be excavated to a suitable foundation of shale and/or sandstone. Suitable dam construction material will be placed in lifts and compacted as required until the design compaction,elevation and configuration is reached. Pipe(s) will be installed at appropriate elevation(s) and orientation and the spillway channel constructed. Erosion control measures will be undertaken including proper routing of incidental runoff, proper placement of rip-rap, seeding and mulching of the disturbed areas, and others as required. Pond(s) will be used to control sediment contained in the surface water runoff from the disturbed area by providing detention time for the settling of solids.

Inspection:

Inspection:

The ponds will be inspected monthly by qualified inspectors. Any debris found clogging discharge structures will be removed and discharge structures will be maintained to perform as designed. Any erosion damage, slope failure, bare spots or other damage to slopes and/or spillways will be repaired. Accumulated sediment will be removed from the pond before the maximum sediment elevation is reached, as shown on the detailed design plans for each pond. Formal inspection will be made yearly in conjunction with the required annual recertification of each pond. Any necessary maintenance will be performed timely to prevent to the extent possible adverse environmental impacts; any disturbance created will be stabilized and revegetated to prevent erosion.

No modification of any structure is anticipated. Any modification that may become necessary will be approved by the Regulatory Authority prior to commencement of work.

All ponds will remain as permanent impoundments pending final ASMC approval. Information needed to meet the permanent impoundment requirements will be submitted prior to Phase II bond release request. If removal is necessary, the pond will be removed as follows: A diversion will be established around the pond, the pond pumped dry and the accumulated sediment allowed to dry. The dam material will be graded onto the accumulated sediment, returning the area to the approximate original contours. A permanent channel designed to pass expected flows will be established across the pond site. This channel will be protected from erosion by using rip rap or other methods suitable for the expected flow velocities. When the channel is complete, flow will be routed to it and the temporary diversion removed and reclaimed. The entire reclaimed pond area will be stabilized and vegetation established to control erosion.

GENERAL DRAINAGE PLAN

ATTACHMENT III.B.2.a

P-3233 Revision 4

I hereby certify that the attached general plan for proposed sedimentation ponds meets the requirements of Rules 880-X-8F.11 of the ASMC Rules for Surface Mine Operations. Detailed design plans for each pond will be submitted to the ASMC and approved by the ASMC prior to any pond construction. Each pond will be constructed prior to any disturbance in it's drainage basin.

Howard W. Jones Jr.
AL P.E. #15101

11 - 9 - 94
Date

General Plan

Five ponds are added by this revision. The slurry Impoundment is modified by this revision. The drainage areas and location of the ponds are given below. The ponds are shown and the drainage areas delineated on the Drainage Map. The ponds are temporary; they will be removed when no longer needed. Ponds 014, 015, 016 and 017 are covered in the report PROPOSED COAL REFUSE DISPOSAL EXPANSION, CONCORD REFUSE DISPOSAL FACILITY, prepared by Almes & Associates, Consulting engineers.

POND#	DRAINAGE AREA (ac)	LOCATION	Almes report pond number
014	51	NE/SW Sec 26	Pond 2
015	44	NE/SW Sec 26	Pond 3
016	66	NW/NW Sec 26	Pond 4
017	66	NW/NW Sec 26	Pond 1
018	32	SW/SE Sec 23	NA

Pond 016 is upstream and in series with Pond 017. All ponds are located in Township 18 South Range 6 West Jefferson County, Alabama. The operator currently holds NPDES permit AL0003620 which is being modified to add the above listed ponds as outfalls. Please note that Ponds 014 and 015 can be routed through existing outfalls.

The locations are shown on the permit map submitted with this revision.

General Plan - Pond 018

Pond 018 is added by this revision. The following information applies only to Pond 018.

The drainage area and location of the pond is shown. The pond is shown and drainage area delineated on the Drainage Map. This pond is temporary; it will be removed when no longer needed.

A typical cross section is included which shows the proposed general configuration of each dam. The Drainage Map shows the land use of all affected area and the locations of the diversions which will direct discharge to the ponds.

All pond sites are underlain by soils of the Montevallo-Nauvoo Series. These soils and the underlying shale and sandstone parent rock have been repeatedly seen to provide adequate foundation materials for small sediment pond dams such as those proposed for this mine.

All ponds are or will be designed by a qualified registered professional engineer and submitted prior to construction for approval by the Regulatory Authority. Upon approval of plans and prior to any mining in the drainage area of the pond, the structure will be built under the supervision of, inspected by, and certified by qualified registered professional engineer.

Sediment Ponds

All sediment basins for this permit will be constructed according to plans prepared by a qualified registered professional engineer and approved by the Regulatory Authority. They will be constructed before any disturbance in that drainage area occurs, will be located as close as possible to the disturbed area and will be designed, constructed and maintained to prevent short circuiting. All ponds will be designed to meet all Federal and State laws and regulations for point source discharges.

No pond will be located in any perennial stream unless authorized by the R.A.

Disturbed areas surrounding the ponds such as temporary access routes and borrow areas will be revegetated to protect them from erosion and to stabilize slopes.

Ponds will be periodically inspected for hazardous conditions and will be maintained until release of the disturbed area by the R.A. Reclamation of the pond will be in strict compliance with current accepted reclamation procedures unless the pond has been approved as a permanent water impoundment.

Detailed plans and specifications for individual ponds will be submitted for approval prior to any construction activity.

SPECIFICATION & REQUIREMENTS FOR SEDIMENTATION PONDS
GENERAL REQUIREMENTS

A. All surface drainage from the disturbed area shall be passed through sedimentation pond or a series of sedimentation ponds.

B. Sedimentation ponds used individually or in series shall:

1. Be constructed as soon as possible after approval by the Regulatory Authority.

2. Be located as near as possible to the disturbed area and out of perennial streams unless approved by the State Regulatory Authority;

3. Be designed and certified by a qualified registered professional engineer licensed to practice in the State of Alabama;

4. Be designed, constructed and maintained to minimize short-circuiting to the extent possible.

II. DESIGN REQUIREMENTS

A. Sedimentation ponds used individually or in series are designed to contain or treat the 10-year, 24-hour precipitation event, unless a lesser event is approved by the regulatory Authority.

B. Sedimentation ponds are designed and constructed to provide adequate sediment storage volume. Accumulated sediment shall be removed when the accumulated sediment elevation reaches the maximum sediment elevation.

C. Spillways

1. Sedimentation ponds meeting the size or other qualifying criteria of 30 CFR77.216(a) shall comply with all the requirements of that section, and shall have principal and emergency spillways that in combination will safely pass a 100-year, 6-hour precipitation event.

2. Sedimentation ponds not meeting the qualifying criteria of 30 CFR 77.216(a)shall have an appropriate combination of principal and emergency spillways to safely discharge the runoff from a 25-year, 6-hour precipitation event.

D. Dams of sediment ponds are designed and constructed to ensure against excessive settlement. Although the required 95% compaction will prohibit excessive settlement, the construction height of the dam will be increased 5% to further protect the structure.

E. Impoundments are designed to have a minimum static safety factor of 1.5 for the normal pool with steady seepage saturation conditions and a seismic safety factor of at least 1.2.

F. Impoundments are designed to have adequate freeboard to resist overtopping by waves and by sudden increases in storage volume. A minimum of 1' between the top of the emergency spillway and the top of the settled dam is required.

G. Foundation and abutments for the impounding structure are designed to be stable under all conditions of construction and operation. All necessary foundation investigation and laboratory testing shall be performed in order to determine the design requirements for foundation stability.

H. Sedimentation pond design will be certified by a registered professional engineer experienced in the design and construction of impoundments to meet the requirements of Rules 880-X-10C-.13, .17, .18 and .20 of ASMC Rules for Surface Coal Mine Operations specifically the design, construction, operation and maintenance requirements and the timetable and plans for removal of the structure, using current prudent engineering practices.

III., CONSTRUCTION REQUIREMENTS

A. The entire area of the impoundment shall be cleared of trees and brush, and the dam foundation area shall be scarified and cleared of all organic matter.

B. Material

1. The dam shall be constructed of suitable compacted material with the core extending a minimum of 2' into an impervious material. Core trench shall be a minimum of 8' wide with side slopes not exceeding 1h : 1v. All material shall be compacted to 95% density as established by AASHTO T-99. To allow for settlement constructed height of dam will be increased 5% above designed height.

2. The fill material shall be free of sod, large roots, other vegetative matter,stones over 6 inches in diameter, frozen soil, and other objectionable material, and in no case shall acid or toxic-forming coal-processing waste be used. All material shall be placed and spread over the entire fill area,starting at the lowest point of the foundation, in horizontal layers not to exceed 12 inches in thickness. Construction of the fill shall be undertaken only at such times that the moisture content of the fill material will permit satisfactory compaction in accordance with AASHTO T-99.

C. Dimensions

1. Dam width will be specified on the dam detailed cross section.

2. Proposed upstream and downstream slopes are as specified on the dam detailed cross section.

3. Any highwalls adjacent to or a part of a sediment pond will be sloped to below the low water line on a maximum of 2h : 1v slope.

D. A non-clogging dewatering device adequate to maintain the required detention time will be constructed. The specific device will be as shown on the detail design plan.

E. Spillway

1. There shall be a minimum of 1.0 feet of freeboard between the maximum design flow of the emergency overflow and the top of the settled dam.

2. The spillway shall be constructed of or in non-erodable material and runoff channeled so that the dam will not be harmed. The slope of the entrance and exit to the spillway control section shall not exceed 3%. The spillway shall be constructed with a control section of at least 20 feet long and side slopes not steeper than 2h : 1v. Riprap and/or concrete and/or grass shall be used to line the spillway channel in order to prevent erosion, unless the channel is constructed in non-erodable material and capable of maintaining sustained flows. Earth or grassed lined spillways for single spillway ponds are prohibited. Spillway stabilization details are included in the detailed design plans for each ponds. Each spillway will be constructed according to these plans.

F. After construction and prior to certification, the dam and surrounding areas disturbed during construction shall be stabilized with respect to erosion by a vegetative cover, or other means. This includes the upstream face of the dam above the low pool elevation. Hay bales or riprap shall be placed at the toe of the dam or trees shall be windrowed at the toe to control erosion. Areas where vegetation is not successful or where rills or gullies develop shall be repaired and revegetated.

G. Sediment shall be removed from sediment pond and property disposed of when the maximum storage elevation, as specified on the detail design, has been reached. If Coal is encountered during the clean out operation, it shall be removed and properly disposed of.

H. Inspections

1. Pond construction will be supervised and inspected by a qualified registered professional engineer or technician under his direction. Certification of the structure by the engineer will be made upon completion of construction. Copies Of the pond certification will be filled with the Regulatory Authority and at the mine office.

2. Ponds will be inspected at least yearly by the engineer or technician under his direction until the removal of the structure or release of the performance bond for any hazardous conditions. Ponds will be maintained for proper operation. Certified inspection reports will be prepared by the engineer and filed with the Regulatory Authority and at the mine office.

3. If any hazardous conditions are found, the Regulatory Authority shall be informed of the problem and the procedure implemented to correct the condition.

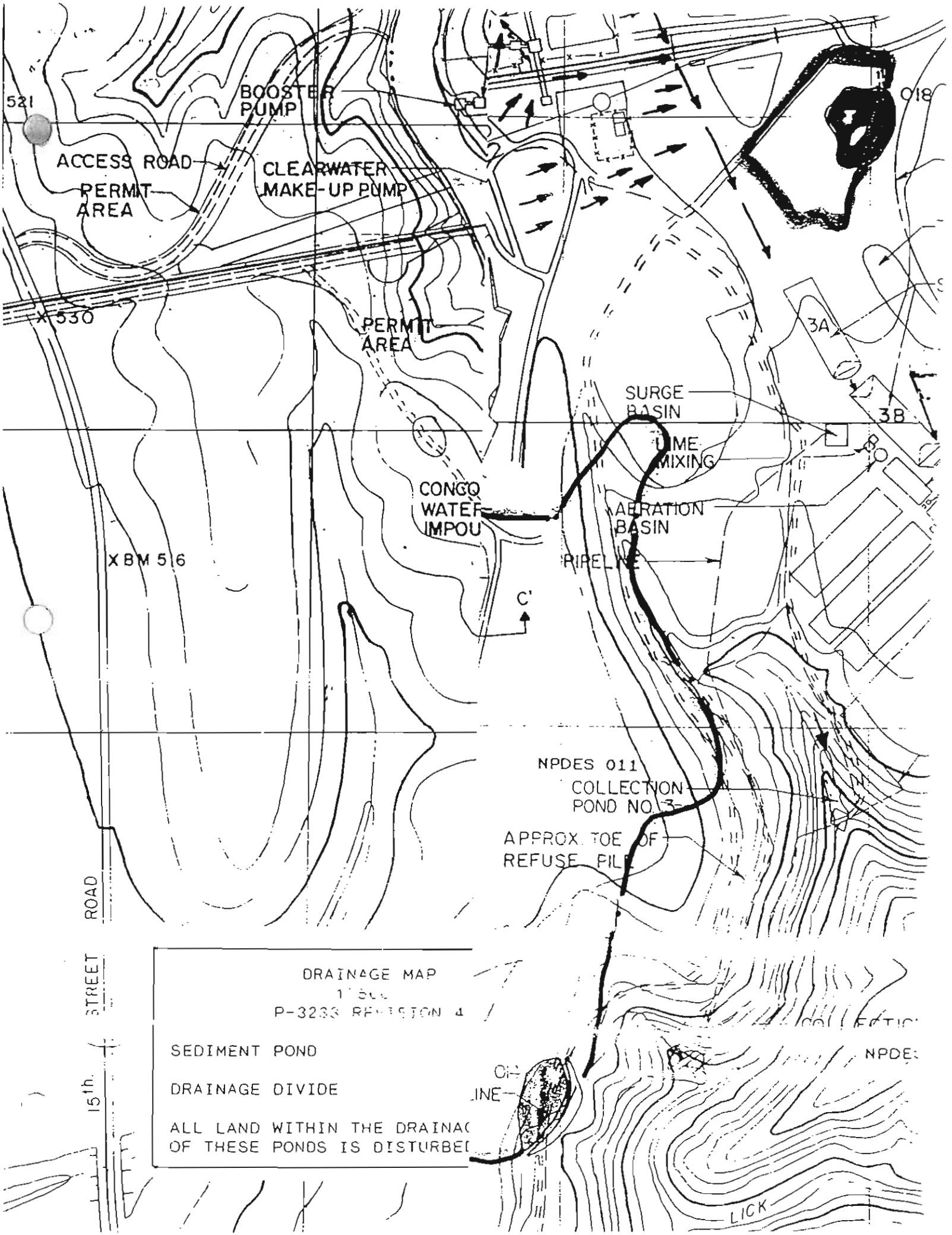
I. Sediment basins will not be removed until reclamation of the mine area is complete,drainage meets water quality requirements and approval is granted by the Regulatory Authority. Reclamation of the pond will be in strict compliance with current reclamation procedures unless the pond has been approved as a permanent water impoundment. The ponds will be reclaimed by the following procedures:

A diversion will be established around the basin to keep runoff from eroding the basin fill material and sediment while it is being stabilized. This diversion will be designed for a 2-year, 24-hour flow since it will be in use for only a short period of time.

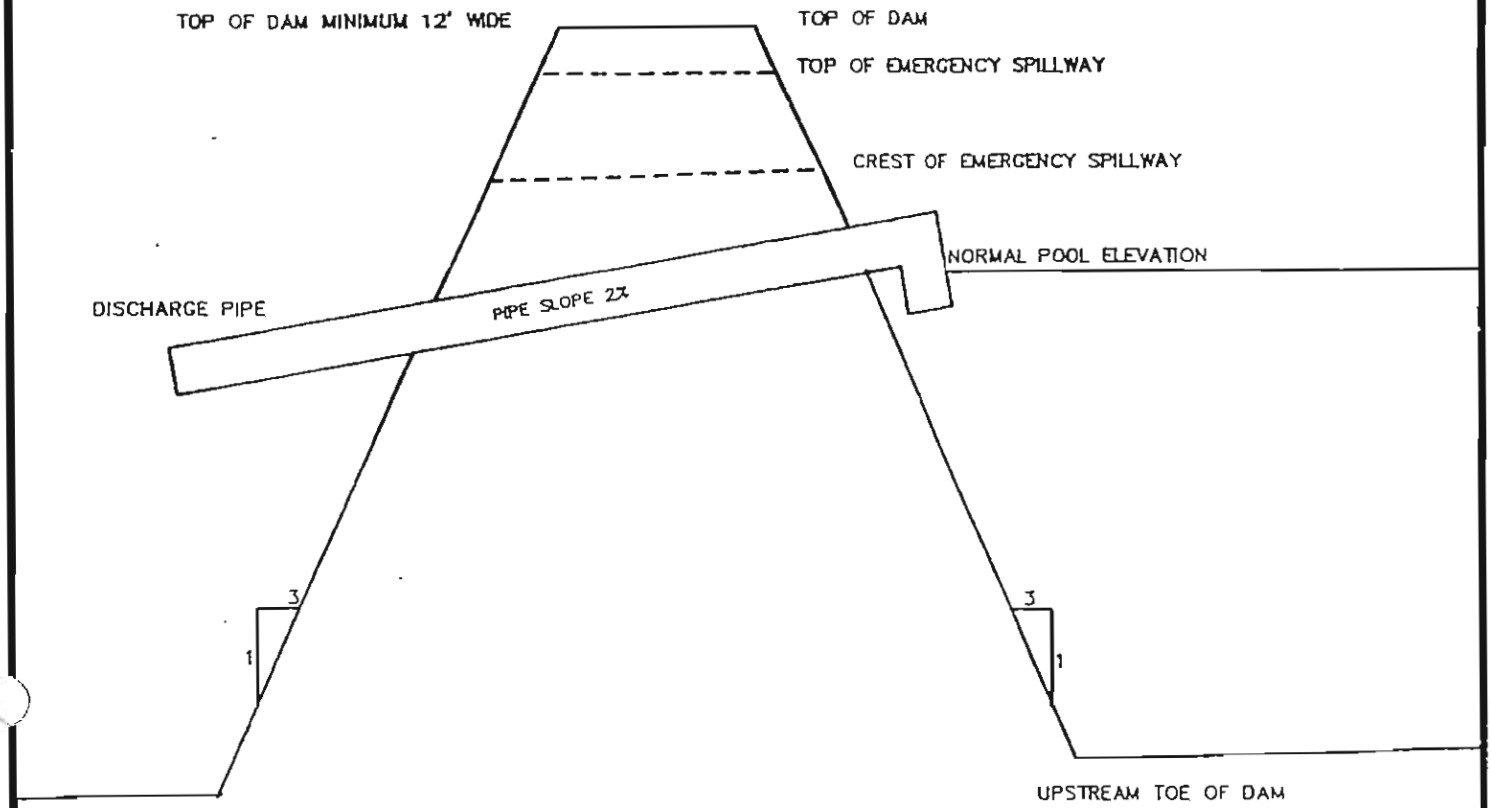
The pond will be pumped dry and the contained sediment then allowed to dry. Dam fill material will then be graded into the excavated area of the pond so as to cover the accumulated sediment and return the pond site to its approximate original contours. The entire area will be stabilized with respect to erosion by a vegetative cover or other means.

A channel will be established across the pond site which is suitable for the expected flows from the drainage basin and will be protected from excessive erosion by the placement of riprap or other suitable methods for the expected flow volumes and velocities. As soon as the new channel is complete and stable, the flow will be routed to it and the temporary diversion removed and revegetated.

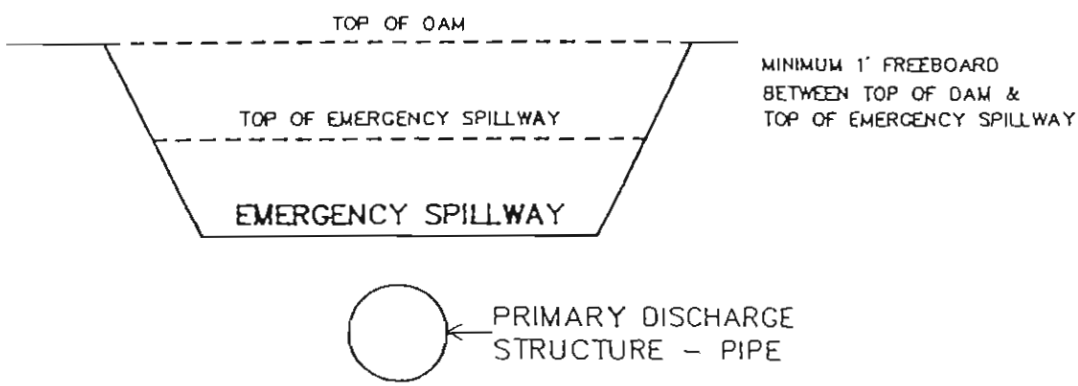
NOTE: All pond plans attached herein and all future pond plans submitted will correspond to specifications approved herein unless otherwise specified.


521
BOOSTER PUMP
ACCESS ROAD
PERMIT AREA
CLEARWATER MAKE-UP PUMP
X 530
PERMIT AREA
018
3A
3B
SURGE BASIN
LIME MIXING
CONCO WATER IMPOU
AERATION BASIN
PIPELINE
XBM 516
C'
NPDES 011
COLLECTION POND NO. 3
APPROX. TOE OF REFUSE PILE
ROAD
STREET
15th.
DRAINAGE MAP
1" = 500'
P-3233 REVISION 4
SEDIMENT POND
DRAINAGE DIVIDE
ALL LAND WITHIN THE DRAINAGE OF THESE PONDS IS DISTURBED
NPDES
LICK

GENERALIZED SECTIONAL VIEW
COMPACTION DAM



SCHEMATIC OF DISCHARGE STRUCTURES



NO SCALE

PREPARED BY:
AVATAR RESOURCE MANAGEMENT
MINING/ENVIRONMENTAL ENGINEERING & GEOLOGY

TABLES

TABLE 1
MAXIMUM FINES ELEVATIONS AND STORAGE CAPACITIES FOR EXISTING IMPOUNDMENT CONCORD COAL REFUSE DISPOSAL AREA

Stage	Crest Elevation (ft)	Required[1] Storm Storage (cy)	Maximum Fines Storage (cy)	Maximum Fines Elevation (ft)
1	670	233,500	902,700	662.7
2	680	253,500	1,429,200	672.4
3	690	268,500	2,012,300	682.7

(1) Required storm storage is based on criteria requiring the impoundment to sufficiently store one Probable Maximum Precipitation (PMP) storm event.

TABLE 1
SUMMARY OF EXPLORATION BORINGS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Boring Number	Total Depth (ft)	Soil Depth (ft)	Rock Coring (ft)	Undisturbed Samples (ea)	Piezometer Installation(1) (ft)	Comments
B-1	38	28	10	1	-	-
B-2	26	11	15	-	23.5	-
B-3	16.5	16.5	-	-	-	-
B-3A	5.5	5.5	-	1	-	-
B-4	54.5	54.5	-	-	53.0	-
B-5	98.5	98.5	-	1	98.0	Fine Coal Refuse 84'-96'
B-6	28	28	-	1	-	Fine Coal Refuse 0'-12'
B-7	33.5	33.5	-	-	-	-
B-8	33	23	10	-	-	-
B-9	78	78	-	-	78.0	-
B-10	42	30	12	1	-	-
B-11	111.5	111.5	-	-	111.0	-
B-12	111	111	-	-	110.0	-
B-13	129.3	129.3	-	-	129.3	-
B-14	121	121	-	-	-	-
B-15	18.5	18.5	-	-	-	-
B-16	26	12	14	1	-	-
B-17	113.5	113.5	-	-	113.5	-
B-18	106.5	106.5	-	-	105.0	Fine Coal Refuse 78'-83'
B-19	106.5	106.5	-	1	-	Fine Coal Refuse 78'-96'
B-20	46.5	46.5	-	2	-	Fine Coal Refuse 18'-30'
B-21	120.5	120.5	-	-	-	Fine Coal Refuse 97'-112'
Totals	**1,464.3**	**1,403.3**	**61**	**9**	**821.3**	

(1) Depth to the bottom of the monitoring zone.

TABLE 2
SUMMARY OF PIEZOMETERS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Boring Number	Total Depth (ft)	Depth of Piezometer (ft)	Surrounding Material	Static Water Level (ft)(1)	Water Level Elevation (MSL)	Date Measured	Comments
B-2	26	23.5	natural	17.30	553.60	2-15-91	
				16.10	557.60	4-15-91	measured from top of casing
B-4	54.5	53	coarse (0-45)	Dry	-	2-07-91	
			natural (45-54.5)	Dry	-	2-15-91	
				Dry	-	4-15-91	measured from top of casing
B-5	98.4	98	coarse (0-84)	78.30	563.00	2-07-11	measured immediately after bailing
			fine (84-96)	77.10	564.20	2-11-91	
			natural (96-98.4)	80.50	564.20	2-15-91	measured from top of casing
				78.15	566.55	4-15-91	measured from top of casing
B-9	78	78	coarse (0-76)	75.20	461.10	2-07-91	
			natural (76-78)	75.00	461.30	2-15-91	
				75.05	465.38	4-15-91	measured from top of casing
B-11	111.5	111	coarse (0-108)	107.50	550.80	2-07-91	
			natural (108-111.5)	106.75	551.55	2-11-91	
				107.00	551.30	2-15-91	
				111.00	550.23	4-15-91	measured from top of casing
B-12	110.9	110	coarse (0-105)	105.90	551.50	2-14-91	measured approx. 2 hrs after bailing
			natural (105-110.9)	105.90	551.50	2-15-91	
				103.00	558.34	4-15-91	measured from top of casing
B-13	129.3	129.3	coarse (0-124)	Dry	-	2-14-91	
			natural (124-129.3)	Dry	-	2-15-91	
				118.40	517.79	4-15-91	measured from top of casing
B-17	113.7	113.5	coarse (0-110)	103.50	531.20	2-14-91	measured before bailing; very muddy
			natural (110-113.7)	108.50	526.20	2-15-91	
				109.50	529.29	4-15-91	measured from top of casing
B-18	106.5	105	coarse (0-78)	81.25	577.55	2-15-91	measured from top of casing
			fine (78-83)	77.55	584.45	4-15-91	
			coarse (83-103)				
			natural (103-106.5)				

(1) Static water levels were measured from the ground surface except where noted.

TABLE 3

CONSTRUCTION STAGING SUMMARY
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Construction Stage	Time to Construct (Years)	Coarse Refuse Needed to Construct (cy)	Fine Refuse Disposal Capacity Created (cy)
Stage 1			
1A - Exist. Imp. to El. 670		83,300	903,000
1B - North Buttress to El. 675		957,000	
1C - East Butttess to El. 580		175,000	
1D - Northwest Embankment		112,000	
Stage 1 Sub Total	1.35	1,327,300	903,000
Cumulative Total	1.35	1,327,300	903,000
Stage 2			
2A - Exist. Imp. to El. 680		89,700	527,000
2B - N. Buttress to El. 690/660		1,711,000	
2C - East Berm to El. 630		257,000	
2D - Dike Embank. to El. 600		322,000	459,000
Stage 2 Sub Total	2.43	2,379,700	986,000
Cumulative Total	3.78	3,707,000	1,889,000
Stage 3			
3A - Exist. Imp. to El. 690		997,000	583,000
3B - N. Buttress to El. 710/690		34,000	
3C - Dike Embank. to El. 620		45,300	562,000
3D - South Area to El. 660		668,000	
Stage 3 Sub Total	1.78	1,744,300	1,145,000
Cumulative Total	5.56	5,451,300	3,034,000
Stage 4			
4A - Dike Embank. to El. 640		795,000	
4B - Close Exist. Imp.		620,000	738,000
4C - East Buttress to El. 690		403,000	
4D - South Area to El. 690		871,000	
Stage 4 Sub Total	2.74	2,689,000	738,000
Cumulative Total	8.30	8,140,300	3,772,000
Stage 5			
5A - East Area to El. 690		3,896,403	
5B - Main Area to El. 730		7,485,950	
Stage 5 Sub Total	11.61	11,382,353	0
Cumulative Total (Fine)	14.44		3,772,000
Cumulative Total (Coarse)	19.91	19,522,653	
Final Total (Fine)	14.44		3,772,000
Final Total (Coarse)	19.91	19,522,653	

TABLE 4

MAXIMUM FINE REFUSE ELEVATIONS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Stage	Substage	Maximum Fine Refuse Elevation (MSL)[1]	
		Existing Impoundment	Proposed Impoundment
1	A	663	-
	B	663	-
	C	663	-
	D	663	-
2	A	672	-
	B	672	-
	C	672	-
	D	672	591
3	A	683	591
	B	683	591
	C	683	611
	D	683	611
4	A	-	632
	B	-	632
	C	-	632
	D	-	632
5	A	-	632
	B	-	632

[1] The maximum fine refuse elevations are the maximum operating levels allowable at the associated stage in order to maintain required stormwater storage capacity and freeboard.

TABLE 5

RECENT WATER LEVEL ELEVATION FOR PIEZOMETERS
ON VARIOUS DATES
U.S. STEEL MINING COMPANY, INC.
CONCORD REFUSE AREA

Boring Number	12/7/93	12/14/93	12/21/93	12/28/93	1/4/94	1/12/94	1/18/94	1/25/94	2/2/94	2/8/94	2/15/94	2/22/94
B-2	533.37	553.51	553.50	553.44	553.52	553.55	553.53	553.55	553.82	553.79	553.66	554.05
B-4	561.77 Dry	561.77 Dry	561.72 Dry	561.74 Dry	561.75 Dry	561.75 Dry	561.75 Dry	561.74 Dry	561.74 Dry	561.74 Dry	561.75 Dry	561.85
B-5	563.48	563.50	563.54	563.52	563.54	563.60	563.59	563.62	563.77	563.75	563.65	563.88
B-9	460.87	460.88	460.90	460.87	460.89	460.92	460.95	460.97	461.05	461.06	461.00	461.54
B-11	551.20	551.25	551.23	551.24	551.20	551.24	551.23	551.25	551.33	551.31	551.32	551.33
B-12	553.60	553.64	553.65	553.65	553.67	553.67	553.68	553.71	553.70	553.70	553.59	553.75
B-13	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	495.70
B-17	522.91	523.02	523.00	523.01	523.06	523.10	523.07	523.11	523.31	523.25	523.21	524.02
B-18	561.21	561.28	561.25	561.23	561.30	561.29	561.28	561.30	561.44	561.43	561.32	562.98

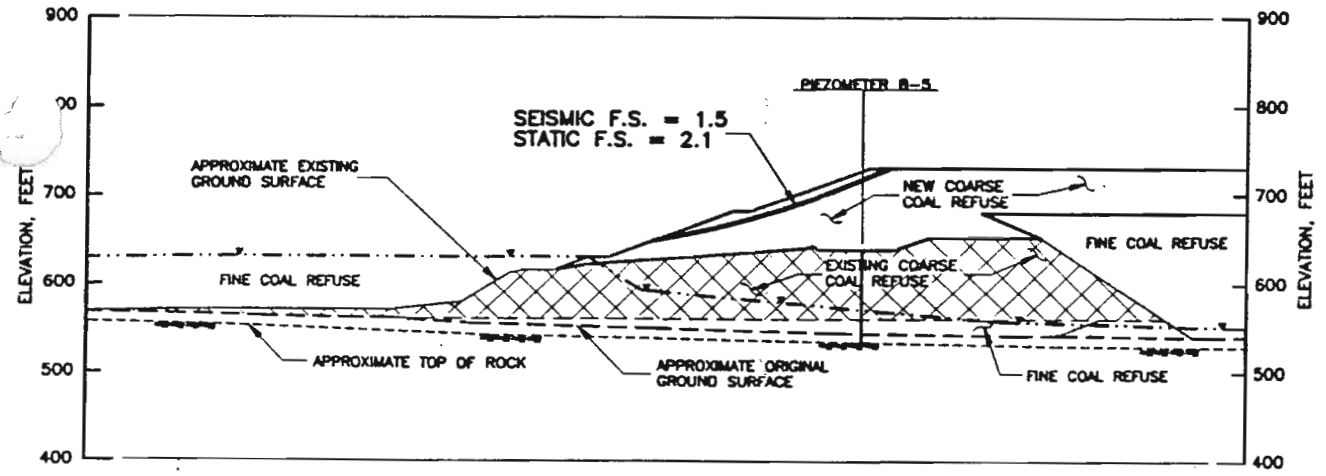
TABLE 5

MAXIMUM ALLOWABLE WATER LEVELS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

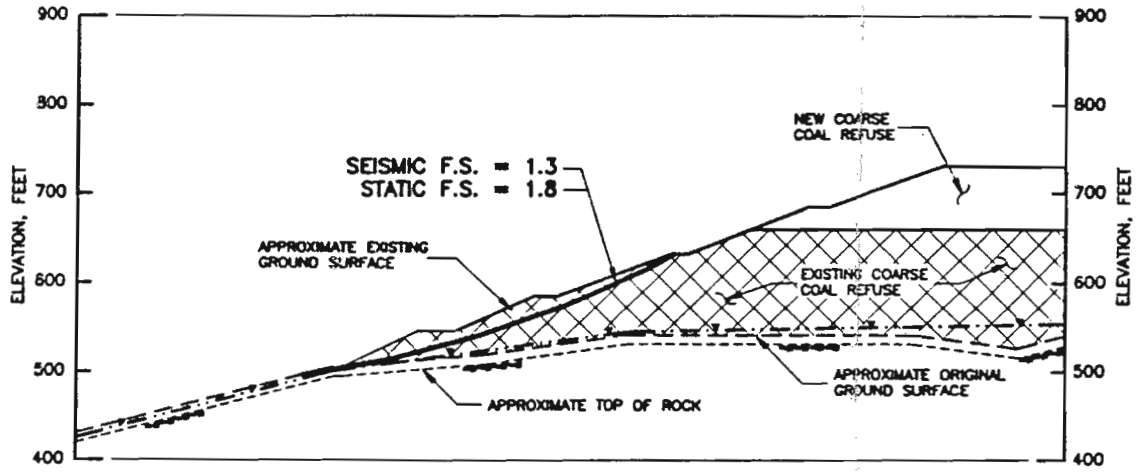
Piezometer[2]	Maximum Allowable Water Level[1]				
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
B-2	NR	NR	575	575	575
B-4	NR	NR	575	575	575
B-5	590	655	665	665	665
B-9	NR	NR	NR	NR	485
B-11	655	665	675	675	675
B-12	590	600	610	610	610
B-13	NR	NR	550	550	550
B-17	NR	NR	550	550	550
B-18	650	[3]	NR	NR	NR

NR - Not Required

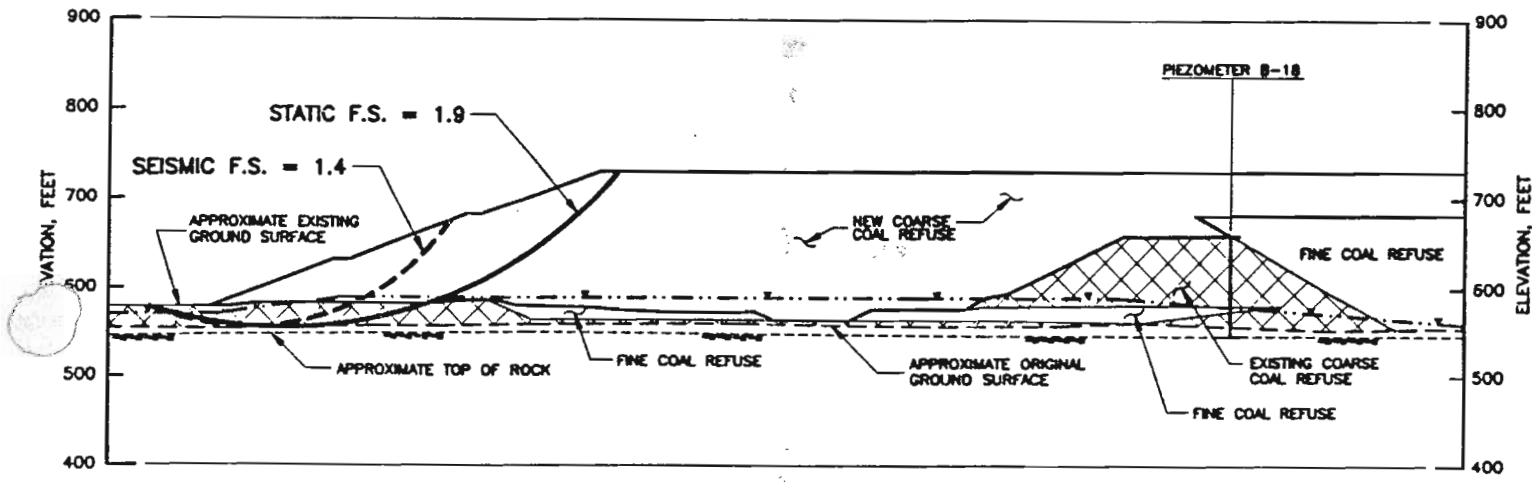
[1] The engineer should be notified immediately if the maximum allowable water level is reached in any piezometer.
[2] All piezometers should be maintained and monitored in accordance with the expansion plan Guideline Technical Specifications.
[3] Piezometer B-18 will be decommissioned prior to construction of Stage 2 of the expansion plan.



STABILITY SECTION A_1–A_1, STAGE 5



CROSS SECTION I–I, STAGE 5



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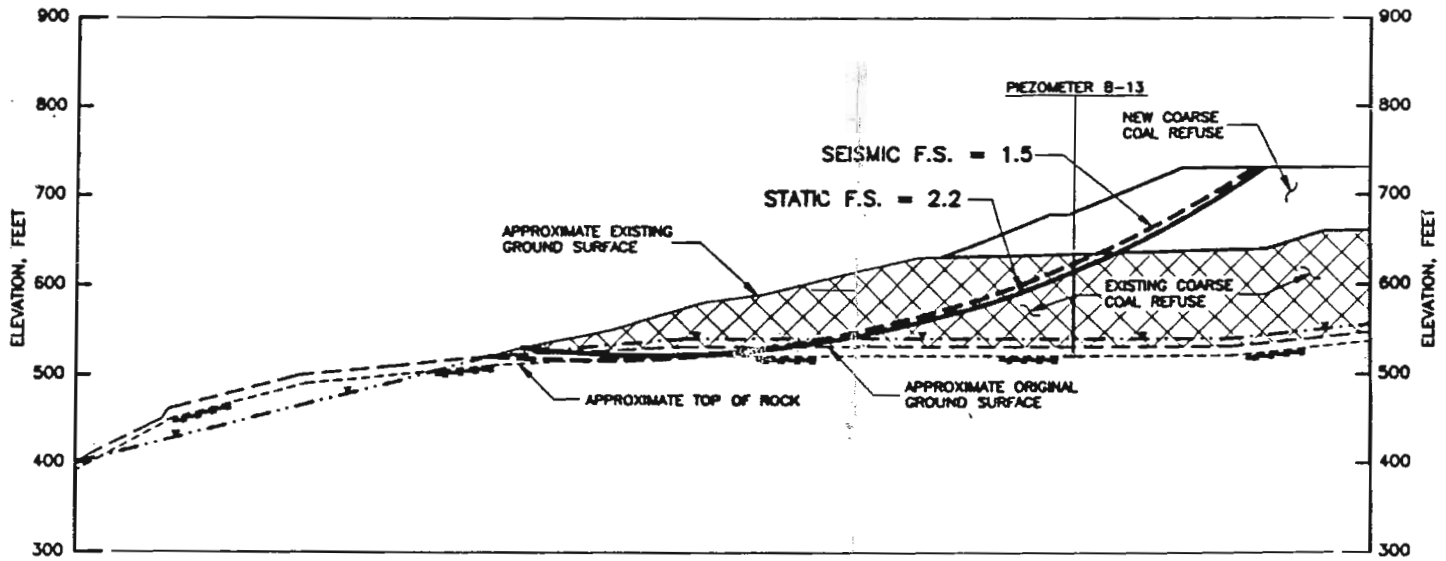
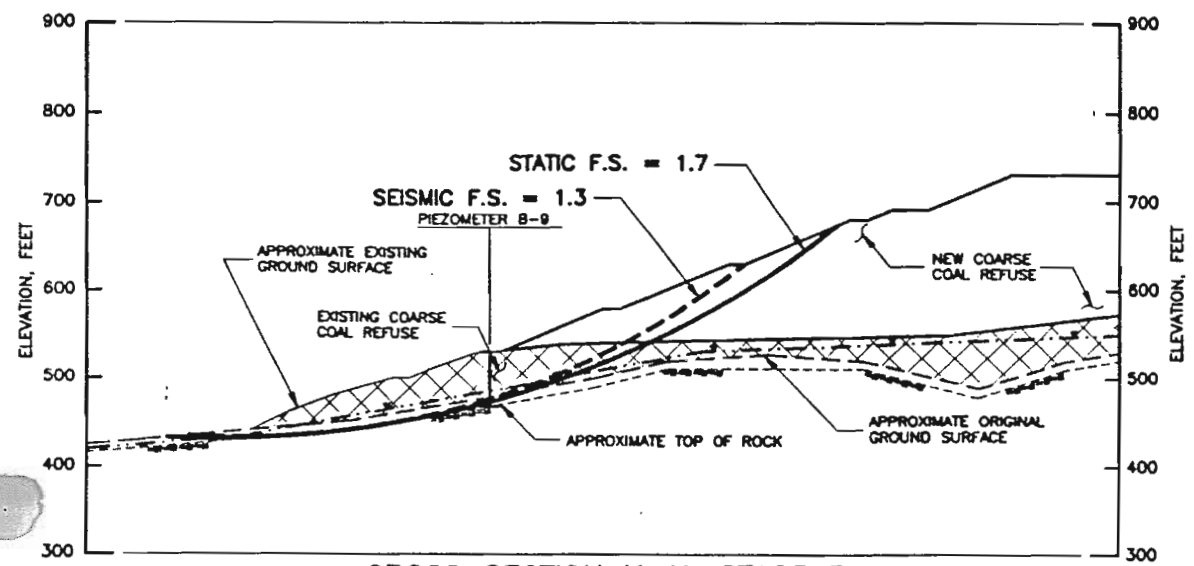


CROSS SECTION J–J, STAGE 5



CROSS SECTION H–H, STAGE 5

MATERIAL PROPERTIES USED IN EMBANKMENT STABILITY ANALYSES

MATERIAL	TOTAL UNIT WEIGHT (PCF)	EFFECTIVE SHEAR STRENGTH PARAMETERS	
		ANGLE OF INTERNAL FRICTION (DEGREES)	COHESION (PSF)
NATURAL SOIL	130	31	0
EXISTING COARSE COAL REFUSE	115	30	0
NEW COARSE COAL REFUSE	118	33	0
FINE COAL REFUSE	72	24/18[1]	0

HORIZONTAL & VERTICAL SCALE
100 0 100 200 FEET

NOTES:

1. A FRICTION ANGLE OF 18 DEGREES WAS USED FOR THE FINE COAL REFUSE IN THE SEISMIC STABILITY ANALYSIS.
2. STABILITY ANALYSES WERE PERFORMED USING THE COMPUTER PROGRAM PC-STABL5. FOR COMPUTER OUTPUT DATA, REFER TO ALMES REPORT, APPENDIX "C".
3. FOR PLAN LOCATIONS OF SECTIONS, SEE DRAWING NOS. 90-55-E102 THROUGH 90-55-E106.
4. SUBSURFACE CONDITIONS WERE DETERMINED, WHERE POSSIBLE, FROM EXPLORATION BORINGS AND PIEZOMETERS. WHEN DIRECT INFORMATION WAS NOT AVAILABLE, CONDITIONS WERE APPROXIMATED FROM MAPS AND GENERALIZED SITE CHARACTERISTICS.
5. A HORIZONTAL EARTHQUAKE ACCELERATION OF 0.1 WAS USED FOR SEISMIC CASES.
6. STRUCTURAL AND 100% COMPACTION ZONES ARE NOT SHOWN ON THESE SECTIONS. REFER TO DRAWING NOS. 90-55-E107, 90-55-E108, 90-55-E111 AND 90-55-E112.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

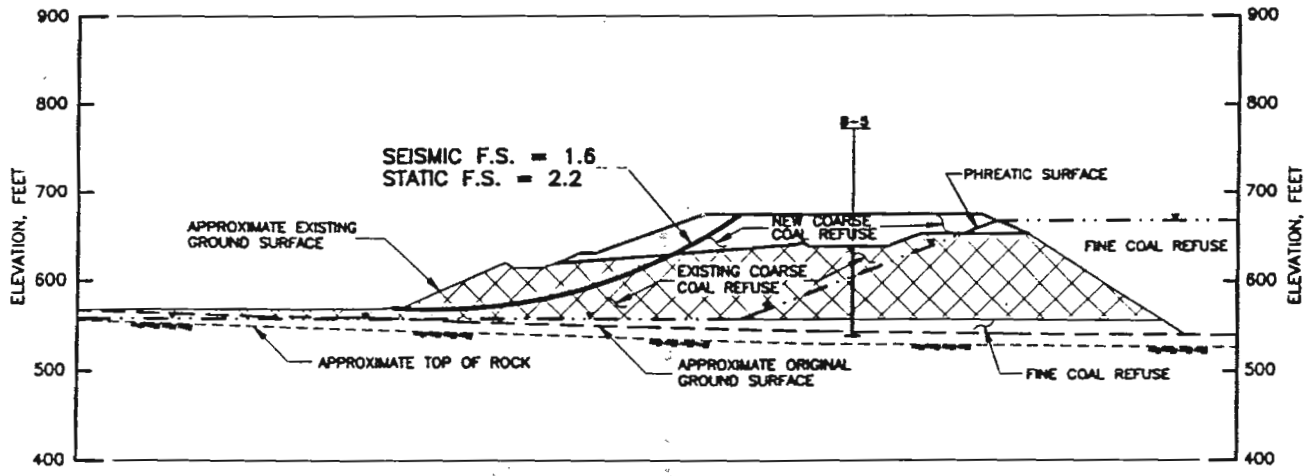
STABILITY CROSS SECTIONS (SHEET 2 OF 2)

PREPARED FOR

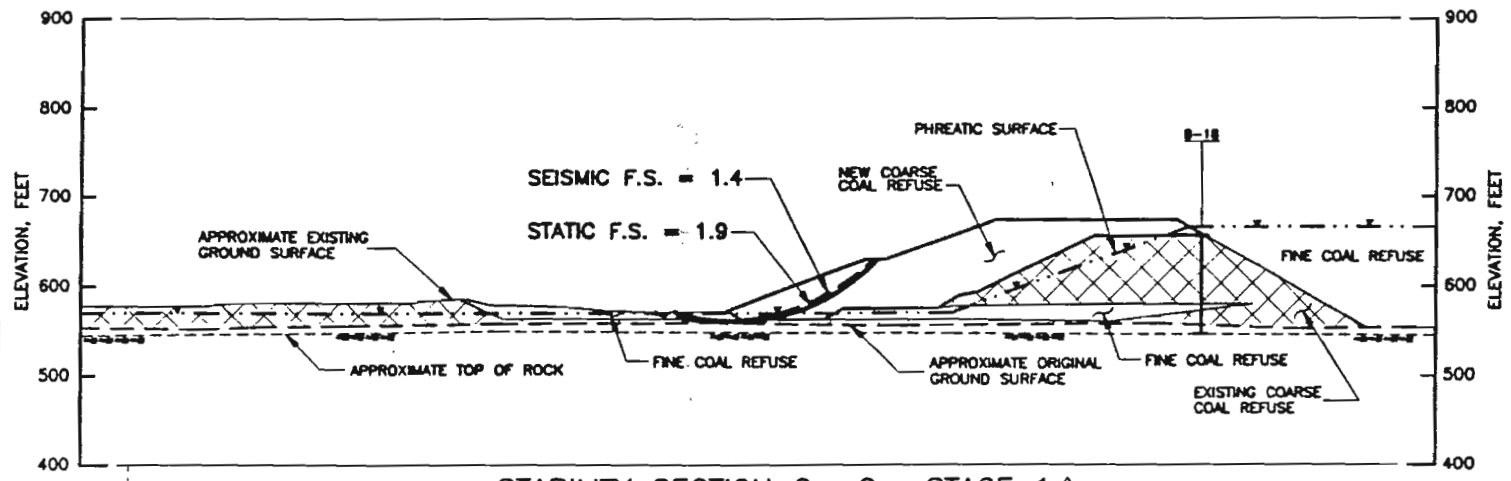
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DSM/MEL	08/03/91	SCALE AS NOTED
CHECKED BY	DMC	9/12/91	DRAWING NO. 90-55-E110
APPROVED BY	RMW	9/12/91	

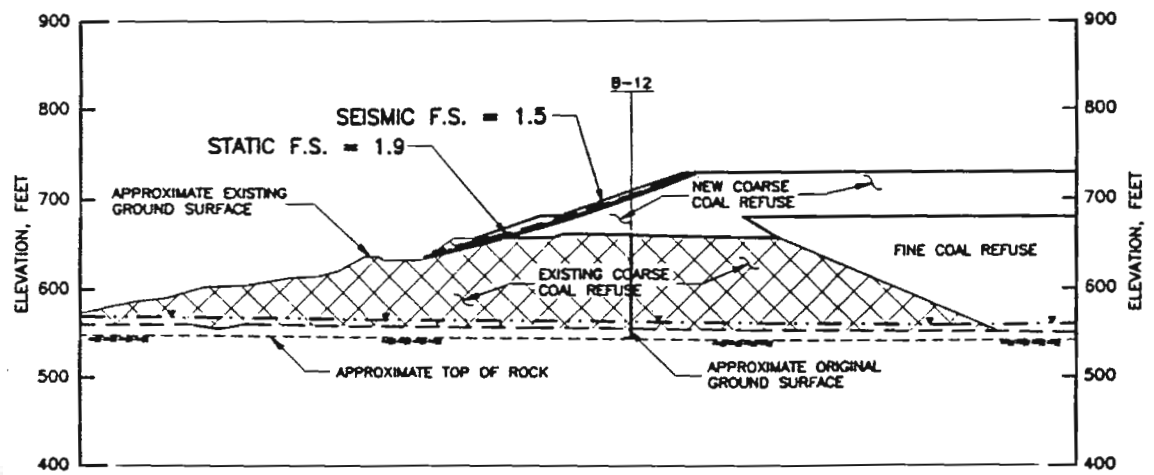
M 743-10



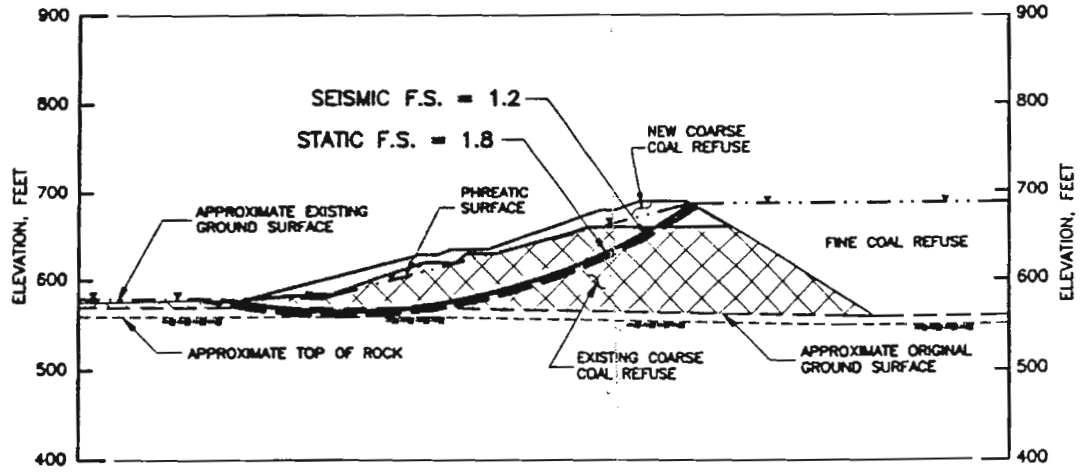
STABILITY SECTION A_1–A_1, STAGE 1 ⚠



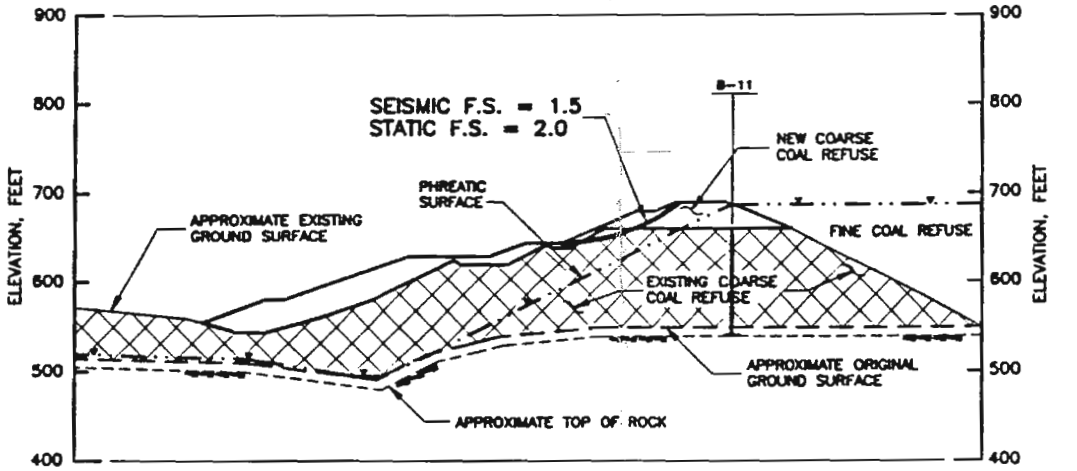
STABILITY SECTION C_1–C_1, STAGE 1 ⚠



STABILITY SECTION D_1–D_1, STAGE 5



CROSS SECTION F–F, STAGE 3 ⚠



CROSS SECTION G–G, STAGE 3 ⚠

MATERIAL PROPERTIES USED IN EMBANKMENT STABILITY ANALYSES

MATERIAL	TOTAL UNIT WEIGHT (PCF)	EFFECTIVE SHEAR STRENGTH PARAMETERS	
		ANGLE OF INTERNAL FRICTION (DEGREES)	COHESION (PSF)
NATURAL SOIL	130	31	0
EXISTING COARSE COAL REFUSE	115	30	0
NEW COARSE COAL REFUSE	118	33	0
FINE COAL REFUSE	72	24/18[1]	0

HORIZONTAL & VERTICAL SCALE
100 0 100 200 FEET

NOTES:

1. A FRICTION ANGLE OF 18 DEGREES WAS USED FOR THE FINE COAL REFUSE IN THE SEISMIC STABILITY ANALYSES.
2. STABILITY ANALYSES WERE PERFORMED USING THE COMPUTER PROGRAM PCSTABL5M. FOR COMPUTER OUTPUT DATA, REFER TO ALMES REPORT, APPENDIX "C".
3. FOR PLAN LOCATIONS OF SECTIONS, SEE DRAWING NOS. 90-55-E102. THROUGH 90-55-E106.
4. SUBSURFACE CONDITIONS WERE DETERMINED, WHERE POSSIBLE, FROM EXPLORATION BORINGS AND PIEZOMETERS. WHEN DIRECT INFORMATION WAS NOT AVAILABLE, CONDITIONS WERE APPROXIMATED FROM MAPS AND GENERALIZED SITE CHARACTERISTICS.
5. A HORIZONTAL EARTHQUAKE ACCELERATION OF 0.1 WAS USED FOR SEISMIC CASES.
6. STRUCTURAL AND 100% COMPACTION ZONES ARE NOT SHOWN ON THESE SECTIONS. REFER TO DRAWING NOS. 90-55-E107, 90-55-E108, 90-55-E111 AND 90-55-E112.

REV	DATE	DESCRIPTION		
⚠	3/94	REVISION TO PHREATIC SURFACE AND MAXIMUM FINE COAL REFUSE ELEVATION	RMW	JHG

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

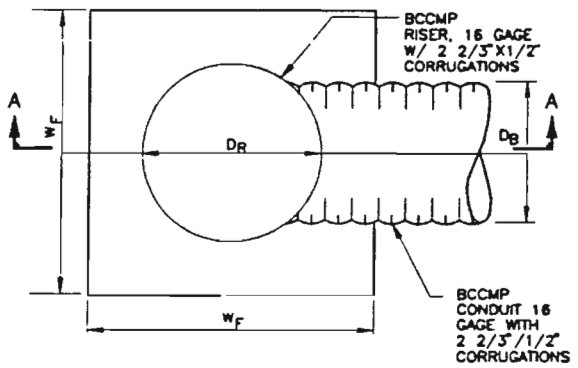
STABILITY CROSS SECTIONS (SHEET 1 OF 2)

PREPARED FOR

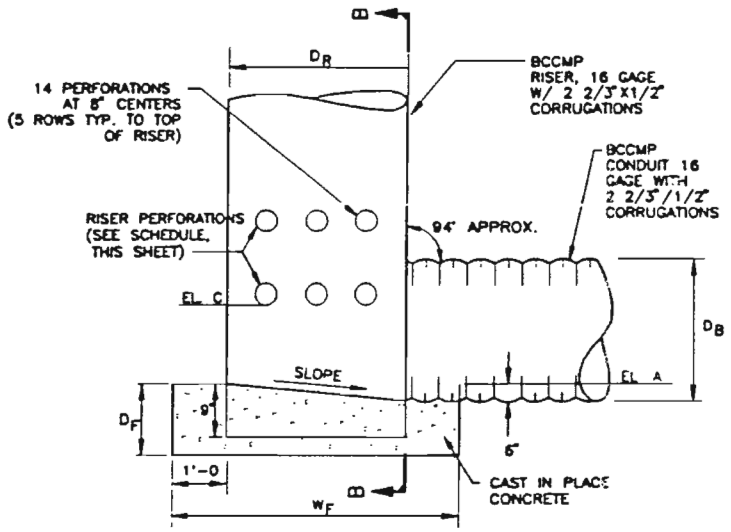
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DSM/MEL	03/08/94	SCALE AS NOTED	M743-9
CHECKED BY	DMC	09/12/91		
APPROVED BY	RMW	09/12/91	DRAWING NO. 90-55-E109	

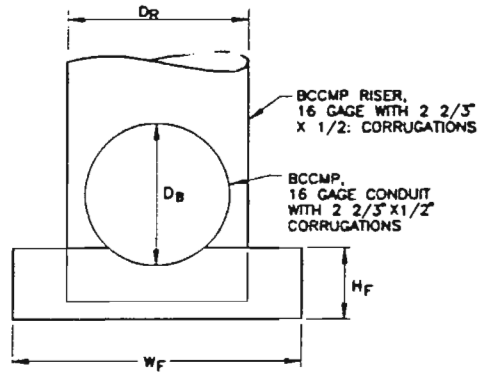
⚠



PLAN
N.T.S.

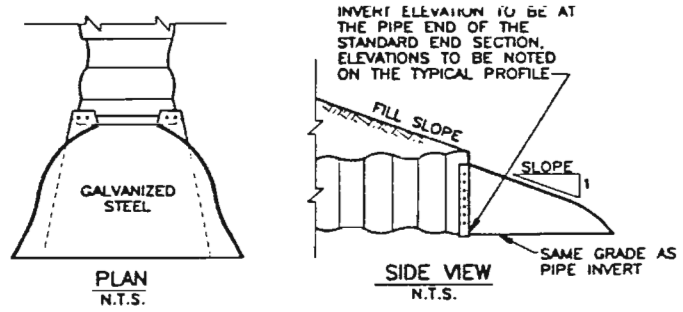


SECTION A–A
N.T.S.

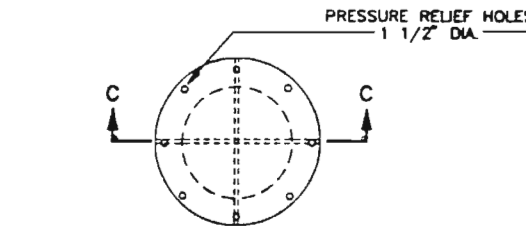


SECTION B–B
N.T.S

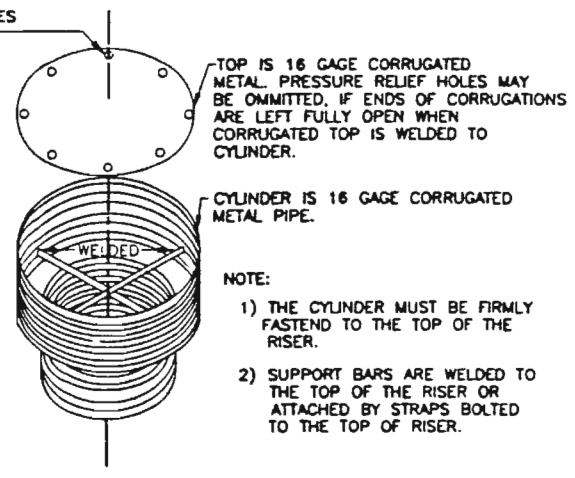
16 E118 SEDIMENT POND RISER FOUNDATION
N.T.S



17 E118 MITERED END SECTIONS
(REFER TO SCHEDULE THIS SHEET)
N.T.S.

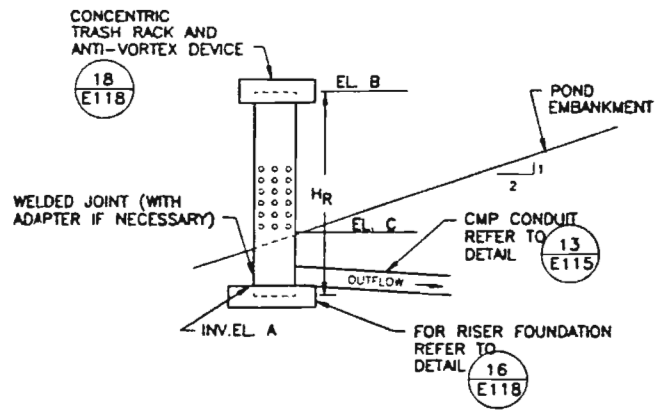


SECTION C–C



ISOMETRIC VIEW

18 E118 CONCENTRIC TRASH RACK AND ANTI–VORTEX DEVICE
N.T.S.



19 E118 SEDIMENT POND PRINCIPLE SPILLWAY RISER
N.T.S.

NOTE: FOR RISER/BARREL DIMENSIONS, SEE SCHEDULES THIS SHEET AND DRAWING NO. 90–55–E117.

SEDIMENT POND RISER/BARREL SCHEDULE

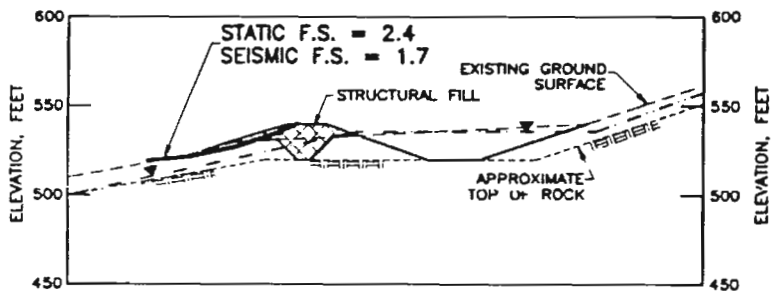
RISER/BARREL SCHEDULE	POND 1	POND 2	POND 3	POND 4
DIAMETER OF RISER, D_R (IN.)	18	18	18	N/A
DIAMETER OF BARREL, D_B (IN.)	18	18	18	18
INVERT OF BARREL, EL. A	550	530	525.5	615
CREST OF RISER, EL. B	543	536	532.5	N/A
START OF PERFORATIONS, INVERT EL. C	547	534	529.5	N/A
HEIGHT OF RISER, H_R (FT)	7	6	7	N/A
DIAMETER OF TRASH RACK, D_T (IN.)	27	27	27	N/A
HEIGHT OF TRASH RACK, H_T (IN.)	8	8	8	N/A
WIDTH OF RISER FOUNDATION, W_F (FT)	4	4	4	N/A
DEPTH OF RISER FOUNDATION, D_F (FT)	1.5	1.5	1.5	N/A

RISER PERFORATION SCHEDULE	INVERT ELEVATION	NO. OF ORIFICES	ORIFICE SIZE (IN.)
SEDIMENT POND 1	547.0	1	0.5
	547.5	1	0.5
	548.0	1	0.5
	548.5	1	0.5
	549.0	1	0.5
SEDIMENT POND 2	534.0	1	6
	534.5	1	6
	535.0	1	6
	535.5	1	6
SEDIMENT POND 3	529.5	3	3
	530.0	3	3
	530.5	3	3
	531.0	3	3
	531.5	3	3

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV

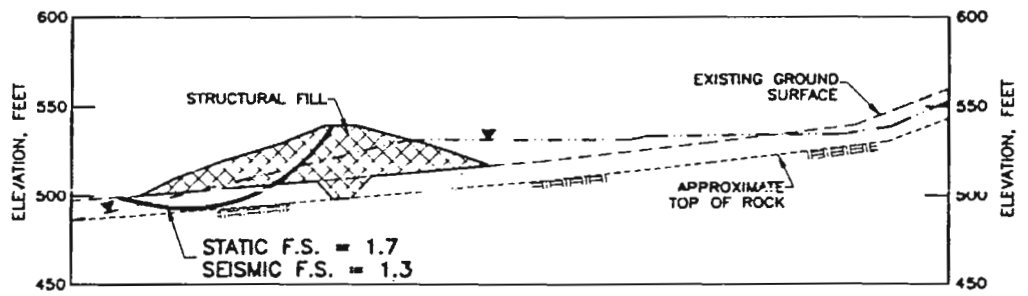
SEDIMENT POND DETAILS
PREPARED FOR
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	MEL	08/04/91	SCALE AS NOTED
CHECKED BY	[illegible]	[illegible]	M743-1
APPROVED BY	[illegible]	[illegible]	DRAWING NO. 90–55–E11



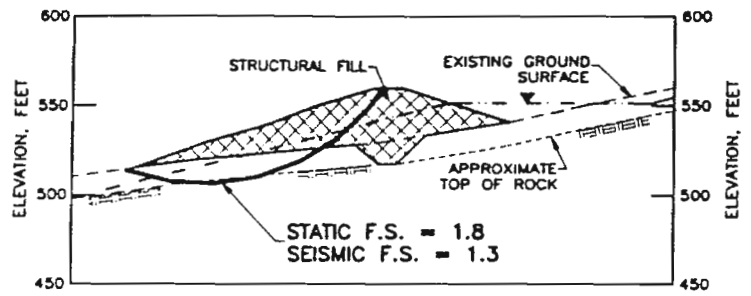
CROSS SECTION SEDIMENT POND 2

SCALE
50 0 50 100 FEET



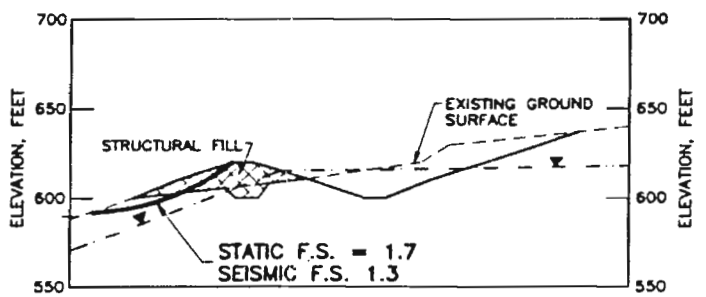
CROSS SECTION SEDIMENT POND 3

SCALE
50 0 50 100 FEET



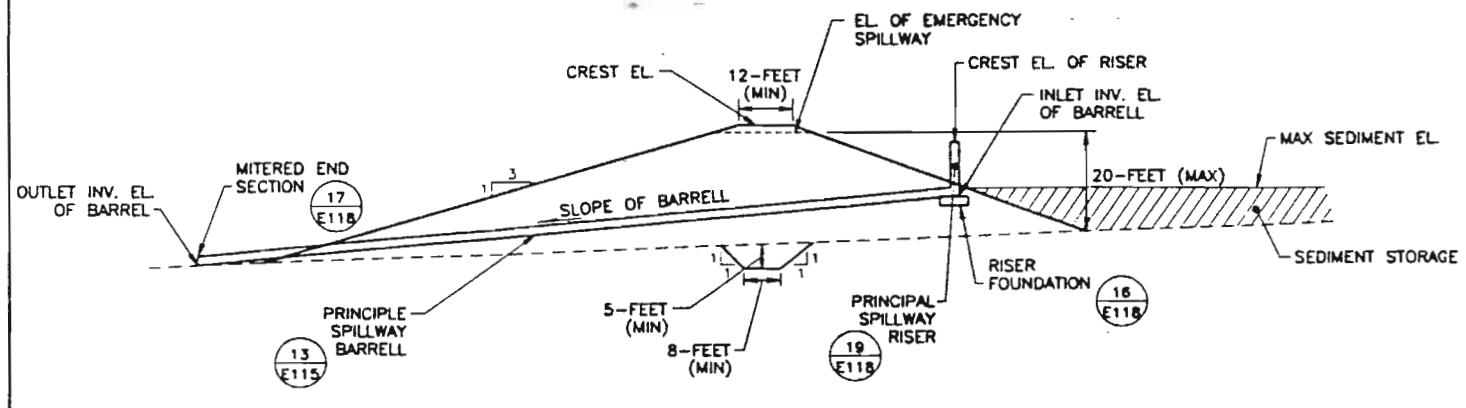
CROSS SECTION SEDIMENT POND 1

SCALE
50 0 50 100 FEET



CROSS SECTION SEDIMENT POND 4

SCALE
50 0 50 100 FEET



TYPICAL PRINCIPLE SPILLWAY PROFILE

SCALE
20 0 20 40 FEET

SEDIMENT POND PROFILE SCHEDULE

	POND 1	POND 2	POND 3	POND 4
CREST ELEVATION	560.00	540.58	540.00	620.00
EL. OF EMER. SPILLWY	551.00	537.00	533.50	617.00
MAXIMUM SEDIMENT EL.	546.00	533.00	528.50	611.00
OUTLET INV. EL. OF BARRELL	523.00	516.00	495.00	612.50
INLET INV. EL. OF BARRELL	543.00	530.00	525.50	615.00
CREST EL. OF RISER	550.00	536.00	532.50	N/A
LENGTH OF BARREL (FT.)	240.00	140.00	200.00	50.00
SLOPE OF BARRELL (%)	8.3	8.6	15.3	5.0

MATERIAL PROPERTIES USED IN EMBANKMENT STABILITY ANALYSES

MATERIAL	TOTAL UNIT WEIGHT (PCF)	EFFECTIVE SHEAR STRENGTH PARAMETERS	
		ANGLE OF INTERNAL FRICTION (DEGREES)	COHESION (PSF)
NATURAL SOIL	130	31	0
EXISTING COARSE COAL REFUSE	115	30	0
STRUCTURAL FILL	118	33	0

NOTES:

1. STABILITY ANALYSES WERE PERFORMED USING THE COMPUTER PROGRAM PC-STABL5. FOR COMPUTER OUTPUT DATA, REFER TO ALMES REPORT, APPENDIX "C".
2. FOR PLAN LOCATIONS OF SECTIONS, SEE DRAWING NO. 90-55-E116
3. SUBSURFACE CONDITIONS WERE DETERMINED, WHERE POSSIBLE, FROM EXPLORATION BORINGS AND PIEZOMETERS. WHEN DIRECT INFORMATION WAS NOT AVAILABLE, CONDITIONS WERE APPROXIMATED FROM MAPS AND GENERALIZED SITE CHARACTERISTICS.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

SEDIMENT POND CROSS SECTIONS AND PROFILE
PREPARED FOR
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	PRH/MEL	08/04/91	SCALE AS NOTED
CHECKED BY	DMC	9/12/91	DRAWING NO. 90-55-E11
APPROVED BY	RMW	9/12/91	

NOTES:

1. HAUL ROADS SHALL BE CONSTRUCTED AND MAINTAINED AS SHOWN IN DETAIL NO. 2 ON DRAWING NO. 90-55-E113 AND AS SPECIFIED IN THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
2. EXISTING PIEZOMETERS SHALL BE EXTENDED AS THE EMBANKMENT IS RAISED, REFER TO DETAIL NO. 10 ON DRAWING NO. 90-55-E114.
3. FOR STAGE 5 CROSS-SECTIONS REFER TO DRAWING NO. 90-55-E107 AND DRAWING NO. 90-55-E108. FOR STAGE 5 STABILITY SECTIONS REFER TO DRAWING NO.S 90-55-E109 AND 90-55E110
4. TEMPORARY DITCHES AND SEDIMENT CONTROL STRUCTURES ARE TO BE CONSTRUCTED AS DETERMINED NECESSARY BY THE ENGINEER.

LEGEND:

- EXISTING STAGE
- PROPOSED STAGE
- FINE COAL REFUSE
- 600 EXISTING CONTOUR
- 600 PROPOSED CONTOUR
- B-9 PIEZOMETER
- CULVERT
- EXISTING ACCESS ROAD
- DITCH
- A CROSS SECTION LOCATION
- X / E113 DETAIL NUMBER / DRAWING WHERE DETAIL IS LOCATED

STAGE 5A EAST AREA TO EL 690

BENCH AND GUTTER (TYP.) (1% MIN. SLOPE) 1 E113

40' HAUL ROAD (SEE NOTE 1) 2 E113

STAGE 5 FINAL CREST (SLOPED TO DRAIN)

EL 730

SLOPE TO DRAIN

APPROXIMATE LOCATION OF DEDICATED DEWATERING PUMP △

FINE COAL REFUSE DISPOSAL AREA (FINAL MAXIMUM LEVEL EL 652±)

STAGE 5B ENTIRE AREA TO EL 730

B-9 B-11 B-13 B-17

N 13,000 N 12,000 N 11,000 E -7000

SCALE 200 0 200 400 FEET

REFERENCE

TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27, 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT AL

REV	DATE	DESCRIPTION	P M	OPER
△	3/94	ADDED LOCATION OF DEDICATED DEWATERING PUMP	RMW	JHC
△	04/29/93	ADDED PIEZOMETER LOCATIONS AND REVISED ELEV	RMW	ACR

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

PLAN-STAGE 5

PREPARED FOR
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DDK/CLG	09/05/91	SCALE AS NOTED	M 743-6
CHECKED BY	DMC	09/12/91		
APPROVED BY	RMW	09/12/91	DRAWING NO. 90-55-E106	

NOTES:

1. HAUL ROADS SHALL BE CONSTRUCTED AND MAINTAINED AS SHOWN IN DETAIL NO. 2 ON DRAWING NO. 90-55-E113 AND AS SPECIFIED IN THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
2. EXISTING PIEZOMETERS SHALL BE EXTENDED AS THE EMBANKMENT IS RAISED, REFER TO DETAIL NO. 10 ON DRAWING NO. 90-55-E114.
3. FOR STAGE 4 CROSS-SECTIONS REFER TO DRAWING NO. 90-55-E107 AND DRAWING NO. 90-55-E108.
4. FOR STRUCTURAL FILL ZONE LOCATIONS AND COMPACTION REQUIREMENTS, REFER TO DRAWING NO. 90-55-E107, DRAWING NO. 90-55-E108 AND GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A" ALMES REPORT).
5. FOR DIKED EMBANKMENT CONSTRUCTION, SEE DRAWING NO. 90-55-E111 FOR PLAN, DRAWING NO. 90-55-E112 FOR TYPICAL CROSS-SECTION AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT)
6. TEMPORARY DITCHES AND SEDIMENT CONTROL STRUCTURES ARE TO BE CONSTRUCTED AS DETERMINED NECESSARY BY THE ENGINEER.
7. CLOSURE OF THE EXISTING IMPOUNDMENT SHALL OCCUR AS SPECIFIED IN THE GUIDELINE TECHNICAL SPECIFICATION (APPENDIX "A", ALMES REPORT).

LEGEND:

- PROPOSED STAGE
- FINE COAL REFUSE
- 600 EXISTING CONTOUR
- 600 PROPOSED CONTOUR
- B-9 PIEZOMETER
- CULVERT
- EXISTING ACCESS ROAD
- DITCH GUTTERS
- A CROSS SECTION LOCATION
- X / E113 DETAIL NUMBER; DRAWING WHERE DETAIL IS LOCATED

PERIMETER DITCH B
40' HAUL ROAD (SEE NOTE 1)
BENCH AND GUTTER (TYP.) (1% MIN. SLOPE)
STAGE 4C-EAST BUTTRESS TO EL. 690
STAGE 4D-SOUTH AREA TO EL. 690
EL. 690
EL. 710
APPROXIMATE LOCATION OF DEDICATED DEWATERING PUMP
STAGE 4A-DIKED EMBANKMENT TO EL. 640 (SEE NOTE 5)
STAGE 4B-CLOSE EXISTING IMPOUNDMENT (SEE NOTE 7)
FINE COAL REFUSE DISPOSAL AREA (FINAL MAXIMUM LEVEL EL. 632±)
B-9, B-11, B-12, B-13, B-15, B-17

REFERENCE
TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27, 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT, AL.

SCALE
200 0 200 400 FEET

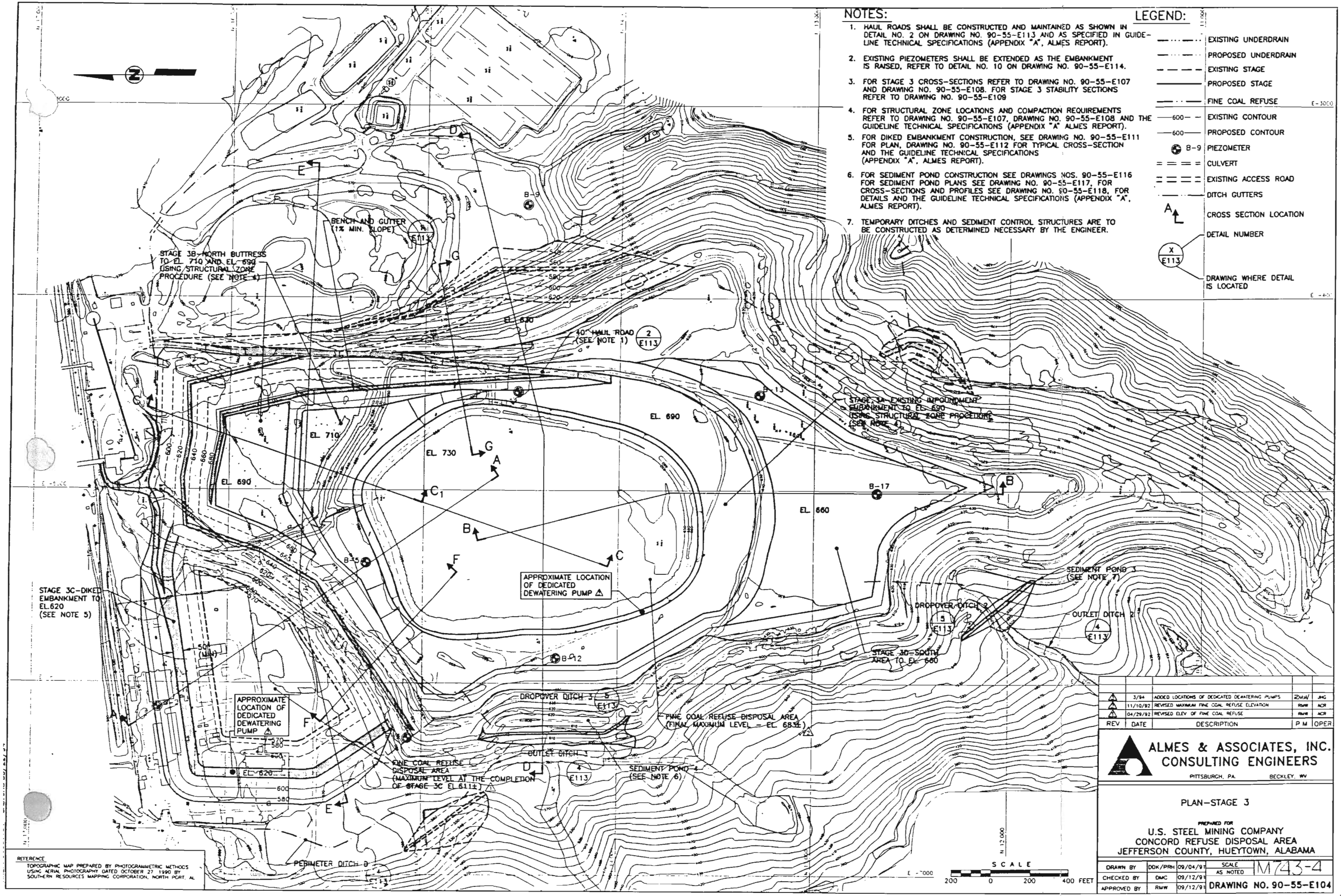
REV	DATE	DESCRIPTION	P M	OPER
2	3/94	ADDED LOCATIONS OF DEDICATED DEWATERING PUMPS	RWW	JMC
1	05/07/92	REVISED ELEV. OF FINE COAL REFUSE	RWW	ACR

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA BECKLEY, WV

PLAN-STAGE 4

PREPARED FOR
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DDK/CLG	09/05/91	SCALE AS NOTED	M 743-5
CHECKED BY	DMC	09/12/91		
APPROVED BY	RWW	09/12/91	DRAWING NO. 90-55-E105	



NOTES:

1. HAUL ROADS SHALL BE CONSTRUCTED AND MAINTAINED AS SHOWN IN DETAIL NO. 2 ON DRAWING NO. 90-55-E113 AND AS SPECIFIED IN GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
2. EXISTING PIEZOMETERS SHALL BE EXTENDED AS THE EMBANKMENT IS RAISED, REFER TO DETAIL NO. 10 ON DRAWING NO. 90-55-E114.
3. FOR STAGE 3 CROSS-SECTIONS REFER TO DRAWING NO. 90-55-E107 AND DRAWING NO. 90-55-E108. FOR STAGE 3 STABILITY SECTIONS REFER TO DRAWING NO. 90-55-E109
4. FOR STRUCTURAL ZONE LOCATIONS AND COMPACTION REQUIREMENTS REFER TO DRAWING NO. 90-55-E107, DRAWING NO. 90-55-E108 AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A" ALMES REPORT).
5. FOR DIKED EMBANKMENT CONSTRUCTION, SEE DRAWING NO. 90-55-E111 FOR PLAN, DRAWING NO. 90-55-E112 FOR TYPICAL CROSS-SECTION AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
6. FOR SEDIMENT POND CONSTRUCTION SEE DRAWINGS NOS. 90-55-E116 FOR SEDIMENT POND PLANS SEE DRAWING NO. 90-55-E117, FOR CROSS-SECTIONS AND PROFILES SEE DRAWING NO. 90-55-E118, FOR DETAILS AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
7. TEMPORARY DITCHES AND SEDIMENT CONTROL STRUCTURES ARE TO BE CONSTRUCTED AS DETERMINED NECESSARY BY THE ENGINEER.

LEGEND:

- EXISTING UNDERDRAIN
- PROPOSED UNDERDRAIN
- EXISTING STAGE
- PROPOSED STAGE
- FINE COAL REFUSE
- 600 EXISTING CONTOUR
- 600 PROPOSED CONTOUR
- B-9 PIEZOMETER
- CULVERT
- EXISTING ACCESS ROAD
- DITCH GUTTERS
- A CROSS SECTION LOCATION
- X E113 DETAIL NUMBER / DRAWING WHERE DETAIL IS LOCATED

REFERENCE
TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT, AL

REV	DATE	DESCRIPTION	P M	OPER
3	3/94	ADDED LOCATIONS OF DEDICATED DEWATERING PUMPS	RMW	JHG
2	11/10/92	REVISED MAXIMUM FINE COAL REFUSE ELEVATION	RMW	ACR
1	04/29/92	REVISED ELEV OF FINE COAL REFUSE	RMW	ACR

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV

PLAN-STAGE 3

PREPARED FOR
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DDK/PRH	09/04/91	SCALE AS NOTED M743-4
CHECKED BY	DMC	09/12/91	
APPROVED BY	RMW	09/12/91	DRAWING NO. 90-55-E104

NOTES:

1. HAUL ROADS SHALL BE CONSTRUCTED AND MAINTAINED AS SHOWN IN DETAIL NO. 2 ON DRAWING NO. 90-55-E113 AND AS SPECIFIED IN GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
2. EXISTING PIEZOMETERS SHALL BE EXTENDED AS THE EMBANKMENT IS RAISED, REFER TO DETAIL NO. 10 ON DRAWING NO. 90-55-E114.
3. FOR STAGE 2 CROSS-SECTIONS, REFER TO DRAWING NO. 90-55-E107 AND DRAWING NO. 90-55-E108.
4. FOR STRUCTURAL ZONE DIMENSIONS, LOCATIONS AND COMPACTION REQUIREMENTS REFER TO DRAWING NO. 90-55-E107, DRAWING NO. 90-55-E108 AND GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A" ALMES REPORT).
5. SLOPE UNDERDRAIN TO BE INSTALLED PRIOR TO THE CONSTRUCTION OF STRUCTURAL FILL ZONE IN STAGE 1D AND 2B. REFER TO DRAWING NO. 90-55-E115 FOR DRAIN DETAILS, DRAWING NO. 90-55-E111 FOR PLAN LOCATION AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A" ALMES REPORT).
6. FOR DIKED EMBANKMENT CONSTRUCTION, SEE DRAWING NO. 90-55-E111 FOR PLAN, DRAWING NO. 90-55-E112 FOR TYPICAL CROSS-SECTION AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A" ALMES REPORT).
7. TEMPORARY DITCHES AND SEDIMENT CONTROL STRUCTURES ARE TO BE CONSTRUCTED AS DETERMINED NECESSARY BY THE ENGINEER.
8. FOR SEDIMENT POND CONSTRUCTION, SEE DRAWING NO. 90-55-E116 FOR SEDIMENT POND PLANS, DRAWING NO. 90-55-E117 FOR CROSS SECTIONS AND PROFILES, DRAWING NO. 90-55-E118 FOR DETAILS AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT)
9. FOR EMBANKMENT SLOPE PLAN, CROSS-SECTION, AND CONSTRUCTION DETAILS REFER TO DRAWING NOS. 90-55-E111 AND 90-55-E112, AND THE GUIDE LINE TECHNICAL SPECIFICATIONS.

LEGEND:

- EXISTING STAGE
- PROPOSED STAGE
- FINE COAL REFUSE
- 600 EXISTING CONTOUR
- 600 PROPOSED CONTOUR
- B-9 PIEZOMETER
- CULVERT
- EXISTING ACCESS ROAD
- DITCH
- A CROSS SECTION LOCATION
- X / E113 DETAIL NUMBER / DRAWING WHERE DETAIL IS LOCATED

PERIMETER DITCH C E113
STAGE 2C-EAST BUTTRESS TO EL. 630
DROPOVER DITCH 1 E113
OUTLET DITCH 1 E113
SEDIMENT POND 2 (SEE NOTE 8)
STAGE 2A-EXISTING IMPOUNDMENT EMBANKMENT TO EL. 680 USING STRUCTURAL ZONE PROCEDURE (SEE NOTE 4)
EL. 660
EL. 690
EL. 680
STAGE 2B-NORTH BUTTRESS TO EL. 660 AND EL. 690
CONSTRUCT EMBANKMENT USING STRUCTURAL ZONE PROCEDURE (SEE NOTE 5 AND 9)
STAGE 2D-STARTER EMBANKMENT FOR NEW FINE REFUSE DISPOSAL AREA (SEE NOTE 6)
APPROXIMATE LOCATION OF DEDICATED DEWATERING PUMP ⚠
APPROXIMATE LOCATION OF DEDICATED DEWATERING PUMP ⚠
EL. 600
FINE COAL REFUSE DISPOSAL AREA (MAXIMUM LEVEL AT COMPLETION OF STAGE 2D-EL. 591±) ⚠
FINE COAL REFUSE DISPOSAL AREA (MAXIMUM LEVEL AT COMPLETION OF STAGE 2A EL. 672±) ⚠
PERIMETER DITCH D E113
B-9, B-11, B-12, B-13, B-15, B-17

REFERENCE:
TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27, 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT, AL

SCALE
200 0 200 400 FEET

REV	DATE	DESCRIPTION	PM	OPER
⚠	3/94	ADDED LOCATIONS OF DEDICATED DEWATERING PUMPS	RMW	JHG
⚠	11/10/92	REVISED MAXIMUM FINE COAL REFUSE ELEVATION	RMW	ACR
⚠	05/01/92	REVISED ELEV. OF FINE COAL REFUSE	RMW	ACR

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV

PLAN-STAGE 2

PREPARED FOR

U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DOK/PRH	09/04/91	SCALE AS NOTED
CHECKED BY	DWC	09/12/91	M743-3
APPROVED BY	RMW	09/12/91	DRAWING NO. 90-55-E103

XREF: 90551103 CAD: JHG 03/21/94

N

LEGEND

- B-1 — BORING LOCATION (FEBRUARY, 1991)
- B-17 — BORING LOCATION WITH PIEZOMETER (FEBRUARY, 1991)
- BS-4 — BAG SAMPLE LOCATION (APPROXIMATE) (FEBRUARY, 1991)
- 16 — IN-PLACE DENSITY TEST LOCATION (APPROXIMATE)
- POWER LINE
- UNDERGROUND GAS LINE
- A — CROSS SECTION LOCATION
- LIMITS OF PROPOSED SLURRY CELL DISPOSAL SYSTEM AREA

SEDIMENTATION PONDS

TREATMENT PONDS

COLLECTION PONDS

PROPOSED SLURRY CELL DISPOSAL SYSTEM AREA

APPROXIMATE LIMITS OF EXISTING COAL REFUSE DISPOSAL AREA

CONCORD COAL PREPARATION PLANT

EXISTING FINE REFUSE DISPOSAL IMPOUNDMENT

MAIN HAUL ROADS

COLLECTION POND

CONCORD DEEP MINE SLOPE ENTRY (ABANDONED AND SEALED)

PACKAGE WASTEWATER TREATMENT PLANT

FRESHWATER RESERVOIR

B-1 B-2 B-3 (B-3A) B-4 B-5 B-7 B-8 B-9 B-10 B-11 B-12 B-13 B-14 B-15 B-17 B-20 B-21

BS-1 BS-2 BS-3 BS-4 BS-5 BS-6 BS-7 BS-8 BS-9

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

REFERENCE.
TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27, 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT, AL

SCALE
300 0 300 600 FEET

REV	DATE	DESCRIPTION	P.M.	OPER.
1	09/16/93	PROPOSED SLURRY CELL DISPOSAL AREA	RMW	

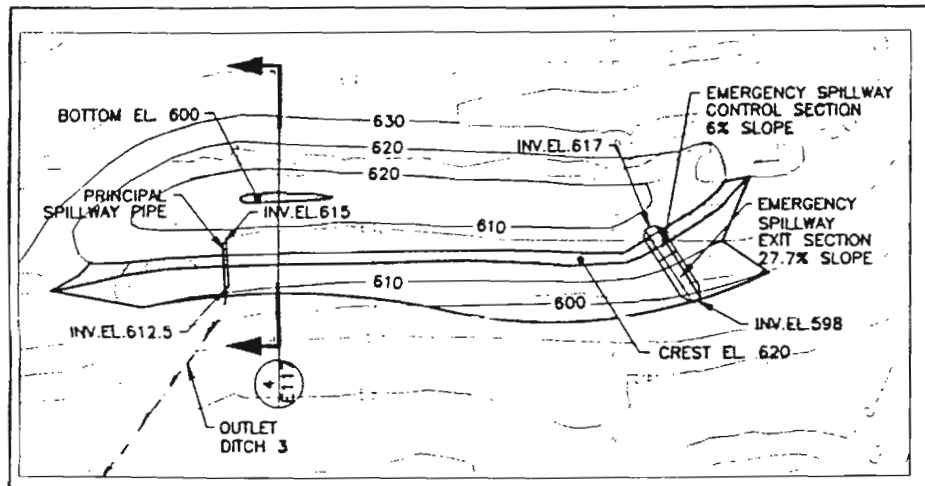
ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA BECKLEY, WV

EXISTING SITE CONDITIONS

PREPARED FOR

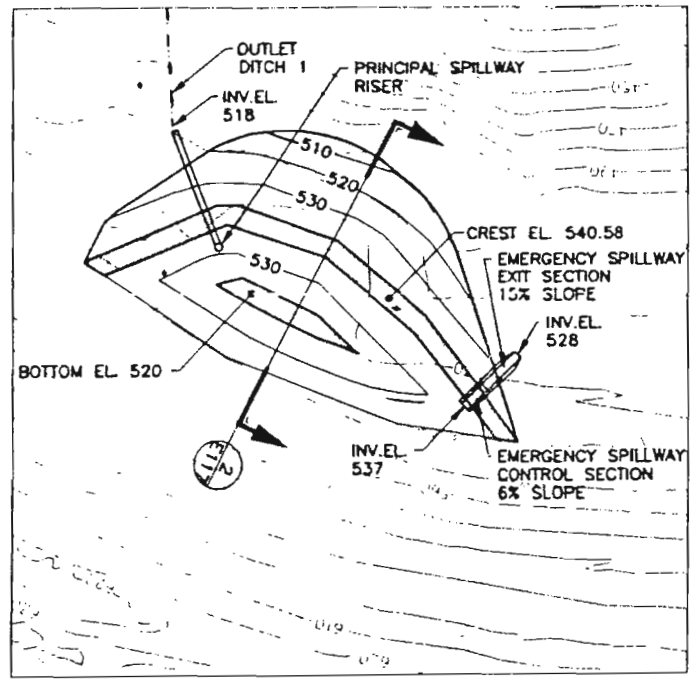
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DC-/PRH	09/05/91	SCALE	M743-1
CHECKED BY	DM	09/05/91	AS NOTED	
APPROVED BY	RMW	09/05/91	DRAWING NO. 90-55-E101	



PLAN – SEDIMENT POND 4

SCALE
100 0 100 200 FEET



PLAN – SEDIMENT POND 2

SCALE
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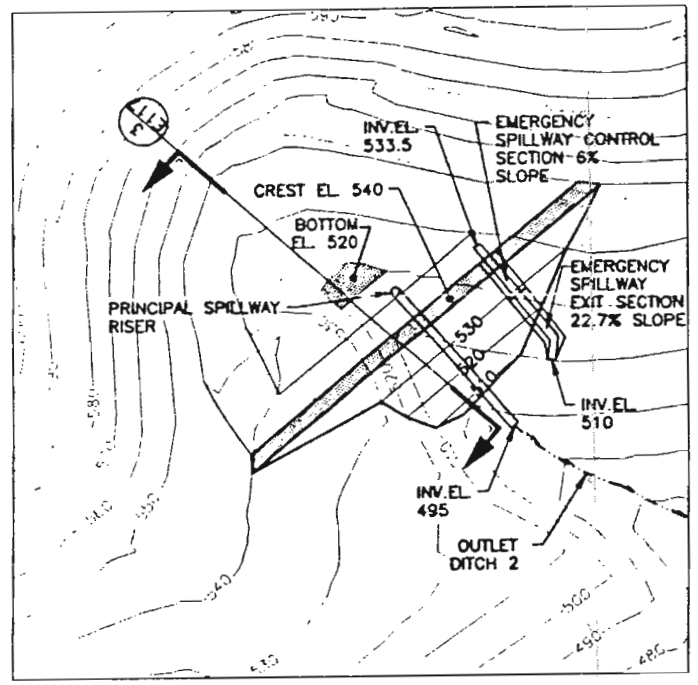
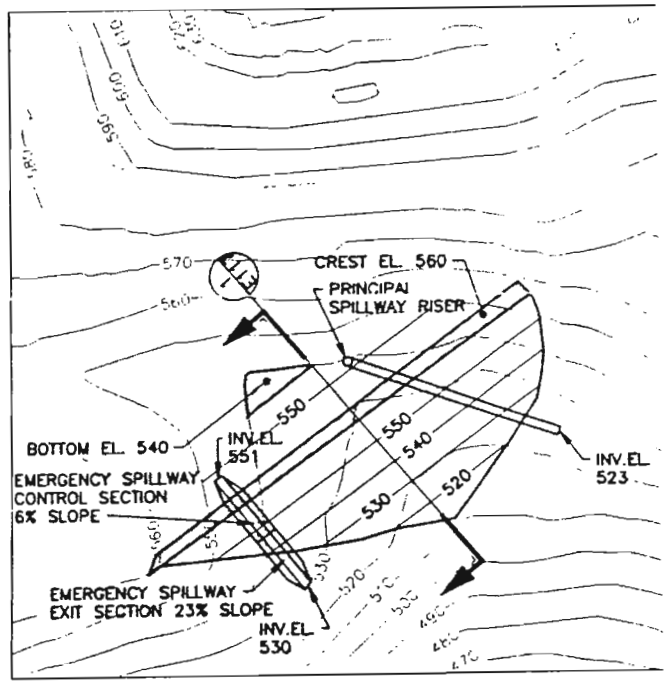


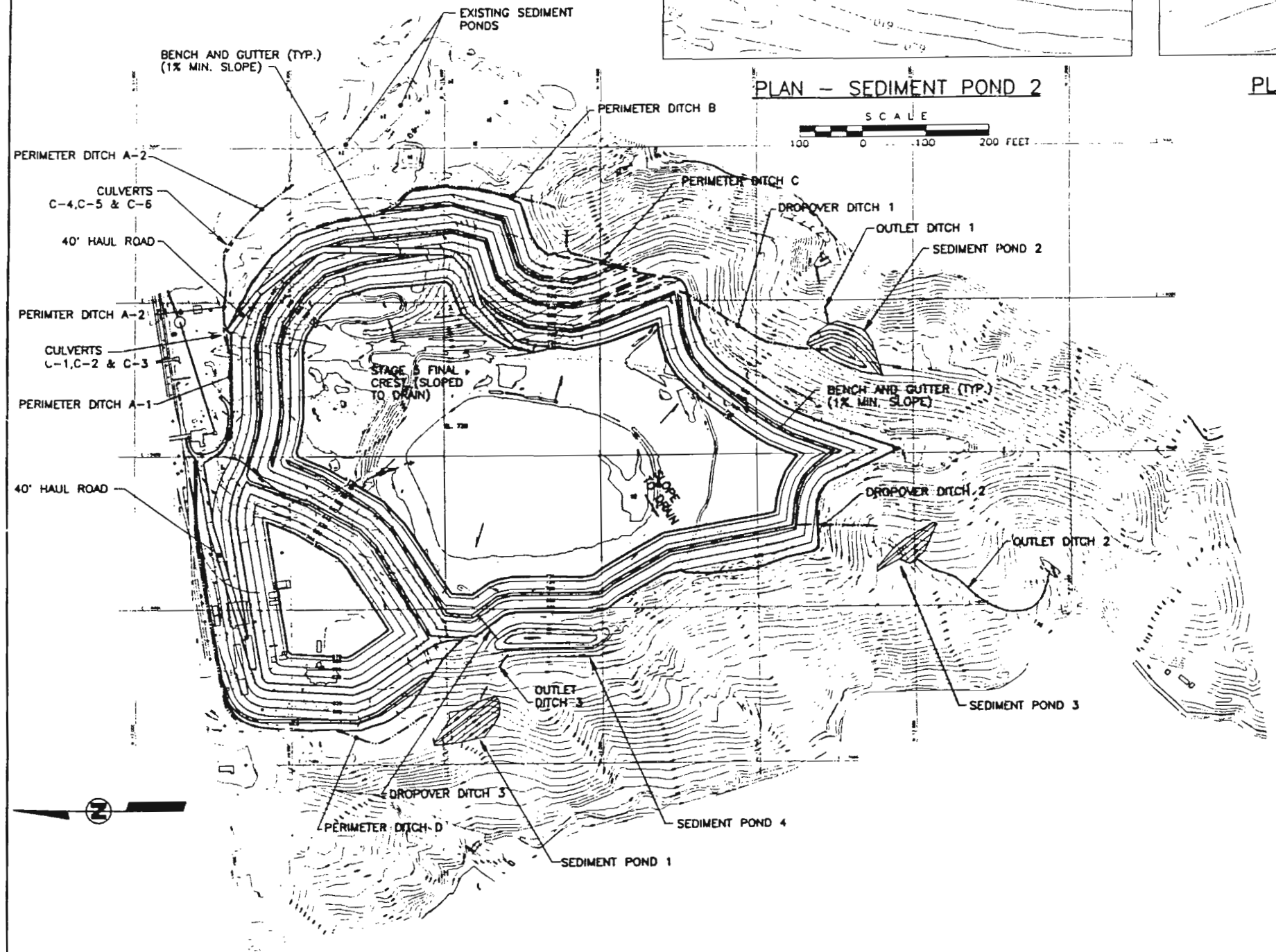
PLAN – SEDIMENT POND 3

SCALE
100 0 100 200 FEET



PLAN – SEDIMENT POND 1

SCALE
100 0 100 200 FEET



SCALE
400 0 400 800 FEET

LEGEND

- DITCH
- CULVERT
- PROPOSED CONTOUR
- PROPOSED EDGE OF SLOPE

NOTES:

1. REFER TO DRAWING NO. 90-55-E113 FOR CHANNEL DETAILS AND SCHEDULE, AND DRAWING NO. 90-55-E114 FOR CULVERT DETAIL AND SCHEDULE.

REV	DATE	DESCRIPTION	P M	O

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

EROSION AND SEDIMENT CONTROL PLAN
PREPARED FOR
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

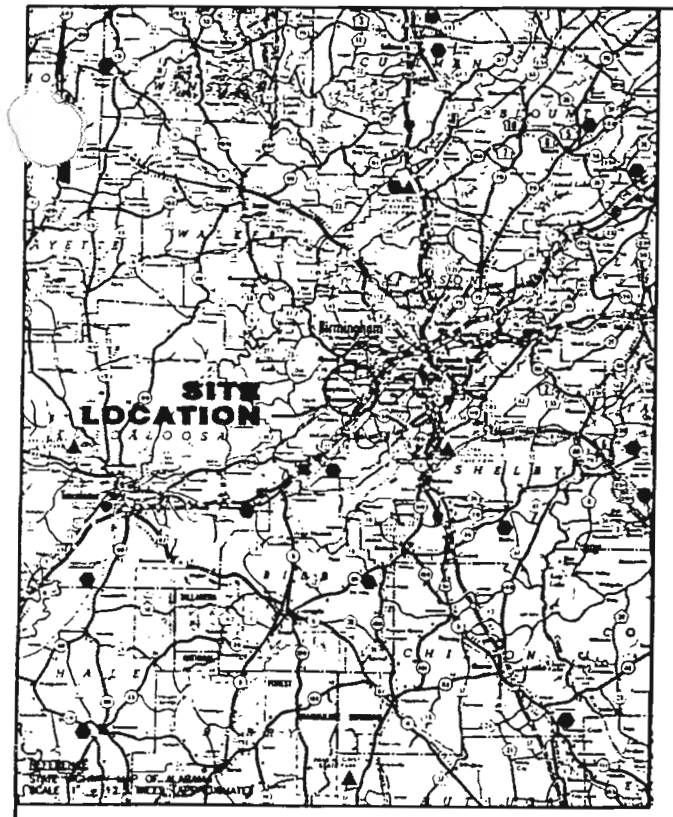
DRAWN BY:	DDK	09/05/91	SCALE AS NOTED	M743-1
CHECKED BY:	DMC	9/12/91		
APPROVED BY	RMW	9/12/91	DRAWING NO. 90-55-E1	

U.S. STEEL MINING COMPANY, INC.

CONCORD COAL REFUSE DISPOSAL FACILITY

JEFFERSON COUNTY

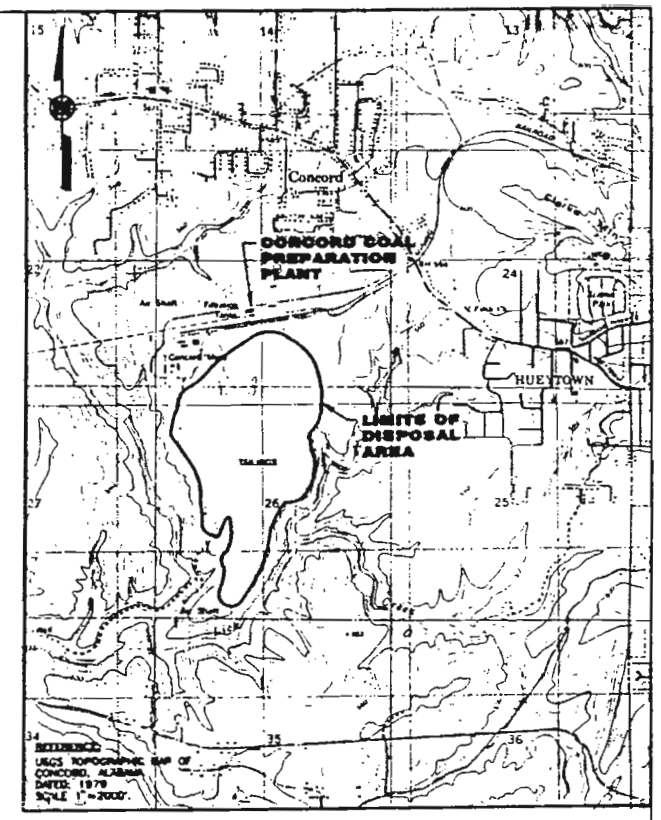
HUEYTOWN, ALABAMA



LOCATION MAP

SCALE

12.5 0 12.5 25 MILES



VICINITY MAP

SCALE

1000 0 1000 2000 FEET

DRAWING INDEX

DWG. NO.	TITLE	DWG. NO.	TITLE
90-55-E100	TITLE SHEET	90-55-E110	STABILITY CROSS SECTIONS SHEET 2 OF 2
90-55-E101	EXISTING SITE CONDITIONS	90-55-E111	PLAN-DIKED IMPOUNDMENT
90-55-E102	PLAN - STAGE 1	90-55-E112	DIKED IMPOUNDMENT AND EMBANKMENT PROFILES
90-55-E103	PLAN - STAGE 2	90-55-E113	DETAILS SHEET 1 OF 3
90-55-E104	PLAN - STAGE 3	90-55-E114	DETAILS SHEET 2 OF 3
90-55-E105	PLAN - STAGE 4	90-55-E115	DETAILS SHEET 3 OF 3
90-55-E106	PLAN - STAGE 5	90-55-E116	EROSION AND SEDIMENT CONTROL PLAN
90-55-E107	CROSS SECTIONS A-A, B-B AND C-C	90-55-E117	SEDIMENT POND CROSS SECTIONS AND PROFILE
90-55-E108	CROSS SECTIONS D-D, AND E-E	90-55-E118	SEDIMENT POND DETAILS
90-55-E109	STABILITY CROSS SECTIONS SHEET 1 OF 2		

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

TITLE SHEET

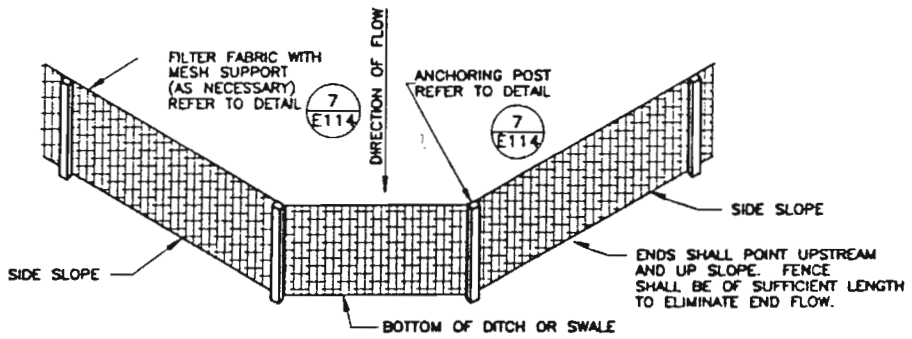
PREPARED FOR

U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DOK/MEL	08/03/91	SCALE AS NOTED
CHECKED BY	DMC	9/12/91	DRAWING NO. 90-55-E100
APPROVED BY	RMW	9/12/91	

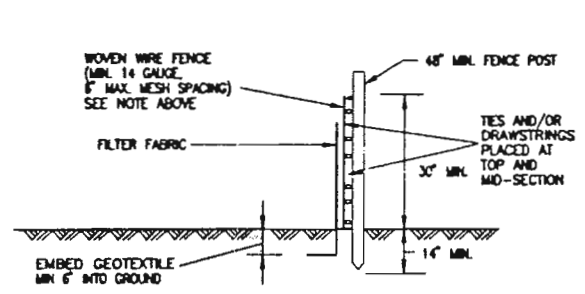
M743

90-55-E24

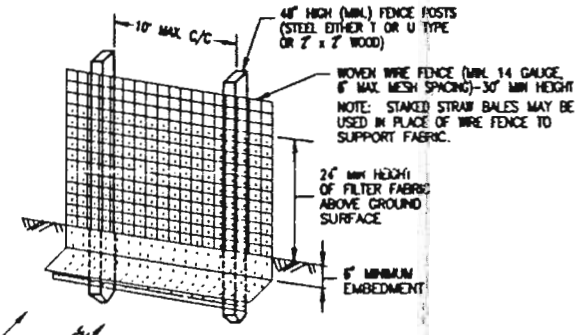


6 E114 SILT FENCE ALONG CHANNEL OR GUTTER

N.T.S.



SECTION



ISOMETRIC VIEW

7 E114 SILT FENCE BARRIER

N.T.S.

CONSTRUCTION NOTES FOR FABRICATED SILT FENCE

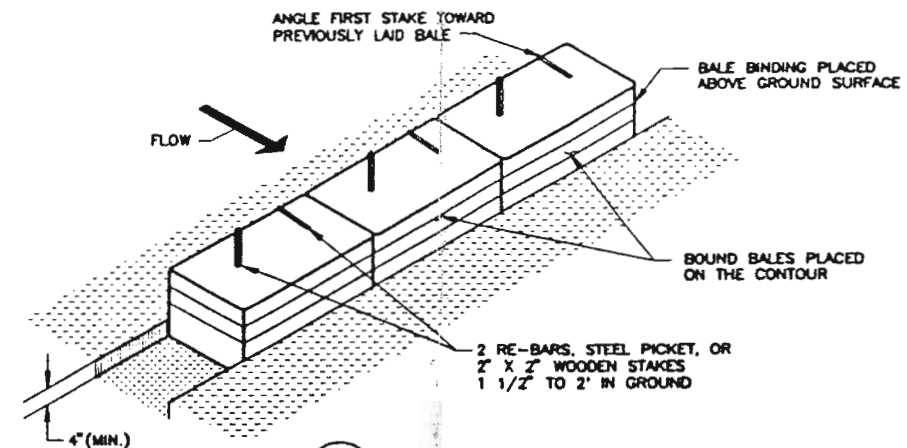
1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID-SECTION
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED
4. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE

POSTS: STEEL EITHER T OR U TYPE OR 2" HARDWOOD

FENCE: WOVEN WIRE 14 1/2 GA. 6" MAX MESH OPENING

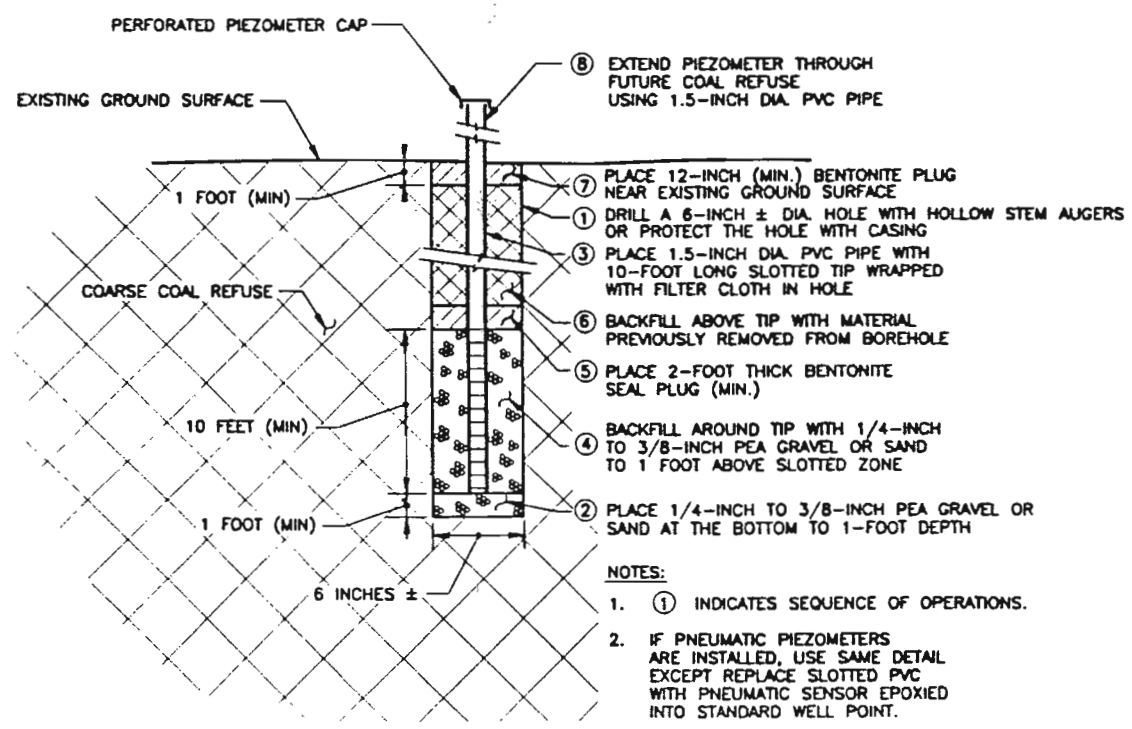
FILTER FABRIC: FILTER X, MIRAFI 100X, STABILINKA T140N OR APPROVED EQUAL

PREFABRICATED UNIT: GEOFAB, ENMIROFENCE, OR APPROVED EQUAL



8 E114 STRAW BALES

N.T.S.

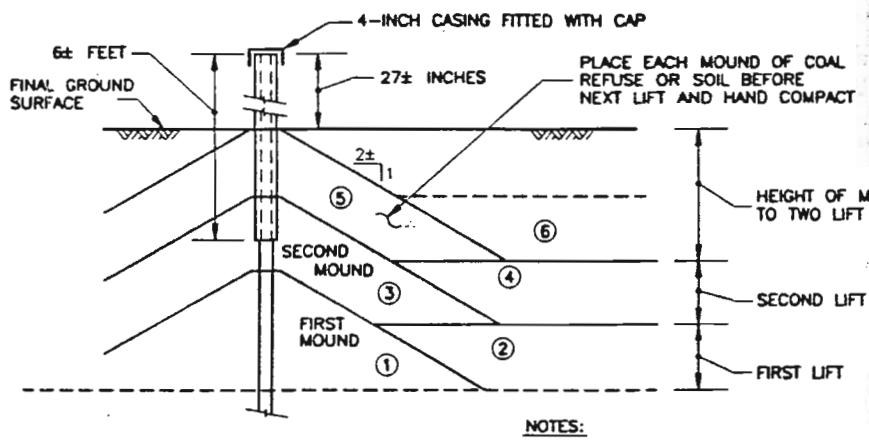


NOTES:

1. ① INDICATES SEQUENCE OF OPERATIONS.
2. IF PNEUMATIC PIEZOMETERS ARE INSTALLED, USE SAME DETAIL EXCEPT REPLACE SLOTTED PVC WITH PNEUMATIC SENSOR EPOXIED INTO STANDARD WELL POINT.

9 E114 PIEZOMETER INSTALLATION

N.T.S.



NOTES:

① INDICATES SEQUENCE OF OPERATIONS.

10 E114 PIEZOMETER EXTENSION PROCEDURE

N.T.S.

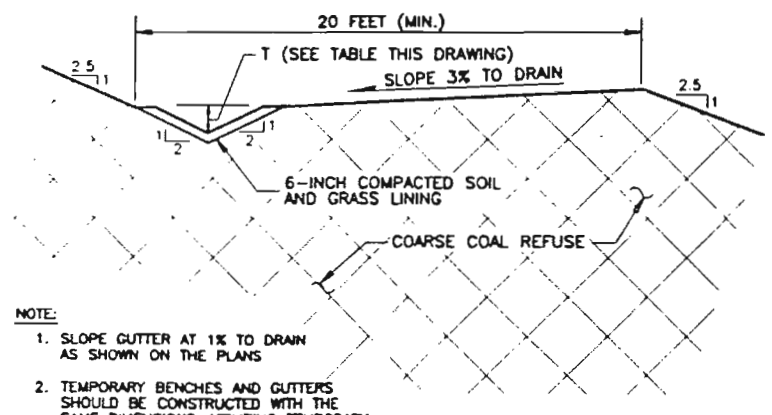
ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

DETAIL SHEET 2 OF 3

PREPARED FOR

U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

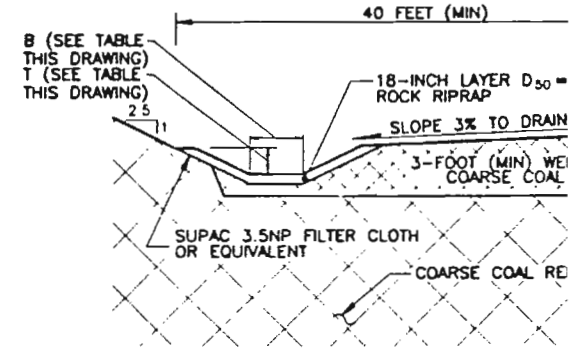
DRAWN BY	PRH/MEL	8/04/91	SCALE AS NOTED	M743-12
CHECKED BY	DJNC	9/12/91		
APPROVED BY	RMW	9/12/91	DRAWING NO. 90-55-E11	



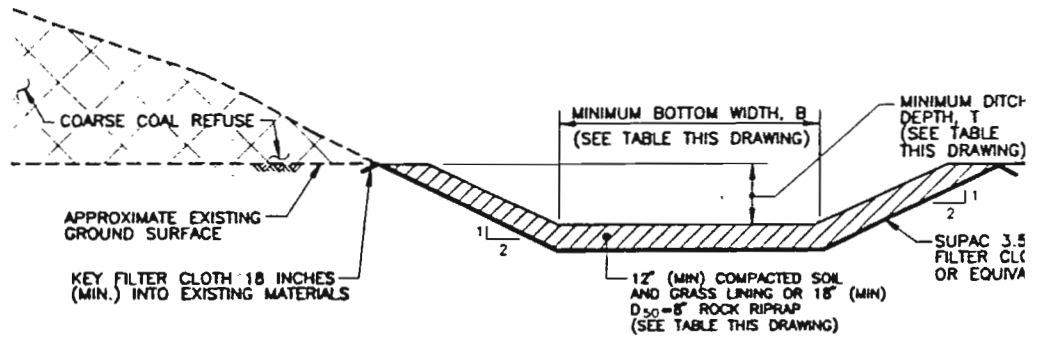
NOTE:

1. SLOPE GUTTER AT 1% TO DRAIN AS SHOWN ON THE PLANS
2. TEMPORARY BENCHES AND GUTTERS SHOULD BE CONSTRUCTED WITH THE SAME DIMENSIONS, UTILIZING TEMPORARY EROSION CONTROL MEASURES.

1 / E113 BENCH AND BENCH GUTTER
N.T.S.



2 / E113 HAUL ROAD AND D
N.T.S.



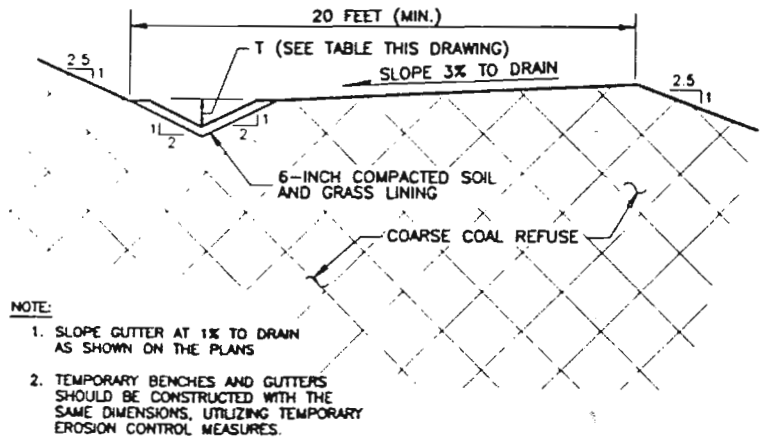
4 / E113 PERIMETER DITCH/OUTLET DITCH
N.T.S.

NOTES FOR DITCHES:

1. 8-INCH FILTER POINT FABRIFORM MAY BE SUBSTITUTED FOR THE GROUTED RIPRAP. FABRIFORM SHOULD BE KEYED 18-INCHES (MIN.) ALONG BOTH EDGES OF DITCH AND UNDERLAIN WITH FILTER CLOTH.
2. ALTERNATE DITCH CONFIGURATIONS ARE ACCEPTABLE PROVIDED THAT THE PEAK FLOW AND FREEBOARD ARE MAINTAINED.

CH

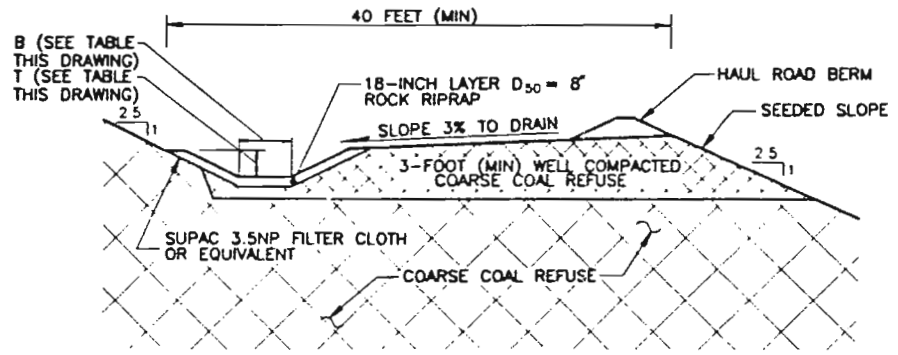
DITCH	DETAIL NO.	MINIMUM CHANNEL DEPTH, T(FT.)	BOTTOM WIDTH B,(FT.)	PEAK DESI FLOW, (CF
PERIMETER A-1	4	2.5	2	35
PERIMETER A-2	4	3.5	3	203
PERIMETER B	4	2.0	4	53
PERIMETER C	4	1.5	2	28
PERIMETER D	4	2.5	2	36
DROP OVER 1	5	3.0	5	271
DROP OVER 2	5	2.0	8	236
DROP OVER 3	5	2	2	167
HAUL ROAD	2	2.5	2	175
BENCH GUTTER	1	3.0	0	70
OUTLET 1	4	1.5	5	76.2
OUTLET 2	4	1.5	4	35.8
OUTLET 3	4	1.5	3	40.5



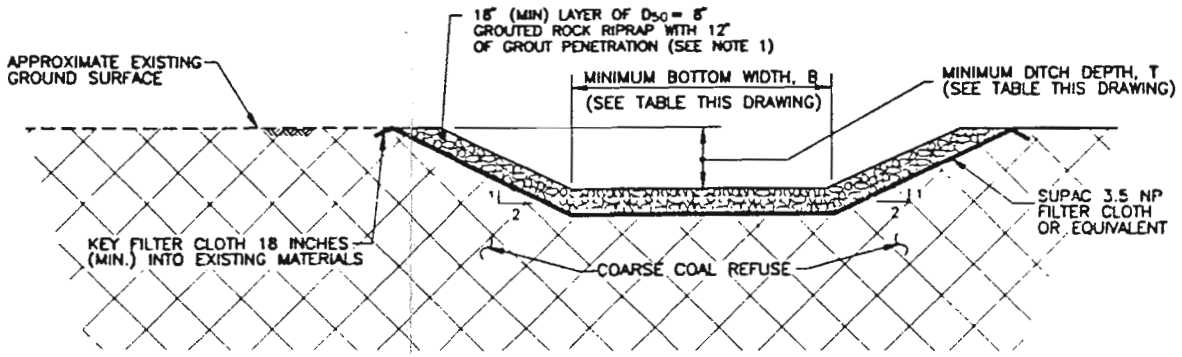
NOTE:

1. SLOPE GUTTER AT 1% TO DRAIN AS SHOWN ON THE PLANS
2. TEMPORARY BENCHES AND GUTTERS SHOULD BE CONSTRUCTED WITH THE SAME DIMENSIONS, UTILIZING TEMPORARY EROSION CONTROL MEASURES.

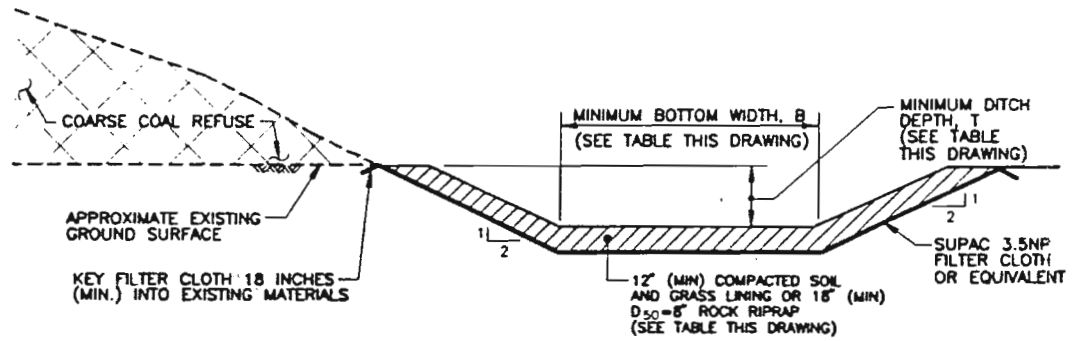
1 / E113 BENCH AND BENCH GUTTER
N.T.S.



2 / E113 HAUL ROAD AND DITCH
N.T.S.



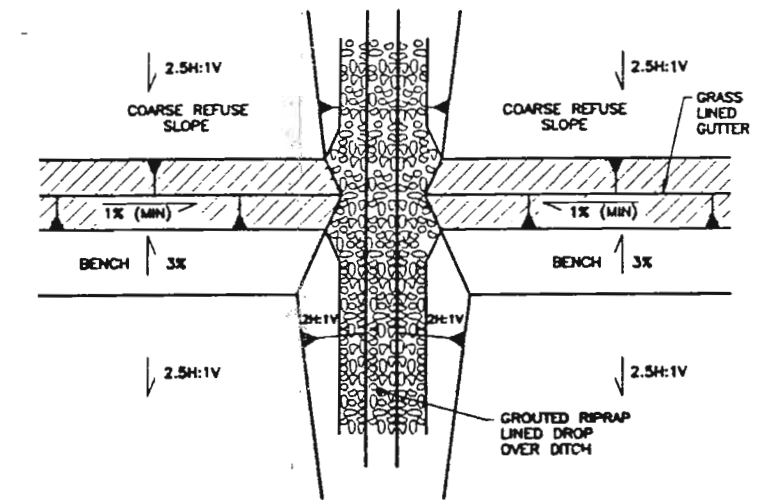
3 / E113 DROPOVER DITCH
N.T.S.



4 / E113 PERIMETER DITCH/OUTLET DITCH
N.T.S.

NOTES FOR DITCHES:

1. 8-INCH FILTER POINT FABRIFORM MAY BE SUBSTITUTED FOR THE GROUTED RIPRAP. FABRIFORM SHOULD BE KEYED 18-INCHES (MIN.) ALONG BOTH EDGES OF DITCH AND UNDERLAIN WITH FILTER CLOTH.
2. ALTERNATE DITCH CONFIGURATIONS ARE ACCEPTABLE PROVIDED THAT THE PEAK FLOW AND FREEBOARD ARE MAINTAINED.



5 / E113 DROPOVER DITCH AND BENCH INTERFACE
N.T.S.

CHANNEL SCHEDULE

DITCH	DETAIL NO.	MINIMUM CHANNEL DEPTH, T(FT.)	BOTTOM WIDTH B,(FT.)	PEAK DESIGN FLOW, (CFS)	MANNINGS N	MAXIMUM BOTTOM SLOPE, (%)	FLOW DEPTH, (FT.)	VELOCITY (FPS)	EROSION PROTECTION
PERIMETER A-1	4	2.5	2	35	0.04	1.0	1.74	3.66	SOIL WITH GRASS LINING
PERIMETER A-2	4	3.5	3	203	0.035	3.0	2.86	8.14	ROCK RIPRAP D_{50} = 8"
PERIMETER B	4	2.0	4	53	0.05	3.0	1.49	5.08	ROCK RIPRAP D_{50} = 8"
PERIMETER C	4	1.5	2	28	0.06	20.0	0.92	7.96	ROCK RIPRAP D_{50} = 8"
PERIMETER D	4	2.5	2	36	0.04	1.0	1.76	3.69	SOIL WITH GRASS LINING
DROP OVER 1	5	3.0	5	271	0.05	10.0	2.20	13.07	GROUTED RIPRAP D_{50} = 8"
DROP OVER 2	5	2.0	8	236	0.05	30.0	1.35	16.32	GROUTED RIPRAP D_{50} = 8"
DROP OVER 3	5	2	2	167	0.035	40.0	1.44	23.77	GROUTED RIPRAP D_{50} = 8"
HAUL ROAD	2	2.5	2	175	0.05	8.0	2.37	10.97	ROCK RIPRAP D_{50} = 8"
BENCH GUTTER	1	3.0	0	70	0.04	1.0	2.83	4.36	SOIL WITH GRASS LINING
OUTLET 1	4	1.5	5	76.2	0.06	30.0	0.95	11.59	ROCK RIPRAP D_{50} = 8"
OUTLET 2	4	1.5	4	35.8	0.06	7.1	0.96	6.26	ROCK RIPRAP D_{50} = 8"
OUTLET 3	4	1.5	3	40.5	0.06	16.7	0.99	8.26	ROCK RIPRAP D_{50} = 8"

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV

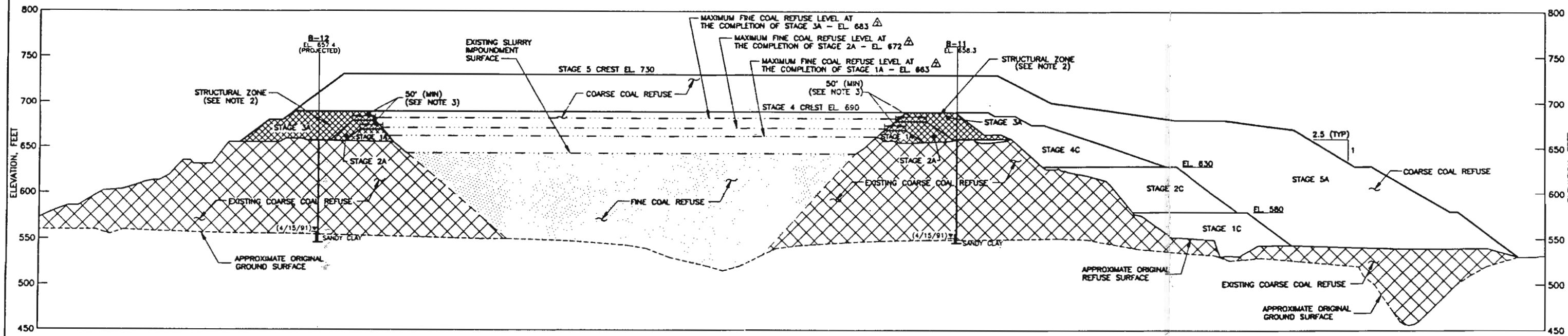
DETAIL SHEET 1 OF 3

PREPARED FOR

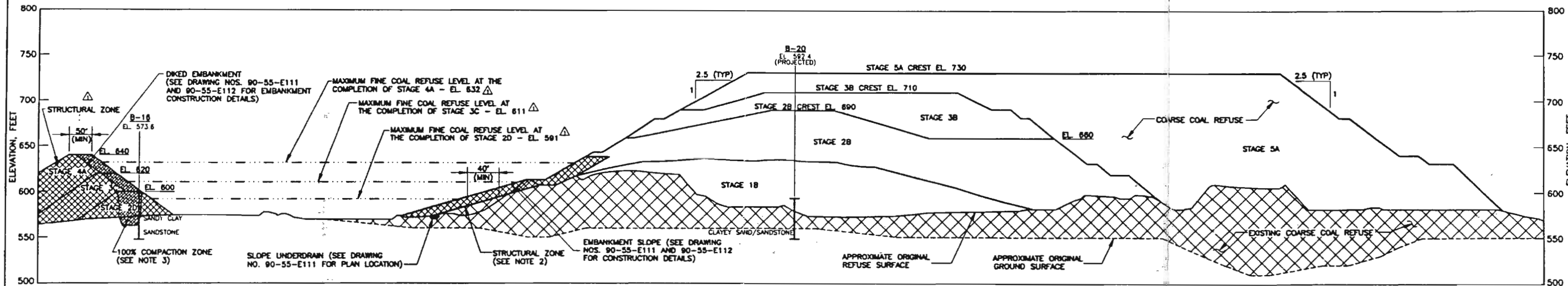
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	PRH/MEL	08/04/91	SCALE AS NOTED	M743-1
CHECKED BY	DMC	9/12/91		
APPROVED BY	RMW	9/12/91	DRAWING NO. 90-55-E1	

90-55-E25



CROSS SECTION D-D



CROSS SECTION E-E

NOTES:
1. SEE DRAWING NOS. 90-55-E102 THROUGH 90-55-E106 FOR CROSS SECTION LOCATIONS AND STAGING PLANS.
2. SEE GUIDELINE TECHNICAL SPECIFICATIONS (ALMES REPORT, APPENDIX A) FOR STRUCTURAL ZONE AND 100% COMPACTION ZONE CONSTRUCTION SPECIFICATIONS.
3. A MINIMUM CREST WIDTH OF 50 FEET MUST BE MAINTAINED AT ALL TIMES FOR BOTH THE EXISTING AND PROPOSED IMPOUNDMENTS.

VERTICAL SCALE
50 0 50 100 FEET

HORIZONTAL SCALE
100 0 100 200 FEET

REV	DATE	DESCRIPTION	P.M.	OPE
⚠	11/10/92	REVISED MAXIMUM FINE COAL REFUSE ELEVATIONS	RAW	MEL
⚠	04/20/92	CHANGED COAL REFUSE ELEVATIONS AND ADDED STRUCTURAL FILL	RAW	MEL

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

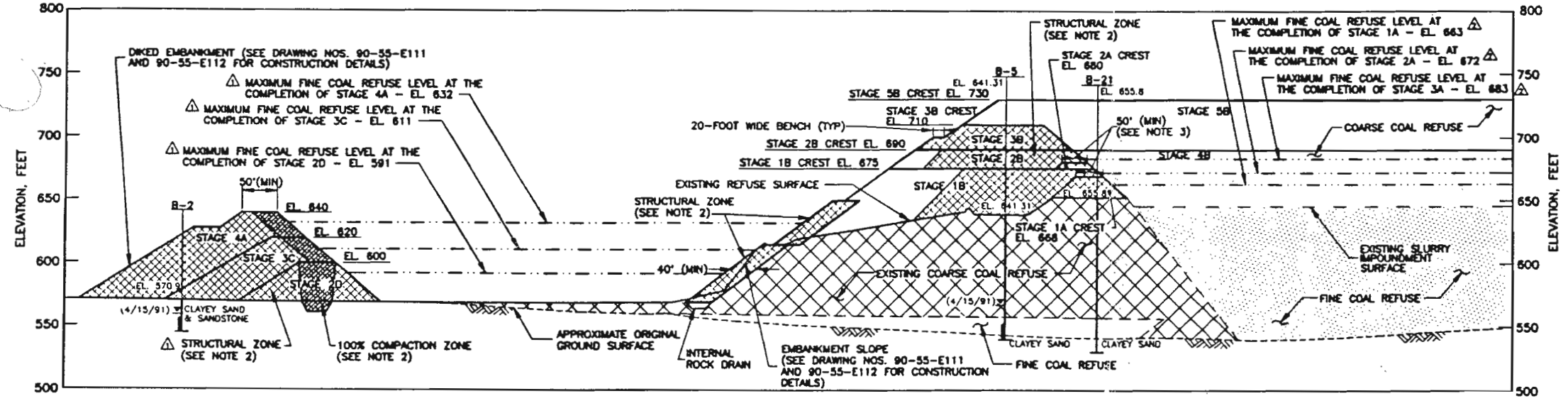
CROSS SECTIONS
D-D & E-E

PREPARED FOR

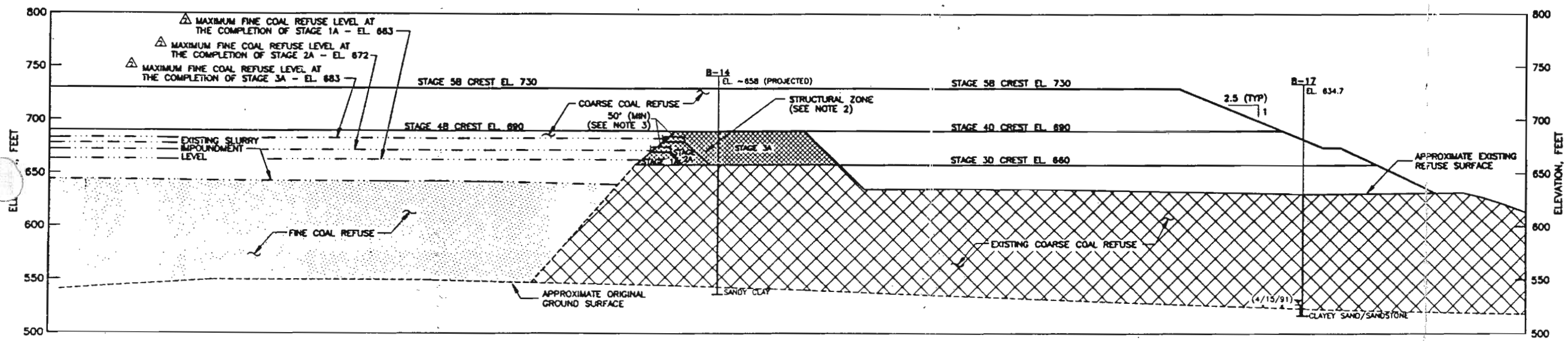
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DSM/MEL	09/04/91	SCALE AS NOTED	IM743-8
CHECKED BY	DMC	09/12/91		
APPROVED BY	RAW	09/12/91	DRAWING NO. 90-55-E10	

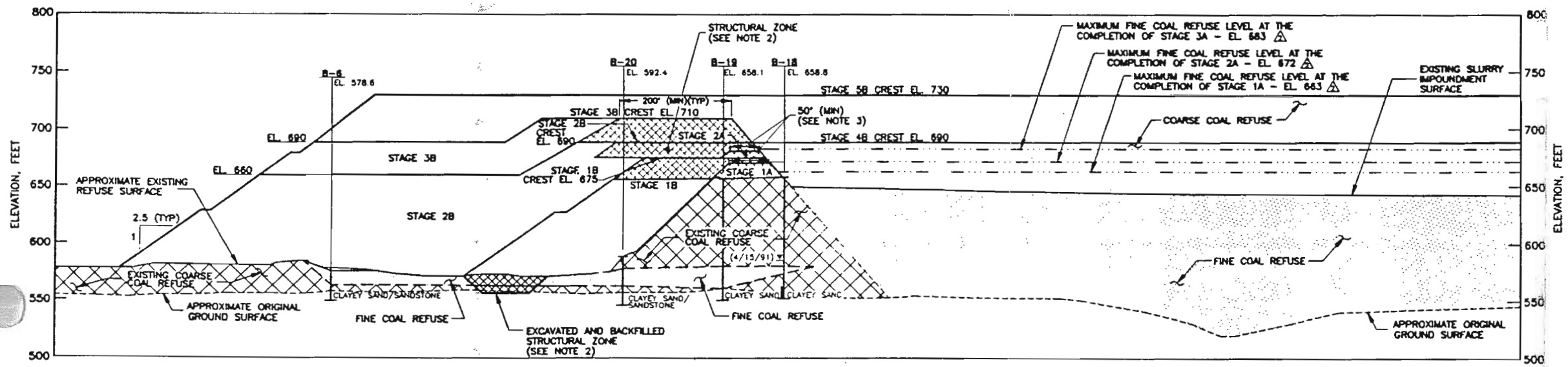
90-55-E15 CAD: MEL 11/12/92



CROSS SECTION A-A
(LOOKING EAST)



CROSS SECTION B-B
(LOOKING EAST)



CROSS SECTION C-C
(LOOKING EAST)

NOTES:

1. SEE DRAWING NO. 90-55-E102 THROUGH 90-55-E106 FOR CROSS SECTION LOCATIONS AND STAGING PLANS.
2. SEE GUIDELINE TECHNICAL SPECIFICATIONS (ALMES REPORT, APPENDIX A) FOR STRUCTURAL ZONE AND 100% COMPACTION ZONE CONSTRUCTION SPECIFICATION.
3. A MINIMUM CREST WIDTH OF 50 FEET MUST BE MAINTAINED AT ALL TIMES FOR BOTH THE EXISTING AND PROPOSED IMPOUNDMENTS.

VERTICAL SCALE
50 0 50 100 FEET

HORIZONTAL SCALE
100 0 100 200 FEET

REV	DATE	DESCRIPTION	P.M	OPER
2	11/10/92	REVISED MAXIMUM FINE COAL REFUSE ELEVATIONS	KHW	MCL
1	04/30/92	CHANGED ZONE REFUSE ELEVATIONS AND ADDED STRUCTURAL ZONE	RMW	MCL

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

CROSS SECTIONS
A-A, B-B & C-C

PREPARED FOR
U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DSM/MEL	05/04/91	SCALE AS NOTED
CHECKED BY	DMC	09/12/91	M743-7
APPROVED BY	RMW	09/12/91	DRAWING NO. 90-55-E107

90-55-E16 CAD: MEL 11/10/92

NOTES:

1. HAUL ROADS SHALL BE CONSTRUCTED AND MAINTAINED AS SHOWN IN DETAIL NO. 2 ON DRAWING NO. 90-55-E113 AND AS SPECIFIED IN GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
2. EXISTING PIEZOMETERS SHALL BE EXTENDED AS THE EMBANKMENT IS RAISED, REFER TO DETAIL NO.10 ON DRAWING NO. 90-55-E114.
3. FOR STAGE 1 CROSS-SECTIONS REFER TO DRAWING NO. 90-55-E107 AND DRAWING NO. 90-55-E108. FOR STABILITY SECTIONS REFER TO DRAWING NO. 90-55-E109.
4. FOR STAGE 1B FINE REFUSE EXCAVATION AND COMPACTED BACKFILL REQUIREMENTS, REFER TO DRAWING NO. 90-55-E107 AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
5. FOR STRUCTURAL ZONE LOCATIONS, DIMENSIONS AND COMPACTION REQUIREMENTS, REFER TO DRAWING NO. 90-55-E107, DRAWING NO. 90-55-E108 AND GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A" ALMES REPORT).
6. SLOPE UNDERDRAIN TO BE INSTALLED PRIOR TO THE CONSTRUCTION OF STRUCTURAL FILL ZONE IN STAGE 1D. REFER TO DRAWING NO. 90-55-E115 FOR DRAIN DETAILS, DRAWING NO. 90-27-E111 FOR PLAN LOCATION, AND GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
7. TEMPORARY DITCHES AND SEDIMENT CONTROL STRUCTURES ARE TO BE CONSTRUCTED AS DETERMINED NECESSARY BY THE ENGINEER.
8. FOR SEDIMENT POND CONSTRUCTION, SEE DRAWING NO. 90-55-E116 FOR SEDIMENT POND PLANS, DRAWING NO. 90-55-E117 FOR CROSS-SECTIONS AND PROFILES, DRAWING NO. 90-55-E118 FOR DETAILS AND THE GUIDELINE TECHNICAL SPECIFICATIONS (APPENDIX "A", ALMES REPORT).
9. FOR EMBANKMENT SLOPE PLAN CROSS-SECTION, AND CONSTRUCTION DETAILS REFER TO DRAWING NOS. 90-55-E111 AND 90-55-E112 AND THE GUIDELINE TECHNICAL SPECIFICATIONS.

LEGEND:

- EXISTING STAGE
- PROPOSED STAGE
- FINE COAL REFUSE
- EXISTING CONTOUR
- PROPOSED CONTOUR
- B-9 PIEZOMETER
- CULVERT
- EXISTING ACCESS ROAD
- DITCH
- CROSS SECTION LOCATION
- DETAIL NUMBER
- DRAWING WHERE DETAIL IS LOCATED

40' WIDE HAUL ROAD (SEE NOTE 1)

STAGE 1C-EAST VALLEY BUTTRESS TO EL. 580

STAGE 1B-NORTH BUTTRESS TO EL. 675

STAGE 1A-EXISTING IMPOUNDMENT TO EL. 670 USING STRUCTURAL FILL PROCEDURE (SEE NOTE 5)

APPROXIMATE LIMITS OF FINE REFUSE EXCAVATION/COMPACTED BACKFILL (SEE NOTE 5)

TEMPORARY BENCH AND GUTTER AT 1% MINE SLOPE (TYP.)

SLOPE DRAIN (SEE NOTE 6)

STAGE 1D-REGRADE AND BEGIN CONSTRUCTION OF EMBANKMENT SLOPE USING STRUCTURAL ZONE PROCEDURE (SEE NOTES 5)

FINE COAL REFUSE DISPOSAL AREA (MAXIMUM LEVEL AT THE COMPLETION OF STAGE 1A EL. 650±)

SEDIMENT POND (SEE NOTE 8)

B-9, B-11, B-12, B-13, B-17, B-18, B-15

SCALE 200 0 200 400 FEET

REFERENCE:
TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27, 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT, AL.

REV	DATE	DESCRIPTION	P.M.	OPER
1	05/01/92	REVISED ELEV. OF FINE COAL REFUSE	KTM/AJ	ACR

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

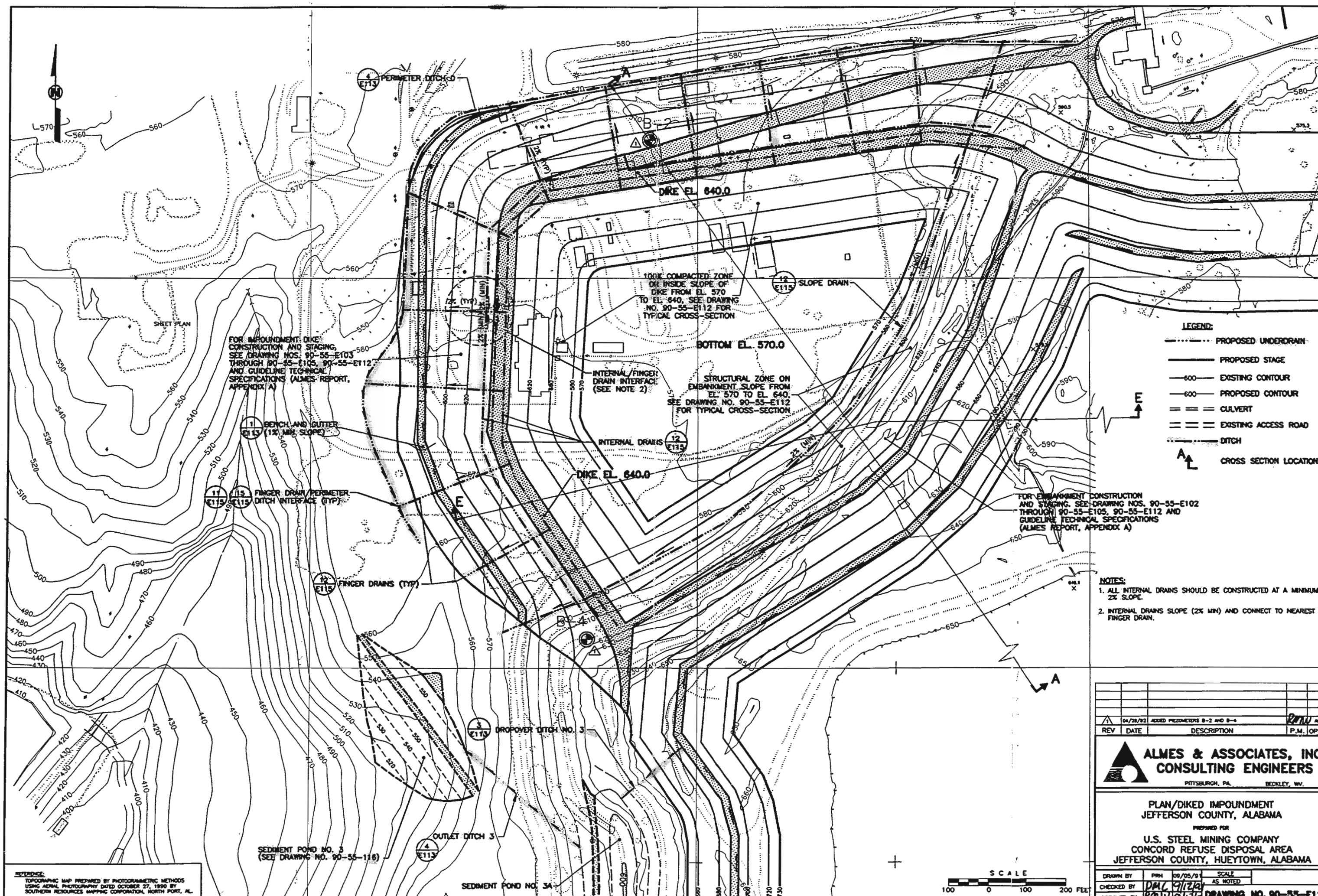
PLAN-STAGE 1

PREPARED FOR

U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DDK	09/04/91	SCALE AS NOTED
CHECKED BY	DMC	9-12-91	
APPROVED BY	RMW	9/12/91	DRAWING NO. 90-55-E102

XREF: 90551102



NOTES:
1. ALL INTERNAL DRAINS SHOULD BE CONSTRUCTED AT A MINIMUM 2% SLOPE.
2. INTERNAL DRAINS SLOPE (2% MIN) AND CONNECT TO NEAREST FINGER DRAIN.

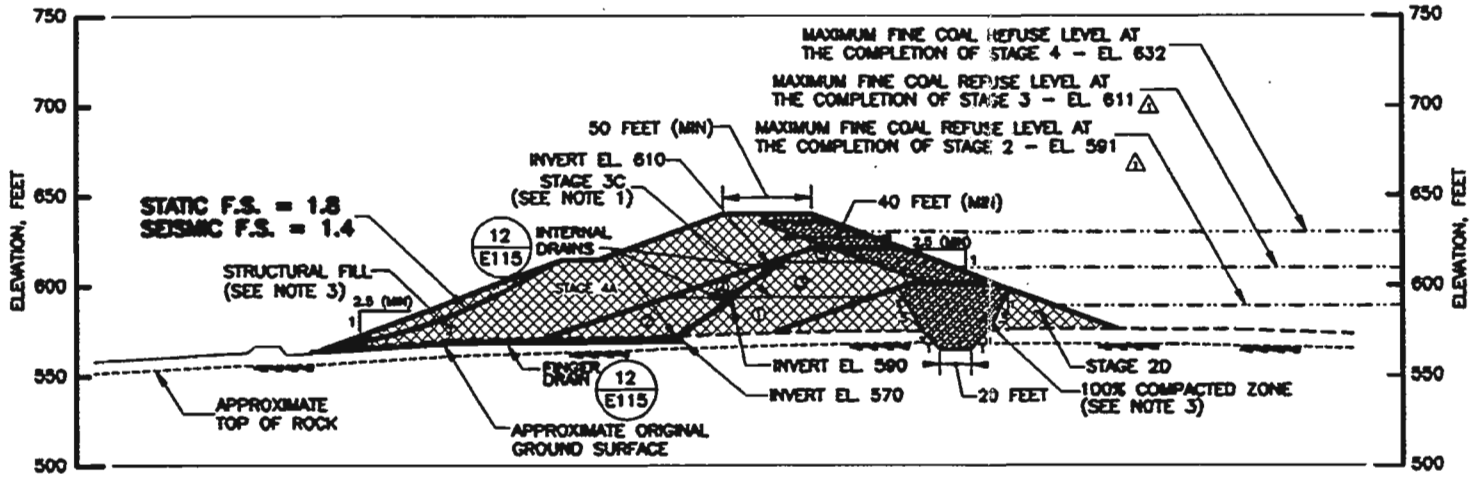
REFERENCE:
TOPOGRAPHIC MAP PREPARED BY PHOTOGRAMMETRIC METHODS USING AERIAL PHOTOGRAPHY DATED OCTOBER 27, 1990 BY SOUTHERN RESOURCES MAPPING CORPORATION, NORTH PORT, AL.

REV	DATE	DESCRIPTION	P.M.	OPER
1	04/29/92	ADDED PIEZOMETERS B-2 AND B-4	RMW	ACR

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

PLAN/DIKED IMPOUNDMENT
JEFFERSON COUNTY, ALABAMA
PREPARED FOR
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

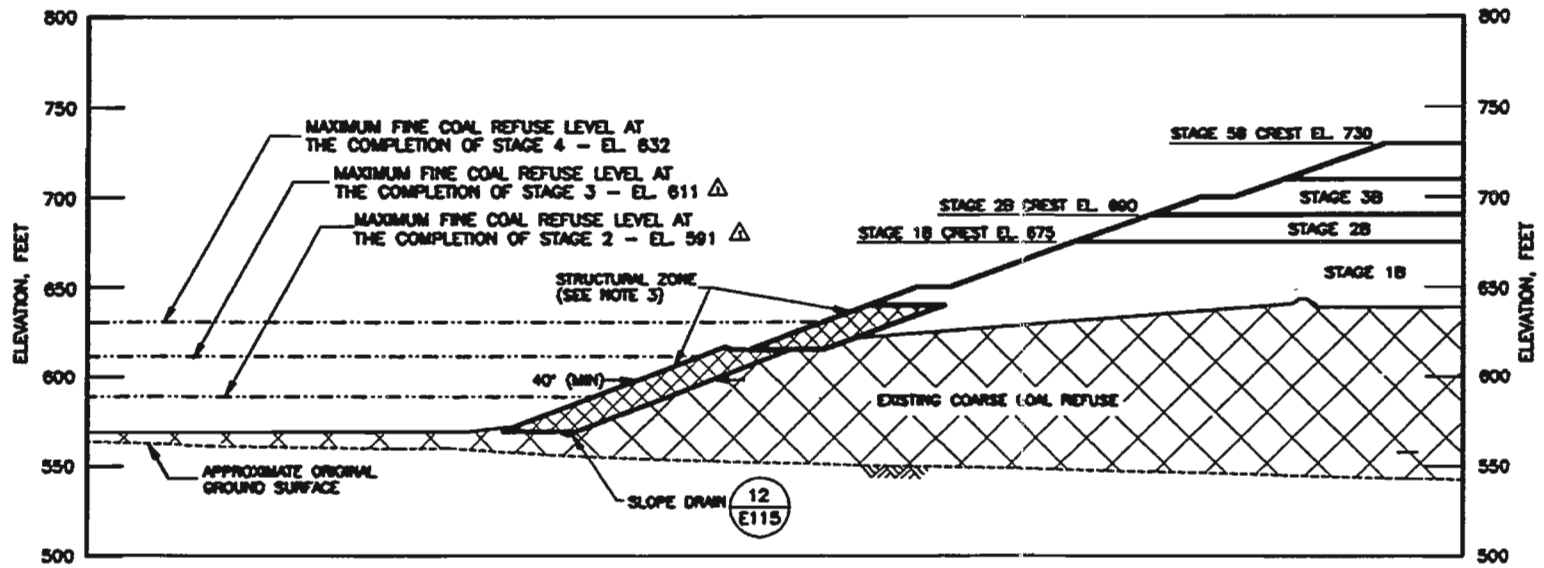
DRAWN BY	PRH	09/05/91	SCALE AS NOTED
CHECKED BY	DML	9/12/91	
APPROVED BY	RMW	9/12/91	DRAWING NO. 90-55-E111



TYPICAL DIKE SECTION

SCALE

50 0 50 100 FEET



TYPICAL EMBANKMENT SLOPE SECTION IN DIKED IMPOUNDMENT

SCALE

50 0 50 100 FEET

NOTES:

1. STAGE 3C SHALL BE CONSTRUCTED IN SUBSTAGES ① THROUGH ⑤ TO FACILITATE PROPER CONSTRUCTION OF THE INTERNAL DRAINS.
2. ALL INTERNAL DRAINS SHALL BE CONSTRUCTED AT A MINIMUM 2% SLOPE.
3. SEE GUIDELINE TECHNICAL SPECIFICATIONS (ALMES REPORT, APPENDIX A) FOR STRUCTURAL AND 100% COMPACTION ZONE CONSTRUCTION SPECIFICATIONS.
4. TYPICAL SECTIONS REPRESENT ONLY GENERALIZED SITE CONDITIONS. THE EXISTING CONDITIONS PRESENTED IN THESE SECTIONS MAY VARY.

REV	DATE	DESCRIPTION	P.M.	OPER
⚠	01/30/92	CHANGED COAL REFUSE ELEVATIONS		MEL

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

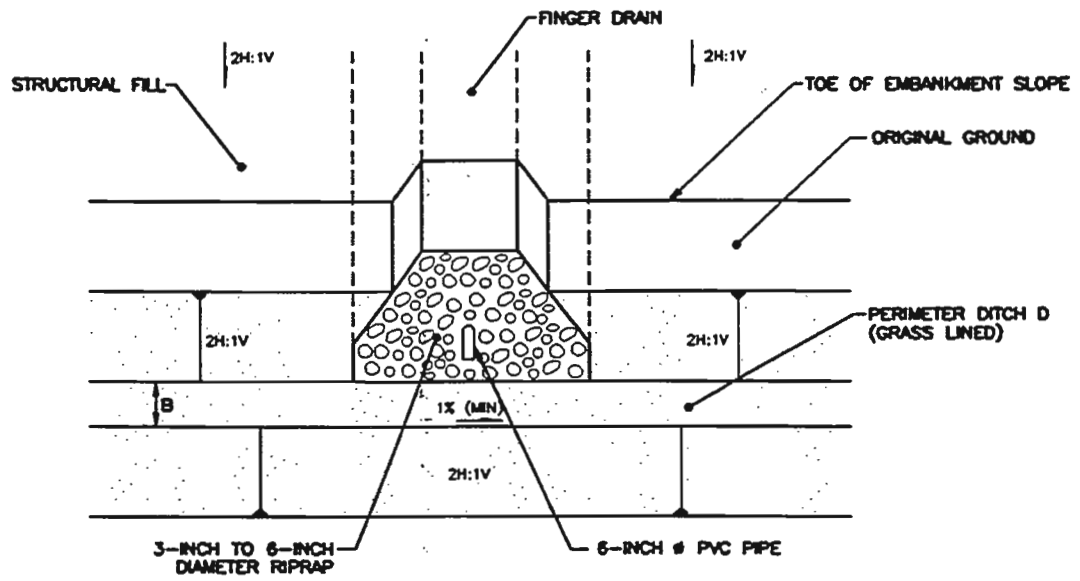
DIKED IMPOUNDMENT AND EMBANKMENT PROFILES

PREPARED FOR

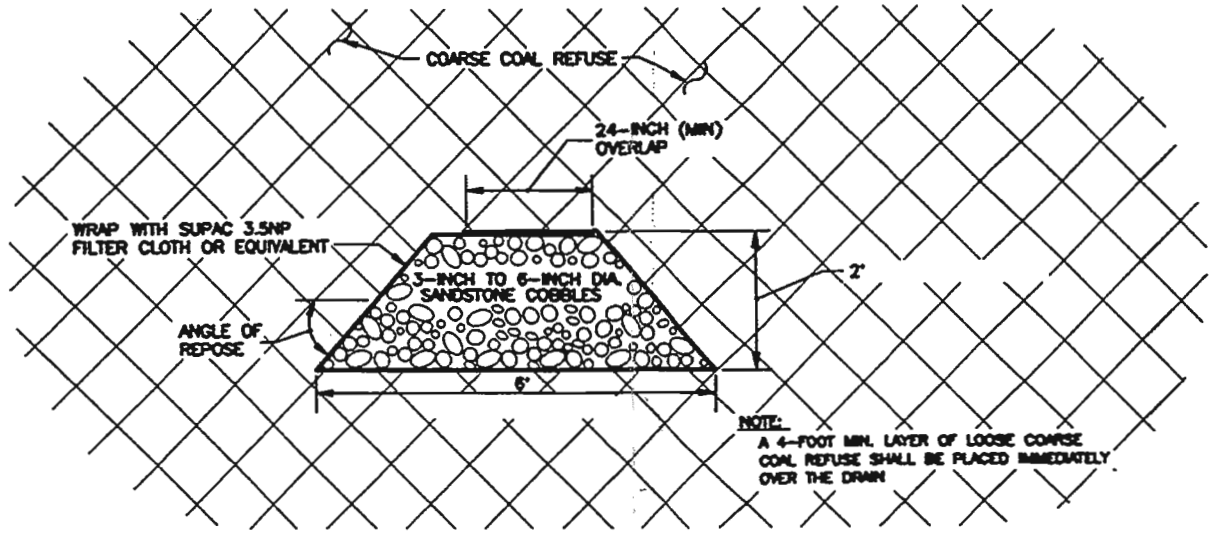
U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	DSH/MEL	08/05/91	SCALE AS NOTED
CHECKED BY	DMC	9-12-91	
APPROVED BY	KMW	9/12/91	DRAWING NO. 90-55-E112

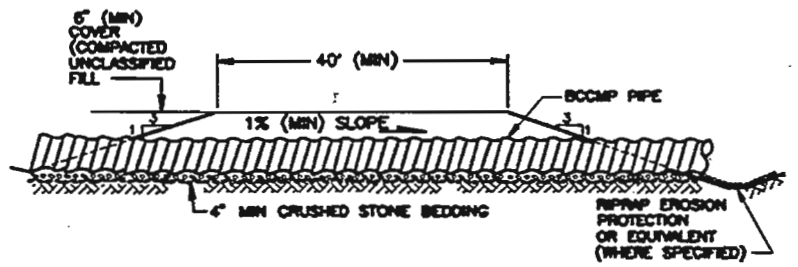
⚠



11 E115 FINGER DRAIN AND PERIMETER DITCH INTERFACE (PLAN)
N.T.S.



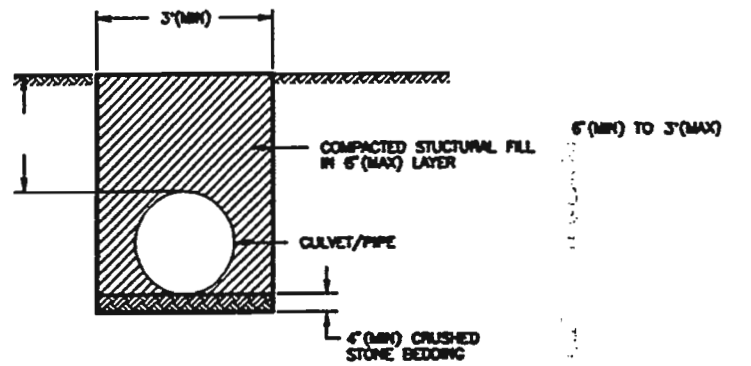
12 E115 INTERNAL/FINGER/SLOPE DRAIN
N.T.S.



13 E115 CULVERT DETAIL

CULVERT SCHEDULE

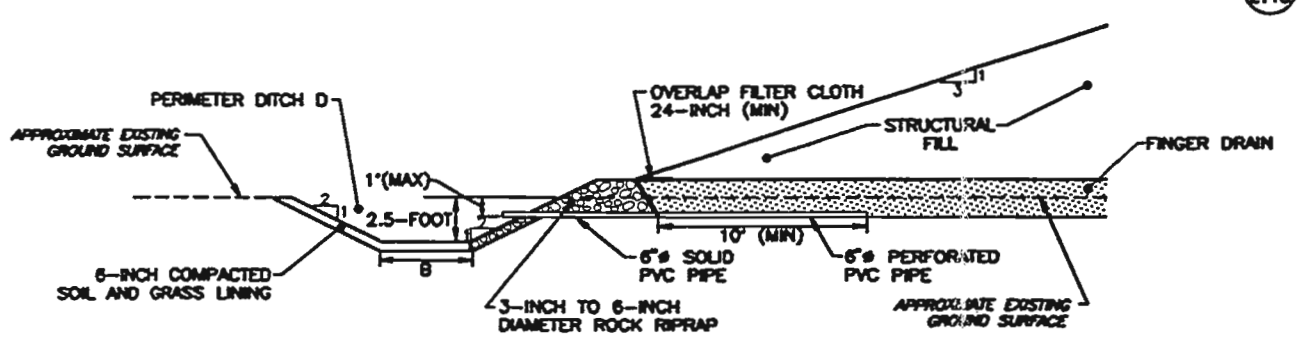
	TYPE	SIZE (IN.)	LENGTH (FT)	SLOPE (%)	ENTRANCE
CULVERTS C-1, C-2, C-3	CMP ARCH	57X38	50	3	PROJECTED
CULVERTS C-4, C-5, C-6	CMP ARCH	57X38	50	3	PROJECTED



SEQUENCE OF OPERATIONS

1. CONSTRUCT FILL (OR NATURAL GROUND) TO ENSURE 6"(MIN) TO 3'(MAX) OF SOIL COVER ABOVE TOP OF PIPE AFTER INSTALLATION.
2. EXCAVATE THE TRENCH TO AT LEAST 4" BELOW THE BOTTOM OF PIPE ELEVATION.
3. CONSTRUCT 4"(MIN) CRUSHED STONE BEDDING.
4. INSTALL CULVERT/PIPE.
5. BACKFILL WITH THE NATURAL SOIL OR COARSE REFUSE 6"(MAX) LAYER TO ACHIEVE 95% ASTM D698 STANDARD COMPACTION.

14 E115 CULVERT INSTALLATION
N.T.S.



15 E115 FINGER DRAIN AND PERIMETER DITCH INTERFACE (PROFILE)
N.T.S.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

DETAIL SHEET 3 OF 3

PREPARED FOR

U.S. STEEL MINING CO., INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	PRM/MEL	08/04/95	SCALE: AS NOTED
CHECKED BY	DMC	9-12-95	
APPROVED BY	RMW	9/12/95	DRAWING NO. 90-55-E115

DRAWINGS

Loaned
to
Cris Lewis
10/18/91

APPENDIX E

SLOPE SHAFT SEAL DETAILS

APPENDIX D

FIELD AND LABORATORY TESTING RESULTS

APPENDIX D

FIELD AND LABORATORY TESTING RESULTS
PROPOSED REFUSE DISPOSAL PLAN
CONCORD REFUSE DISPOSAL AREA
U.S. STEEL MINING CO.

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PROJECT: U.S. STEEL - CONCORD BY: DMC DATE: 4-8-91

PROJECT NO.: 90-55-27 CHK: DATE:

DESCRIPTION: Adjusted In-place Density Data

Test No.	Measured Dry Unit Wt (pcf)	Measured Water Cont.	Moist Unit Wt(pcf)	Adj.Water Cont.	Adj Dry Unit Wt (pcf)	Descrption
1	127.5	6.7	136.0	6.7	127.5	Natural Soil
2	134.6	4.6	140.9	4.6	134.7	Natural Soil
3	109.8	12.2	123.2	12.2	109.8	Natural Soil
4	90	29.3	116.4	29.3	90.0	Natural Soil
5	105.5	12.2	118.5	3.7	114.3	Fresh Coarse
6	109	12.5	122.6	3.8	118.2	Fresh Coarse
7	110.9	9.1	121.0	2.7	117.8	Fresh Coarse
8	101.6	11.4	113.2	3.4	109.5	Fresh Coarse
9	104	10.6	115.5	3.2	111.9	Fresh Coarse
10	108	9.1	117.8	2.7	114.7	Fresh Coarse
11	47.4	68.4	79.8	60.9	49.6	Fines
12	54.8	56	85.5	49.8	57.1	Fines
13	54.9	45.5	79.9	40.5	56.9	Fines
14	105.4	9.1	115.0	6.1	108.4	Decomp Coarse
15	118.4	9.7	129.9	6.5	122.0	Decomp Coarse
16	99.7	12.4	112.0	8.308	103.4	Decomp Coarse

PROJECT: U.S. STEEL - CONCORD **BY:** DMC **DATE:** 3-25-91

PROJECT NO.: 90-55-27 **CHK:** **DATE:**

DESCRIPTION: In-place Density Test Adjustment Factor Calculation

In-place Sample No.	Water Content (%)	Field Sample No.	Water Content (%)	% of In-place	Description
5	12.9	BS-6	3	0.23	Coarse
7	10.1	B-14, S-1	3.7	0.37	Coarse
12	30.7	BS-8	23.5	0.77	Fine
13	25	BS-9	25.5	1.02	Fine
15	11.6	BS-3	7.8	0.67	Decomp. Coarse

Adjustment Factors:

Coarse	0.30
Fine	0.89
Decomp. Coarse	0.67

GROUND ENGINEERING AND TESTING SERVICE, INC.
4764 FIRST AVE SOUTH
BIRMINGHAM, ALABAMA

R E P O R T O F F I E L D D E N S I T Y T E S T S

PROJECT NAME: CONCORD MINE — JOB NUMBER: B6122-001

CLIENT: ALMES AND ASSOCIATES INC — DATE: 03-27-1991

TEST NO	TEST DATE	DRY #/CF	WATER (%)	WET DENSITY #/CF	APPROXIMATE LOCATION OF THE FIELD DENSITY TESTS	DEPTH ELEV.
1	02/05	127.5	6.7	136.0	BORING NO. 16	0
2	02/05	134.6	4.6	140.9	BORING NO. 2	0
3	02/05	109.8	12.2	123.2	BORING NO. 15	0
4	02/05	90	29.3	116.4	BORING NO. 3	0
5	02/05	105.5	12.2	118.5	E SIDE OF POND	0
6	02/05	109	12.5	122.6	E SIDE OF POND	0
7	02/05	110.9	9.1	121.0	S END OF POND	0
8	02/05	101.6	11.4	113.2	W SIDE OF POND	0
9	02/05	104	10.6	115.5	W SIDE OF POND	0
10	02/05	108	9.1	117.8	N END OF POND	0
11	02/05	47.4	68.4	79.8	IN SIDE OF POND N END	0
12	02/05	54.8	56	85.5	OLD POND N END (B-6)	0
13	02/05	54.9	45.5	79.9	OLD POND SOUTH W END	0
14	02/05	105.4	9.1	115.0	SOUTHERN AREA	0
15	02/05	118.4	9.7	129.9	SOUTHERN AREA	0
16	02/05	99.7	12.4	112.0	SOUTHERN AREA	0

RESPECTFULLY SUBMITTED

Johnny F. Carpenter

GROUND ENGINEERING & TESTING SERVICE, INC.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
P.O. #1 BOX 520
PLEASANT VALLEY ROAD
BEAVER, WV 25813
TRAFFORD, PA 15085
(304) 255-0491
(412) 744-3610

WATER CONTENT

BY: MWS DATE: 3/7/91 CHKD BY: RLE DATE: 3/7/91

PROJECT NAME: U. S. STEEL-CONCORD

PROJECT NUMBER: 90-55-27 SHEET 1 OF 1

DESCRIPTION

SAMPLE NUMBER	BS-1	BS-1	BS-2	BS-2	BS-3	BS-3	
DEPTH	-	-	-	-	-	-	
TARE NUMBER	32	15	40	100	8	42	
WT. TARE+WS, GM.	244.55	246.03	174.82	188.24	213.47	207.66	
WT. TARE+DS, GM.	200.14	202.83	160.47	174.55	204.98	199.78	
W, %	39.9	41.0	19.8	19.5	7.9	7.7	
COMMENTS							
	AVG.= 40.5%		AVG.= 19.7%		AVG.= 7.8%		

SAMPLE NUMBER	BS-5	BS-5	BS-7	BS-7			
DEPTH	-	-	-	-			
TARE NUMBER	15	54	54	92			
WT. TARE+WS, GM.	245.43	247.85	250.65	227.10			
WT. TARE+DS, GM.	240.16	242.83	246.28	223.46			
W, %	3.7	3.6	3.0	3.0			
COMMENTS							
	AVG.= 3.7%		AVG.= 3.0%				

SAMPLE NUMBER							
DEPTH							
TARE NUMBER							
WT. TARE+WS, GM.							
WT. TARE+DS, GM.							
W, %							
COMMENTS							

SAMPLE NUMBER							
DEPTH							
TARE NUMBER							
WT. TARE+WS, GM.							
WT. TARE+DS, GM.							
W, %							
COMMENTS							

NOTES:

BS-1: FINE COAL REFUSE
BS-2: FINE COAL REFUSE
BS-3: WEATHERED COARSE COAL REFUSE
BS-5: FRESH COARSE COAL REFUSE
BS-7: COARSE COAL REFUSE

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MOISTURE CONTENT DETERMINATION

Client	ALMES & ASSOC.	Tested By	TO	Date	3-8-91
Client Project	US STEEL CONCORD	Checked By	JCM	Date	3-19-91
Project No.	91033				

MOISTURE CONTENT

Boring No.	BS-6	BS-8	BS-9
Sample No.	NA	NA	NA
Depth	NA	NA	NA
Tare Number	806	683	1004
Wt. Tare & WS(gm.)	1013.00	613.60	646.70
Wt. Tare & DS(gm.)	986.45	518.00	537.53
Wt. Water(gm.)	26.55	95.60	109.17
Wt. Tare(gm.)	103.67	110.72	109.75
Wt. DS(gm.)	882.78	407.28	427.78
Moisture Content(%)	3.0	23.5	25.5

Geotechnics

MOISTURE CONTENT DETERMINATION

Client	ALMES & ASSOC.	Tested By	TO	Date	3-14-91
Client Project	US STEEL CONCORD	Checked By	gw	Date	3.27.91
Project No.	91033-01				

MOISTURE CONTENT

Boring No.	BS-1	BS-2
Sample No.	NA	NA
Depth	NA	NA
Tare Number	K15	674
Wt. Tare & WS(gm.)	212.75	348.06
Wt. Tare & DS(gm.)	177.46	298.45
Wt. Water(gm.)	35.29	49.61
Wt. Tare(gm.)	74.37	74.94
Wt. DS(gm.)	103.09	223.51
Moisture Content(%)	34.2	22.2

geotechnics

WASH SIEVE ANALYSIS

Client	ALMES & ASSOC.	Tested By TO	Date 3-14-91
Client Project	US STEEL CONCORD	Checked By SW	Date 3-28-91
Project No.	91033-01		
Boring No.	BS-1		
Depth(ft.)	NA		
Sample No.	NA		
Visual Description	BLACK FINE COAL REFUSE		

Wt. of Total Sample(dry)	623.93gm.
Wt. of +#200 Sample	187.68gm.
Wt. of -#200 Sample	436.25gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
3"	75.00	0.00	0.0	0.0	100.00
1 1/2"	37.50	0.00	0.0	0.0	100.00
3/4"	19.00	0.00	0.0	0.0	100.00
3/8"	9.50	0.00	0.0	0.0	100.00
#4	4.75	0.00	0.0	0.0	100.00
#10	2.00	0.50	0.1	0.1	99.92
#20	0.85	1.44	0.2	0.3	99.69
#40	0.425	16.68	2.7	3.0	97.02
#60	0.250	36.60	5.9	8.9	91.15
#140	0.106	100.22	16.1	24.9	75.09
#200	0.075	32.24	5.2	30.1	69.92
Pan	-	436.25	69.9	100.0	-

Water Content	
Tare No.	680
Wgt. Tare + WS.	974.45
Wgt. Tare + DS.	733.16
Wgt. Tare	109.23
Wgt. Of Water	241.29
Wgt. Of DS.	623.93
% Water	38.7

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HYDROMETER ANALYSIS

Client	ALMES & ASSOC.	Tested By TO	Date 3-18-91
Client Project	US STEEL CONCORD	Checked By [illegible]	Date 3-28-91
Project No.	91033-01		
Boring No.	BS-1		
Depth(ft.)	NA		
Sample No.	NA		

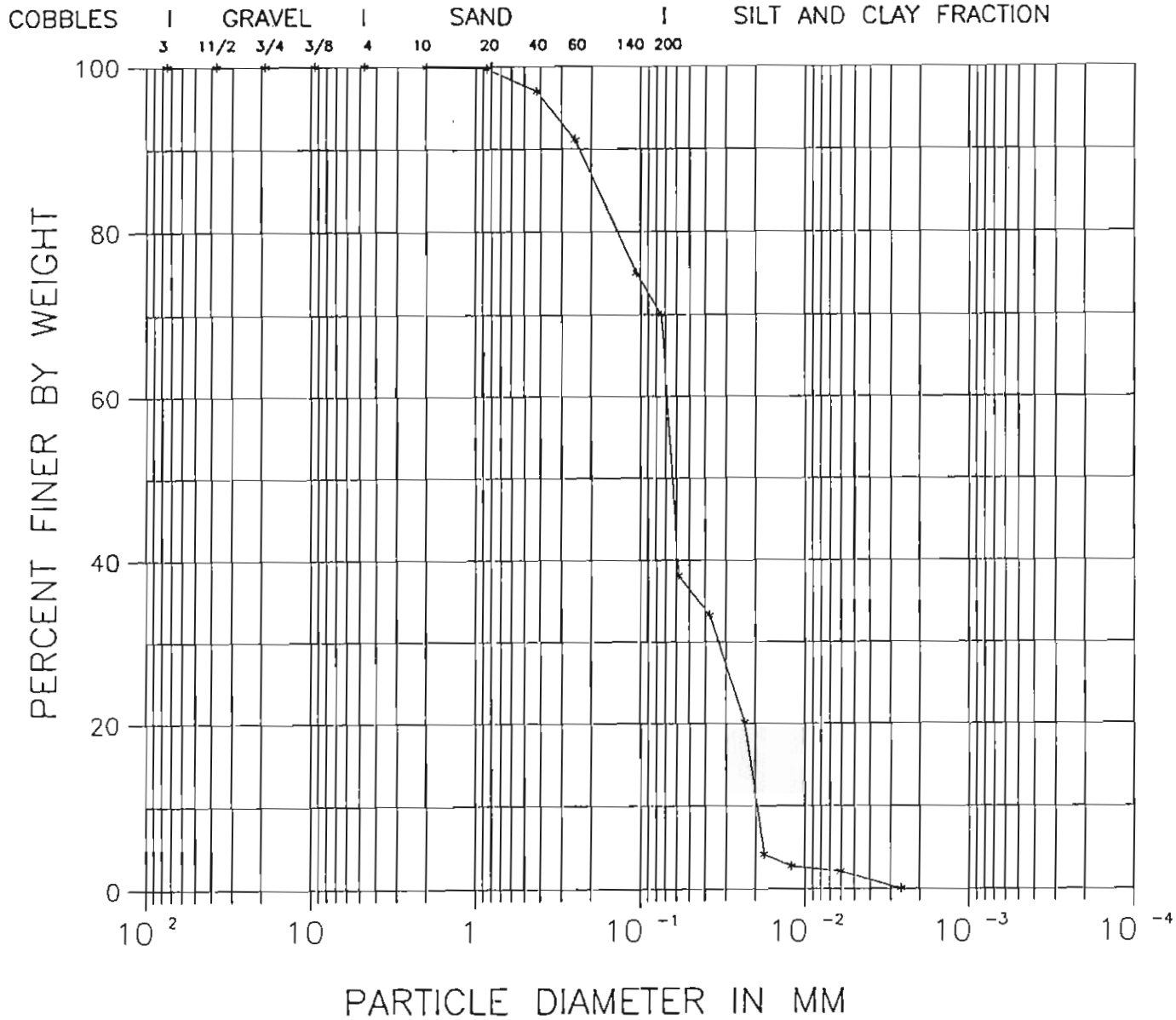
Soil Sample Weight			
Container No.	811		
Wt. Contain. & Dry Soil	172.04gm.	K Factor	0.02538
Wt. Contain.	104.68gm.	Composite Correction	7.49
Wt. Dispers.	5.00gm.	a Factor	1.24
Wt. Dry Soil	62.36gm.	% Finer Than No. 200	0.699
Temperature C	20.5		
Specific Gravity	1.47		
	Measured		

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
0.25	42.5	42.5	35.0	69.4	0.1550	48.5
0.50	42.0	42.0	34.5	68.4	0.1101	47.8
1	38.0	38.0	30.5	60.5	0.0805	42.3
2	35.0	35.0	27.5	54.5	0.0583	38.1
2		35.0	27.5	54.5	0.0583	38.1
5		31.5	24.0	47.6	0.0379	33.3
15		22.0	14.5	28.8	0.0233	20.1
30		10.5	3.0	6.0	0.0177	4.2
65		9.5	2.0	4.0	0.0121	2.8
258		9.0	1.5	3.0	0.0061	2.1
1440		7.5	0.0	0.0	0.0026	0.0

CLIENT: ALMES & ASSOC.
PROJECT NO. 91033-01
DEPTH: NA
DESCRIPTION: BLACK FINE COAL REFUSE
USCS CLASSIFICATION: NA

CLIENT PROJECT: US STEEL CONCORD
BORING NO. BS-1
SAMPLE NO. NA

SIEVE ANALYSIS HYDROMETER



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ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
R.D. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3610

SIEVE ANALYSIS

PROJECT	U. S. STEEL-CONCORD		TESTED BY	DSM	DATE	03-04-91
PROJECT NO.	90-55-27		CHKD BY	RLF	DATE	3/11/91
BORING NO.	-					
DEPTH	-					
SAMPLE	BS-1					

WT. OF TOTAL SAMPLE = 530.86
WT. OF +200 SAMPLE = 157.95
WT. OF -200 SAMPLE = 372.91

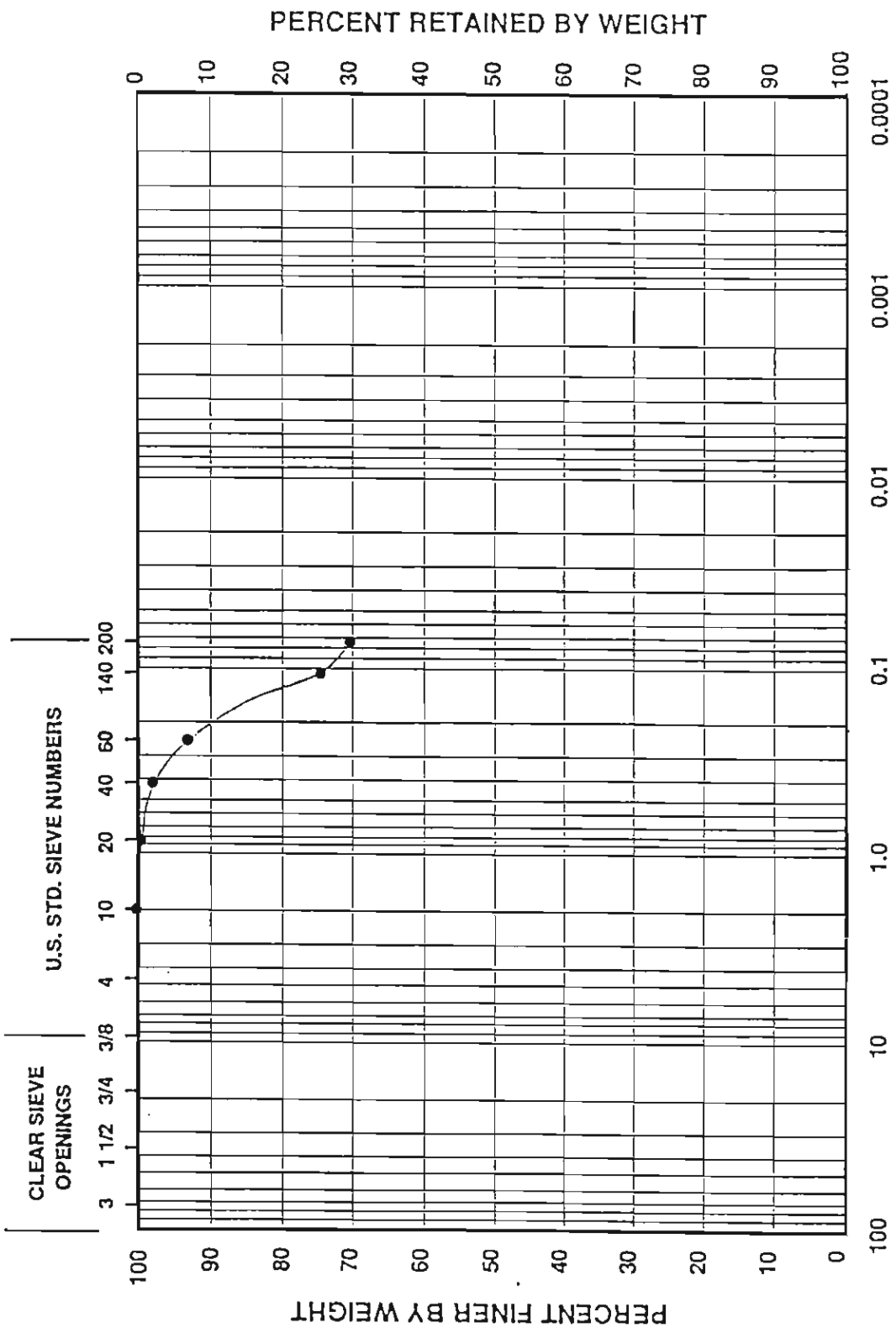
SPECIFIC GRAVITY N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	545.10	545.10	0.00	0.00	0.00	100.00
1.5	38.10	532.30	532.30	0.00	0.00	0.00	100.00
0.75	19.05	536.50	536.50	0.00	0.00	0.00	100.00
0.375	9.50	522.10	522.10	0.00	0.00	0.00	100.00
No. 4	4.75	540.60	540.60	0.00	0.00	0.00	100.00
No. 10	2.00	538.90	538.90	0.00	0.00	0.00	100.00
No. 20	0.85	416.08	416.43	0.35	0.07	0.07	99.93
No. 40	0.425	363.79	374.96	11.17	2.10	2.17	97.83
No. 60	0.25	368.05	396.04	27.99	5.27	7.44	92.56
No. 140	0.106	348.02	441.81	93.79	17.67	25.11	74.89
No. 200	0.075	281.54	306.19	24.65	4.64	29.75	70.25
PAN				372.91	70.25	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: WS 3/11/91

GRAIN SIZE ANALYSIS



BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL.	P.L	WC, %
	BS-1	Fine coal refuse	ML-OL			40.5

COBBLES | GRAVEL: COARSE, FINE | SAND: COARSE, MEDIUM, FINE | SILT AND CLAY: SILT FRACTION, CLAY FRACTION

Geotechnics

WASH SIEVE ANALYSIS

Client	ALMES & ASSOC.		Tested By	TO	Date 3-14-91
Client Project	US STEEL CONCORD		Checked By	SW	Date 3-28-91
Project No.	91033-01				
Boring No.	BS-2				
Depth(ft.)	NA				
Sample No.	NA				
Visual Description	BLACK FINE TO MEDIUM CAOL REFUSE				

Wt. of Total Sample(dry)	613.31gm.
Wt. of +#200 Sample	413.61gm.
Wt. of -#200 Sample	199.70gm.

Sieve	Sieve Opening (mm)	Wt. of Soil Retained (gm.)	Percent Retained	Accumulated Percent Retained	Percent Finer
3"	75.00	0.00	0.0	0.0	100.00
1 1/2"	37.50	0.00	0.0	0.0	100.00
3/4"	19.00	0.00	0.0	0.0	100.00
3/8"	9.50	0.00	0.0	0.0	100.00
#4	4.75	0.00	0.0	0.0	100.00
#10	2.00	0.76	0.1	0.1	99.88
#20	0.85	8.12	1.3	1.4	98.55
#40	0.425	72.06	11.7	13.2	86.80
#60	0.250	123.70	20.2	33.4	66.63
#140	0.106	172.22	28.1	61.4	38.55
#200	0.075	36.75	6.0	67.4	32.56
Pan	-	199.70	32.6	100.0	-

Water Content	
Tare No.	1020
Wgt. Tare + WS.	864.56
Wgt. Tare + DS.	717.54
Wgt. Tare	104.23
Wgt. Of Water	147.02
Wgt. Of DS.	613.31
% Water	24.0

Geotechnics

HYDROMETER ANALYSIS

Client	ALMES & ASSOC.	Tested By TO	Date 3-18-91
Client Project	US STEEL CONCORD	Checked By SW	Date 3-28-91
Project No.	91033-01		
Boring No.	BS-2		
Depth(ft.)	NA		
Sample No.	NA		

Soil Sample Weight			
Container No.	800		
Wt. Contain. & Dry Soil	175.29gm.	K Factor	0.02368
Wt. Contain.	104.55gm.	Composite Correction	7.49
Wt. Dispers.	5.00gm.	a Factor	1.22
Wt. Dry Soil	65.74gm.	% Finer Than No. 200	0.326

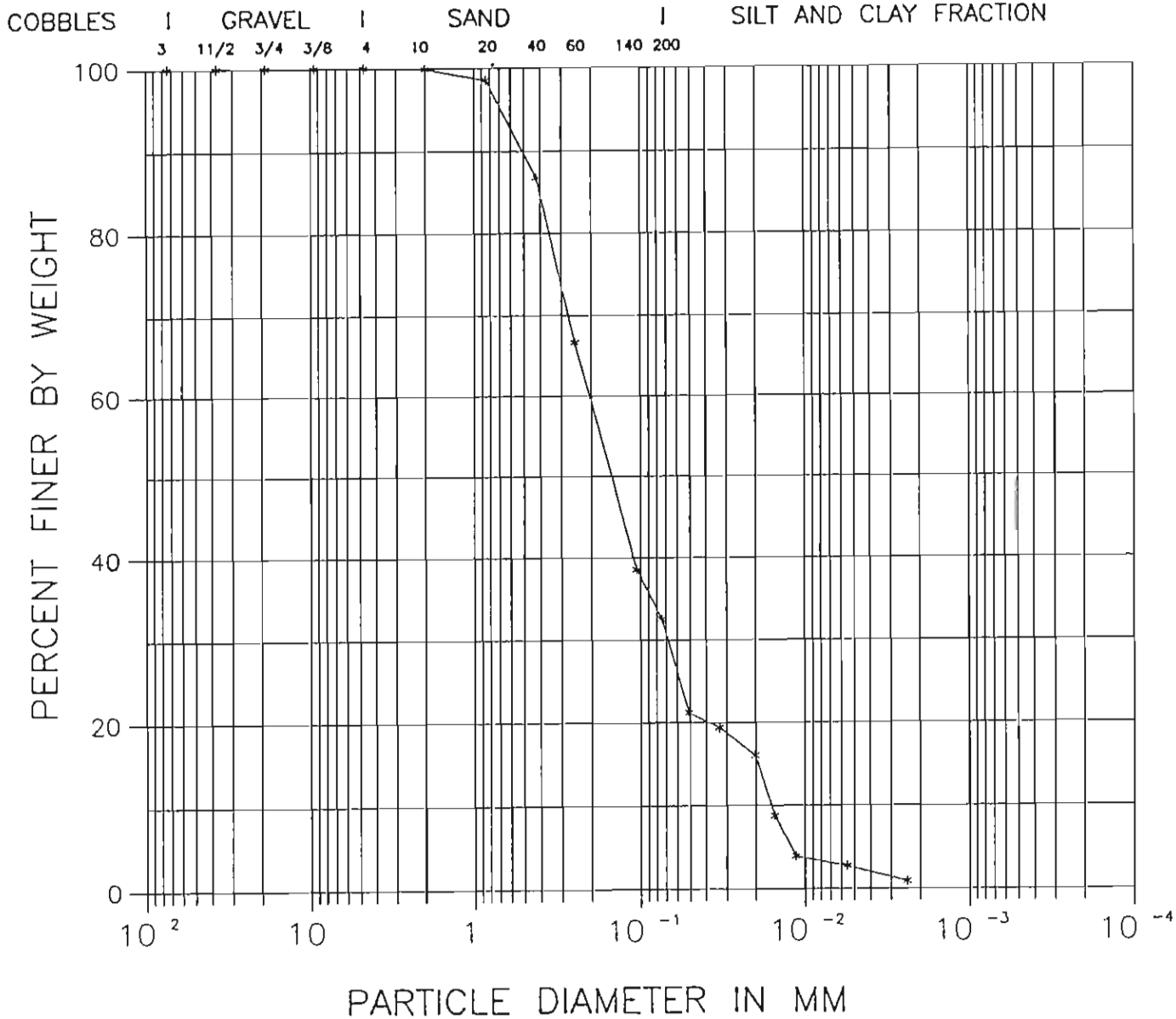
Temperature C	20.5
Specific Gravity	1.54
	Measured

Elapsed Time (min.)	R Measured		R Corrected	N (%)	D (mm)	N' (%)
0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
0.25	44.0	44.5	37.0	68.8	0.1421	22.4
0.50	43.5	44.0	36.5	67.9	0.1009	22.1
1	42.0	42.5	35.0	65.1	0.0723	21.2
2	41.0	41.5	34.0	63.2	0.0516	20.6
2		42.5	35.0	65.1	0.0511	21.2
5		39.5	32.0	59.5	0.0332	19.4
15		34.0	26.5	49.3	0.0200	16.0
30		22.0	14.5	27.0	0.0154	8.8
60		14.0	6.5	12.1	0.0114	3.9
256		12.0	4.5	8.4	0.0056	2.7
1440		9.0	1.5	2.8	0.0024	0.9

CLIENT: ALMES & ASSOC.
PROJECT NO. 91033-01
DEPTH: NA
DESCRIPTION: BLACK FINE TO MEDIUM COAL REFUSE
USCS CLASSIFICATION: NA

CLIENT PROJECT: US STEEL CONCORD
BORING NO. BS-2
SAMPLE NO. NA

SIEVE ANALYSIS HYDROMETER



Geotechnics

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
R.D. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3610

SIEVE ANALYSIS

PROJECT: U. S. STEEL-CONCORD
PROJECT NO.: 90-55-27
BORING NO.: -
DEPTH: -
SAMPLE: BS-2

TESTED BY: DSM
DATE: 03-04-91
CHKD BY: RLF
DATE: 3/11/91

WT. OF TOTAL SAMPLE = 521.01
WT. OF +200 SAMPLE = 361.46
WT. OF -200 SAMPLE = 159.55

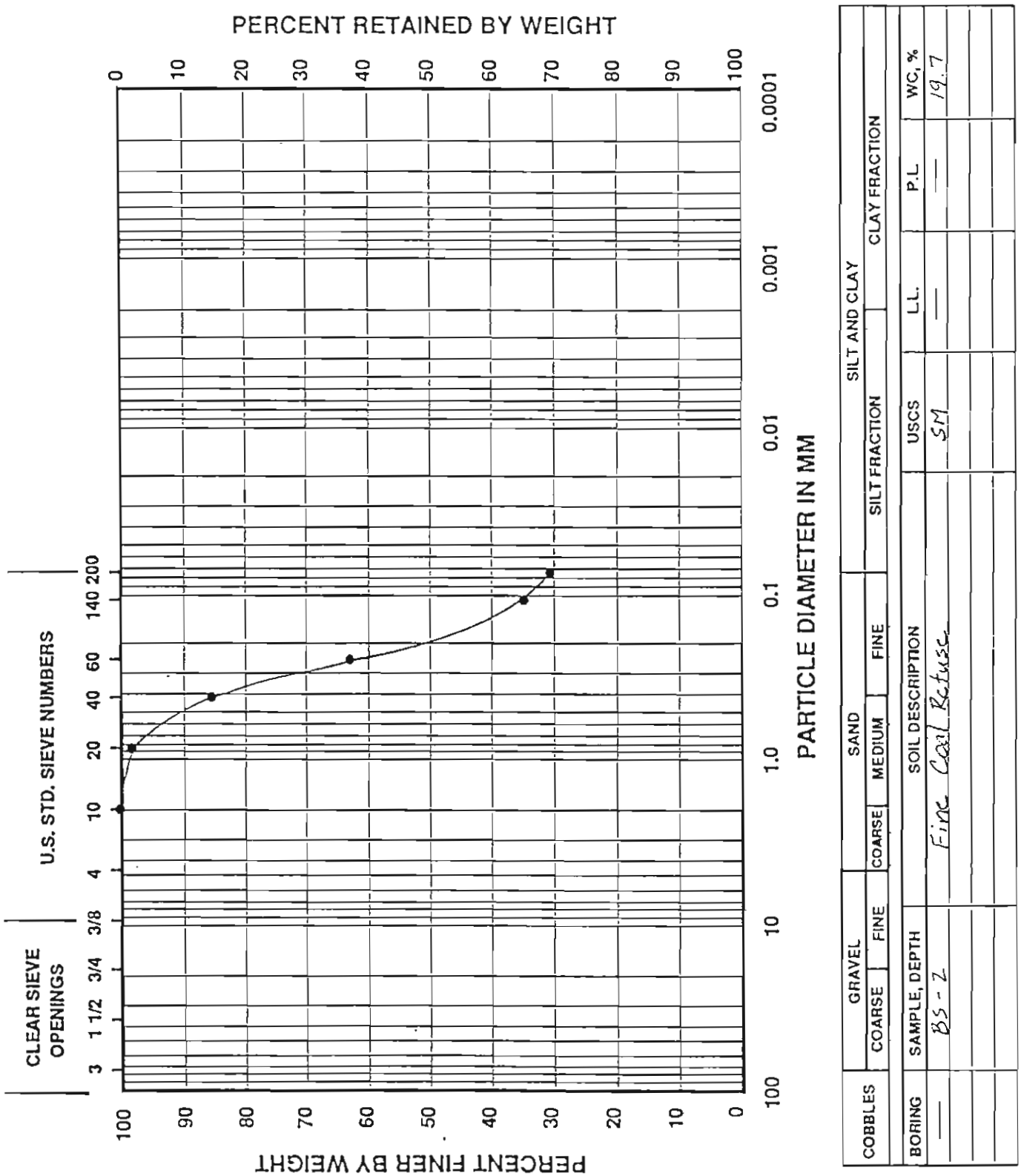
SPECIFIC GRAVITY: N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	545.10	545.10	0.00	0.00	0.00	100.00
1.5	38.10	532.30	532.30	0.00	0.00	0.00	100.00
0.75	19.05	536.50	536.50	0.00	0.00	0.00	100.00
0.375	9.50	522.10	522.10	0.00	0.00	0.00	100.00
No. 4	4.75	540.60	540.60	0.00	0.00	0.00	100.00
No. 10	2.00	538.90	538.90	0.00	0.00	0.00	100.00
No. 20	0.85	416.10	422.79	6.69	1.28	1.28	98.72
No. 40	0.425	363.78	430.47	66.69	12.80	14.08	85.92
No. 60	0.25	368.04	489.25	121.21	23.26	37.35	62.65
No. 140	0.106	348.03	490.76	142.73	27.39	64.74	35.26
No. 200	0.075	281.54	305.67	24.13	4.63	69.37	30.63
PAN				159.55	30.62	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: MS 3/11/91

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY		BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL.	P.L	WC, %
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION							
								—	BS-2	Fine Coal Reluse	SM	—	—	19.7

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
R.D. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3610

SIEVE ANALYSIS

	US.STEEL-CONCORD	TESTED BY	D.C.	DATE	03-11-91
PROJECT NO.	90-55-27	CHKD BY	RLF	DATE	3/11/91
BORING NO.	-				
DEPTH	-				
SAMPLE	BS-3				

WT. OF TOTAL SAMPLE = 3031.75
WT. OF +200 SAMPLE = 2891.77
WT. OF -200 SAMPLE = 139.98

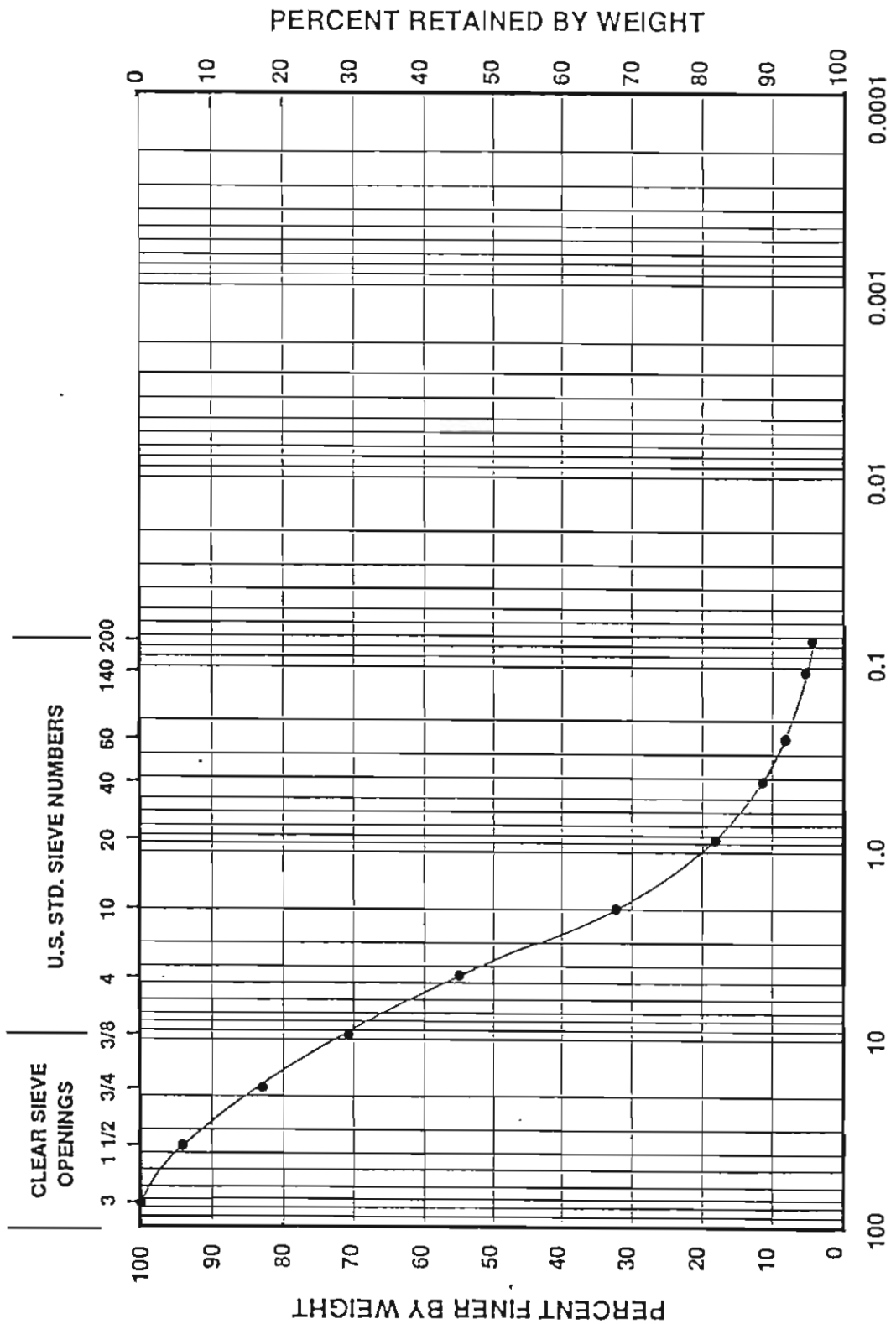
SPECIFIC GRAVITY N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	527.02	527.02	0.00	0.00	0.00	100.00
1.5	38.10	572.06	761.27	189.21	6.24	6.24	93.76
0.75	19.05	580.47	907.30	326.83	10.78	17.02	82.98
0.375	9.50	545.28	922.74	377.46	12.45	29.47	70.53
No. 4	4.75	504.44	960.93	456.49	15.06	44.53	55.47
No. 10	2.00	466.16	1159.70	693.54	22.88	67.40	32.60
No. 20	0.85	416.09	850.77	434.68	14.34	81.74	18.26
No. 40	0.425	363.77	568.17	204.40	6.74	88.48	11.52
No. 60	0.25	368.03	466.96	98.93	3.26	91.75	8.25
No. 140	0.106	348.07	439.63	91.56	3.02	94.77	5.23
No. 200	0.075	281.57	300.24	18.67	0.62	95.38	4.62
PAN				139.98	4.62	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: RS 3/11/91

GRAIN SIZE ANALYSIS



BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	L.L.	P.L.	WC, %
—	BS-3	Weathered coarse coal refuse	SW	—	—	7.8

COBBLES	GRAVEL		SAND			SILT AND CLAY	
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE
R.D. #1 BOX 520
PLEASANT VALLEY ROAD

BEAVER, WV 25813
TRAFFORD, PA 15085

(304)255-0491
(412)744-3610

SIEVE ANALYSIS

PROJECT	US.STEEL CONCORD	TESTED BY	D.C.
PROJECT NO.	90-55-27	CHKD BY	RLF
BORING NO.	-	DATE	03-11-91
DEPTH	-	DATE	3/11/91
SAMPLE	BS-5		

WT. OF TOTAL SAMPLE = 4866.65
WT. OF +200 SAMPLE = 4819.65
WT. OF -200 SAMPLE = 47.00

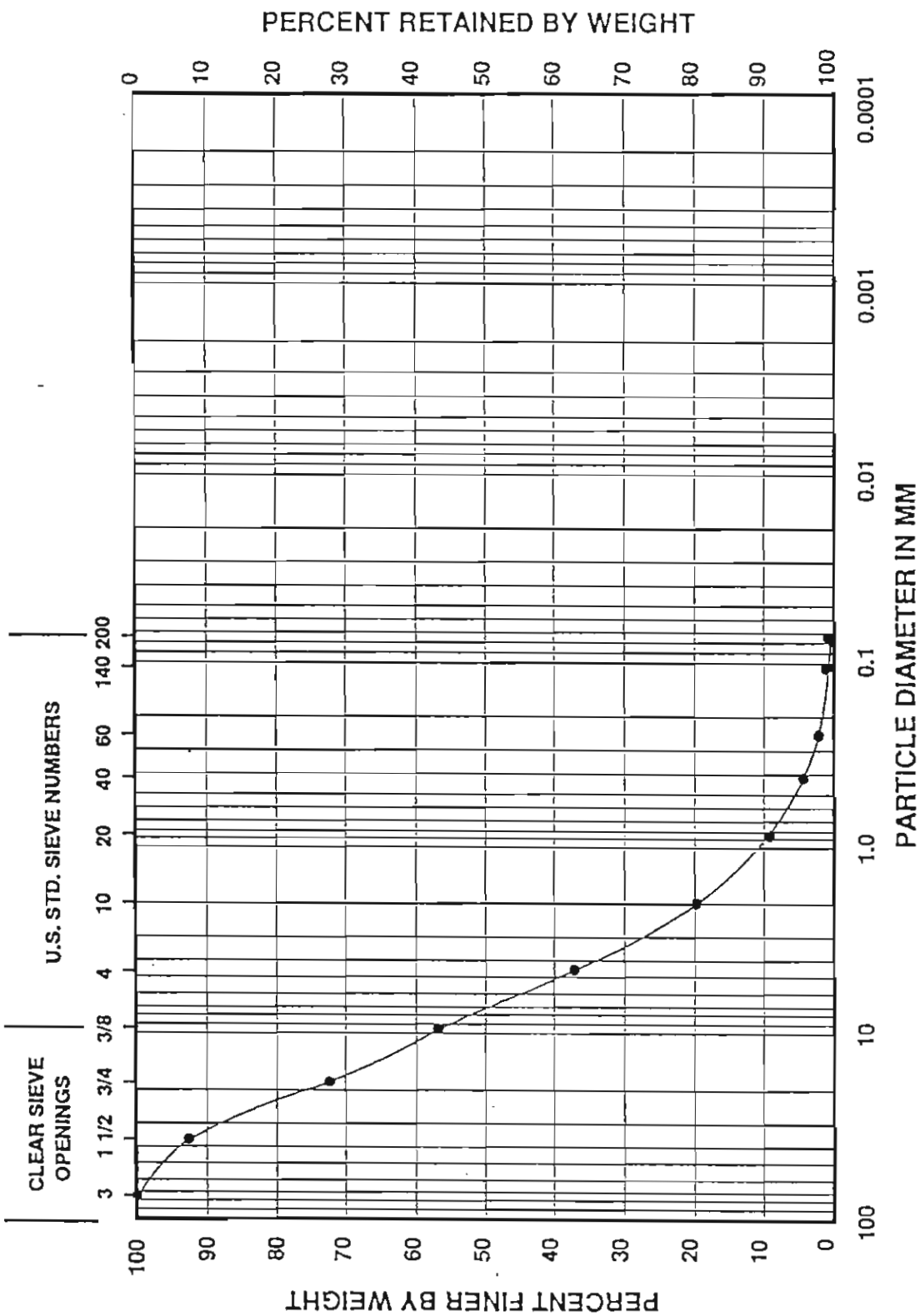
SPECIFIC GRAVITY N.A.

SIEVE NO.	SIEVE OPENING mm	SIEVE WT. gm	SIEVE WT. + SOIL WT. gm	WT. RETAINED gm	PERCENT RETAINED	ACCUMULATIVE PERCENT RETAINED	PERCENT FINER
3 IN.	76.10	527.01	527.01	0.00	0.00	0.00	100.00
1.5	38.10	572.05	906.58	334.53	6.87	6.87	93.13
0.75	19.05	580.50	1567.90	987.40	20.29	27.16	72.84
0.375	9.50	545.26	1330.00	784.74	16.12	43.29	56.71
No. 4	4.75	504.55	1442.90	938.35	19.28	62.57	37.43
No. 10	2.00	466.17	1327.00	860.83	17.69	80.26	19.74
No. 20	0.85	416.10	906.20	490.10	10.07	90.33	9.67
No. 40	0.425	363.83	609.66	245.83	5.05	95.38	4.62
No. 60	0.25	368.09	471.62	103.53	2.13	97.51	2.49
No. 140	0.106	348.04	414.32	66.28	1.36	98.87	1.13
No. 200	0.075	281.57	289.63	8.06	0.17	99.03	0.97
PAN				47.00	0.97	100.00	0.00

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: WS 3/11/91

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY					
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION				

BORING	SAMPLE, DEPTH	SOIL DESCRIPTION	USCS	LL.	P.L.	WC, %
—	B5-5	Coarse coal refuse	GM	—	—	3.7

Geotechnics

SPECIFIC GRAVITY DETERMINATION

Client	ALMES & ASSOC.	Tested By	BS	Date	3-15-91
Client Project	US STEEL CONCORD	Checked By	JW	Date	3.27.91
Project No.	91033-01				
Boring No.	BS-1				
Depth (ft.)	NA				
Sample No.	NA				

Soil Description BLACK FINE COAL REFUSE

Determination No.	1	2
Bottle No.	A	C
Wgt. Bottle+Soil+Water (gms.)	691.26	691.25
Temperature (c)	28.10	27.90
Wgt. Bottle + Water (gms.)	670.75	670.29
Tare No.	502	1024
Wgt. of Tare + Dry Soil (gms.)	173.46	167.68
Wgt. of Tare (gms.)	108.89	103.02
Wgt. of Dry Soil (gms.)	64.57	64.66
Specific Gravity of Soil At T.	1.466	1.480
Specific Gravity of Water at T.	0.9962	0.9963
Conversion Factor For Temp. T	0.9980	0.9981
Specific Gravity of Soil at 20 c.	1.460	1.474

Avg. Specific Gravity 1.47

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 2/28/91 CHKD BY: RLF DATE: 3/11/91
PROJECT NAME: U. S. STEEL - CONCORD
PROJECT NO.: 90-55-27
SAMPLE DESCRIPTION: BS-1

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	689.26	675.78		
TEMPERATURE, T, °C	26.0	26.0		
WT. PYCNOMETER+WATER W2, gm.	658.52	649.61		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	258.61	234.44		
WT. PYCNOMETER, gm.	160.90	151.98		
WT. DRY SAMPLE, Ws,	97.71	82.46		
Ws-W1+W2, gm.	66.97	56.29		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	1.46	1.46		
CONVERSION FACTOR FOR TEMP. T, K	0.9986	0.9986		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	1.46	1.46		
AVG. SPECIFIC GRAVITY	1.46			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS: _____

REF: ASTM D 854

geotechnics

SPECIFIC GRAVITY DETERMINATION

Client	ALMES & ASSOC.	Tested By	TO	Date	3-14-91
Client Project	US STEEL CONCORD	Checked By	SW	Date	3-27-91
Project No.	91033-01				
Boring No.	BS-2				
Depth (ft.)	NA				
Sample No.	NA				

Soil Description BLACK FINE COAL REFUSE

Determination No.	1	2
Bottle No.	A	C
Wgt. Bottle+Soil+Water (gms.)	687.76	689.90
Temperature (c)	24.80	25.30
Wgt. Bottle + Water (gms.)	671.19	670.65
Tare No.	K7	200
Wgt. of Tare + Dry Soil (gms.)	153.28	163.37
Wgt. of Tare (gms.)	106.85	107.88
Wgt. of Dry Soil (gms.)	46.43	55.49
Specific Gravity of Soil At T.	1.555	1.531
Specific Gravity of Water at T.	0.9971	0.9970
Conversion Factor For Temp. T	0.9989	0.9988
Specific Gravity of Soil at 20 c.	1.550	1.527

Avg. Specific Gravity 1.54

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 2/28/91 CHKD BY: RLF DATE: 3/11/91
PROJECT NAME: U. S. STEEL - CONCORD
PROJECT NO.: 90-55-27
SAMPLE DESCRIPTION: BS-2

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	681.52	670.01		
TEMPERATURE, T, °C	26.0	26.0		
WT. PYCNOMETER+WATER W2, gm.	658.52	649.61		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	241.06	237.37		
WT. PYCNOMETER, gm.	160.60	151.70		
WT. DRY SAMPLE, Ws,	80.46	85.67		
Ws-W1+W2, gm.	57.46	65.27		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	1.40	1.31		
CONVERSION FACTOR FOR TEMP. T, K	0.9986	0.9986		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	1.40	1.31		
AVG. SPECIFIC GRAVITY	1.35			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS:

REF: ASTM D 854

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
P.O. BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/11/91

PROJECT NAME: U. S. STEEL - CONCORD

PROJECT NO.: 90-55-27

SAMPLE DESCRIPTION: BS-3

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	726.30	721.43		
TEMPERATURE, T, °C	30.0	30.0		
WT. PYCNOMETER+WATER W2, gm.	658.03	649.12		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	297.66	294.76		
WT. PYCNOMETER, gm.	160.61	151.72		
WT. DRY SAMPLE, Ws,	137.05	143.04		
Ws-W1+W2, gm.	68.78	70.73		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	1.99	2.02		
CONVERSION FACTOR FOR TEMP. T, K	0.9974	0.9974		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	1.99	2.02		
AVG. SPECIFIC GRAVITY	**2.00**			

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS: _____

REF: ASTM D 854

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

+3/4 SPECIFIC GRAVITY

BY: DC DATE: 3/14/91 CHKD BY: RLF DATE: 3/15/91

PROJECT NAME: U. S. STEEL-CONCORD

PROJECT NUMBER: 90-55-27

SAMPLE DESCRIPTION: BS-3

WEIGHT OF DRY SAMPLE & PAN	933.21	gms
WEIGHT OF PAN	118.27	gms
WEIGHT OF OVEN-DRIED SAMPLE (A)	814.94	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE & PAN	945.99	gms
WEIGHT OF PAN	118.27	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE (B)	827.72	gms
WEIGHT OF SATURATED SAMPLE IN WATER & BASKET	2481.00	gms
WEIGHT OF BASKET IN WATER	1990.00	gms
WEIGHT OF SATURATED SAMPLE IN WATER (C)	491.00	gms
SPECIFIC GRAVITY OF SAMPLE A/(B-C)	**2.42**	

REMARKS:

-3/4" SPECIFIC GRAVITY

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/11/91

PROJECT NAME: U. S. STEEL - CONCORD

PROJECT NO.: 90-55-27

SAMPLE DESCRIPTION: BS-5

TEST NO.	1	2		
WT. PYCNOMETER+ WATER+SAMPLE, W1, gm.	728.26	738.78		
TEMPERATURE, T, °C	31.0	31.0		
WT. PYCNOMETER+WATER W2, gm.	657.90	648.99		
PYCNOMETER NO.	D	E		
WT. PYCNOMETER+ DRY SAMPLE, gm.	287.83	315.28		
WT. PYCNOMETER, gm.	163.23	153.65		
WT. DRY SAMPLE, Ws,	124.60	161.63		
Ws-W1+W2, gm.	54.24	71.84		
SPECIFIC GRAVITY OF SAMPLE AT T, Gs	2.30	2.25		
CONVERSION FACTOR FOR TEMP. T, K	0.9971	0.9971		
SPECIFIC GRAVITY OF SAMPLE AT 20 °C, G	2.29	2.24		

AVG. SPECIFIC GRAVITY	**2.27**

$$GS = \frac{Ws}{Ws-W1+W2} \qquad G = KGs$$

REMARKS: _____

REF: ASTM D 854

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D.#1 BOX 520 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY ROAD

+3/4 SPECIFIC GRAVITY

BY: DC DATE: 3/14/91 CHKD BY: RLF DATE: 3/15/91

PROJECT NAME: U. S. STEEL-CONCORD

PROJECT NUMBER: 90-55-27

SAMPLE DESCRIPTION: BS-5

WEIGHT OF DRY SAMPLE & PAN	1012.00	gms
WEIGHT OF PAN	120.60	gms
WEIGHT OF OVEN-DRIED SAMPLE (A)	891.40	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE & PAN	1027.89	gms
WEIGHT OF PAN	120.60	gms
WEIGHT OF SATURATED SURFACE-DRY SAMPLE (B)	907.29	gms
WEIGHT OF SATURATED SAMPLE IN WATER & BASKET	2534.00	gms
WEIGHT OF BASKET IN WATER	1985.00	gms
WEIGHT OF SATURATED SAMPLE IN WATER (C)	549.00	gms
SPECIFIC GRAVITY OF SAMPLE A/(B-C)	**2.49**	

REMARKS:

Geotechnics

ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	TO	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033-01				
Boring No.	BS-1				
Depth(ft.)	NA				
Sample No.	NA				
Soil Description	NON PLASTIC (-40)				

LIQUID LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	
NO. OF BLOWS	

PLASTIC LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	NON PLASTIC
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
105 PHILPOTT LANE BEAVER, WV 25813 (304)255-0491
R.D. #1 BOX 250 TRAFFORD, PA 15085 (412)744-3610
PLEASANT VALLEY RD

ATTERBERG LIMITS TESTS

PROJECT NAME: U.S. STEEL-CONCORD TESTED BY: RLF DATE: 3/13/91

PROJECT NUMBER: 90-55-27

SAMPLE: BS-1 CHECKED BY: WS DATE: 3/15/91

SOIL DESCRIPTION: FINE COAL REFUSE

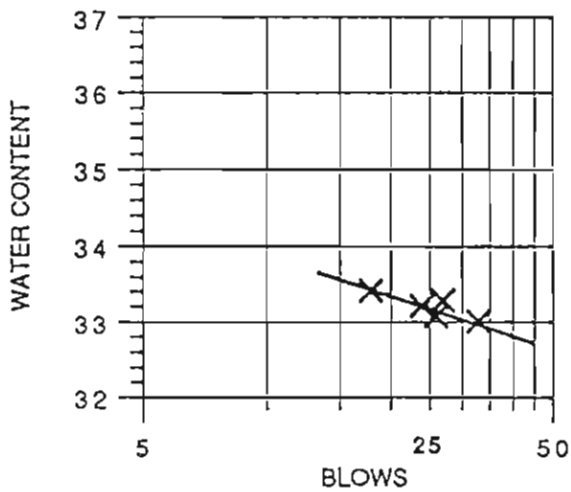
LIQUID LIMIT

DETERMINATION NO.	1	2	3	4	5
TARE NO.	226	27	99	44	29
WT. OF TARE + WET SOIL, gms	118.89	108.51	114.70	108.40	107.20
WT. OF TARE + DRY SOIL, gms	115.87	106.19	111.98	106.28	105.19
WATER CONTENT	33.4	33.0	33.2	33.1	33.3
NO. OF BLOWS	18	33	24	26	27

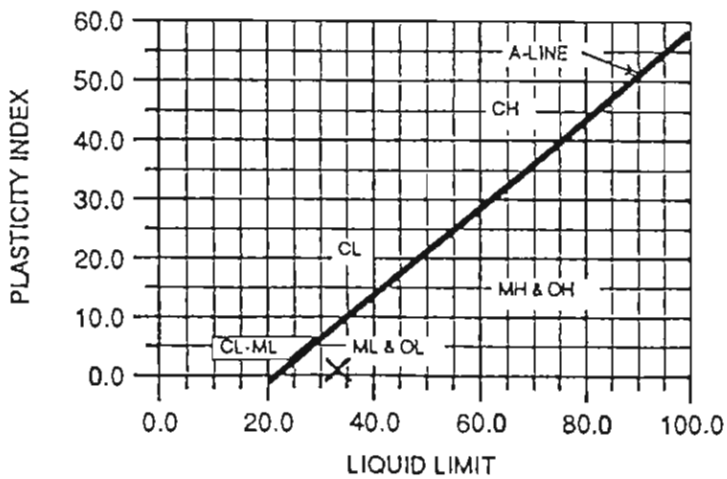
PLASTIC LIMIT

DETERMINATION NO.	1	2	3
TARE NO.	1	54	92
WT. OF TARE + WET SOIL, gms	100.90	103.25	101.97
WT. OF TARE + DRY SOIL, gms	100.73	103.05	101.66
WATER CONTENT	30.4	33.9	32.6
AVERAGE WATER CONTENT	32.3		

FLOW CURVE



PLASTICITY CHART



SUMMARY OF RESULTS	
LIQUID LIMIT	33.2
PLASTIC LIMIT	32.3
PLASTICITY INDEX	0.9
NATURAL WATER CONTENT	40.5
USCS SYMBOL	ML&OL

Geotechnics

ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	TM	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033-01				
Boring No.	BS-2				
Depth(ft.)	NA				
Sample No.	NA				
Soil Description	NON PLASTIC (-40)				

LIQUID LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	
NO. OF BLOWS	

PLASTIC LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	NON PLASTIC
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	

Geotechnics

ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	TM	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033				
Boring No.	B-20				
Depth(ft.)	27.6'-27.8'				
Sample No.	ST-2				
Soil Description	NON PLASTIC (-40)				

LIQUID LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	
NO. OF BLOWS	

PLASTIC LIMIT	
Tare Number	
Wt. Tare & WS(gm.)	
Wt. Tare & DS(gm.)	
Wt. Water(gm.)	NON PLASTIC
Wt. Tare(gm.)	
Wt. DS(gm.)	
Moisture Content(%)	

Geotechnics

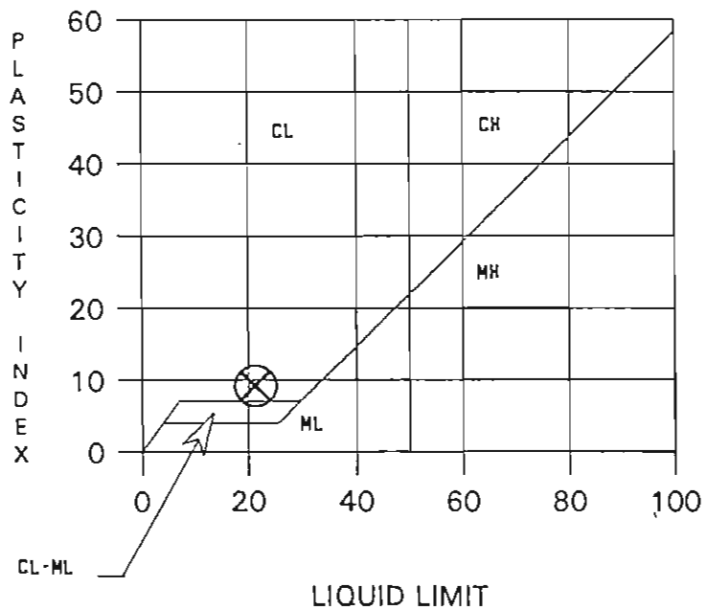
ATTERBERG LIMITS TEST

Client	ALMES & ASSOC.	Tested By	SW	Date	03-19-91
Client Project	US STEEL CONCORD	Checked By	BS	Date	3-20-91
Project No.	91033				
Boring No.	B-3A				
Depth(ft.)	3.5'-3.7'				
Sample No.	ST-1				
Soil Description	BROWN LEAN CLAY (-40)				

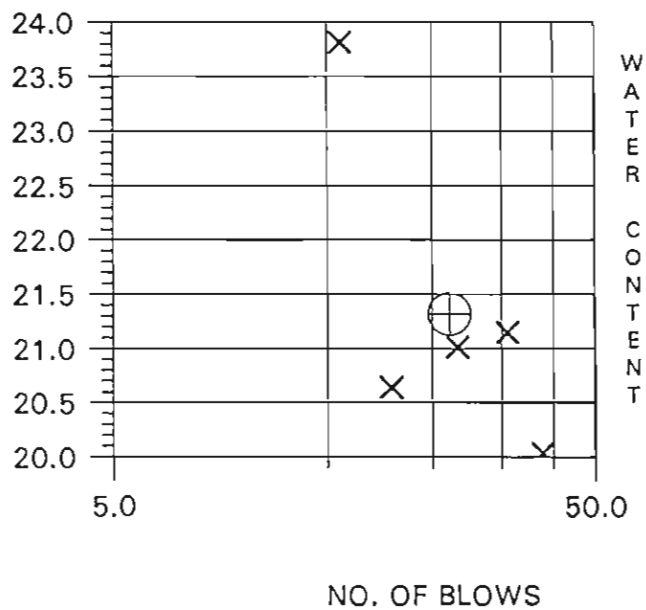
LIQUID LIMIT					
Tare Number	1310	89	456	778	667
Wt. Tare & WS(gm.)	109.35	107.38	105.47	40.11	41.57
Wt. Tare & DS(gm.)	108.23	105.98	104.43	38.68	40.12
Wt. Water(gm.)	1.12	1.40	1.04	1.43	1.45
Wt. Tare(gm.)	102.64	99.36	99.48	31.75	34.03
Wt. DS(gm.)	5.59	6.62	4.95	6.93	6.09
NO. OF BLOWS	39	33	26	19	15
Moisture Content(%)	20.0	21.1	21.0	20.6	23.8

PLASTIC LIMIT					
Tare Number	771	770	755	Summary	
Wt. Tare & WS(gm.)	39.05	42.62	38.14	Liquid Limit %	21
Wt. Tare & DS(gm.)	38.32	41.93	37.40	Plastic Limit %	12
Wt. Water(gm.)	0.73	0.69	0.74	Plasticity Index	9
Wt. Tare(gm.)	32.37	36.02	31.44	USCS Symbol	CL
Wt. DS(gm.)	5.95	5.91	5.96		
Moisture Content(%)	12.3	11.7	12.4		

PLASTICITY CHART



FLOW CURVE



MOISTURE-DENSITY RELATIONSHIP

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

118 HARPER PARK, STE. J, BECKLEY, WV 25801, (304)255-0491
R.D. #1 BOX 520, PLEASANT VALLEY ROAD, TRAFFORD, PA 15085, (412)744-3610

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/15/91

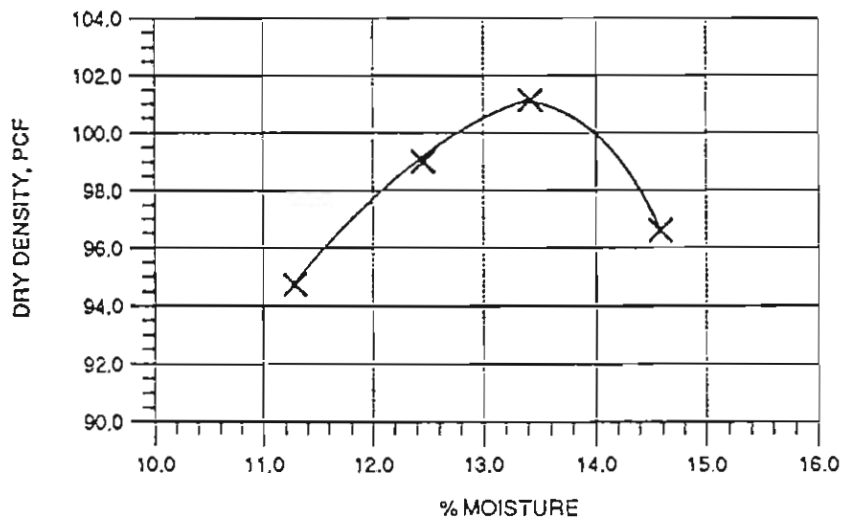
PROJECT NAME: US. STEEL-CONCORD

PROJECT NO.: 90-55-27 SHEET 1 OF 1

POINT NO.	PT. 1		PT. 2		PT. 3		PT. 4			
WT. MOLD+WS, GM	10577		10440		10262		10462			
WT. MOLD, GM	6675		6675		6675		6675			
WT. WS, GM	3902		3765		3587		3787			
VOL. MOLD, CU. FT.	0.075		0.075		0.075		0.075			
WT. WS, LBS	8.602		8.300		7.908		8.349			
WET DENSITY, PCF	114.7		110.7		105.4		111.3			
TARE NO.	100	92	48	96	24	29	24	29		
WT. TARE+WS, GM	247.33	264.47	207.99	219.03	239.76	247.35	242.10	222.10		
WT. TARE+DS, GM	230.15	245.37	193.91	204.32	224.04	232.81	226.38	207.56		
% MOISTURE	13.4		14.6		11.3		12.5			
DRY DENSITY, PCF	101.1		96.6		94.7		99.0			

SAMPLE DESCRIPTION

WEATHERED COARSE
COAL REFUSE
SAMPLE NO. BS-3



MAX. DRY DENSITY 101.1 PCF

OPTIMUM MOISTURE 13.4 %

METHOD	MATERIAL SIZE	MOLD SIZE	BLOWS
A	ALL PASSING #4	4" DIA.	25
B	ALL PASSING #4	6" DIA.	56
C	ALL PASSING 3/4"	6" DIA.	56
D	ALL PASSING 3/4"	6" DIA.	56
E	ALL PASSING 1 1/2"	6" DIA.	56

DESIGNATION USED: STD

METHOD USED: E

DESIGNATION	HAMMDROP	LAYER
STANDARD	5.5#/12"	3
MODIFIED	10#/18"	5

NOTES:

MOISTURE-DENSITY RELATIONSHIP

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

118 HARPER PARK, STE. J, BECKLEY, WV 25801, (304)255-0491
R.D. #1 BOX 520, PLEASANT VALLEY ROAD, TRAFFORD, PA 15085, (412)744-3610

BY: DC DATE: 3/11/91 CHKD BY: RLF DATE: 3/15/91

PROJECT NAME: US. STEEL-CONCORD

PROJECT NO.: 90-55-27 SHEET 1 OF 1

POINT NO.	PT. 1		PT. 2		PT. 3		PT. 4			
WT. MOLD+WS, GM	10579		10770		10835		10714			
WT. MOLD, GM	6675		6675		6675		6675			
WT. WS, GM	3904		4095		4160		4039			
VOL. MOLD, CU. FT.	0.075		0.075		0.075		0.075			
WT. WS, LBS	8.607		9.028		9.171		8.904			
WET DENSITY, PCF	114.8		120.4		122.3		118.7			
TARE NO.	15	54	10	65	5	20	1	131		
WT. TARE+WS, GM	245.43	247.85	259.43	214.07	280.79	275.07	239.97	275.80		
WT. TARE+DS, GM	240.16	242.83	251.70	208.01	270.33	264.62	230.84	262.80		
% MOISTURE	3.6		5.1		6.2		7.6			
DRY DENSITY, PCF	110.7		114.5		115.1		110.3			

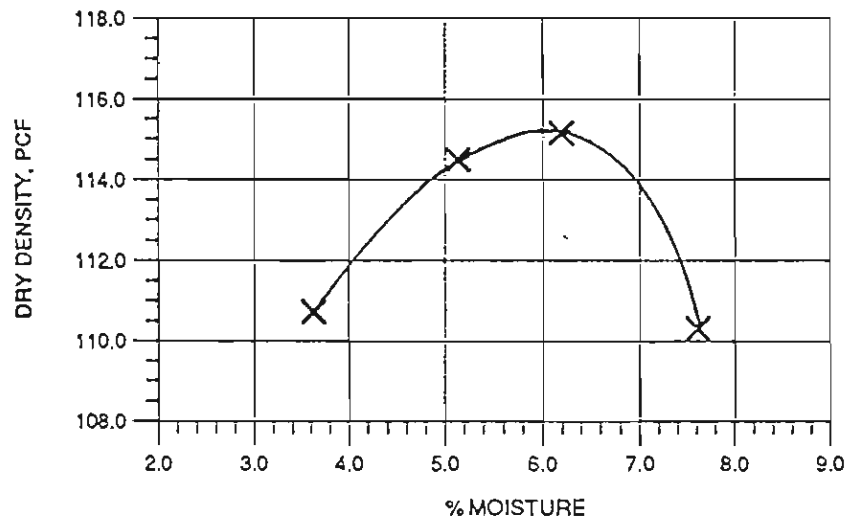
SAMPLE DESCRIPTION

FRESH COARSE COAL REFUSE

SAMPLE NO. BS-5

MAX. DRY DENSITY 115.1 PCF

OPTIMUM MOISTURE 6.2 %



METHOD	MATERIAL SIZE	MOLD SIZE	BLOWS
A	ALL PASSING #4	4" DIA.	25
B	ALL PASSING #4	6" DIA.	56
C	ALL PASSING 3/4"	6" DIA.	56
D	ALL PASSING 3/4"	6" DIA.	56
E	ALL PASSING 1 1/2"	6" DIA.	56

DESIGNATION USED: STD

METHOD USED: E

DESIGNATION	HAMMDROP	LAYER
STANDARD	5.5#/12"	3
MODIFIED	10#/18"	5

NOTES:

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MOISTURE-DENSITY RELATIONSHIP

Client	ALMES & ASSOC.	Tested By	JP/SW	DATE	04-02-91
Client Project	US STEEL CONCORD	Checked By	JCM	DATE	4-4-91
Project No.	91033-02				
Boring No.	BS-6	Test Type			STANDARD
Depth (ft.)	NA	Wt. of Mold (gm.)			6431
Sample No.	NA	Mold Volume (cm^3)			2124

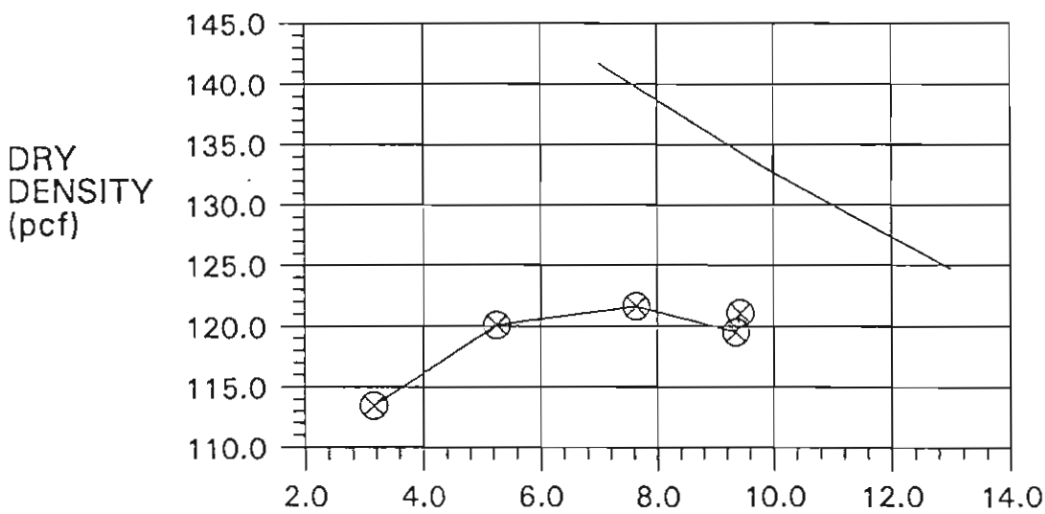
Description: COAL REFUSE

WET DENSITY

Wt. Mold & WS(gm.)	10415	10734	10887	10880	10940
Wt. Mold(gm.)	6431	6431	6431	6431	6431
Wt. WS(gm.)	3984	4303	4456	4449	4509
Mold Volume(cm^3)	2124	2124	2124	2124	2124
Wet Density(gm./cm^3)	1.88	2.03	2.10	2.09	2.12
Wet Density(pcf)	117.04	126.42	130.91	130.71	132.47

WATER CONTENT

Tare Number	728	9	781	782	785
Wt. Tare & WS(gm.)	383.43	393.31	468.70	667.40	575.50
Wt. Tare & DS(gm.)	374.36	377.38	441.50	617.60	533.30
Wt. Water(gm.)	9.07	15.93	27.20	49.80	42.20
Wt. Tare(gm.)	86.67	74.59	85.27	85.66	85.93
Wt. DS(gm.)	287.69	302.79	356.23	531.94	447.37
Moisture Content(%)	3.15	5.26	7.64	9.36	9.43
Dry Density(pcf)	113.47	120.10	121.62	119.52	121.05



Specific Gravity
2.70
ASSUMED

Zero Air Voids

Moisture Content (%)	Dry Unit Weight (pcf)
7.00	141.70
10.00	132.66
13.00	124.71

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PERMEABILITY TEST

Client	ALMES & ASSOC.	Tested By JCM Date	4-4-91
Client Project	US STEEL CONCORD	Checked By MM Date	4-12-91
Project No.	91033-02		
Boring No.	BS-6	Specific Gravity	2.70
Depth(ft.)	NA		ASSUMED
Sample No.	NA		

SOIL DESCRIPTION COAL REFUSE (REMOLDED)

	BEFORE TEST	AFTER TEST
MOISTURE CONTENT		
Tare Number	718	8
Wt. Tare & WS(gm.)	206.56	708.50
Wt. Tare & DS(gm.)	194.87	654.00
Wt. Water(gm.)	11.69	54.50
Wt. Tare(gm.)	35.56	74.44
Wt. DS(gm.)	159.31	579.56
Moisture Content(%)	7.3	9.4
UNIT WEIGHT		
Wt. Tube & WS.(gms.)	1129.10	NA
Wt. Of Tube(gms.)	269.80	NA
Wt. Of WS.(gms.)	859.30	875.84
Length 1 (in.)	3.98	3.96
Length 2 (in.)	3.98	3.98
Length 3 (in.)	3.98	3.96
Top Diameter (in.)	2.89	3.00
Middle Diameter (in.)	2.89	2.99
Bottom Diameter (in.)	2.89	3.00
Average Length (in)	3.98	3.97
Average Area (in.)	6.56	7.05
Sample Volume(cc.)	428.45	458.23
Unit Wet Wt.(gms/cc)	2.006	1.911
Unit Wet Wt.(pcf.)	125.2	119.3
Unit Dry Wt.(pcf.)	116.6	109.0
Unit Dry Wt.(gms/cc)	1.869	1.747
Intial Void Ratio,e	0.445	0.545

Geotechnics

PERMEABILITY TEST

Client	ALMES & ASSOC.	Tested By JCM Date	4-4-91
Client Project	US STEEL CONCORD	Checked By JMM Date	4-12-91
Project No.	91033-02		
Boring No.	BS-6	Specific Gravity	2.70
Depth(ft.)	NA		ASSUMED
Sample No.	NA		

Pressures		Final Sample Dimensions	
Top Cap (psi)	25.0	Sample Length (in.)	3.97
Bottom Cap (psi)	30.0	Sample Diameter (in.)	3.00
Cell (psi)	35.0	Sample Area (in.^2)	7.05
Total Head (cm)	351.5		

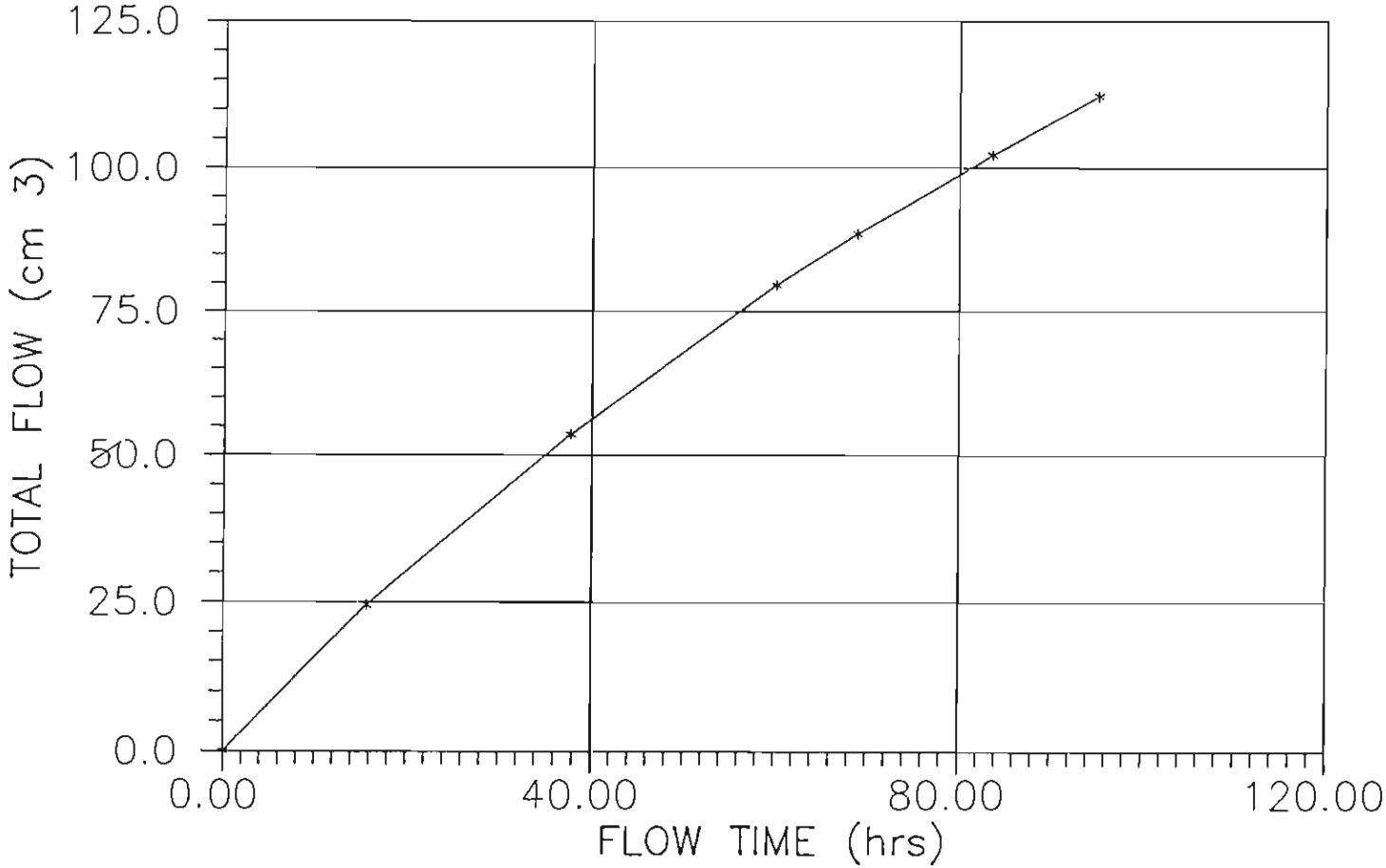
B PARAMETER 97%

TIME 1	60.17	hrs.	PERMEABILITY	1.63e-007	CM/SEC
TOTAL FLOW 1	79.6	cm^3	AVG. TEST TEMP	23.2	CELSIUS
TIME 2	95.17	hrs.	PERMEABILITY	1.51e-007	CM/SEC
TOTAL FLOW 2	112.2	cm^3	CORRECTED TO	20.0	CELSIUS

DATE	TIME		ELAPSE TIME	BURETTE READINGS		TOTAL FLOW	FLOW 0 RUN 1 STOP
				INITIAL	FINAL		
dy-mon-yr	hr	min	hrs	cm^3		cm^3	
5-APR-1991	18	50	0.00	31.5	31.5	0.0	0
6-APR-1991	10	35	15.75	56.1	0.0	24.5	0
7-APR-1991	8	35	37.75	29.0	29.0	53.6	1
7-APR-1991	9	35	37.75	29.0	29.0	53.6	0
8-APR-1991	8	0	60.17	55.1	55.1	79.6	0
8-APR-1991	16	45	68.92	64.1	64.1	88.6	0
9-APR-1991	7	25	83.58	77.6	77.6	102.1	0
9-APR-1991	19	0	95.17	87.6	87.6	112.2	0

Client ALMES & ASSOC. Boring No. BS-6
Client Project US STEEL CONCORD Sample No. NA
Project No. 91033-02 Depth (ft.) NA
Soil Description: COAL REFUSE (REMOLDED)

PERMEABILITY TEST
PERMEABILITY = 1.51E-07 CM/SEC



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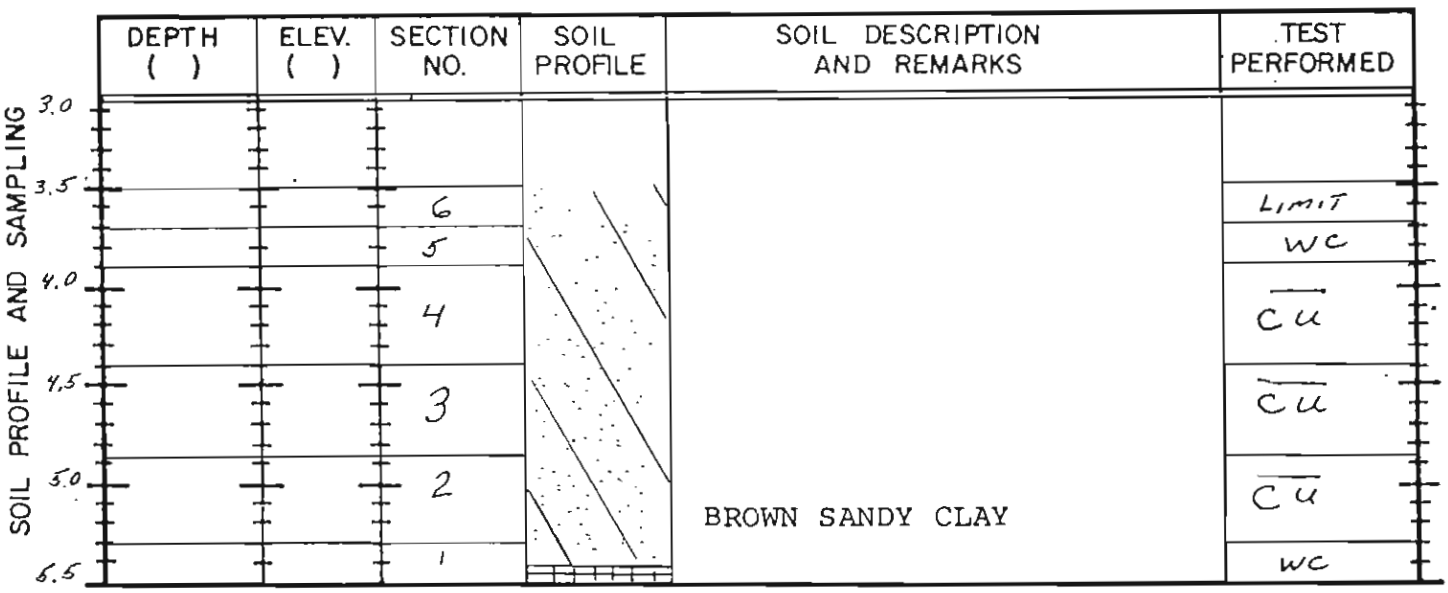
SHELBY TUBE UNIT WEIGHT

Client	ALMES & ASSOC.	Boring No.	B-3A
Client Project	US STEEL CONCORD	Depth Pushed	3'-5.5'
Project No.	91033	Shelby Tube No.	ST-1
Tested By	JCM 3-11-91	Tube Recovery	2.5'
Checked By	DB 3/20/91		



NOTE: WHEN FULL RECOVERY IS NOT ACHIEVED, SOIL ELEVATION CAN NOT BE ACCURATELY DEFINED

INDICATE EACH CUT OF THE TUBE WITH AN ARROW ——►

INDICATE EACH SOIL CUT (AFTER EXTRUDING) BY A BROKEN LINE- - - - - -

INDICATE DIVIDING LINE BETWEEN SOIL TYPES BY A SOLID LINE ——————

INDICATE WAX BY CROSS-HATCHING ▦

INDICATE SOIL TYPES BY STANDARD SYMBOLS

MOISTURE CONTENT

Section Number	1	2	3	4	5
Tare Number	602				829
Wt. Tare & WS(gm.)	192.04				205.54
Wt. Tare & DS(gm.)	170.59				180.94
Wt. Tare(gm.)	37.29				31.61
Moisture Content(%)	16.1				16.5

UNIT WEIGHT

Wt. Tube & WS.(gms.)	1601.70	1575.10	1619.50
Wt. Of Tube(gms.)	398.74	379.25	388.71
Wt. Of WS.(gms.)	1202.96	1195.85	1230.79
Length 1 (in.)	5.52	5.40	5.50
Length 2 (in.)	5.51	5.39	5.50
Length 3 (in.)	5.55	5.42	5.49
Top Diameter (in.)	2.86	2.87	2.88
Middle Diameter (in.)	2.88	2.86	2.86
Bottom Diameter (in.)	2.88	2.88	2.88
Sample Volume (cc)	586.27	572.31	582.87
Moisture Content(%)	16.1	16.1	16.5
Unit Wet Wt.(gms/cc)	2.05	2.09	2.11
Unit Wet Wt.(pcf.)	128.04	130.39	131.76
Unit Dry Wt.(pcf.)	90.42	92.08	93.05
Unit Dry Wt.(gms/cc)	1.45	1.48	1.49

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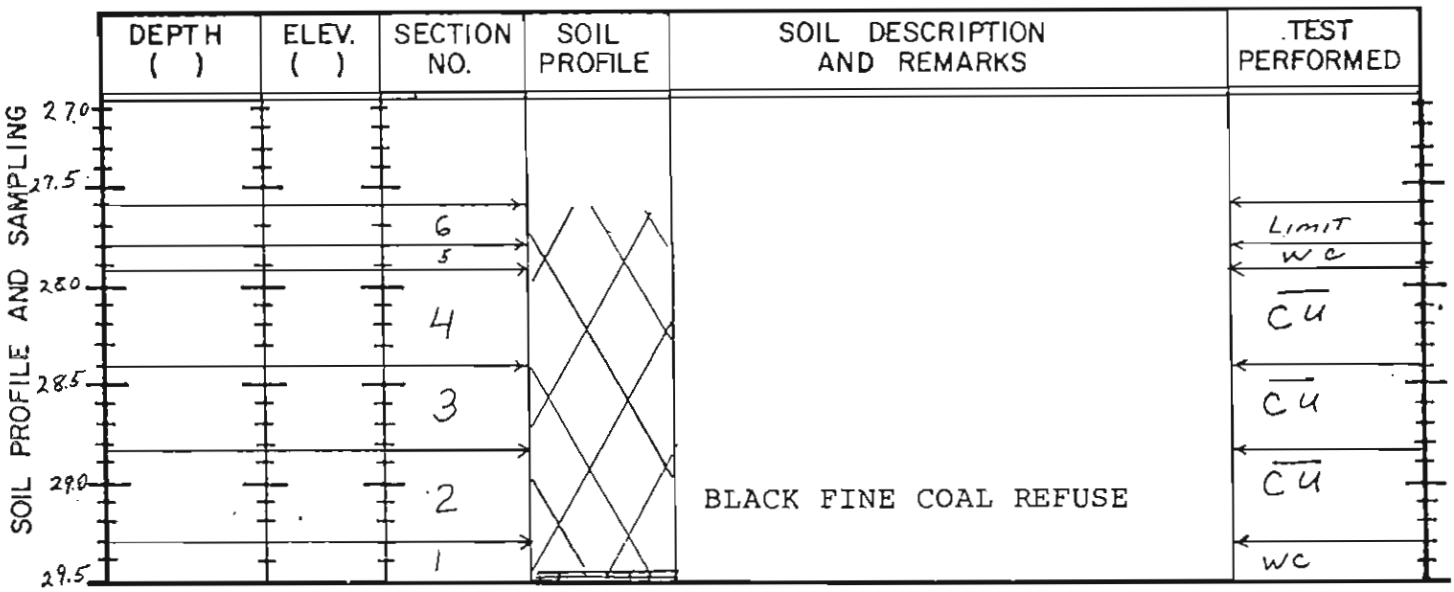
SHELBY TUBE UNIT WEIGHT

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth Pushed	27'-29.5'
Project No.	91033	Shelby Tube No.	ST-2
Tested By	JCM 3-7-91	Tube Recovery	2.5'
Checked By	DB 3/20/91		



NOTE: WHEN FULL RECOVERY IS NOT ACHIEVED, SOIL ELEVATION CAN NOT BE ACCURATELY DEFINED

INDICATE EACH CUT OF THE TUBE WITH AN ARROW ——►

INDICATE EACH SOIL CUT (AFTER EXTRUDING) BY A BROKEN LINE- - - - - -

INDICATE DIVIDING LINE BETWEEN SOIL TYPES BY A SOLID LINE ——————

INDICATE WAX BY CROSS-HATCHING ▦▦▦▦▦

INDICATE SOIL TYPES BY STANDARD SYMBOLS

MOISTURE CONTENT					
Section Number	1	2	3	4	5
Tare Number	654				808
Wt. Tare & WS(gm.)	174.51				121.68
Wt. Tare & DS(gm.)	133.99				109.72
Wt. Tare(gm.)	36.54				36.52
Moisture Content(%)	41.6				16.3

UNIT WEIGHT			
Wt. Tube & WS.(gms.)	1071.80	1051.00	1039.40
Wt. Of Tube(gms.)	381.20	383.36	390.05
Wt. Of WS.(gms.)	690.60	667.64	649.35
Length 1 (in.)	5.40	5.40	5.51
Length 2 (in.)	5.43	5.41	5.54
Length 3 (in.)	5.42	5.41	5.51
Top Diameter (in.)	2.87	2.87	2.87
Middle Diameter (in.)	2.88	2.87	2.87
Bottom Diameter (in.)	2.89	2.87	2.87
Sample Volume (cc)	578.14	573.47	585.45
Moisture Content(%)	41.6	41.6	41.6
Unit Wet Wt.(gms/cc)	1.19	1.16	1.11
Unit Wet Wt.(pcf.)	74.54	72.65	69.21
Unit Dry Wt.(pcf.)	52.64	51.30	48.88
Unit Dry Wt.(gms/cc)	0.84	0.82	0.78

Geotechnics

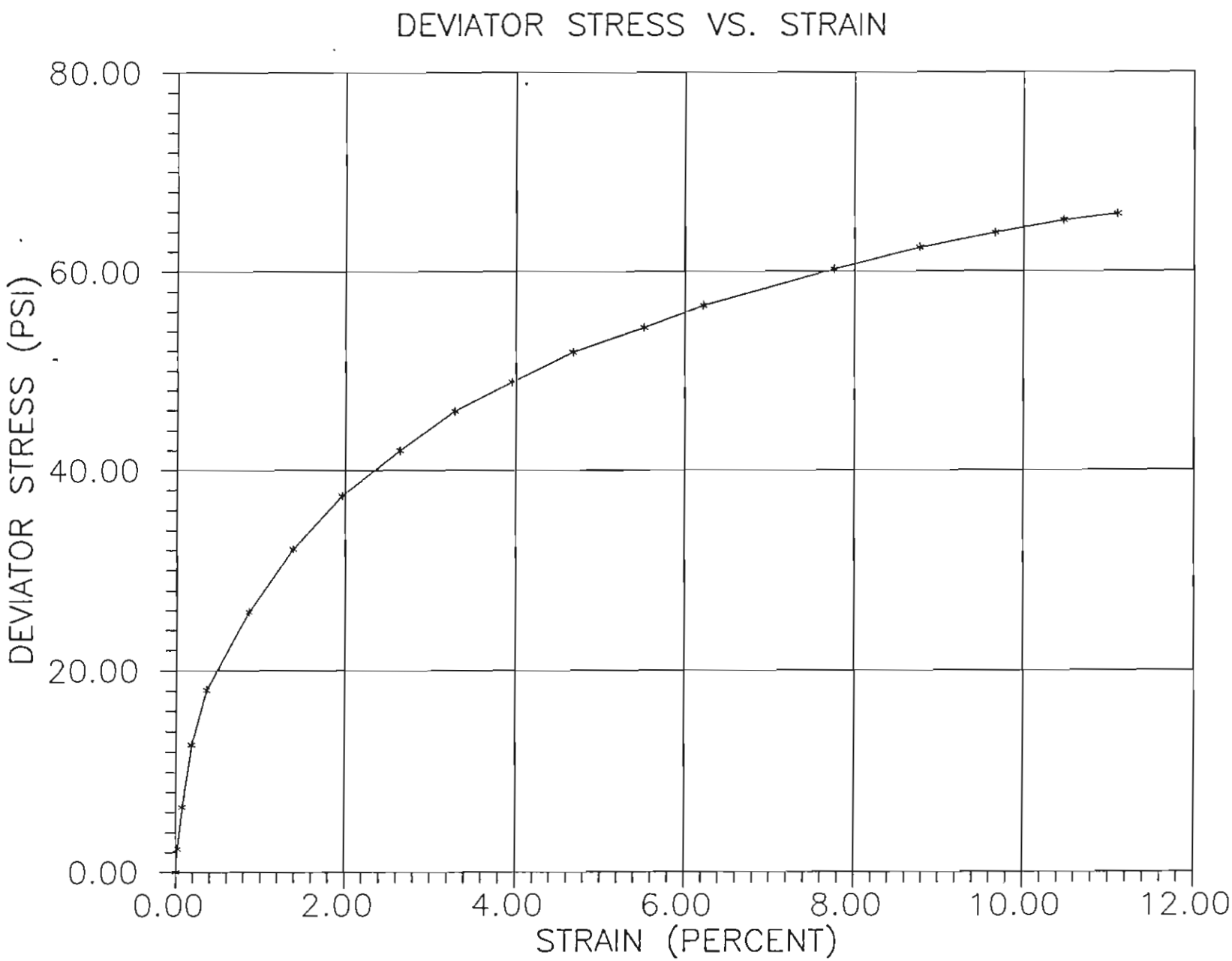
CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

CLIENT	ALMES & ASSOC.	BORING NO.	BS-6
CLIENTS JOB	US STEEL CONCORD	SAMPLE NO.	NA
PROJECT	91033-02		
TESTED BY	JCM 4-4-91		
CHECKED BY	MM 4-12-91		

SAMPLE CONDITION SUMMARY

TEST NO:	T1	T2	T3
DEPTH (ft):	NA	NA	NA
DEF. RATE (in/min):	0.002	0.002	0.002
BACK PRESSURE (psi):	39.7	39.3	39.4
CONSOLIDATION TIME (days):	1.0	1.0	1.0
INITIAL STATE (w%):	7.3	7.3	7.3
TOTAL UNIT WEIGHT (pcf):	125.1	125.0	124.1
DRY UNIT WEIGHT (pcf):	116.6	116.5	115.7
FINAL STATE (w%):	9.6	9.1	9.1

CLIENT: ALMES & ASSOC. BORING NO. BS-6
CLIENTS JOB:US STEEL CONCORD SAMPLE NO. NA
PROJECT NO. 91033-02 DEPTH: NA TEST 1
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	BS-6
Client Project	US STEEL CONCORD	Depth(ft.)	NA
Project No.	91033-02	Sample No.	NA
Tested By	JCM 4-4-91	Stage No.	1
Checked By	MM 4-12-91	Test No.	1

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	59.60	INITIAL SAMPLE LENGTH	5.57
BACK PRESSURE	39.70	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	36.03
EFF. CONS. PRESS	19.90	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	22.50
RESPONSE (%)	97	FINAL CHANGE	2.50
		VOL. AFTER CONS.	35.88
		LENGTH AFTER CONS.	5.57
		AREA AFTER CONS.	6.45

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
13.00	0	39.70
28.00	1	40.40
55.00	4	42.20
95.00	10	45.10
130.00	20	48.00
181.00	48	50.30
223.00	77	50.00
259.00	109	49.00
291.00	147	47.70
319.00	183	46.50
341.00	220	45.50
364.00	260	44.40
384.00	307	43.20
402.00	346	42.40
434.00	432	41.10
454.00	488	40.30
469.00	538	39.50
482.00	583	39.00
490.00	618	38.60

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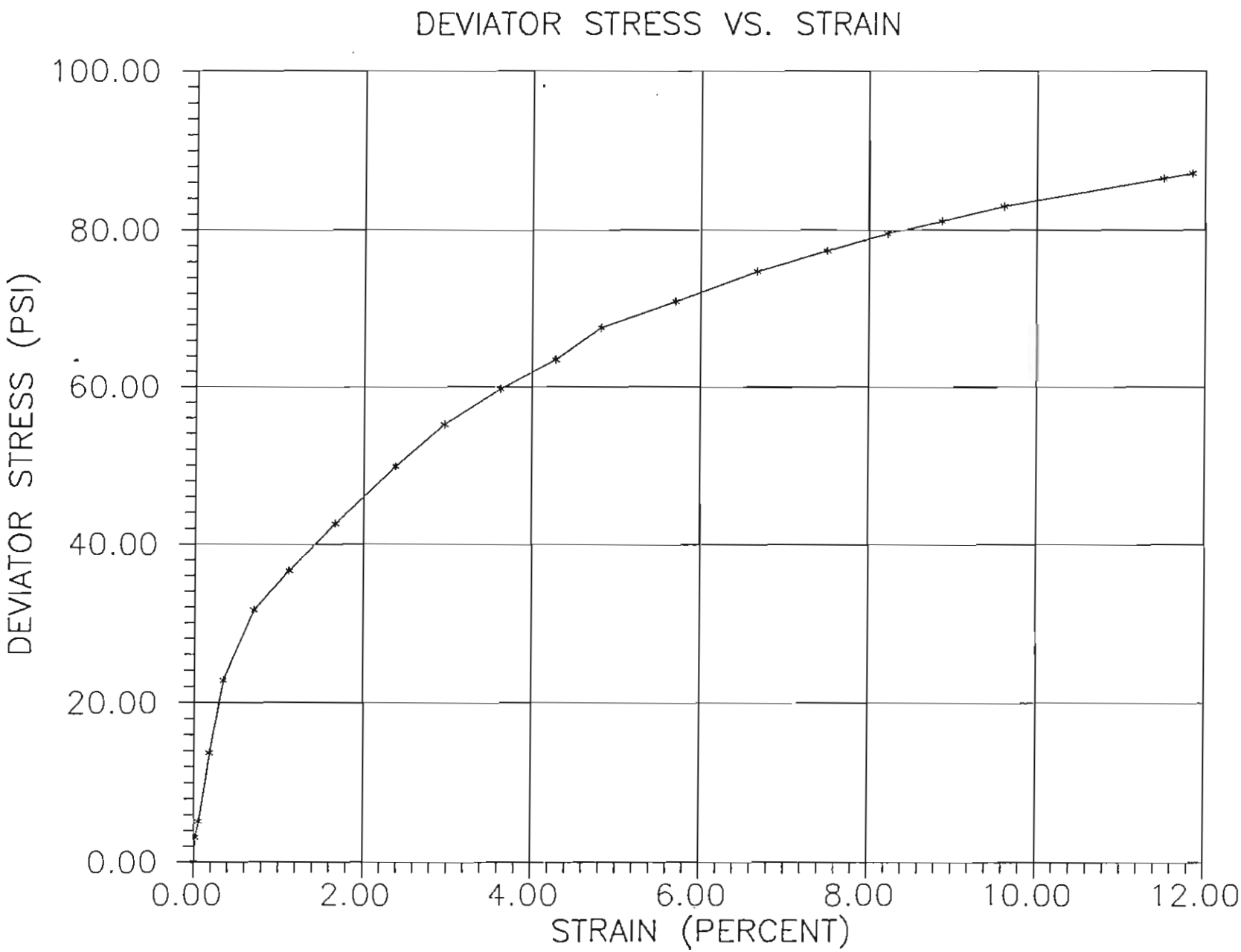
Test No. 1
Boring No. BS-6
Depth(ft.) NA
Sample No. NA

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	2.33	0.70	21.53	19.20	1.12	0.31	20.36	1.16
0.07	6.51	2.50	23.91	17.40	1.37	0.40	20.66	3.26
0.18	12.70	5.40	27.20	14.50	1.88	0.44	20.85	6.35
0.36	18.08	8.30	29.68	11.60	2.56	0.47	20.64	9.04
0.86	25.84	10.60	35.14	9.30	3.78	0.42	22.22	12.92
1.38	32.13	10.30	41.73	9.60	4.35	0.33	25.66	16.06
1.96	37.41	9.30	48.01	10.60	4.53	0.26	29.31	18.71
2.64	41.99	8.00	53.89	11.90	4.53	0.20	32.89	20.99
3.29	45.91	6.80	59.01	13.10	4.50	0.15	36.05	22.95
3.95	48.87	5.80	62.97	14.10	4.47	0.12	38.53	24.43
4.67	51.90	4.70	67.10	15.20	4.41	0.09	41.15	25.95
5.52	54.38	3.50	70.78	16.40	4.32	0.07	43.59	27.19
6.22	56.59	2.70	73.79	17.20	4.29	0.05	45.50	28.30
7.76	60.24	1.40	78.74	18.50	4.26	0.02	48.62	30.12
8.77	62.41	0.60	81.71	19.30	4.23	0.01	50.51	31.21
9.67	63.90	-0.20	84.00	20.10	4.18	-0.00	52.05	31.95
10.48	65.13	-0.70	85.73	20.60	4.16	-0.01	53.17	32.57
11.10	65.78	-1.10	86.78	21.00	4.13	-0.02	53.89	32.89

CLIENT: ALMES & ASSOC. BORING NO. BS-6
CLIENTS JOB:US STEEL CONCORD SAMPLE NO. NA
PROJECT NO. 91033-02 DEPTH: NA TEST 2
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)



Geotechnics

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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	BS-6
Client Project	US STEEL CONCORD	Depth(ft.)	NA
Project No.	91033-02	Sample No.	NA
Tested By	JCM 4-4-91	Stage No.	1
Checked By	TMM 4-12-91	Test No.	2

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	79.10	INITIAL SAMPLE LENGTH	5.57
BACK PRESSURE	39.30	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	36.03
EFF. CONS. PRESS	39.80	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	16.70
RESPONSE (%)	97	FINAL CHANGE	8.30
		VOL. AFTER CONS.	35.52
		LENGTH AFTER CONS.	5.55
		AREA AFTER CONS.	6.40

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
12.00	0	39.30
32.00	1	40.20
45.00	3	41.00
100.00	10	46.70
158.00	19	54.80
216.00	39	63.40
249.00	62	66.30
289.00	92	66.80
339.00	132	65.80
376.00	164	64.60
409.00	201	63.30
437.00	237	61.90
467.00	267	60.50
494.00	316	59.10
525.00	370	57.80
548.00	416	56.60
567.00	456	55.80
582.00	492	55.10
600.00	533	54.20
638.00	638	52.60
645.00	657	52.40

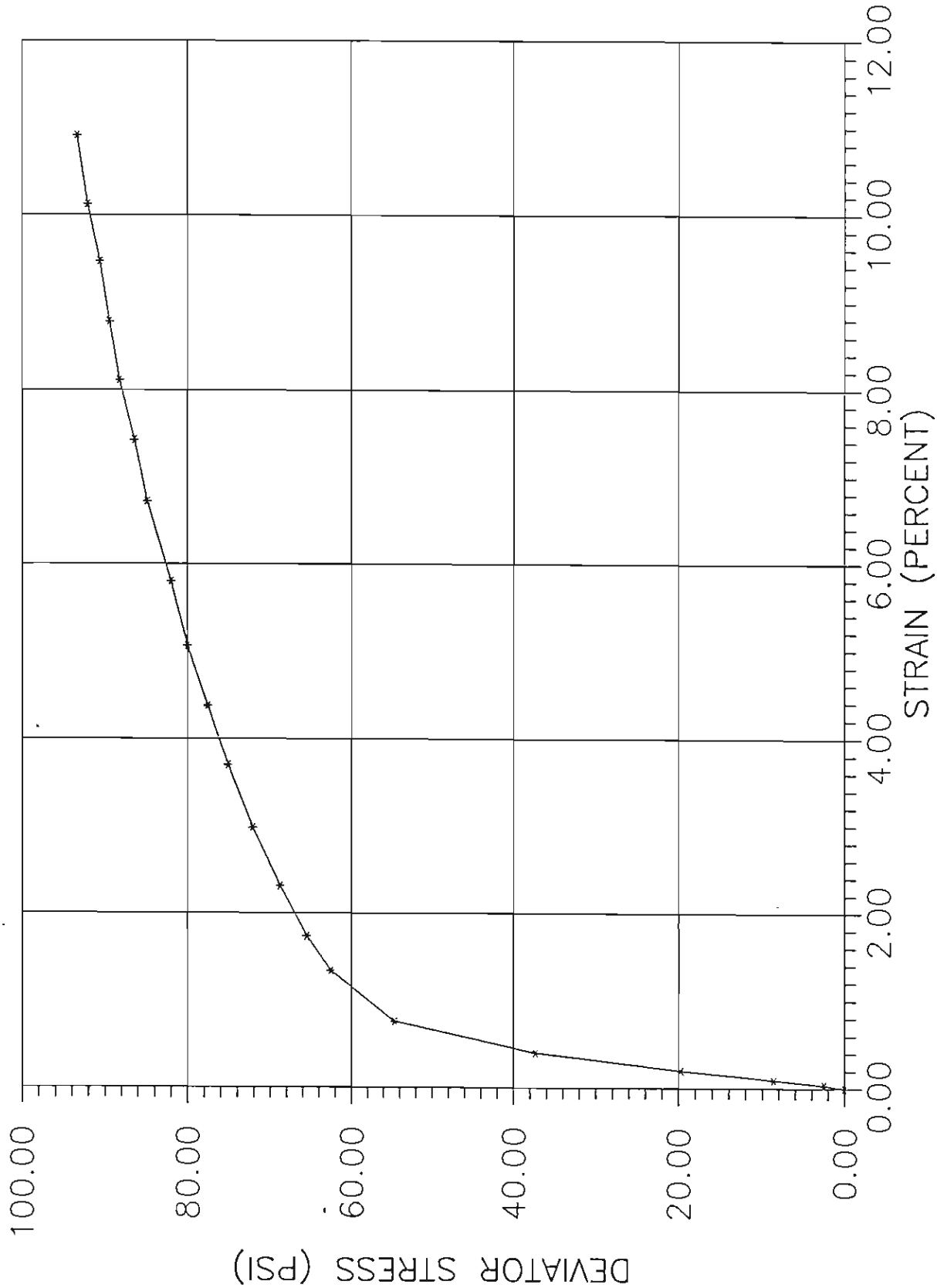
Geotechnics

Test No. 2
Boring No. BS-6
Depth(ft.) NA
Sample No. NA

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	3.12	0.90	42.02	38.90	1.08	0.30	40.46	1.56
0.05	5.15	1.70	43.25	38.10	1.14	0.34	40.68	2.58
0.18	13.72	7.40	46.12	32.40	1.42	0.56	39.26	6.86
0.34	22.72	15.50	47.02	24.30	1.94	0.70	35.66	11.36
0.70	31.63	24.10	47.33	15.70	3.01	0.79	31.52	15.82
1.12	36.60	27.00	49.40	12.80	3.86	0.76	31.10	18.30
1.66	42.54	27.50	54.84	12.30	4.46	0.67	33.57	21.27
2.38	49.85	26.50	63.15	13.30	4.75	0.55	38.22	24.92
2.96	55.16	25.30	69.66	14.50	4.80	0.47	42.08	27.58
3.62	59.75	24.00	75.55	15.80	4.78	0.41	45.67	29.87
4.27	63.53	22.60	80.73	17.20	4.69	0.37	48.97	31.77
4.81	67.63	21.20	86.23	18.60	4.64	0.32	52.42	33.82
5.70	70.98	19.80	90.98	20.00	4.55	0.29	55.49	35.49
6.67	74.76	18.50	96.06	21.30	4.51	0.26	58.68	37.38
7.50	77.42	17.30	99.92	22.50	4.44	0.23	61.21	38.71
8.22	79.54	16.50	102.84	23.30	4.41	0.21	63.07	39.77
8.87	81.11	15.80	105.11	24.00	4.38	0.20	64.56	40.56
9.61	83.00	14.90	107.90	24.90	4.33	0.19	66.40	41.50
11.50	86.51	13.30	113.01	26.50	4.26	0.16	69.75	43.25
11.84	87.14	13.10	113.84	26.70	4.26	0.15	70.27	43.57

Geotechnics

CLIENT: ALMES & ASSOC. BORING NO. BS-6
CLIENTS JOB:US STEEL CONCORD SAMPLE NO. NA
PROJECT NO. 91033-02 DEPTH: NA TEST 3
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	BS-6
Client Project	US STEEL CONCORD	Depth(ft.)	NA
Project No.	91033-02	Sample No.	NA
Tested By	JCM 4-4-91	Stage No.	1
Checked By	TMM 4-12-91	Test No.	3

PRESSURES (psi)	
CELL PRESSURE	119.30
BACK PRESSURE	39.40
EFF. CONS. PRESS	79.90
PORE PRESSURE RESPONSE (%)	98

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.57
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.46
INITIAL SAMPLE VOL. (in^3)	36.03

VOLUME CHANGE	
INT. BURRETE RDG.	25.00
FINAL BURETTE RDG.	12.60
FINAL CHANGE	12.40
VOL. AFTER CONS.	35.27
LENGTH AFTER CONS.	5.53
AREA AFTER CONS.	6.37

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
25.00	0	39.40
41.00	2	40.50
80.00	5	42.90
151.00	11	49.90
264.00	22	65.70
376.00	42	83.70
429.00	74	93.10
450.00	96	95.00
474.00	128	95.70
499.00	165	95.50
522.00	205	94.90
542.00	242	94.20
562.00	280	93.30
580.00	321	93.00
605.00	372	92.00
620.00	411	91.40
637.00	449	90.60
650.00	486	90.00
663.00	524	89.30
678.00	560	88.70
693.00	604	88.90

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Test No. 3
Boring No. BS-6
Depth(ft.) NA
Sample No. NA

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.04	2.51	1.10	81.31	78.80	1.03	0.45	80.05	1.25
0.09	8.62	3.50	85.02	76.40	1.11	0.41	80.71	4.31
0.20	19.73	10.50	89.13	69.40	1.28	0.54	79.26	9.86
0.40	37.35	26.30	90.95	53.60	1.70	0.72	72.27	18.67
0.76	54.65	44.30	90.25	35.60	2.54	0.83	62.93	27.33
1.34	62.54	53.70	88.74	26.20	3.39	0.88	57.47	31.27
1.73	65.52	55.60	89.82	24.30	3.70	0.87	57.06	32.76
2.31	68.82	56.30	92.42	23.60	3.92	0.83	58.01	34.41
2.98	72.15	56.10	95.95	23.80	4.03	0.79	59.88	36.08
3.70	75.09	55.50	99.49	24.40	4.08	0.75	61.94	37.54
4.37	77.57	54.80	102.67	25.10	4.09	0.72	63.88	38.78
5.06	79.99	53.90	105.99	26.00	4.08	0.69	66.00	40.00
5.80	82.03	53.60	108.33	26.30	4.12	0.67	67.31	41.01
6.72	84.88	52.60	112.18	27.30	4.11	0.63	69.74	42.44
7.43	86.42	52.00	114.32	27.90	4.10	0.61	71.11	43.21
8.11	88.23	51.20	116.93	28.70	4.07	0.59	72.82	44.12
8.78	89.45	50.60	118.75	29.30	4.05	0.58	74.02	44.72
9.47	90.62	49.90	120.62	30.00	4.02	0.56	75.31	45.31
10.12	92.09	49.30	122.69	30.60	4.01	0.55	76.64	46.04
10.91	93.37	49.50	123.77	30.40	4.07	0.54	77.08	46.68

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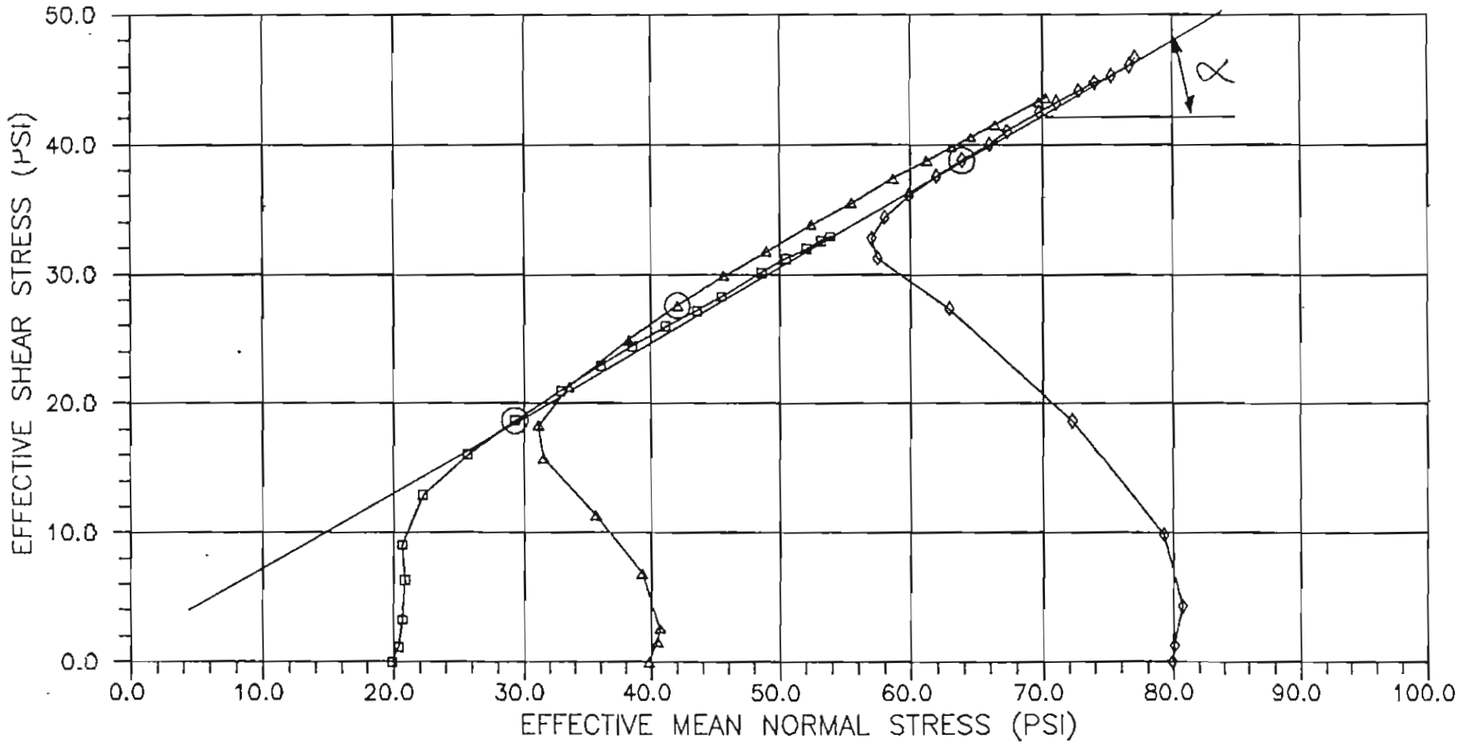
CLIENT: ALMES & ASSOC.
CLIENT PROJECT: US STEEL CONCORD
PROJECT NO. 91033
SOIL DESCRIPTION: COAL REFUSE (REMOLDED)

BORING NO. BS-6
SAMPLE NO. NA
DEPTH (ft.) NA

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS



$\sin \Phi = \tan \alpha$

α = 30.14 DEGREES

Φ = 35.49 DEGREES

$$C = \frac{a}{\cos \Phi}$$

C = 0 PSI

EFFECTIVE STRESS FAILURE ENVELOPE
TEST NO. 1
TEST NO. 2
TEST NO. 3

Geotechnics

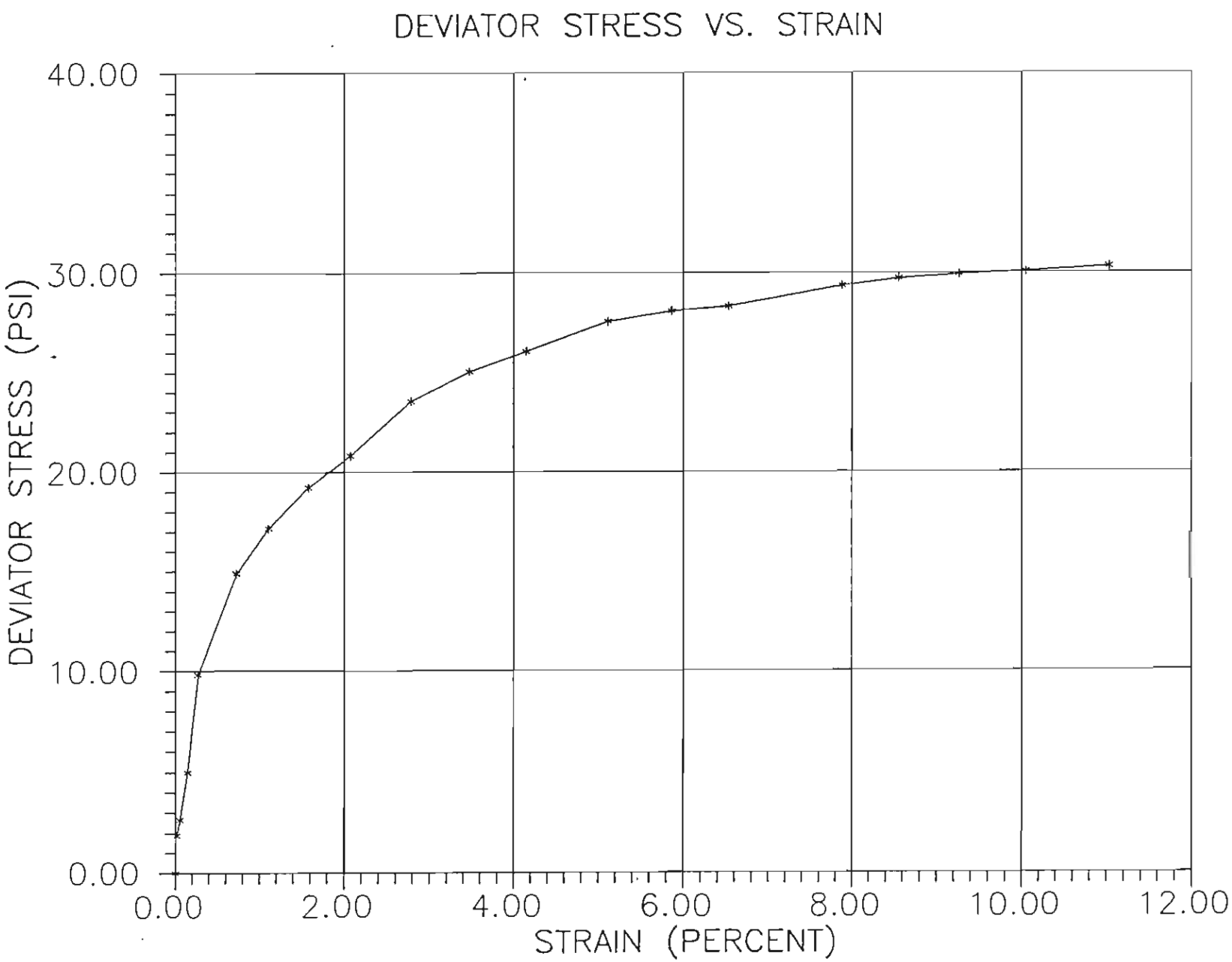
CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

CLIENT	ALMES & ASSOC.	BORING NO.	B 3A
CLIENTS JOB	US STEEL CONCORD	SAMPLE NO.	ST-1
PROJECT	91033		
TESTED BY	JCM 3-11-91		
CHECKED BY	DB 3/20/91		

SAMPLE CONDITION SUMMARY

TEST NO:	T4	T5	T6
DEPTH (ft):	4.8'-5.3	4.4'-4.8'	3.9'-4.4
DEF. RATE (in/min):	0.002	0.002	0.002
BACK PRESSURE (psi):	34.9	39.1	35.2
CONSOLIDATION TIME (days):	1.0	1.0	1.0
INITIAL STATE (w%):	16.1	16.1	16.5
TOTAL UNIT WEIGHT (pcf):	128.0	130.4	131.8
DRY UNIT WEIGHT (pcf):	110.3	112.3	113.1
FINAL STATE (w%):	18.4	15.7	13.9

CLIENT: ALMES & ASSOC. BORING NO. B 3A
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-1 SEC 2
PROJECT NO. 91033 DEPTH:4.8'-5.3'TEST NO. 4
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B 3A
Client Project	US STEEL CONCORD	Depth(ft.)	4.8'-5.3'
Project No.	91033	Sample No.	ST-1 SEC 2
Tested By	JCM 3-11-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	4

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	54.30	INITIAL SAMPLE LENGTH	5.53
BACK PRESSURE	34.90	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.47
		INITIAL SAMPLE VOL. (in^3)	35.78
EFF. CONS. PRESS	19.40	VOLUME CHANGE	
		INT. BURRETE RDG.	50.00
PORE PRESSURE		FINAL BURETTE RDG.	39.90
RESPONSE (%)	97	FINAL CHANGE	10.10
		VOL. AFTER CONS.	35.16
		LENGTH AFTER CONS.	5.49
		AREA AFTER CONS.	6.40

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
10.00	0	34.90
22.00	1	35.50
27.00	3	35.80
42.00	8	36.80
73.00	15	40.00
106.00	40	46.00
121.00	61	47.50
135.00	87	48.10
146.00	114	48.20
165.00	153	47.90
176.00	191	47.50
184.00	228	47.00
196.00	281	46.30
201.00	322	45.90
204.00	359	45.50
214.00	433	45.10
218.00	470	45.00
221.00	509	44.80
224.00	552	44.70
228.00	606	44.50

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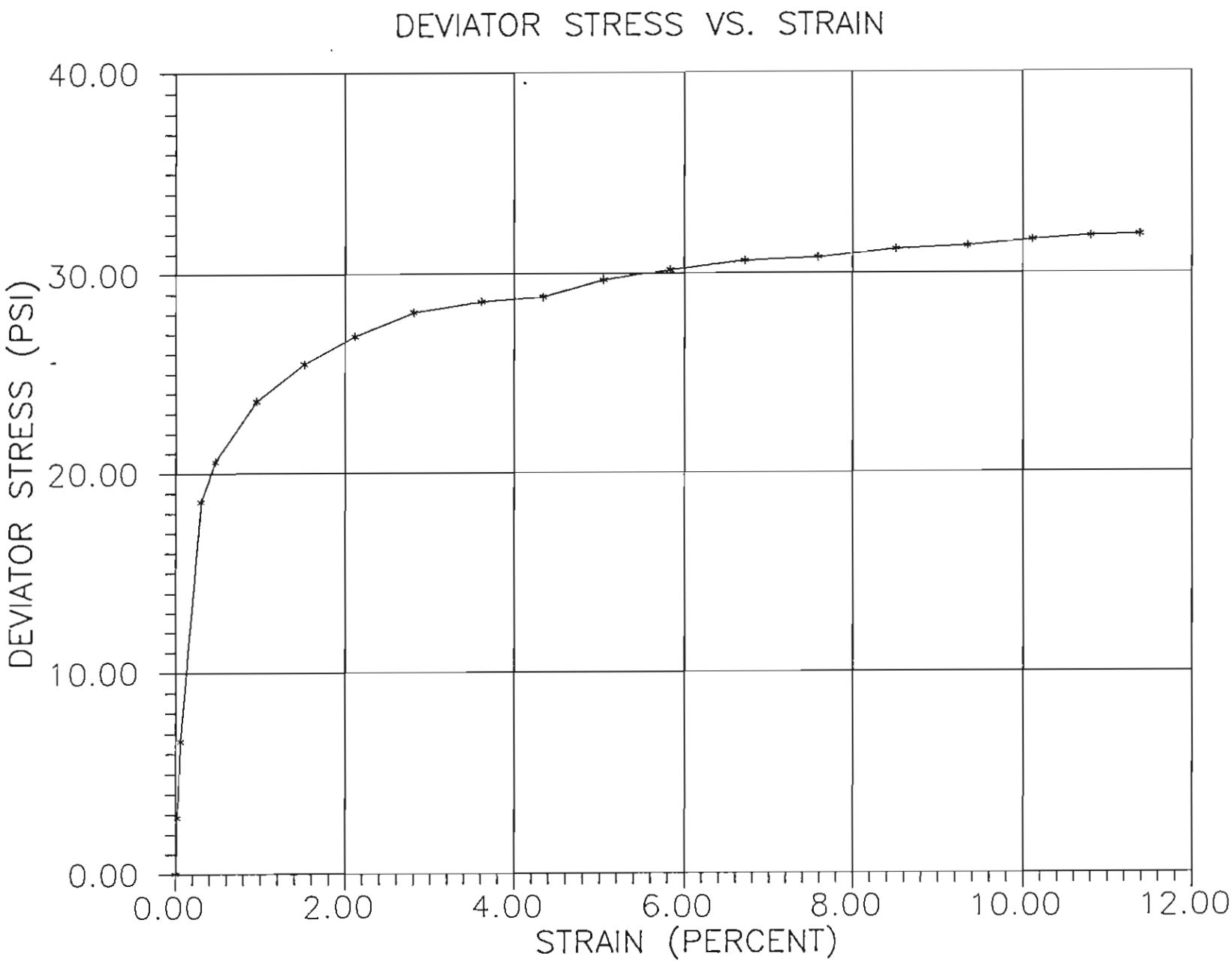
Test No. 4
Boring No. B 3A
Depth(ft.) 4.8'-5.3'
Sample No. ST-1 SEC 2

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	1.87	0.60	20.67	18.80	1.10	0.33	19.74	0.94
0.05	2.66	0.90	21.16	18.50	1.14	0.35	19.83	1.33
0.15	4.99	1.90	22.49	17.50	1.29	0.39	20.00	2.50
0.27	9.82	5.10	24.12	14.30	1.69	0.54	19.21	4.91
0.73	14.89	11.10	23.19	8.30	2.79	0.77	15.75	7.45
1.11	17.15	12.60	23.95	6.80	3.52	0.76	15.38	8.58
1.58	19.23	13.20	25.43	6.20	4.10	0.71	15.81	9.61
2.07	20.81	13.30	26.91	6.10	4.41	0.66	16.51	10.41
2.78	23.55	13.00	29.95	6.40	4.68	0.57	18.17	11.77
3.48	25.04	12.60	31.84	6.80	4.68	0.52	19.32	12.52
4.15	26.06	12.10	33.36	7.30	4.57	0.48	20.33	13.03
5.11	27.58	11.40	35.58	8.00	4.45	0.43	21.79	13.79
5.86	28.10	11.00	36.50	8.40	4.35	0.40	22.45	14.05
6.53	28.34	10.60	37.14	8.80	4.22	0.39	22.97	14.17
7.88	29.37	10.20	38.57	9.20	4.19	0.36	23.88	14.68
8.55	29.72	10.10	39.02	9.30	4.20	0.35	24.16	14.86
9.26	29.92	9.90	39.42	9.50	4.15	0.34	24.46	14.96
10.05	30.08	9.80	39.68	9.60	4.13	0.34	24.64	15.04
11.03	30.31	9.60	40.11	9.80	4.09	0.33	24.96	15.16

CLIENT: ALMES & ASSOC. BORING NO. B 3A
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-1 SEC 3
PROJECT NO. 91033 DEPTH:4.4'-4.8'TEST NO. 5
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B 3A
Client Project	US STEEL CONCORD	Depth(ft.)	4.4'-4.8'
Project No.	91033	Sample No.	ST-1 SEC 3
Tested By	JCM 3-11-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	5

PRESSURES (psi)		DIMENSIONS (in)	
CELL PRESSURE	79.30	INITIAL SAMPLE LENGTH	5.40
BACK PRESSURE	39.10	INITIAL SAMPLE DIAMETER	2.87
		INITIAL SAMPLE AREA(in^2)	6.46
		INITIAL SAMPLE VOL. (in^3)	34.92
EFF. CONS. PRESS	40.20	VOLUME CHANGE	
		INT. BURRETE RDG.	25.00
PORE PRESSURE		FINAL BURETTE RDG.	7.80
RESPONSE (%)	100	FINAL CHANGE	17.20
		VOL. AFTER CONS.	33.88
		LENGTH AFTER CONS.	5.35
		AREA AFTER CONS.	6.33

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
15.00	0	39.10
33.00	1	40.00
57.00	3	41.60
133.00	16	51.70
146.00	25	56.60
166.00	51	63.20
179.00	81	66.10
189.00	113	67.30
198.00	150	67.70
203.00	193	67.80
206.00	232	67.80
213.00	270	67.60
218.00	312	67.40
223.00	359	67.20
226.00	406	66.90
231.00	455	66.80
234.00	500	66.70
238.00	541	66.50
241.00	578	66.40
243.00	609	66.30

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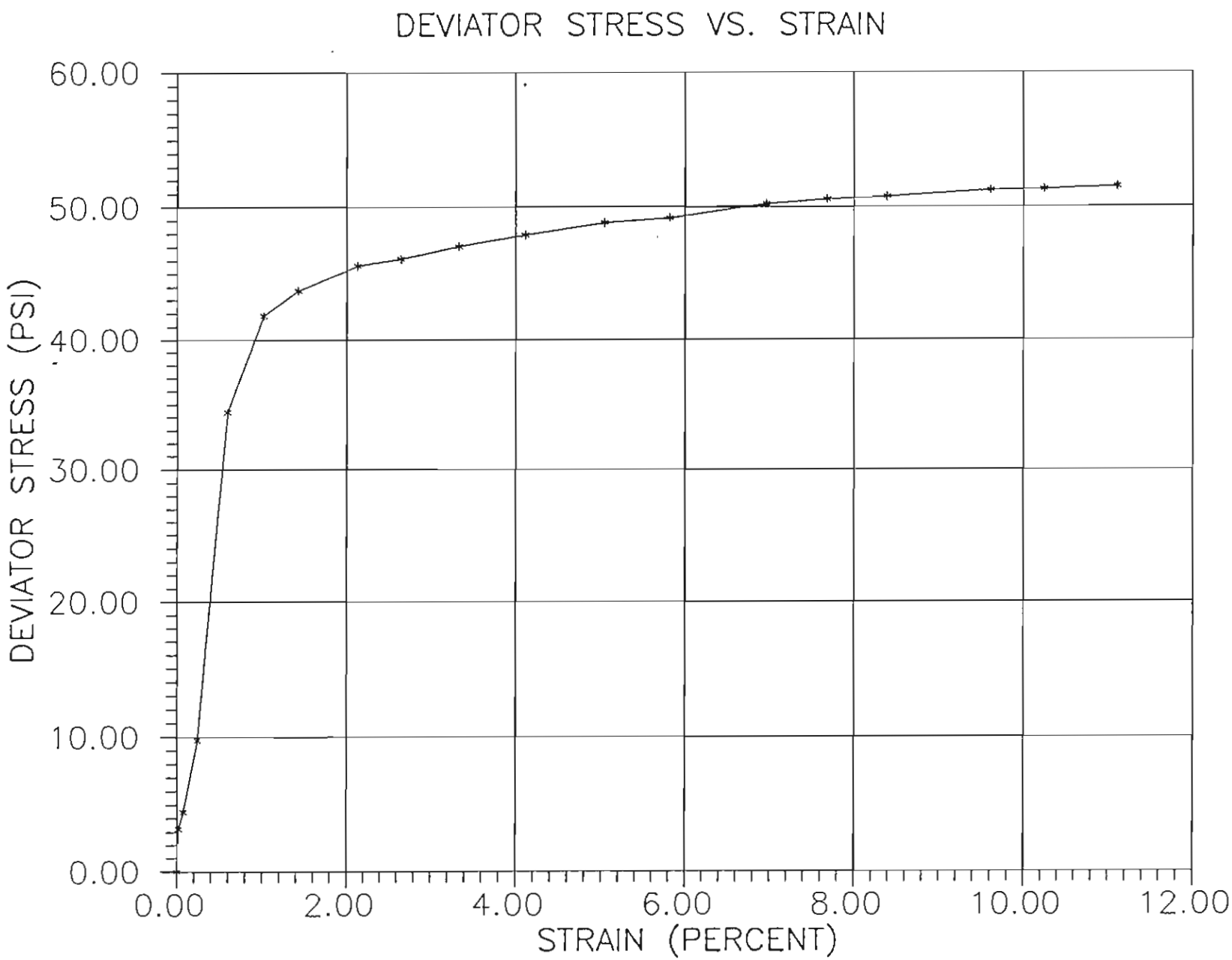
Test No. 5
Boring No. B 3A
Depth(ft.) 4.4'-4.8'
Sample No. ST-1 SEC 3

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	2.84	0.90	42.14	39.30	1.07	0.32	40.72	1.42
0.06	6.63	2.50	44.33	37.70	1.18	0.38	41.01	3.31
0.30	18.57	12.60	46.17	27.60	1.67	0.68	36.89	9.29
0.47	20.59	17.50	43.29	22.70	1.91	0.85	32.99	10.29
0.95	23.61	24.10	39.71	16.10	2.47	1.02	27.91	11.81
1.51	25.50	27.00	38.70	13.20	2.93	1.06	25.95	12.75
2.11	26.89	28.20	38.89	12.00	3.24	1.05	25.45	13.45
2.80	28.08	28.60	39.68	11.60	3.42	1.02	25.64	14.04
3.61	28.61	28.70	40.11	11.50	3.49	1.00	25.81	14.31
4.34	28.85	28.70	40.35	11.50	3.51	0.99	25.92	14.42
5.05	29.68	28.50	41.38	11.70	3.54	0.96	26.54	14.84
5.83	30.18	28.30	42.08	11.90	3.54	0.94	26.99	15.09
6.71	30.63	28.10	42.73	12.10	3.53	0.92	27.42	15.32
7.59	30.78	27.80	43.18	12.40	3.48	0.90	27.79	15.39
8.51	31.20	27.70	43.70	12.50	3.50	0.89	28.10	15.60
9.35	31.34	27.60	43.94	12.60	3.49	0.88	28.27	15.67
10.12	31.65	27.40	44.45	12.80	3.47	0.87	28.62	15.82
10.81	31.82	27.30	44.72	12.90	3.47	0.86	28.81	15.91
11.39	31.90	27.20	44.90	13.00	3.45	0.85	28.95	15.95

CLIENT: ALMES & ASSOC. BORING NO. B 3A
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-1 SEC 4
PROJECT NO. 91033 DEPTH:3.9'-4.4'TEST NO. 6
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B 3A
Client Project	US STEEL CONCORD	Depth(ft.)	3.9'-4.4'
Project No.	91033	Sample No.	ST-1 SEC 4
Tested By	JCM 3-11-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	6

PRESSURES (psi)	
CELL PRESSURE	115.20
BACK PRESSURE	35.20
EFF. CONS. PRESS	80.00
PORE PRESSURE RESPONSE (%)	98

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.49
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.57

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	19.60
FINAL CHANGE	30.40
VOL. AFTER CONS.	33.71
LENGTH AFTER CONS.	5.40
AREA AFTER CONS.	6.24

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
20.00	0	35.20
40.00	1	36.20
48.00	4	36.60
81.00	13	38.60
236.00	32	62.80
284.00	55	80.50
297.00	77	87.50
311.00	115	91.70
316.00	143	93.00
324.00	180	93.90
332.00	222	94.20
341.00	272	94.20
346.00	314	94.10
357.00	376	93.90
362.00	415	93.70
366.00	453	93.60
374.00	519	93.30
377.00	553	93.20
382.00	600	93.00

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Test No. 6
Boring No. B 3A
Depth(ft.) 3.9'-4.4'
Sample No. ST-1 SEC 4

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	3.20	1.00	82.20	79.00	1.04	0.32	80.60	1.60
0.07	4.48	1.40	83.08	78.60	1.06	0.32	80.84	2.24
0.24	9.74	3.40	86.34	76.60	1.13	0.36	81.47	4.87
0.59	34.38	27.60	86.78	52.40	1.66	0.82	69.59	17.19
1.02	41.85	45.30	76.55	34.70	2.21	1.10	55.62	20.92
1.43	43.73	52.30	71.43	27.70	2.58	1.22	49.56	21.86
2.13	45.61	56.50	69.11	23.50	2.94	1.26	46.30	22.80
2.65	46.14	57.80	68.34	22.20	3.08	1.28	45.27	23.07
3.33	47.06	58.70	68.36	21.30	3.21	1.27	44.83	23.53
4.11	47.91	59.00	68.91	21.00	3.28	1.26	44.95	23.95
5.04	48.81	59.00	69.81	21.00	3.32	1.23	45.41	24.41
5.82	49.17	58.90	70.27	21.10	3.33	1.22	45.68	24.58
6.96	50.21	58.70	71.51	21.30	3.36	1.19	46.40	25.10
7.69	50.56	58.50	72.06	21.50	3.35	1.18	46.78	25.28
8.39	50.76	58.40	72.36	21.60	3.35	1.17	46.98	25.38
9.61	51.24	58.10	73.14	21.90	3.34	1.16	47.52	25.62
10.24	51.31	58.00	73.31	22.00	3.33	1.15	47.66	25.66
11.11	51.53	57.80	73.73	22.20	3.32	1.14	47.96	25.76

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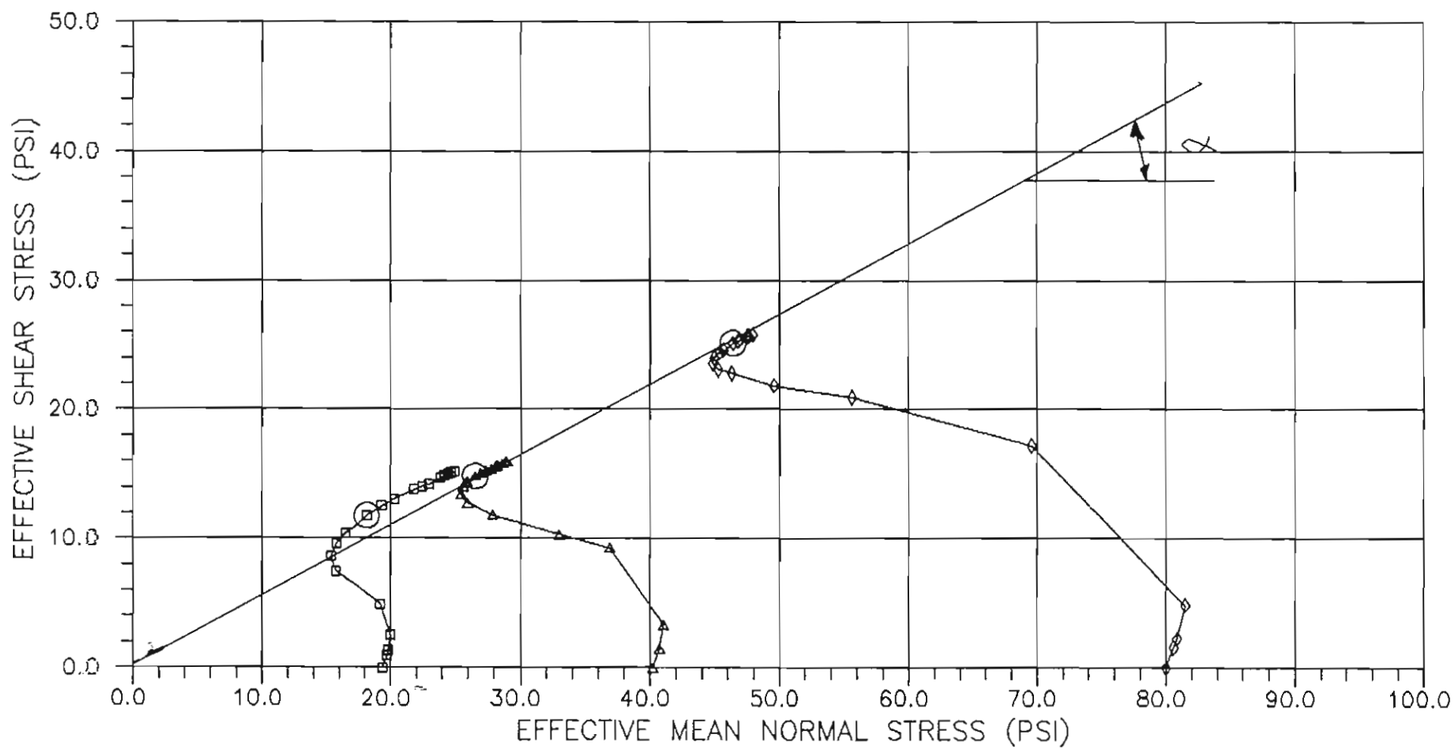
CLIENT: ALMES & ASSOC. BORING NO. B-3A
CLIENT PROJECT:US STEEL CONCORD SAMPLE NO. ST-1
PROJECT NO. 91033 DEPTH (ft.) 3.0'-5.5'
SOIL DESCRIPTION: BROWN SANDY CLAY (UNDISTURBED)

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS



$\sin \Phi = \tan \alpha$

$\alpha = 27.32$ DEGREES

$\Phi = 31.11$ DEGREES

$C = \rightarrow\rightarrow 0 \rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow\rightarrow$ (a)

$C = \frac{0}{\cos \Phi}$ PSI

EFFECTIVE STRESS FAILURE ENVELOPE
TEST NO. 4
TEST NO. 5
TEST NO. 6

Geotechnics

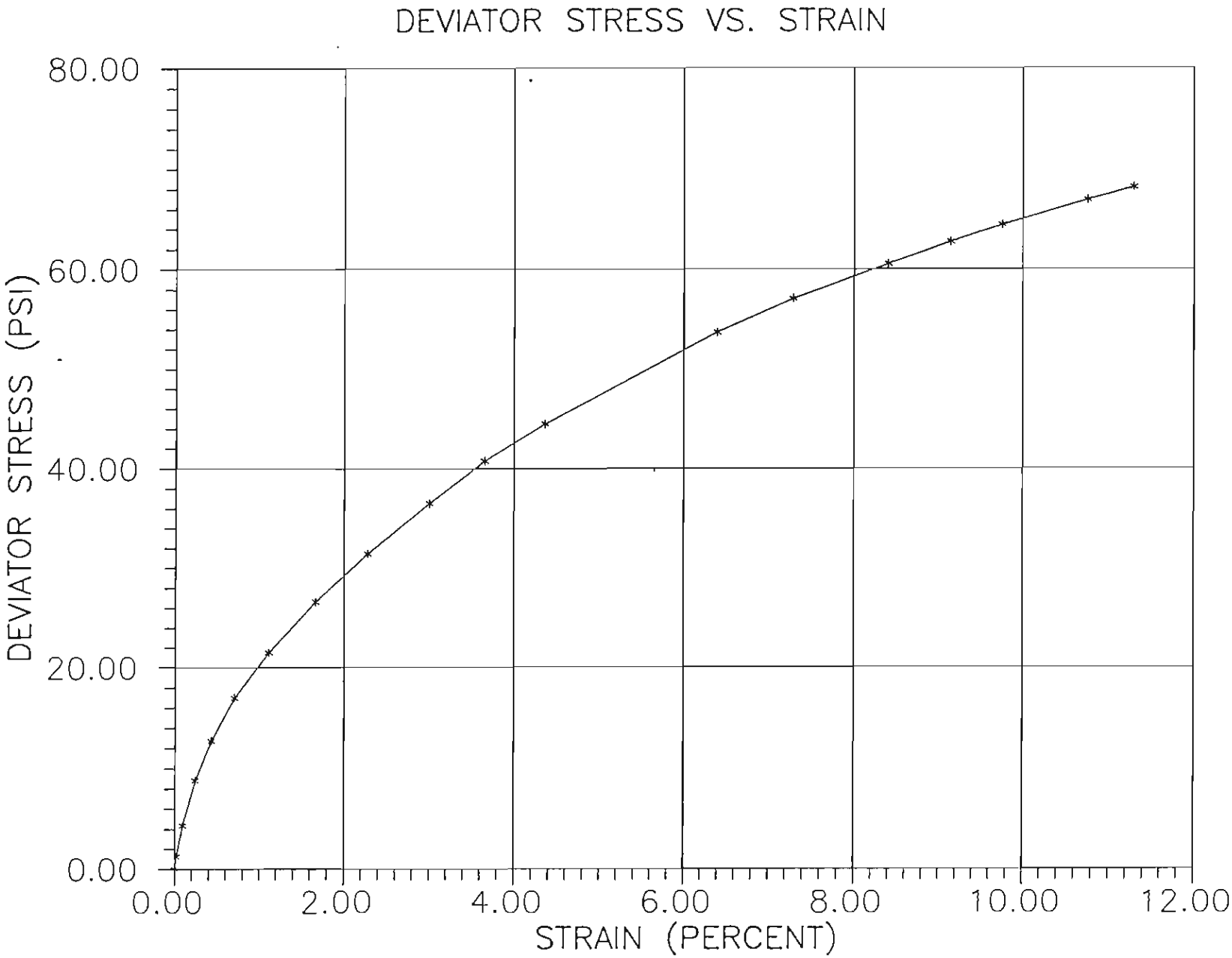
CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

CLIENT	ALMES & ASSOC.	BORING NO.	B-20
CLIENTS JOB	US STEEL CONCORD	SAMPLE NO.	ST-2
PROJECT	91033		
TESTED BY	JCM 3-7-91		
CHECKED BY	DB 3/20/91		

SAMPLE CONDITION SUMMARY

TEST NO:	T1	T2	T3
DEPTH (ft):	28.4-28.9	28.9-29.3	27.9-28.
DEF. RATE (in/min):	0.002	0.002	0.002
BACK PRESSURE (psi):	30.0	30.0	29.8
CONSOLIDATION TIME (days):	1.0	1.0	1.0
INITIAL STATE (w%):	41.6	41.6	41.6
TOTAL UNIT WEIGHT (pcf):	72.6	74.5	69.2
DRY UNIT WEIGHT (pcf):	51.3	52.6	48.9
FINAL STATE (w%):	40.6	39.0	40.2

CLIENT: ALMES & ASSOC. BORING NO. B-20
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-2 SEC 3
PROJECT NO. 91033 DEPTH:28.4'-28.9' TEST NO. 1
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth(ft.)	28.4'-28.9'
Project No.	91033	Sample No.	ST-2 SEC 3
Tested By	JCM 3-7-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	1

PRESSURES (psi)	
CELL PRESSURE	50.10
BACK PRESSURE	30.00
EFF. CONS. PRESS	20.10
PORE PRESSURE RESPONSE (%)	99

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.41
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.00

VOLUME CHANGE	
INT. BURRETE RDG.	25.00
FINAL BURETTE RDG.	19.70
FINAL CHANGE	5.30
VOL. AFTER CONS.	34.67
LENGTH AFTER CONS.	5.39
AREA AFTER CONS.	6.43

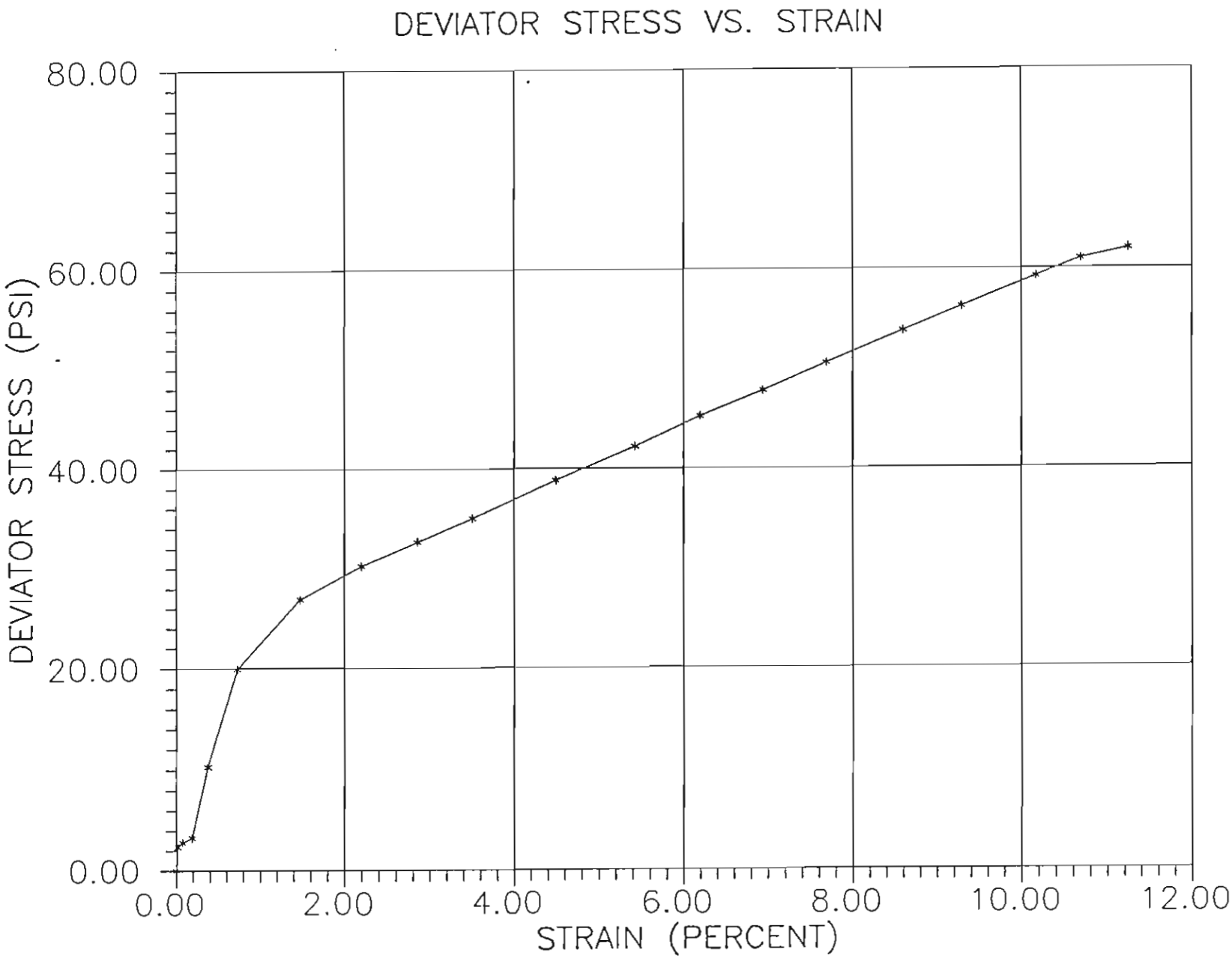
LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
17.00	0	30.00
25.00	1	30.70
45.00	5	32.40
74.00	13	35.50
99.00	23	38.10
127.00	38	40.10
157.00	60	41.10
191.00	90	41.10
224.00	123	40.50
259.00	162	39.50
289.00	197	38.50
316.00	235	37.40
386.00	345	34.70
413.00	393	33.60
442.00	453	32.50
461.00	493	31.70
476.00	526	31.10
499.00	580	30.20
511.00	609	29.60

Geotechnics

Test No. 1
Boring No. B-20
Depth(ft.) 28.4'-28.9'
Sample No. ST-2 SEC 3

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	1.24	0.70	20.64	19.40	1.06	0.57	20.02	0.62
0.09	4.35	2.40	22.05	17.70	1.25	0.56	19.87	2.17
0.24	8.84	5.50	23.44	14.60	1.61	0.63	19.02	4.42
0.43	12.69	8.10	24.69	12.00	2.06	0.64	18.35	6.35
0.70	16.98	10.10	26.98	10.00	2.70	0.60	18.49	8.49
1.11	21.52	11.10	30.52	9.00	3.39	0.52	19.76	10.76
1.67	26.60	11.10	35.60	9.00	3.96	0.42	22.30	13.30
2.28	31.45	10.50	41.05	9.60	4.28	0.34	25.32	15.72
3.01	36.49	9.50	47.09	10.60	4.44	0.26	28.85	18.25
3.65	40.74	8.50	52.34	11.60	4.51	0.21	31.97	20.37
4.36	44.46	7.40	57.16	12.70	4.50	0.17	34.93	22.23
6.40	53.70	4.70	69.10	15.40	4.49	0.09	42.25	26.85
7.29	57.08	3.60	73.58	16.50	4.46	0.06	45.04	28.54
8.40	60.52	2.50	78.12	17.60	4.44	0.04	47.86	30.26
9.15	62.71	1.70	81.11	18.40	4.41	0.03	49.76	31.36
9.76	64.40	1.10	83.40	19.00	4.39	0.02	51.20	32.20
10.76	66.87	0.20	86.77	19.90	4.36	0.00	53.34	33.44
11.30	68.12	-0.40	88.62	20.50	4.32	-0.01	54.56	34.06

CLIENT: ALMES & ASSOC. BORING NO. B-20
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-2 SEC 2
PROJECT NO. 91033 DEPTH:28.9'-29.3' TEST NO. 2
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)



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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth(ft.)	28.9'-29.3'
Project No.	91033	Sample No.	ST-2 SEC 2
Tested By	JCM 3-7-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	2

PRESSURES (psi)	
CELL PRESSURE	70.30
BACK PRESSURE	30.00
EFF. CONS. PRESS	40.30
PORE PRESSURE RESPONSE (%)	98

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.42
INITIAL SAMPLE DIAMETER	2.88
INITIAL SAMPLE AREA(in^2)	6.51
INITIAL SAMPLE VOL. (in^3)	35.28

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	31.40
FINAL CHANGE	18.60
VOL. AFTER CONS.	34.15
LENGTH AFTER CONS.	5.36
AREA AFTER CONS.	6.37

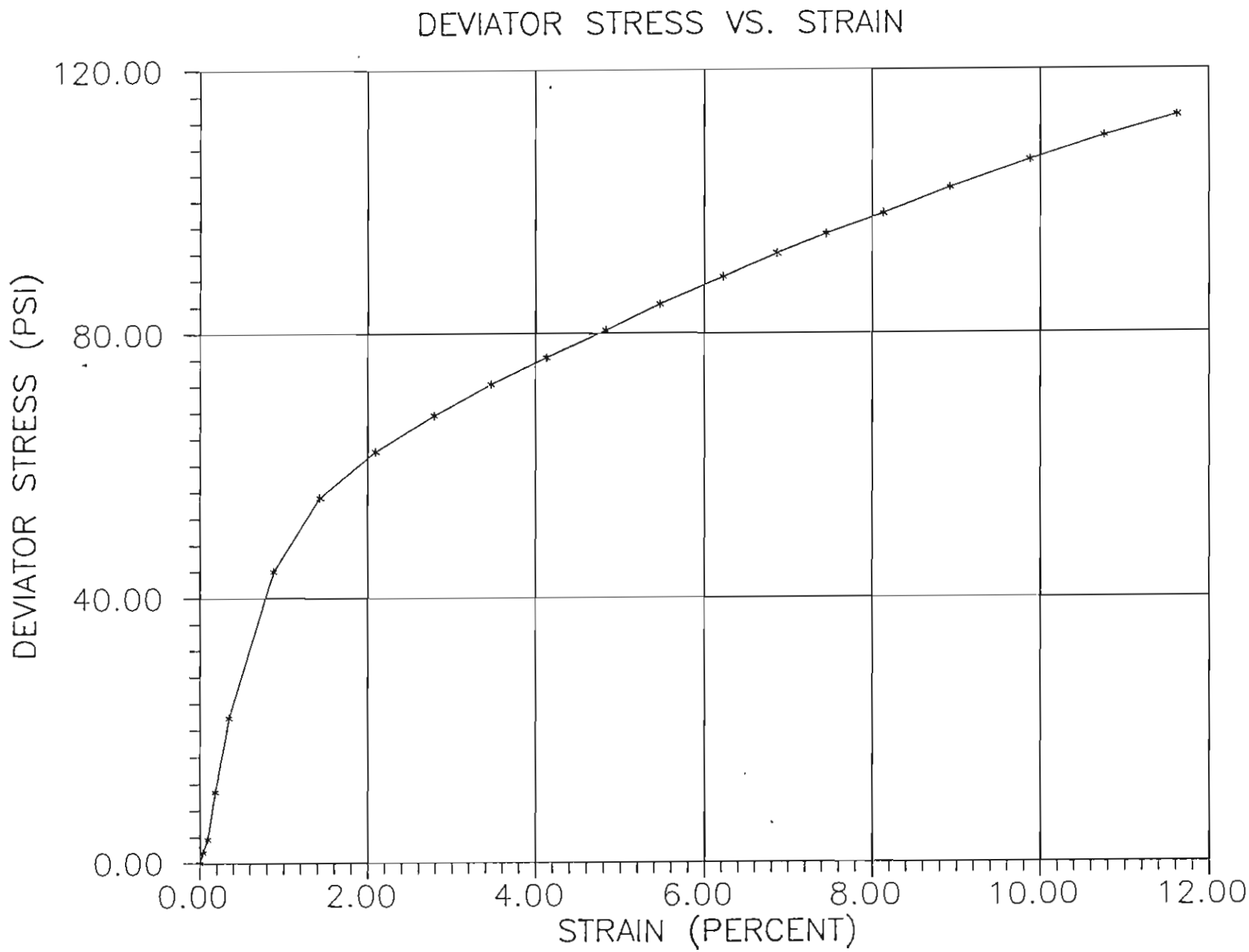
LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
17.00	0	30.00
32.00	1	30.90
35.00	4	31.20
38.00	10	31.50
83.00	20	36.00
145.00	39	45.50
191.00	79	53.50
214.00	118	55.80
231.00	153	56.60
248.00	188	56.70
276.00	241	56.40
301.00	291	55.80
324.00	332	55.30
344.00	372	54.60
366.00	412	53.90
392.00	461	53.00
412.00	498	52.40
437.00	545	51.40
452.00	573	50.90
462.00	603	50.30

Geotechnics

Test No. 2
Boring No. B-20
Depth(ft.) 28.9'-29.3'
Sample No. ST-2 SEC 2

STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.02	2.35	0.90	41.75	39.40	1.06	0.39	40.58	1.18
0.07	2.82	1.20	41.92	39.10	1.07	0.43	40.51	1.41
0.19	3.29	1.50	42.09	38.80	1.08	0.47	40.44	1.64
0.37	10.32	6.00	44.62	34.30	1.30	0.59	39.46	5.16
0.73	19.94	15.50	44.74	24.80	1.80	0.79	34.77	9.97
1.47	26.91	23.50	43.71	16.80	2.60	0.89	30.25	13.45
2.20	30.24	25.80	44.74	14.50	3.09	0.87	29.62	15.12
2.86	32.63	26.60	46.33	13.70	3.38	0.83	30.01	16.31
3.51	34.98	26.70	48.58	13.60	3.57	0.78	31.09	17.49
4.50	38.82	26.40	52.72	13.90	3.79	0.69	33.31	19.41
5.43	42.15	25.80	56.65	14.50	3.91	0.62	35.58	21.08
6.20	45.20	25.30	60.20	15.00	4.01	0.57	37.60	22.60
6.94	47.76	24.60	63.46	15.70	4.04	0.53	39.58	23.88
7.69	50.56	23.90	66.96	16.40	4.08	0.48	41.68	25.28
8.60	53.79	23.00	71.09	17.30	4.11	0.44	44.20	26.90
9.29	56.23	22.40	74.13	17.90	4.14	0.41	46.02	28.12
10.17	59.21	21.40	78.11	18.90	4.13	0.37	48.51	29.61
10.69	60.97	20.90	80.37	19.40	4.14	0.35	49.89	30.49
11.25	61.98	20.30	81.98	20.00	4.10	0.33	50.99	30.99

CLIENT: ALMES & ASSOC. BORING NO. B-20
CLIENTS JOB: US STEEL CONCORD SAMPLE NO. ST-2 SEC 4
PROJECT NO. 91033 DEPTH:27.9'-28.4' TEST NO. 3
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)



Geotechnics

Geotechnics

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

Client	ALMES & ASSOC.	Boring No.	B-20
Client Project	US STEEL CONCORD	Depth(ft.)	27.9'-28.4'
Project No.	91033	Sample No.	ST-2 SEC 4
Tested By	JCM 3-7-91	Stage No.	1
Checked By	DB 3/20/91	Test No.	3

PRESSURES (psi)	
CELL PRESSURE	110.70
BACK PRESSURE	29.80
EFF. CONS. PRESS	80.90
PORE PRESSURE RESPONSE (%)	97

DIMENSIONS (in)	
INITIAL SAMPLE LENGTH	5.52
INITIAL SAMPLE DIAMETER	2.87
INITIAL SAMPLE AREA(in^2)	6.47
INITIAL SAMPLE VOL. (in^3)	35.73

VOLUME CHANGE	
INT. BURRETE RDG.	50.00
FINAL BURETTE RDG.	27.40
FINAL CHANGE	22.60
VOL. AFTER CONS.	34.35
LENGTH AFTER CONS.	5.45
AREA AFTER CONS.	6.30

LOAD (LBS)	DEFORMATION (DIVISIONS)	PORE PRESSURE (PSI)
20.00	0	29.80
30.00	2	30.40
43.00	5	31.30
88.00	10	35.00
158.00	19	42.60
300.00	48	63.10
373.00	78	74.10
420.00	114	80.10
458.00	152	82.50
492.00	189	83.20
522.00	225	83.50
553.00	263	83.20
583.00	298	82.50
615.00	339	81.90
643.00	374	81.20
667.00	406	80.40
693.00	443	79.60
726.00	486	78.60
763.00	538	77.30
796.00	586	76.10
826.00	633	75.00

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Test No. 3
Boring No. B-20
Depth(ft.) 27.9'-28.4'
Sample No. ST-2 SEC 4

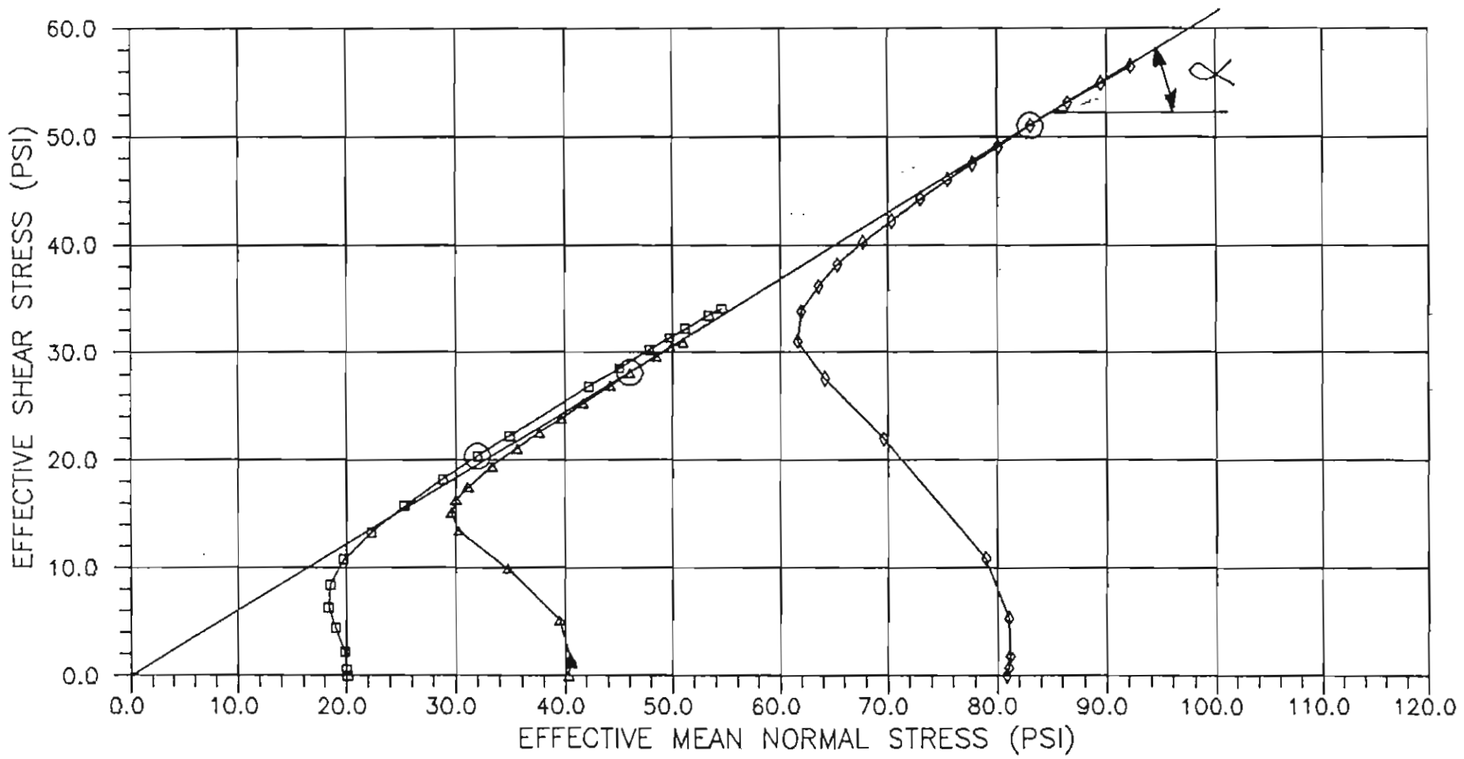
STRAIN (%)	DEV. STRESS	DELTA U	SIGMA 1BAR	SIGMA 3BAR	EFFECTIVE PRINCIPLE STRESS RATIO	A-BAR	P-BAR	Q
0.04	1.59	0.60	81.89	80.30	1.02	0.39	81.09	0.79
0.09	3.64	1.50	83.04	79.40	1.05	0.42	81.22	1.82
0.18	10.77	5.20	86.47	75.70	1.14	0.50	81.08	5.38
0.35	21.81	12.80	89.91	68.10	1.32	0.61	79.01	10.91
0.88	44.02	33.30	91.62	47.60	1.92	0.78	69.61	22.01
1.43	55.19	44.30	91.79	36.60	2.51	0.83	64.19	27.59
2.09	62.11	50.30	92.71	30.60	3.03	0.83	61.66	31.06
2.79	67.53	52.70	95.73	28.20	3.39	0.80	61.97	33.77
3.47	72.26	53.40	99.76	27.50	3.63	0.76	63.63	36.13
4.13	76.33	53.70	103.53	27.20	3.81	0.73	65.37	38.17
4.83	80.46	53.40	107.96	27.50	3.93	0.68	67.73	40.23
5.47	84.41	52.70	112.61	28.20	3.99	0.64	70.40	42.20
6.22	88.50	52.10	117.30	28.80	4.07	0.61	73.05	44.25
6.87	92.03	51.40	121.53	29.50	4.12	0.58	75.51	46.01
7.45	94.97	50.60	125.27	30.30	4.13	0.55	77.78	47.48
8.13	98.06	49.80	129.16	31.10	4.15	0.52	80.13	49.03
8.92	101.99	48.80	134.09	32.10	4.18	0.49	83.09	50.99
9.88	106.21	47.50	139.61	33.40	4.18	0.46	86.50	53.10
10.76	109.84	46.30	144.44	34.60	4.17	0.43	89.52	54.92
11.62	112.98	45.20	148.68	35.70	4.16	0.41	92.19	56.49

Geotechnics

CLIENT: ALMES & ASSOC.
CLIENT PROJECT:US STEEL CONCORD
PROJECT NO. 91033
SOIL DESCRIPTION: BLACK FINE COAL REFUSE (UNDISTURBED)

BORING NO. B-20
SAMPLE NO. ST-2
DEPTH (ft.) 27.0'-29.5'

CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE MEASUREMENTS



$$\sin \Phi = \tan \alpha$$

α = 31.43 DEGREES

Φ = 37.66 DEGREES

$$C = \frac{a}{\cos \Phi}$$

$$C = \frac{0}{} \text{ PSI}$$

EFFECTIVE STRESS FAILURE ENVELOPE
TEST NO. 1
TEST NO. 2
TEST NO. 3

APPENDIX C

CALCULATION BRIEF

APPENDIX C
CALCULATION BRIEF
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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PROJECT NAME: U.S. STEEL BY: RMW DATE: 1/3/91

PROJECT NUMBER: 90-55-27 CHK: DMC DATE:3/15/91

DESCRIPTION: CONCORD PREPARATION PLANT
LONG TERM SLURRY DISPOSAL VOLUME ESTIMATES
REVISED BASED ON PREPARATION PLANT OUTPUT

ASSUMPTIONS:

Coal Preparation Plan Output:

Total Refuse = 337 Ton/Hour

Coarse Refuse = 303.3 Ton/Hour

Fine Refuse = 40.4 Ton/Hour

Average Plant Operation = 20 Hours/Day; 240 Days/Year

Estimated Years of Production = 20 Years

Unit Weight of Coarse Refuse = 110 lbs/cf

Unit Weight of Fine Refuse = 55 lbs/cf

ESTIMATED YEARLY PRODUCTION

	TONS	CUBIC YARDS
Total Refuse = 337 T/H * 20H/D * 240 D/YR =	1,617,600	
Coarse Refuse = 303.3 T/H * 20 H/D * 240 D/YR =	1,455,840	980,364
Fine Refuse = 40.4 T/H * 20 H/D * 240 D/YR =	193,920	261,172

ESTIMATED LIFE REFUSE PRODUCTION (20 YEARS)

	TONS	CUBIC YARDS
Total Refuse = 1,617,600 T/YR * 20YR =	32,352,000	
Total Coarse Refuse = 1,455,840 T/YR * 20 YR =	29,116,800	19,607,273
Total Fine Refuse = 193,920 T/YR * 20 YR =	3,878,400	5,223,434

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DKL DATE: 4-25-92 CHKD BY: PMW DATE: 5/6/92
PROJECT NAME: Concord
PROJECT NO. 89-55-27 SHEET ____ OF ____
DESCRIPTION PMF Calculations

The purpose of the following calculations is to determine the total runoff from the PMP storm event for the existing and proposed impoundments

72 hr PMP = 50 in (Fig 13, p 52, Hydromet Report No 51)

Since the area contributing to each impoundment is largely the impoundment itself, it will be assumed all rainfall in the drainage area will runoff to the impoundments

Existing Impoundment

The existing impoundment will have no outlet structures for storm discharge, therefore, the storage will be determined using the 2PMF criteria

2 PMF = 2 PMP rainfall = 2 × 50 in. = 100 in.

Stage 3

Drainage Area = 1,740,000 sf
Runoff = 1,740,000 sf × 100 in × $\frac{1 ft}{12 in}$ = 14,500,000 cf = 537,000 cy

Stage 2

Drainage Area = 1,642,000 sf
Runoff = 1,642,000 sf × $\frac{100 in.}{12 in/ft}$ = 13,680,000 cf = 507,000 cy

Stage 1

Drainage Area = 1,513,000 sf
Runoff = 1,513,000 sf × $\frac{100 in}{12 in/ft}$ = 12,610,000 cf = 467,000 cy

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: CMC DATE: 4-25-92 CHKD BY: RMM DATE: 5/6/92
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION PMF Calculations

Proposed Impoundment

Stage 2

Drainage Area = 950,000 ft²

Runoff = 950,000 ft² × $\frac{50 \text{ in}}{12 \text{ in/ft}}$ = 3,960,000 = 147,000 cy

Stage 3

Drainage Area = 1,021,000 ft²

Runoff = 1,021,000 ft² × $\frac{50 \text{ in}}{12 \text{ in/ft}}$ = 4,500,000 cf = 167,000 cy

Stage 4

Drainage Area = 1,216,000 ft²

Runoff = 1,216,000 ft² × $\frac{50 \text{ in}}{12 \text{ in/ft}}$ = 5,070,000 cf = 188,000 cy

PROJECT: U.S. STEEL - CONCORD **BY: DMC** **DATE: 3-28-91**

PROJECT NO.: 90-55-27 **CHK:** **DATE:**

DESCRIPTION: SCS Type II 6-Hour PMP Storm Distribution

6-Hour Rainfall= 31

Time (Hours)	0	1	2	3	4	5	6	7	8	9
%PMP	0.0	9.0	22.0	70.0	82.0	92.0	100.0	102.0	104.0	106.0
Cum. Rainfall (in)	0.0	2.8	6.8	21.7	25.4	28.5	31.0	31.6	32.2	32.9

Time (Hours)	10	11	12	13	14	15	16	17	18	19
%PMP	108.0	109.5	111.0	112.5	114.0	115.0	116.0	117.0	118.0	119.0
Cum. Rainfall (in)	33.5	33.9	34.4	34.9	35.3	35.7	36.0	36.3	36.6	36.9

Time (Hours)	20	21	22	23	24	25	26	27	28	29
%PMP	120.0	121.0	122.0	123.0	124.0	124.8	125.7	126.5	127.3	128.2
Cum. Rainfall (in)	37.2	37.5	37.8	38.1	38.4	38.7	39.0	39.2	39.5	39.7

Time (Hours)	30	31	32	33	34	35	36	37	38	39
%PMP	129.0	129.8	130.7	131.5	132.2	133.2	134.0	134.5	135.1	135.6
Cum. Rainfall (in)	40.0	40.2	40.5	40.8	41.0	41.3	41.5	41.7	41.9	42.0

Time (Hours)	40	41	42	43	44	45	46	47	48	49
%PMP	136.1	136.7	137.2	137.7	138.3	138.8	139.3	139.9	140.4	140.8
Cum. Rainfall (in)	42.2	42.4	42.5	42.7	42.9	43.0	43.2	43.4	43.5	43.6

Time (Hours)	50	51	52	53	54	55	56	57	58	59
%PMP	141.1	141.5	141.8	142.2	142.5	142.9	143.2	143.6	143.9	144.3
Cum. Rainfall (in)	43.7	43.9	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7

Time (Hours)	60	61	62	63	64	65	66	67	68	69
%PMP	144.6	144.8	145.1	145.3	145.5	145.8	146.0	146.2	146.5	146.7
Cum. Rainfall (in)	44.8	44.9	45.0	45.0	45.1	45.2	45.3	45.3	45.4	45.5

Time (Hours)	70	71	72
%PMP	146.9	147.2	147.4
Cum. Rainfall (in)	45.5	45.6	45.7

PROJECT U.S. Steel - Concord BY: DMC Date: 5-9-91

PROJECT No. 90-55-27 CHK: JDD Date: 5-23-91

Description Exsisting Impoundment Volumes

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change In Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
642	0	61,000				0	0
			699,500.0	8.0	5,596,000		
650	0	1,338,000				5,596,000	207,259
			1,475,500.0	30.0	44,265,000		
680	0	1,613,000				49,861,000	1,846,704
			1,674,500.0	10.0	16,745,000		
690	0	1,736,000				66,606,000	2,466,889

PROJECT U.S. Steel - Concord BY: DMC Date: 4-15-91

PROJECT No. 90-55-27 CHK: JDD Date: 5-23-91

Description Proposed Impoundment Volumes

Elevation	Planimetar Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
558	0	0				0	0
			151,500.0	12.0	1,818,000		
570	0	303,000				1,818,000	67,333
			411,500.0	10.0	4,115,000		
580	0	520,000				5,933,000	219,741
			613,000.0	20.0	12,260,000		
600	0	706,000				18,193,000	673,815
			817,000.0	20.0	16,340,000		
620	0	928,000				34,533,000	1,279,000
			1,061,000.0	20.0	21,220,000		
640	0	1,194,000				55,753,000	2,064,926

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 1 Volumes

Stage 1 Substages	Volume (cy)
1A	83,300
1B	957,000
1C	175,000
1D	112,000

Stage 1 total = 1,327,300 cy

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD STAGE I- AREA 1A

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DM/ 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
660	7.78	3.11E+05	2.25E+05	10	2.25E+06	0.00E+00	0.00E+00
670	3.46	1.38E+05				2.25E+06	8.33E+04

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I - AREA 1B

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DMC 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
580	2.37	9.48E+04				0.00E+00	0.00E+00
			1.39E+05	20	2.78E+06		
600	4.57	1.83E+05				2.78E+06	1.03E+05
			1.80E+05	20	3.60E+06		
620	4.43	1.77E+05				6.38E+06	2.36E+05
			1.93E+05	20	3.86E+06		
640	5.21	2.08E+05				1.02E+07	3.79E+05
			4.04E+05	20	8.08E+06		
660	14.98	5.99E+05				1.83E+07	6.78E+05
			5.01E+05	15	7.52E+06		
675	10.09	4.04E+05				2.58E+07	9.57E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I - AREA 1C-1

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DMC 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
540	1.95	7.80E+04				0.00E+00	0.00E+00
			9.94E+04	20	1.99E+06		
560	3.02	1.21E+05				1.99E+06	7.36E+04
			1.36E+05	20	2.73E+06		
580	3.80	1.52E+05				4.72E+06	1.75E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE I - 1D

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: DML 6-3-91

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
580	1.21	4.84E+04				0.00E+00	0.00E+00
			4.44E+04	20	8.88E+05		
600	1.01	4.04E+04				8.88E+05	3.29E+04
			4.72E+04	20	9.44E+05		
620	1.35	5.40E+04				1.83E+06	6.79E+04
			5.96E+04	20	1.19E+06		
640	1.63	6.52E+04				3.02E+06	1.12E+05

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 2 volumes

Stage 2 Substages	Volume to Construct from Current Topo (CY)	Previous Stages Volume (CY)	Stage 2 Volume
2A	173,000	83,300 (1A)	89,700
2B	2,780,000	1,069,000 (1B, 1D)	1,711,000
2C	432,000	175,000 (1C)	257,000
2D	322,000	–	322,000

Stage 2 total = 2,379,700 CY

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE II - 2A

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
660	8.43	3.37E+05				0.00E+00	0.00E+00
			2.34E+05	20	4.68E+06		
680	3.27	1.31E+05				4.68E+06	1.73E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE II - 2B

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
600	20.63	8.25E+05				0.00E+00	0.00E+00
			8.46E+05	20	1.69E+07		
620	21.65	8.66E+05				1.69E+07	6.26E+05
			8.71E+05	20	1.74E+07		
640	21.90	8.76E+05				3.43E+07	1.27E+06
			9.43E+05	20	1.89E+07		
660	25.23	1.01E+06				5.32E+07	1.97E+06
			7.27E+05	30	2.18E+07		
690	11.13	4.45E+05				7.50E+07	2.78E+06

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD STAGE II - 2C *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
540	2.02	8.08E+04				0.00E+00	0.00E+00
			1.05E+05	20	2.09E+06		
560	3.21	1.28E+05				2.09E+06	7.75E+04
			1.37E+05	20	2.73E+06		
580	3.62	1.45E+05				4.82E+06	1.79E+05
			1.42E+05	20	2.85E+06		
600	3.50	1.40E+05				7.67E+06	2.84E+05
			1.29E+05	20	2.58E+06		
620	2.96	1.18E+05				1.03E+07	3.80E+05
			1.41E+05	10	1.41E+06		
630	4.08	1.63E+05				1.17E+07	4.32E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE II - 2D (DIKE)

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
570	11.86	4.74E+05				0.00E+00	0.00E+00
			4.11E+05	10	4.11E+06		
580	8.71	3.48E+05				4.11E+06	1.52E+05
			2.29E+05	20	4.59E+06		
600	2.76	1.10E+05				8.70E+06	3.22E+05

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55.27 SHEET ____ OF ____

DESCRIPTION Stage 3 Volumes

Stage 3 Substages	Volume to Construct from Current Topo (c.y.)	Previous Stages Volume (c.y.)	Stage 3 Volume (c.y.)
3A	1,170,000	173,000 (1A, 1A)	997,000
3B	3,120,000	2,780,000 (1B, 2B)	340,000
3C	775,000	322,000 (2D)	453,000
3D	668,000	-	668,000

Stage 3 total = 2,458,000 cy

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE III - 3A

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
660	32.35	1.29E+06				0.00E+00	0.00E+00
			1.05E+06	30	3.16E+07		
690	20.37	8.15E+05				3.16E+07	1.17E+06

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 — *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD STAGE III - 3B — *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
600	19.22	7.69E+05				0.00E+00	0.00E+00
			8.28E+05	20	1.66E+07		
620	22.20	8.88E+05				1.66E+07	6.14E+05
			8.74E+05	40	3.50E+07		
660	21.50	8.60E+05				5.15E+07	1.91E+06
			7.77E+05	30	2.33E+07		
690	17.36	6.94E+05				7.48E+07	2.77E+06
			4.67E+05	20	9.34E+06		
710	5.98	2.39E+05				8.42E+07	3.12E+06

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD STAGE III - 3C *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
570	17.30	6.92E+05				0.00E+00	0.00E+00
			6.12E+05	10	6.12E+06		
580	13.31	5.32E+05				6.12E+06	2.27E+05
			4.77E+05	20	9.54E+06		
600	10.54	4.22E+05				1.57E+07	5.80E+05
			2.63E+05	20	5.26E+06		
620	2.60	1.04E+05				2.09E+07	7.75E+05

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27 *CALCS. BY:* J.D. DOUGLAS 5/31/91

PROJECT NAME: US STEEL - CONCORD
STAGE III - 3D *CHECKED BY:* _____

SCALE: 200

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
640	27.40	1.10E+06				0.00E+00	0.00E+00
			9.01E+05	20	1.80E+07		
660	17.67	7.07E+05				1.80E+07	6.68E+05

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 4 Volumes

Stage 4 Substages	Volume to Construct from Current Topo (cy)	Previous Stages Volume (cy	Stage 4 Volume (cy)
4A	–	–	620,000
4B	1,570,000	775,000 (20,3c)	795,000
4C	–	–	403,000
4D	–	–	871,000

Stage 4 total = 2,689,000 cy

PROJECT U.S. Steel - Concord BY: DMC Date: 5-25-91

PROJECT No. 90-55-27 CHK: Date:

Description Stage 4A-Close exsisting Impoundment

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
680	0	1,613,000				0	0
			1,674,500.0	10.0	16,745,000		
690	0	1,736,000				16,745,000	620,185

ALMES AND ASSOCIATES, INC.
CONSULTING ENGINEERS

VOLUME COMPUTATIONS

PROJECT NO.: 90-55-27

PROJECT NAME: US STEEL - CONCORD
STAGE IV - 4B

SCALE: 200

CALCS. BY: J.D. DOUGLAS 5/31/91

CHECKED BY: _____

ELEV. (FT)	PLANIM. READING	AREA (SQ.FT.)	AVG AREA (SQ.FT.)	CHANGE IN EL.	VOL. (CU.FT.)	CUM. VOL. (CU.FT.)	CUM VOL.(CU.YD.)
570	23.89	9.56E+05				0.00E+00	0.00E+00
			9.07E+05	10	9.07E+06		
580	21.44	8.58E+05				9.07E+06	3.36E+05
			7.82E+05	20	1.56E+07		
600	17.67	7.07E+05				2.47E+07	9.15E+05
			5.76E+05	20	1.15E+07		
620	11.14	4.46E+05				3.62E+07	1.34E+06
			3.07E+05	20	6.15E+06		
640	4.23	1.69E+05				4.24E+07	1.57E+06

PROJECT U.S. Steel - Concord BY: DMC Date: 5-25-91

PROJECT No. 90-55-27 CHK: Date:

Description Stage 4C - East Buttress to El. 690

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
630	0	148,000				0	0
			163,000.0	30.0	4,890,000		
660	0	178,000				4,890,000	181,111
			199,500.0	30.0	5,985,000		
690	0	221,000				10,875,000	402,778

PROJECT U.S. Steel - Concord BY: DMC Date: 5-25-91

PROJECT No. 90-55-27 CHK: Date:

Description Stage 4D - South Area to El. 690

Elevation	Planimeter Reading	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation (Ft.)	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
660	0	875,000				0	0
			783,500.0	30.0	23,505,000		
690	0	692,000				23,505,000	870,556

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-3-91 CHKD BY: RMW DATE: 6/6/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET ____ OF ____

DESCRIPTION Stage 5 Volumes

Stage 5 Substages	Volume (cy)
5A	3,896,000
5B	7,486,000

Stage 5 total = 11,382,000 cy

Stage 5 East Area

PROJECT: U.S.Steel Mining Co.
Concord Disposal Area
PROJECT NO.: 90-55-27

BY: DMC Date: 3-22-91
CHK: RMW Date: 4/6/91

Description: Stage 5A East Area to 690

Elevation (Ft.)	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
540	81,120				0	0
		200,830	40.0	8,033,200		
580	320,540				8,033,200	297,526
		691,611	50.0	34,580,550		
630	1,062,682				42,613,750	1,578,287
		1,043,152	60.0	62,589,120		
690	1,023,622				105,202,870	3,896,403

Stage 5B

PROJECT: U.S.Steel Mining Co.
Concord Disposal Area
PROJECT NO.: 90-55-27

BY: DMC Date: 3-22-91
CHK: RMW Date: 6/6/91

Description: Stage 5B, Entire Pile to 730

Elevation (Ft.)	Area (Sq Ft)	Avg Area (Sq. Ft.)	Change in Elevation	Volume (Cu Ft)	Cumulative Volume (Cu Ft)	Cumulative Volume (Cu Yd)
690	5,515,530				0	0
		5,053,010	40.0	202,120,380		
730	4,590,489				202,120,380	7,485,940

PROJECT NAME: U.S. STEEL - CONCORD BY: DMC Date: 5-5-91 5-2-92

PROJECT NUMBER: 90-55-27 CHK: [illegible] Date: 5/12/92

DESCRIPTION: CONSTRUCTION STAGING VOLUME SUMMARY

ASSUMPTIONS:

		TONS	CUBIC YARDS
Total Annual Refuse Production =		1,617,600	
	Coarse Refuse=	1,455,840	980,364
	Fine Refuse=	193,920	261,172

CONSTRUCTION STAGE	YEAR	COARSE REFUSE USED IN CONSTRUCTION (CY)	FINE REFUSE DISPOSAL CAPACITY (CY)	REFUSE PRODUCTION COARSE (CY)	REFUSE PRODUCTION FINES (CY)
	1.00			980,364	261,172
Stage 1					
1A - Exist. Imp. to El. 670		83,300	669,000		
1B - North Buttress to El. 675		957,000			
1C - East Butttess to El. 580		175,000			
1D - Northwest Embankment		112,000			
Stage 1 Sub Total	1.35	1,327,300	669,000	1,327,300	353,597
Cumulative Total	1.35	1,327,300	669,000	1,327,300	353,597
Stage 2					
2A - Exist. Imp. to El. 680		89,700	507,000		
2B - N. Buttress to El. 690/660		1,711,000			
2C - East Berm to El. 630		257,000			
2D - Dike Embank. to El. 600		322,000	459,000		
Stage 2 Sub Total	2.43	2,379,700	966,000	2,379,700	633,959
Cumulative Total	3.78	3,707,000	1,635,000	3,707,000	987,556
Stage 3					
3A - Exist. Imp. to El. 690		997,000	568,000		
3B - N. Buttress to El. 710/690		34,000			
3C - Dike Embank. to El. 620		45,300	562,000		
3D - South Area to El. 660		668,000			
Stage 3 Sub Total	1.78	1,744,300	1,130,000	1,744,300	464,687
Cumulative Total	5.56	5,451,300	2,765,000	5,451,300	1,452,243
Stage 4					
4A - Dike Embank. to El. 640		795,000			
4B - Close Exist. Imp.		620,000	738,000		
4C - East Buttress to El. 690		403,000			
4D - South Area to El. 690		871,000			
Stage 4 Sub Total	2.74	2,689,000	738,000	2,689,000	716,358
Cumulative Total	8.30	8,140,300	3,503,000	8,140,300	2,168,601
Stage 5					
5A - East Area to El. 690		3,896,403			
5B - Main Area to El. 730		7,485,950			
Stage 5 Sub Total	11.61	11,382,353	0	11,382,353	3,032,294
Cumulative Total (Fine)	13.41		3,503,000		
Cumulative Total (Coarse)	19.91	19,522,653		19,522,653	5,200,895
Final Total (Fine)	13.41		3,503,000		
Final Total (Coarse)	19.91	19,522,653		19,522,653	5,200,895

Revised 5/92

PROJECT: U.S. STEEL - CONCORD BY: DMC DATE: 4-17-91 5-2-92

PROJECT NO.: 90-55-27 CHK: RMW DATE: 5/12/92

DESCRIPTION: Impoundment Fine Elevations

Existing Impoundment

Stage (end)	Year	Impoudment Volume (cy)	Cumulative Volume (cy)	Elevation	
	0.00	000	000	642.00	
	0.79	207,259	207,259	650.00	
	1.21	316,555	316,555	652.00	
	1.63	425,851	425,851	654.00	
	2.05	535,148	535,148	656.00	
1	2.47	644,444	644,444	658.00	
	2.89	753,740	753,740	660.00	
	3.30	863,016	863,016	662.00	
	3.72	972,293	972,293	664.00	
	4.14	1,081,569	1,081,569	666.00	
2	4.35	1,136,207	1,136,207	667.00	
	4.56	1,190,846	1,190,846	668.00	
	4.98	1,300,122	1,300,122	670.00	
	5.40	1,409,438	1,409,438	672.00	
	5.82	1,518,755	1,518,755	674.00	
	6.23	1,628,071	1,628,071	676.00	
3	6.65	1,737,388	1,737,388	678.00	Max. Elev.
		1,792,046		679.00	
		1,846,704	-	680.00	
		1,970,741	-	682.00	
		2,094,778	-	684.00	
		2,218,815	-	686.00	
		2,342,852	-	688.00	
		2,466,889	-	690.00	

New Impoundment

Stage	Year	Impoudment Volume (cy)	Cumulative Volume (cy)	Elevation	
	6.65	0	1,737,388	558.00	
	6.91	67,333	1,804,721	570.00	
	7.20	143,537	1,880,925	575.00	
	7.49	219,741	1,957,129	580.00	
	7.93	333,260	2,070,648	585.00	
	8.36	446,778	2,184,166	590.00	
2	8.45	469,482	2,206,870	591.00	
	8.80	560,297	2,297,685	595.00	
	9.23	673,815	2,411,203	600.00	
	9.81	825,111	2,562,499	605.00	
	10.39	976,408	2,713,796	610.00	
3	10.51	1,006,667	2,744,055	611.00	
	10.97	1,127,704	2,865,092	615.00	
	11.55	1,279,000	3,016,388	620.00	
	12.30	1,475,482	3,212,870	625.00	
	13.05	1,671,963	3,409,351	630.00	
4	13.35	1,750,556	3,487,944	632.00	Max. Elev.
		1,868,445	-	635.00	
		2,064,926	-	640.00	

Revised 5/92

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: CMC DATE: 4-25-92 CHKD BY: FMM DATE: 5/6/92

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 1

DESCRIPTION Maximum Five Release Elevations

Existing Impoundment

Stage	Crest	Crest - Freeboard	Volume (1)	Volume - (2) storage	Max Fine
1	670	667	1,136,208	669,000	658 ±
2	680	677	1,682,730	1,176,000	667 ±
3	690	687	2,280,934	1,749,000	678 ±

Proposed Impoundment

2	600	597	505,701	459,000	591 ±
3	620	617	1,188,222	1,021,000	611 ±
4	640	637	1,947,037	1,759,000	632 ±

(1) Impoundment Volumes were intepolated from the table on p C-35

(2) Storage Volumes were determine in PMF calcs

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-2-92 CHKD BY: RMW DATE: 5/6/92
PROJECT NAME: Conrad
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION Storm Evacuation Pump Capacity

The purpose of this calculation is to determine the capacity of the pump needed to evacuate PMF design storm from both the existing and proposed impoundments.

Existing Impoundment

Since the existing impoundment provides 2 PMF of flood storage, it is require to evacuate 90% of the PMF in 30 days.

The maximum PMF runoff occurs during Stage 3

Runoff from 1 PMF = 7,250,000 cf

$$\text{Pump Capacity} = \frac{(7{,}250{,}000 \text{ cf})(7.48 \text{ gal/cf})(0.9)}{(30 \text{ days})(24 \text{ hr/day})(60 \text{ min/hr})}$$

$$= 1130 \text{ gpm}$$

Proposed Impoundment

Since the proposed impoundment provides only 1 PMF of flood storage, it will be required to evacuate 90% of the PMF in 10 days

The maximum PMF runoff occurs during Stages 4 and 5

Runoff from 1 PMF = 5,070,000 cf

$$\text{Pump Capacity} = \frac{(5{,}070{,}000 \text{ cf})(7.48 \text{ gal/cf})(0.9)}{(10 \text{ days})(24 \text{ hr/day})(60 \text{ min/hr})}$$

$$= 2370 \text{ gpm}$$

BY: ADW DATE: 5-31-91
CHK: MC DATE: 6-10-91

STAGE 5 (FINAL) SURFACE DRAINAGE

The purpose of the following calculation is to design surface drainage facilities for the subject report. The surface drainage facilities are sized for the 100 year, 24 hour storm event with freeboard (where applicable).

The following data was used in the surface drainage design:

- The 100 year, 24 hour rainfall for Jefferson County, Alabama is 8.5 inches. (from Figure B-8, Soil Conservation Service Technical Release 55)
- The hydrologic soil group chosen for the cover soil is type "B" since the on-site soil would be texturally classified as a loam or sandy loam. (from Appendix A, Soil Conservation Service Technical Release 55)
- The Curve Number chosen is 75 since the site will be vegetated (grass covered open space, poor to fair condition) when permanent slopes are achieved. (from Table 2-2a, Soil Conservation Service Technical Release 55)

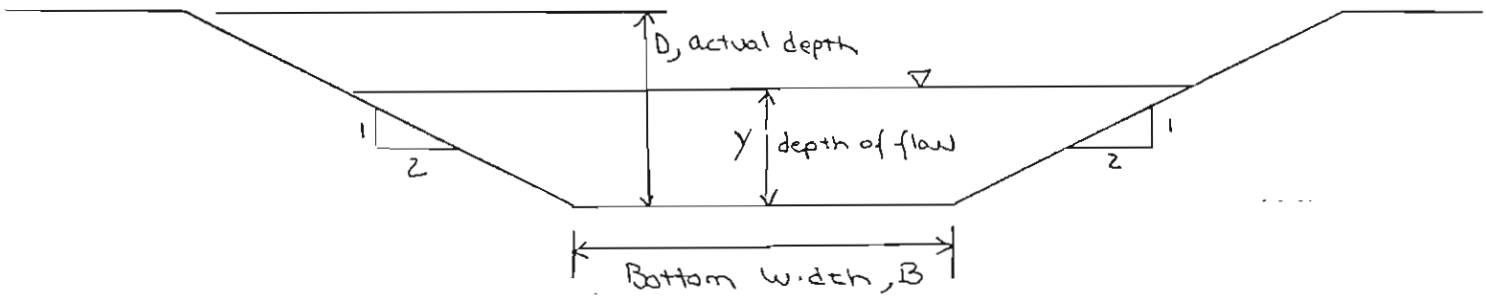
Peak flows were determined using the Soil Conservation Service Tabular Hydrograph Method

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DML DATE: 5-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 2 OF 27
DESCRIPTION Stage 5 (final) surface drainage

Typical Trapezoidal Channel

These channel dimensions are typical for perimeter and drop over ditches.



Freeboard

Ditches are designed with at least 0.5 ft. of freeboard.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/6/91 CHKD BY: DMC DATE: 6-15-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 3 OF 17

DESCRIPTION Stage 5 (final) surface drainage

Haul Road Ditch :

This is a typical design for the main haul road ditches in all stages. By inspection, the maximum area draining to a haul road is 36.0 acres

INTERMEDIATE HAUL ROAD

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
HAUL ROAD	36.00	75.0	0.20	0.00	8.50	5.50	.08	.10

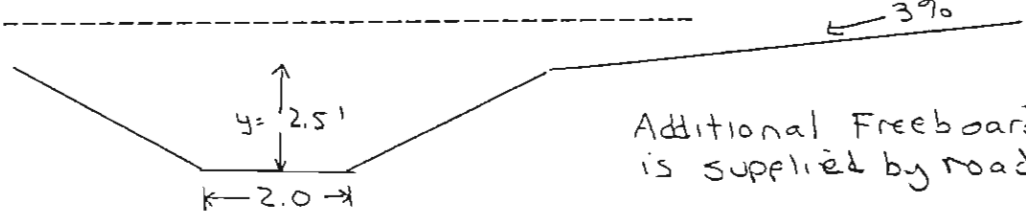
* Travel time from subarea outfall to composite watershed outfall point.

Total area = 36.00 acres or 0.05625 sq.mi

Peak discharge = 175 cfs

SOLUTION FOR MANNING'S EQUATION: HAUL ROAD DITCH : RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.08
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	175.00
VELOCITY (fps)	10.97
DEPTH OF FLOW (ft)	2.37
FLOW AREA (sf)	15.96
WETTED PERIMETER (ft)	12.59
HYDRAULIC RADIUS (ft)	1.27
ACTUAL MANNINGS N	.045
D50 RIPRAP SIZE (in)	8.00



Additional Freeboard is supplied by road slope.

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked DWL Date 6/6/91

Circle one: Present (Developed) E. Intermediate Haul Road

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)		refuse		
2. Manning's roughness coeff., n (table 3-1)		0.011		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	4.2		
5. Land slope, s	ft/ft	0.005		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.07	+	= 0.07

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)		unpaved		
8. Flow length, L	ft	300		
9. Watercourse slope, s	ft/ft	0.005		
10. Average velocity, V (figure 3-1)	ft/s	1.2		
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.07	+	= 0.07

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s	10.97		
18. Flow length, L	ft	2000		
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr	0.05	+	= 005

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.19

use 0.2

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/6/91 CHKD BY: DML DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 5 OF 17

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch A-1 : Ditch starts at uppermost point of ditch (along northeast haulroad) and terminates at the intersection with the main haul road ditch (west side of site)

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH A-1

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH A-1	6.20	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 6.20 acres or 0.00969 sq.mi
Peak discharge = 35 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH A-1 : GRASS LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.01
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	35.00
VELOCITY (fps)	3.66
DEPTH OF FLOW (ft)	1.74
FLOW AREA (sf)	9.55
WETTED PERIMETER (ft)	9.79
HYDRAULIC RADIUS (ft)	.98

The depth of the chamel = 1.74 + 0.5' = 2.24'
Freeboard = 0.76 ft

Actual Depth = 2.5'

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By AOW Date 6/6/91

Location 90-55-27 Checked DM/ Date 6-10-91

Circle one: Present / Developed — Perimeter Ditch A-1

Circle one: T_c / T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID	Along Northeast Railroad	A-1
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		10.97	3.66
18. Flow length, L	ft		1200	300
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.03 +	0.06 = 0.09

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr — use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DMC DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 6 OF 12

DESCRIPTION Stage 5 (final) Surface Drainage

Perimeter Ditch A-2 : Ditch starts at the culvert under the haul road and empties into the existing sediment pond.

Ditch A-2 carries the combined peak flow from Ditch A-1 and the Haul Road Ditch.

The combined peak flow from Ditch A-1 and the Haul Road Ditch is 203 cfs. See below:

File Summary for Composite Hydrograph

Time (hrs)	(A-1) PERDITCH (cfs)	(HAUL ROAD) INTHAUL (cfs)	(A-2) PER-A2 (Total)
11.00	2.0	8.0	10.0
11.10	2.0	9.0	11.0
11.20	2.0	10.0	12.0
11.30	2.0	11.0	13.0
11.40	2.0	12.0	14.0
11.50	3.0	14.0	17.0
11.60	3.0	15.0	18.0
11.70	5.0	22.0	27.0
11.80	7.0	30.0	37.0
11.90	9.0	37.0	46.0
12.00	13.0	54.0	67.0
12.10	23.0	80.0	103.0
12.20	35.0	139.0	174.0
12.30	28.0	175.0	203.0
12.40	18.0	149.0	167.0
12.50	14.0	111.0	125.0
12.60	10.0	84.0	94.0

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: CMC DATE: 6-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 7 OF 22
DESCRIPTION Stage 5 (final) Surface drainag

Perimeter Ditch A-2 (cont.)

The peak flow through Perimeter Ditch A-2 = 203cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH A-2 : RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	

SLOPE (ft/ft)	.03
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	3.00
OUTPUT VALUES	

FLOWRATE (cfs)	203.00
VELOCITY (fps)	8.14
DEPTH OF FLOW (ft)	2.86
FLOW AREA (sf)	24.94
WETTED PERIMETER (ft)	15.79
HYDRAULIC RADIUS (ft)	1.58
ACTUAL MANNINGS N	.043
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 2.86' + 0.5 = 3.36'

Actual Depth = 3.5 ft

Freeboard = 0.64 ft.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 5/6/91 CHKD BY: [illegible] DATE: 4-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 8 OF ??

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch B

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH B

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH B	9.40	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.

Total area = 9.40 acres or 0.01469 sq.mi

Peak discharge = 53 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH B : RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.03
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	4.00
OUTPUT VALUES	
FLOWRATE (cfs)	53.00
VELOCITY (fps)	5.08
DEPTH OF FLOW (ft)	1.49
FLOW AREA (sf)	10.43
WETTED PERIMETER (ft)	10.68
HYDRAULIC RADIUS (ft)	.98
ACTUAL MANNINGS N	.05
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 1.49 + 0.5 = 1.99 ft Actual Depth = 2.0'

Freeboard = 0.51 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By AOW Date 5/6/91

Location 90-55-27 Checked SMC Date 5-10-91

Circle one: Present (Developed) Perimeter Ditch B

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	5.08		
18. Flow length, L	ft	1900		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.1	+	= 0.1
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 5/6/91 CHKD BY: DMC DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 10 OF 22

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch C

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH C

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH C	5.00	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 5.00 acres or 0.00781 sq.mi
Peak discharge = 28 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH C ; RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.2
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	28.00
VELOCITY (fps)	7.96
DEPTH OF FLOW (ft)	.92
FLOW AREA (sf)	3.52
WETTED PERIMETER (ft)	6.10
HYDRAULIC RADIUS (ft)	.58
ACTUAL MANNINGS N	.058
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 0.92' + 0.5' = 1.42'

Actual Depth = 1.5 ft Freeboard = 0.58 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked TJM Date 6-10-91

Circle one: Present (Developed) Perimeter Ditch C

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		7.96	
18. Flow length, L	ft		600	
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.02	= 0.02
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	use 0.1		

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOJ DATE: 6/5/91 CHKD BY: DMC DATE: 6-16-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 12 OF 27

DESCRIPTION Stage 5 (final) surface drainage

Perimeter Ditch D

Watershed in TypeIII 24hr Storm Hydrograph

PERIMETER DITCH D

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DITCH D	7.40	75.0	0.20	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 7.40 acres or 0.01156 sq.mi
Peak discharge = 36 cfs

SOLUTION FOR MANNING'S EQUATION: PERIMETER DITCH D : GRASS LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.01
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	2.00
OUTPUT VALUES	
FLOWRATE (cfs)	36.00
VELOCITY (fps)	3.69
DEPTH OF FLOW (ft)	1.76
FLOW AREA (sf)	9.75
WETTED PERIMETER (ft)	9.89
HYDRAULIC RADIUS (ft)	.99

The depth of the channel = 1.76' + 0.5' = 2.26 ft

Actual Depth: 2.5 ft Freeboard: 0.74 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked DML Date 6-10-91

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea Perimeter Ditch D.

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	3.69		
18. Flow length, L	ft	3000		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.2	+	= 0.2
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			0.2

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: AOW DATE: 6/6/91 CHKD BY: DMC DATE: 6-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 14 OF 77
DESCRIPTION Stage 5 (final) Surface Drainage

Drop over Ditch 1

Watershed in TypeIII 24hr Storm Hydrograph

DROP OVER DITCH 1

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DROP OVER #1	47.60	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 47.60 acres or 0.07437 sq.mi
Peak discharge = 271 cfs

SOLUTION FOR MANNING'S EQUATION: DROP OVER DITCH 1 ; RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.1
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	5.00
OUTPUT VALUES	
FLOWRATE (cfs)	271.00
VELOCITY (fps)	13.07
DEPTH OF FLOW (ft)	2.20
FLOW AREA (sf)	20.73
WETTED PERIMETER (ft)	14.85
HYDRAULIC RADIUS (ft)	1.40
ACTUAL MANNINGS N	.045
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 2.2' + 0.5' = 2.7'
Actual Depth = 3.0 ft. Freeboard = 0.8 ft.

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked CML Date 6-10-91

Circle one: Present (Developed) Drop over Ditch 1

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID	Bench Gutter	Channel		
12. Cross sectional flow area, a	ft^2					
13. Wetted perimeter, p_w	ft					
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft					
15. Channel slope, s	ft/ft					
16. Manning's roughness coeff., n						
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		4.36	13.07		
18. Flow length, L	ft		1700	900		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.1	+ 0.019	=	0.12
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr					Use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DML DATE: 6-6-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 16 OF 22

DESCRIPTION Stage 5 (final) Surface Drainage

Drop Over Ditch 2

Watershed in TypeIII 24hr Storm Hydrograph

DROP OVER DITCH 2

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
DROP OVER #2	41.50	75.0	0.10	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.

Total area = 41.50 acres or 0.06484 sq.mi

Peak discharge = 236 cfs

SOLUTION FOR MANNING'S EQUATION: DROP OVER DITCH 2 ; RIP-RAP LINED

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.3
ROUGHNESS COEFFICIENT (Manning's n)	.05
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	8.00
OUTPUT VALUES	
FLOWRATE (cfs)	236.00
VELOCITY (fps)	16.32
DEPTH OF FLOW (ft)	1.35
FLOW AREA (sf)	14.46
WETTED PERIMETER (ft)	14.04
HYDRAULIC RADIUS (ft)	1.03
ACTUAL MANNINGS N	.051
D50 RIPRAP SIZE (in)	8.00

The depth of the channel = 1.35' + 0.5' = 1.85'

Actual depth = 2.0ft. Freeboard = 0.65ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/6/91

Location 90-55-27 Checked DML Date 6-10-91

Circle one: Present (Developed) Drop over Ditch 2

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1) ..				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID	Bench Gutter	Channel
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s		4.36	16.32
18. Flow length, L	ft		1500	600
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		0.095 + 0.01	= 0.105

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr Use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/5/91 CHKD BY: DML DATE: 6-10-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 19 OF 37
DESCRIPTION Stage 5 (final) Surface Drainage

Drop Over Ditch 3

Watershed in TypeIII 24hr Storm Hydrograph

DROP OVER DITCH 3

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/P input/used	
DROP OVER #3	45.90	75.0	0.10	0.00	8.50	5.50	.09	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 45.90 acres or 0.07172 sq.mi
Peak discharge = 261 cfs

SOLULTION FOR MANNING'S EQUATION: DROP OVER DITCH 3

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.4
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	10.00
OUTPUT VALUES	
FLOWRATE (cfs)	261.00
VELOCITY (fps)	16.41
DEPTH OF FLOW (ft)	1.27
FLOW AREA (sf)	15.91
WETTED PERIMETER (ft)	15.67
HYDRAULIC RADIUS (ft)	1.01
ACTUAL MANNINGS N	.058
D50 RIPRAP SIZE	10.00

The depth of the channel = 1.27' + 0.5' = 1.77'
Actual Depth = 2.0ft Freeboard = 0.73 ft

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By ADW Date 6/5/91

Location 90-55-27 Checked DMC Date 6-10-91

Circle one: Present (Developed) Drop over D.Fe in 3

Circle one: (T_c) T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1)				
3. Flow length, L (total L ≤ 300 ft)	ft			
4. Two-yr 24-hr rainfall, P_2	in			
5. Land slope, s	ft/ft			
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr		+	=

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr		+	=

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	15.59		
18. Flow length, L	ft	500		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.009	+	= 0.009
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr			Use 0.1

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: MCJ DATE: 5'6'91 CHKD BY: DML DATE: 5.10.91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 70 OF 77
DESCRIPTION Stage 5 (final) Surface drainage

Final Bench Gutters

This is a typical design for all the bench gutters. By inspection, the maximum area draining to a bench gutter is 23.7 acres. The bench will be vegetated, manning's n = 0.4. The bench will be 20 ft wide, with a 3% slope adjoining a V-shaped ditch. See diagram below:

Freeboard will be supplied by the bench slope.

GRASS LINED PERMANENT BENCH

)))) Input Parameters Used to Compute Hydrograph ((((

Subarea Description	AREA (acres)	CN	Tc (hrs)	* Tt (hrs)	Precip. (in)	Runoff (in)	Ia/p input/used	
BENCH	23.70	75.0	0.75	0.00	8.50	5.50	.08	.10

* Travel time from subarea outfall to composite watershed outfall point.
Total area = 23.70 acres or 0.03703 sq.mi
Peak discharge = 70 cfs

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/6/91 CHKD BY: DWL DATE: 6-10-91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 21 OF 32

DESCRIPTION Stage 5 (final) surface drainage

Final Bench Gutters (continued)

SOLUTION FOR MANNING'S EQUATION: PERMANENT GRASSED BENCHES

24 HOUR STORM FREQUENCY (years)	100
INPUT PARAMETERS	
SLOPE (ft/ft)	.01
ROUGHNESS COEFFICIENT (Manning's n)	.04
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	0.00
OUTPUT VALUES	
FLOWRATE (cfs)	70.00
VELOCITY (fps)	4.36
DEPTH OF FLOW (ft)	2.83
FLOW AREA (sf)	16.05
WETTED PERIMETER (ft)	12.67
HYDRAULIC RADIUS (ft)	1.27

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project Concord By AOW Date 5/6/91

Location 90-55-27 Checked TM/ Date 6-10-91

Circle one: Present (Developed) Permanent Bench

Circle one: (T_c) T_t through subarea with maximum Tributary Area

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID		
1. Surface description (table 3-1)		Short Grass		
2. Manning's roughness coeff., n (table 3-1)		0.15		
3. Flow length, L (total L ≤ 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	4.2		
5. Land slope, s	ft/ft	0.005		
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t	hr	0.60	+	= 0.60

Shallow concentrated flow		Segment ID		
7. Surface description (paved or unpaved)		Short Grass		
8. Flow length, L	ft	430	80	
9. Watercourse slope, s	ft/ft	0.005	0.40	
10. Average velocity, V (figure 3-1)	ft/s	1.2	10.0	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.01	+ 0.002	= 0.012

Channel flow		Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, p_w	ft			
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft/s	4.36		
18. Flow length, L	ft	1600		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr	0.1	+	= 0.1

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) ..... hr 0.7

used .75

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-11-91 CHKD BY: AOW DATE: 6-13-91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION Stage 5 (Final) surface drainage

Culverts

Culverts are required to carry storm water flow at 2 points along Perimeter channel A-2. First, at the start of the channel under the main haul road, and second, under the northeast site access road. Design flows and slopes are the same as ditch A-2 (203 cfs and 3%). Culverts are designed using procedures in "Hydraulic Design of Highway Culverts", USDOT, Report No. FHWA-IP-85-15

PROJECT: Concord
90-55-27

STATION: _____

SHEET _____ OF _____

CULVERT DESIGN FORM

DESIGNER / DATE: DMC / 6-11-91

REVIEWER / DATE: AD(a) / 6/13/91

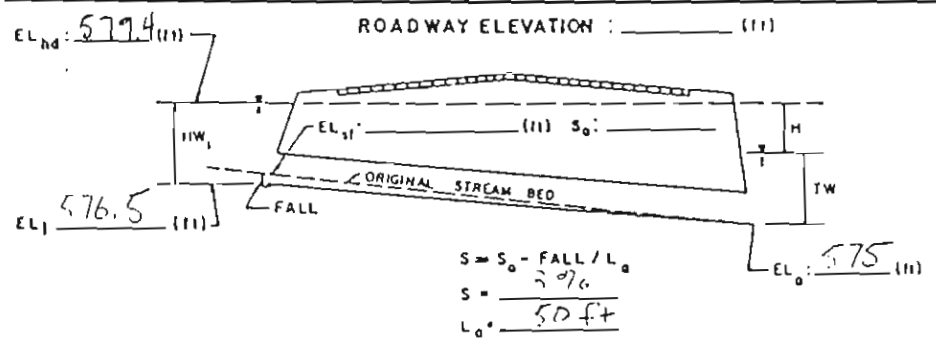
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD: Tabular hydrograph
- ☐ DRAINAGE AREA: _____ ☐ STREAM SLOPE: 3%
- ☐ CHANNEL SHAPE: Trapezoidal
- ☐ ROUTING: _____ ☐ OTHER: _____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
100	203	2.9



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_hi (4)	OUTLET CONTROL TW (5)	d_c	(d_c+D)/2	h_o (6)	h_e	H (7)	EL_ho (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
RCMP 57x38 Arch (3 ea.)	203	68	1.1	3.5	0	580	2.9	1.7	2.5	2.9	0.1	1.6	584	584		

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW/D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) EL_{hi} = HW_i + EL_i (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29n^2 L)/R^{1.33}\right] v^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f. CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho. HEADWATER IN OUTLET CONTROL
- i. INLET CONTROL SECTION
- o. OUTLET
- sf. STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 57x38

SHAPE: Arch

MATERIAL: CMP n 0.024

ENTRANCE: Projected

57x38 Equiv. diam = 48"

Area = $\pi r^2 = \pi 24^2 = 12.6$ ft^2

CHART 43

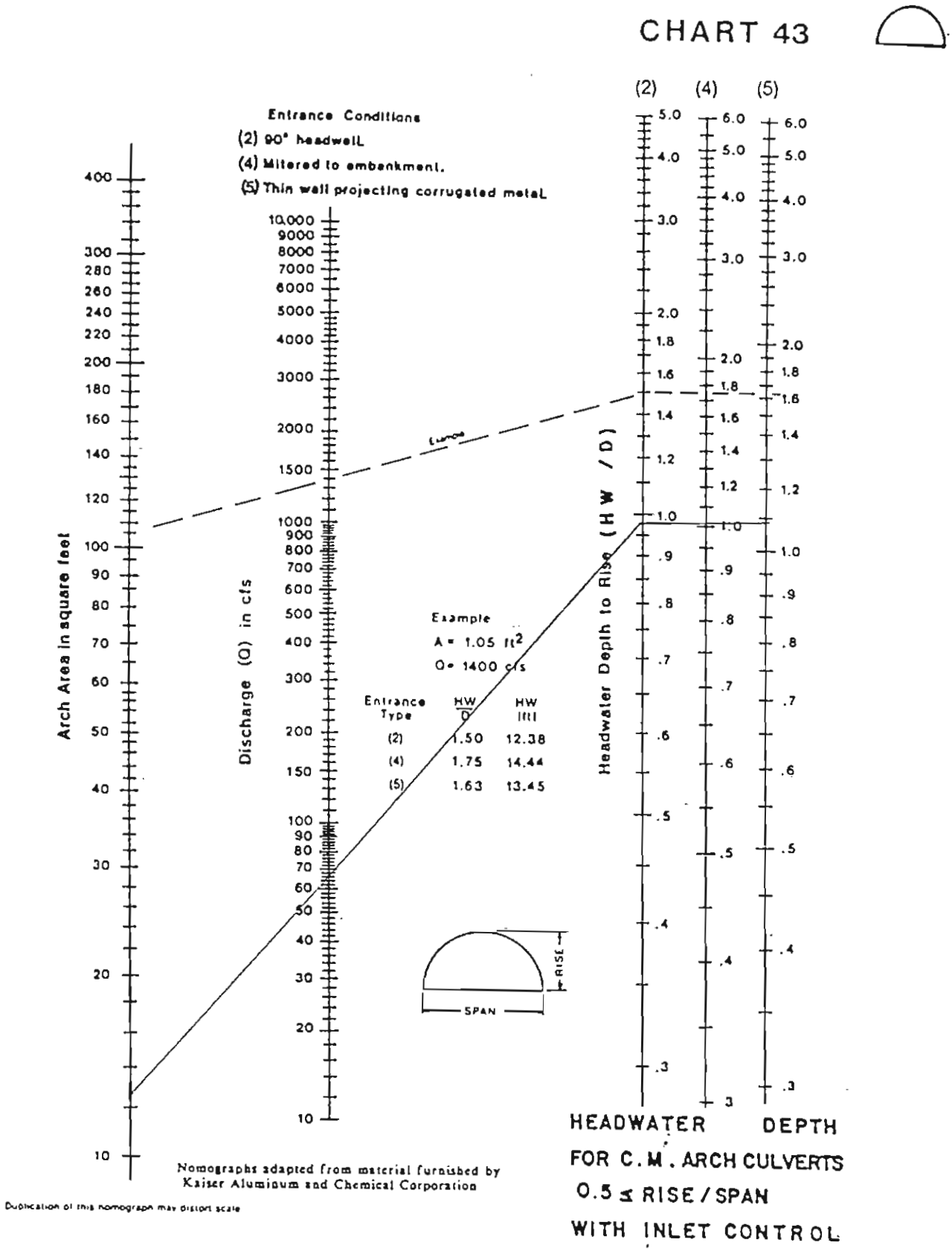
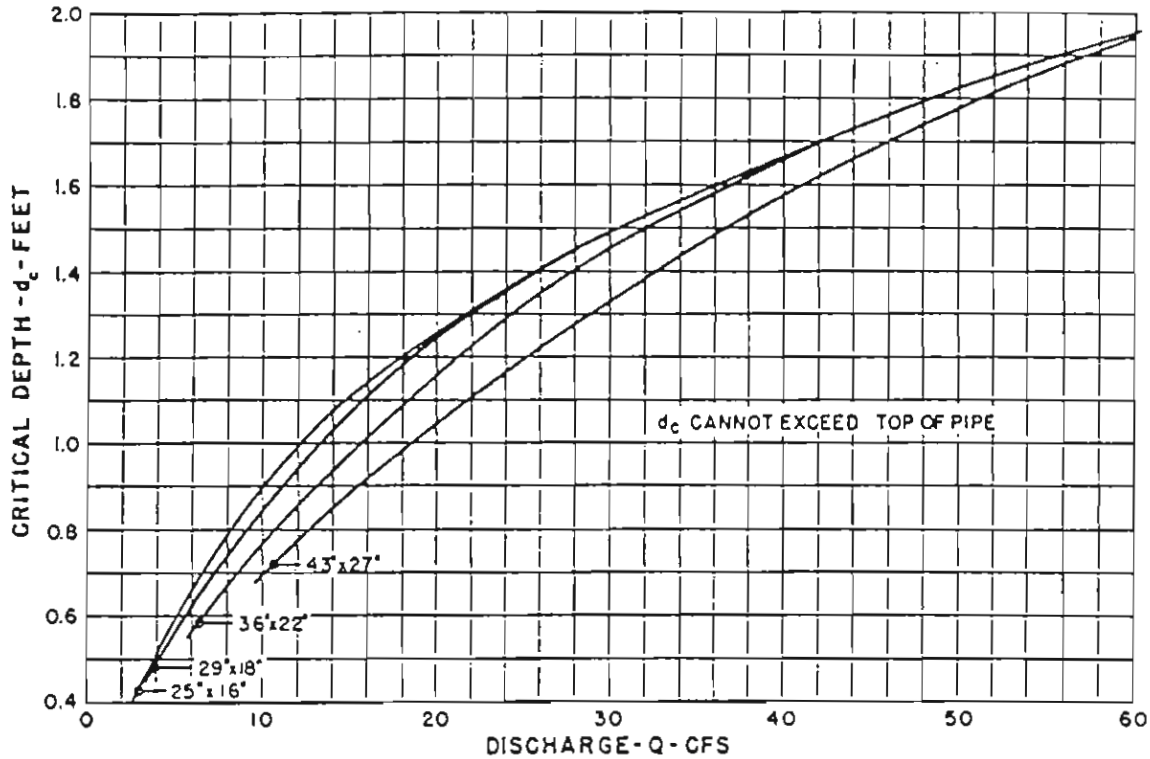
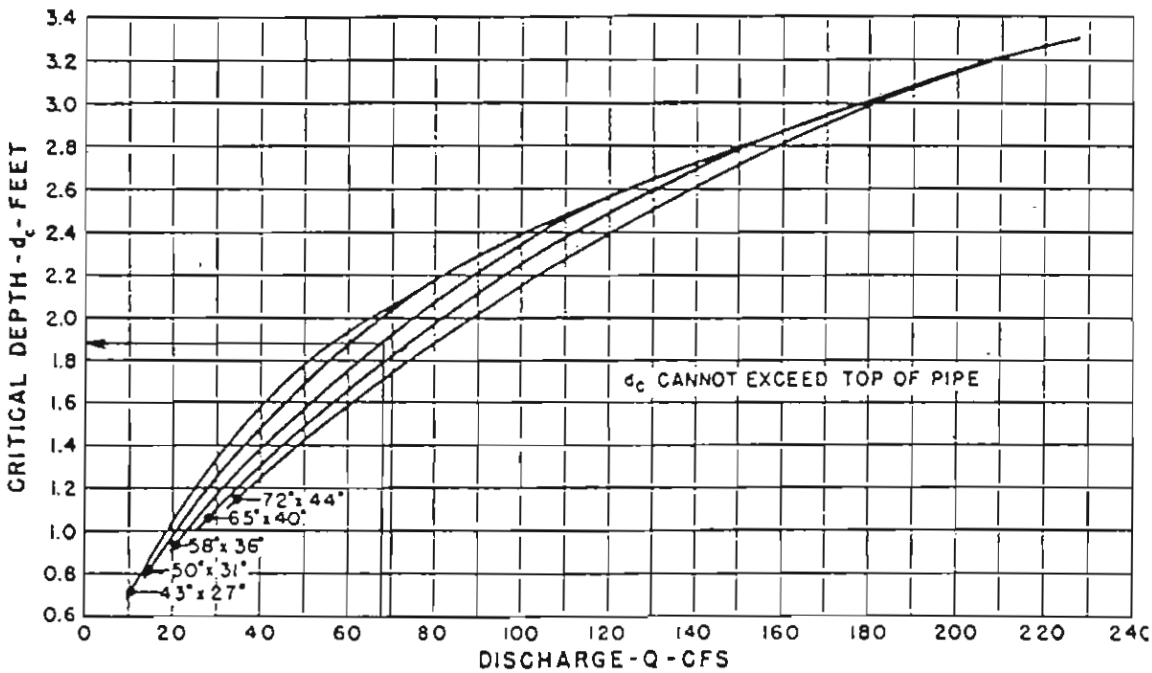

Entrance Conditions
(2) 90° headwall
(4) Mitered to embankment.
(5) Thin wall projecting corrugated metal
Arch Area in square feet
Discharge (Q) in cfs
Headwater Depth to Rise (HW / D)
(2)
(4)
(5)
Example
A = 1.05 ft²
Q = 1400 cfs
Entrance Type
HW/D
HW ft
(2) 1.50 12.38
(4) 1.75 14.44
(5) 1.63 13.45
RISE
SPAN
HEADWATER DEPTH
FOR C.M. ARCH CULVERTS
0.5 ≤ RISE / SPAN
WITH INLET CONTROL
Nomographs adapted from material furnished by
Kaiser Aluminum and Chemical Corporation
Duplication of this nomograph may distort scale

CHART 37



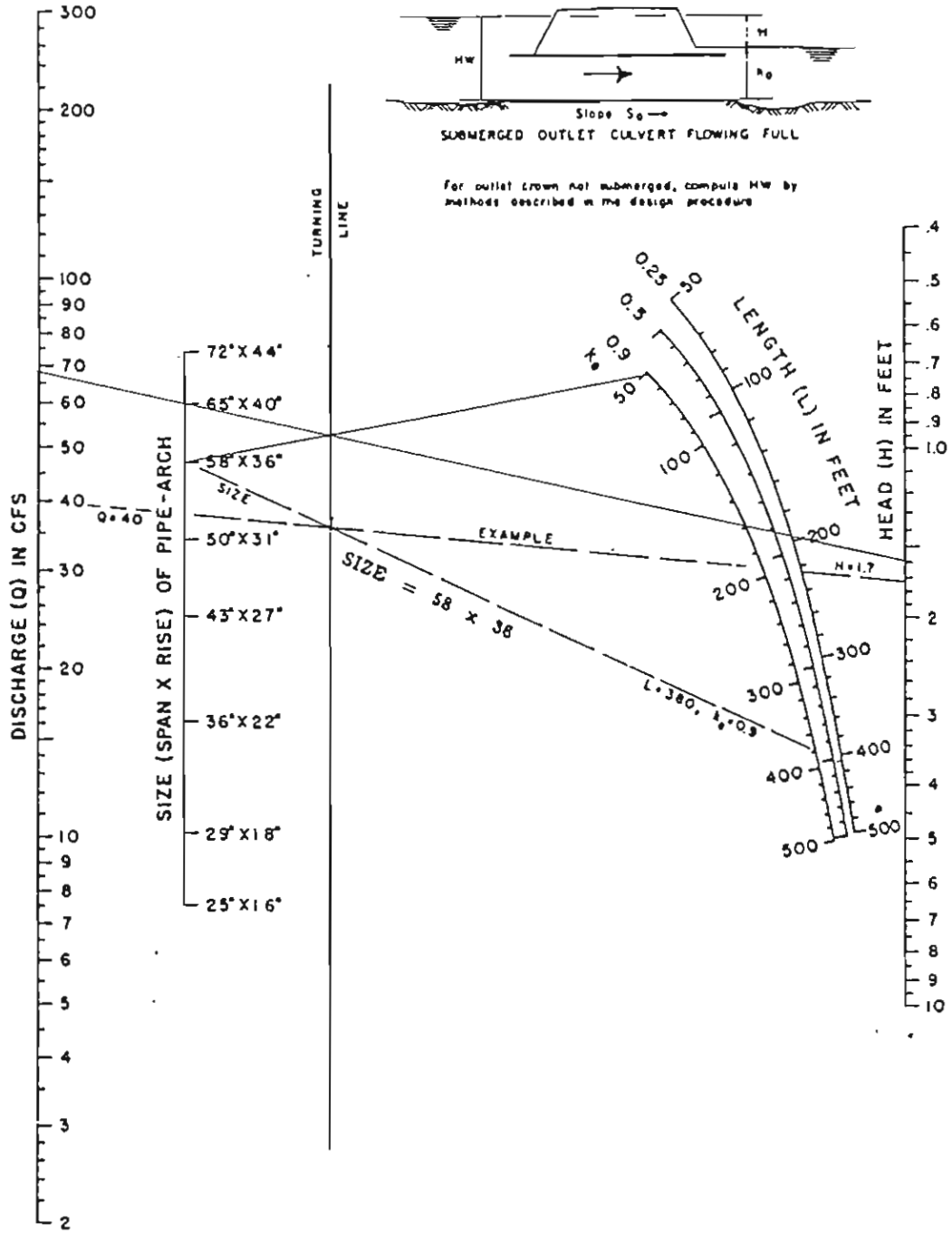


BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH.
STANDARD C.M. PIPE-ARCH

CHART 39



HEAD FOR STANDARD C. M. PIPE-ARCH CULVERTS FLOWING FULL n=0.024

BUREAU OF PUBLIC ROADS JAN. 1963

C-4, [illegible] below NL [illegible] road

PROJECT: Concord 90-55-27	STATION: ____ SHEET ____ OF ____	CULVERT DESIGN FORM DESIGNER/DATE: DMC / 6-11-91 REVIEWER/DATE: ADW / 6/13/91

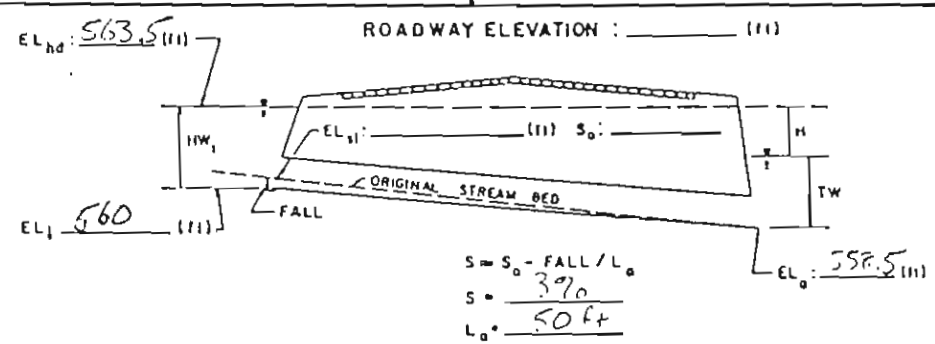
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD: Tabular hydrograph
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE: 3%
- ☐ CHANNEL SHAPE: Trapezoidal
- ☐ ROUTING: ____ ☐ OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
100	203	2.86



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	k_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
BCCMP 57x38 Arch (3 [illegible])	203	68	1.1	3.5	0	563.5	2.9	1.9	2.5	2.9	0.9	1.6	563	563.5		

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i/D = HW/D$ OR HW_i/D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{si})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + k_e + (29n^2 L)/R^{1.33}\right] V^2/2g$ [illegible]

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f. CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho. HEADWATER IN OUTLET CONTROL
- i. INLET CONTROL SECTION
- o. OUTLET
- si. STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 57x38

SHAPE: Arch

MATERIAL: CMP n 0.024

ENTRANCE: Projected

57x38 Equiv diam. = 48"

Area = $\pi 2^2$ = 12.6 ft²

CHART 43

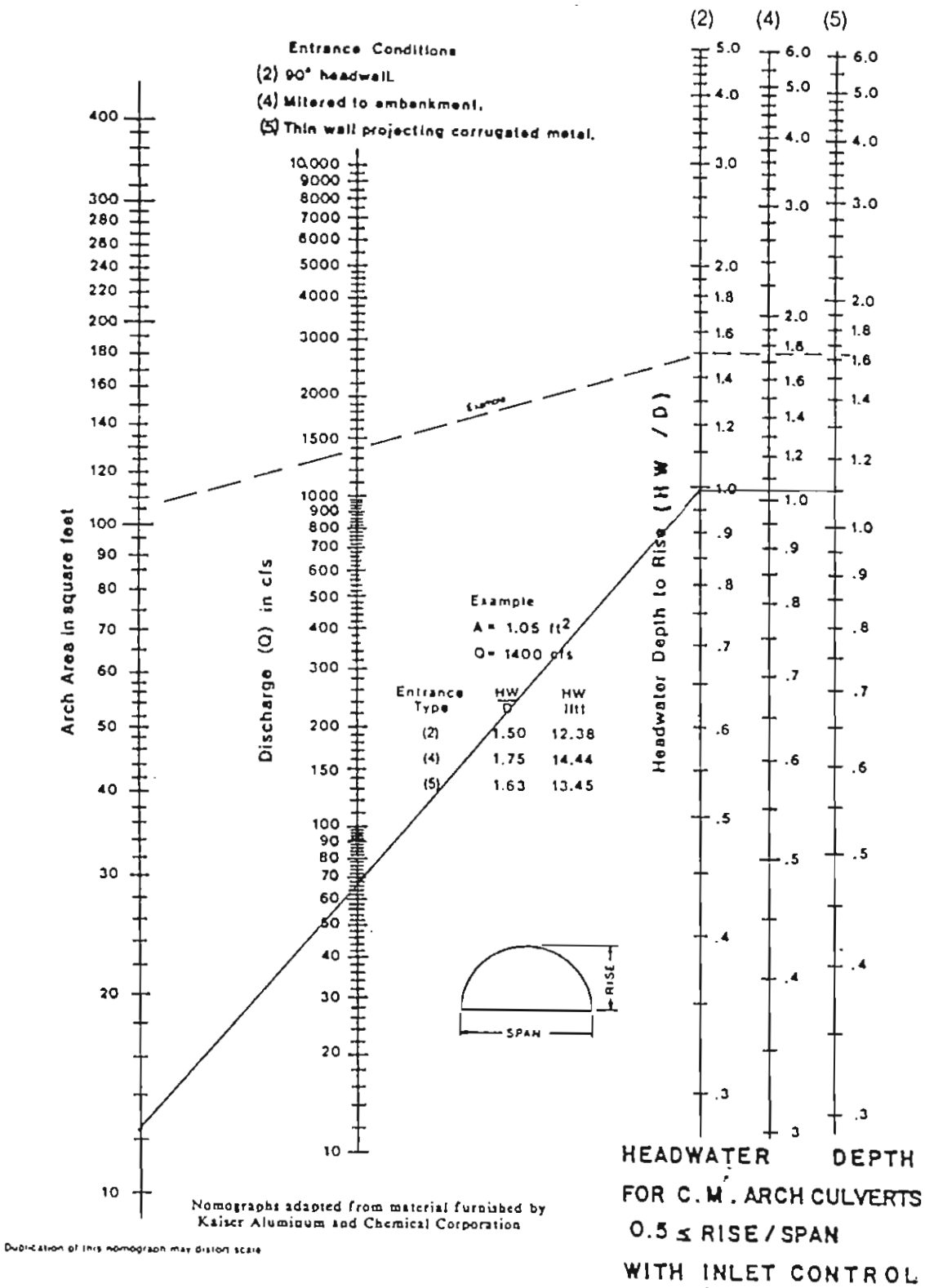
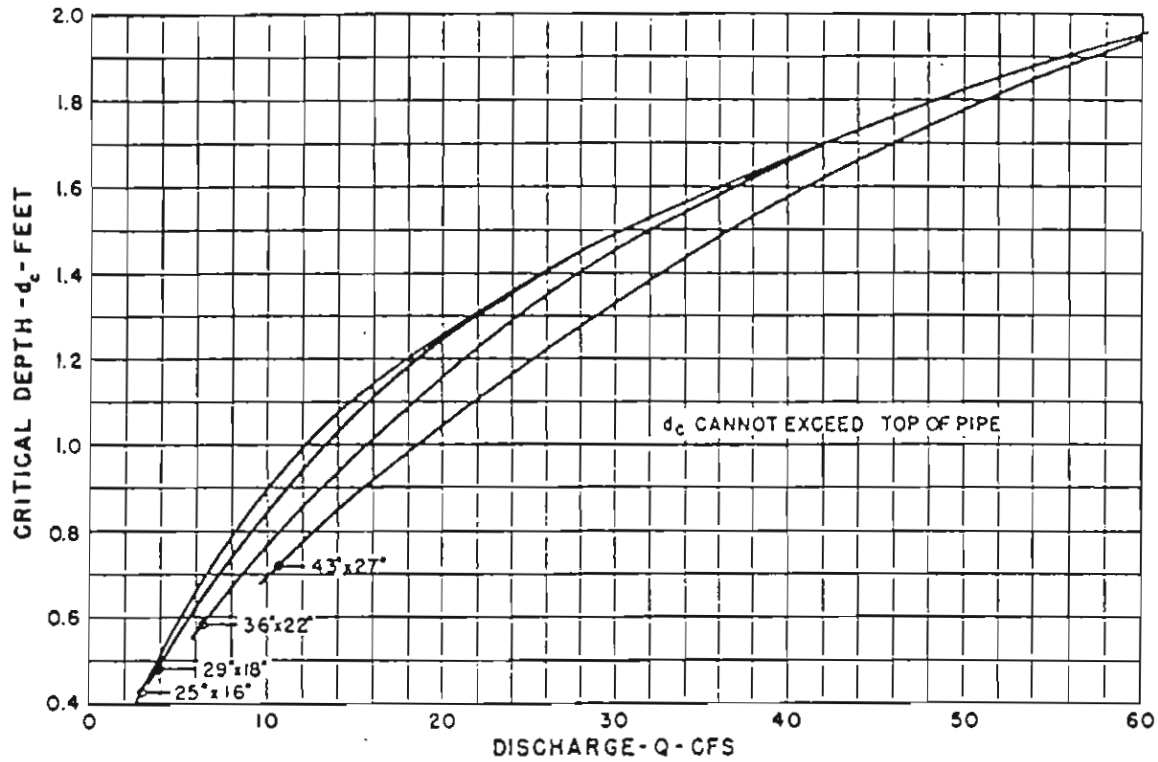
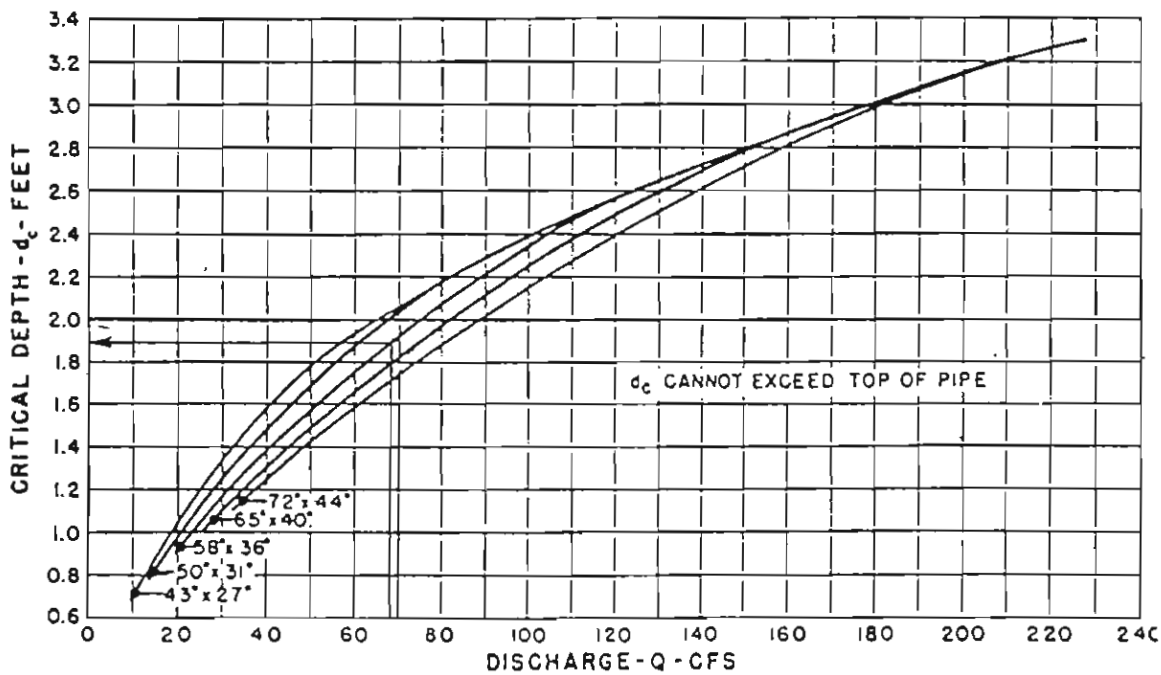

Entrance Conditions
(2) 90° headwall.
(4) Mitered to embankment.
(5) Thin wall projecting corrugated metal.
Arch Area in square feet
Discharge (Q) in cfs
Headwater Depth to Rise (H W / D)
(2)
(4)
(5)
Example
A = 1.05 ft²
Q = 1400 cfs
Entrance Type
HW/D
HW
(2) 1.50 12.38
(4) 1.75 14.44
(5) 1.63 13.45
RISE
SPAN
HEADWATER DEPTH
FOR C.M. ARCH CULVERTS
0.5 ≤ RISE / SPAN
WITH INLET CONTROL
Nomographs adapted from material furnished by
Kaiser Aluminum and Chemical Corporation
Duplication of this nomograph may distort scale

CHART 37



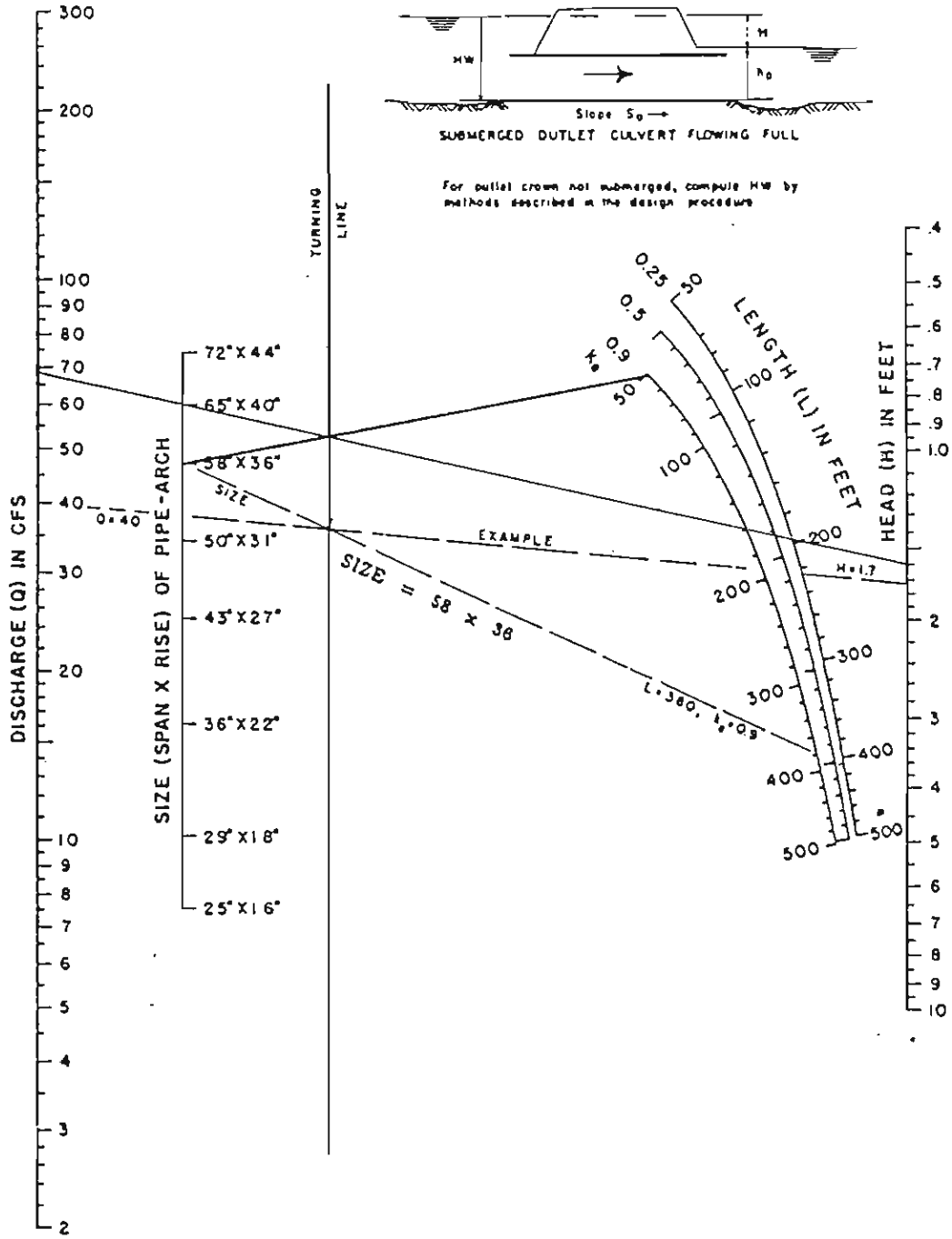


BUREAU OF PUBLIC ROADS

JAN. 1964

CRITICAL DEPTH
STANDARD C.M. PIPE-ARCH

CHART 39



HEAD FOR STANDARD C. M. PIPE-ARCH CULVERTS FLOWING FULL n=0.024

BUREAU OF PUBLIC ROADS JAN. 1963

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-13-91 CHKD BY: RMW DATE: 6/17/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 3

DESCRIPTION Intermediate Stage (Temporary) Surface Drainage

Outlet Ditch 1

This ditch will carry outflow from the principle spillway of Sediment Pond 1 to the existing collection pond. This needs only to be designed for the maximum flow from the spillway since it will be abandoned with the pond when the pile is vegetated and closed

Q = 76.16 cfs S = 30%

SOLUTION FOR MANNING'S EQUATION: OPEN CHANNEL FLOW

24 HOUR STORM FREQUENCY (years)	10
INPUT PARAMETERS	
SLOPE (ft/ft)	.3
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	5.00
OUTPUT VALUES	
FLOWRATE (cfs)	76.16
VELOCITY (fps)	11.59
DEPTH OF FLOW (ft)	.95
FLOW AREA (sf)	6.57
WETTED PERIMETER (ft)	9.26
HYDRAULIC RADIUS (ft)	.71
ACTUAL MANNINGS N	.057
D50 RIPRAP SIZE (in)	8.00

Channel Depth = 0.95 ft + 0.5 = 1.45 say 1.5 ft

Freeboard = 0.55 ft

Riprap lined

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: TMC DATE: 5-13-91 CHKD BY: PNW DATE: 6/17/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 2 OF 3

DESCRIPTION Intermediate Stage (Temporary) Surface Drainage

Outlet Ditch 2

This ditch will carry outflow from the principle spillway of Sediment Pond 2 to the existing collection pond. This ditch needs only to be designed for the maximum flow from the spillway since it will be abandoned with the pond when the pile is revegetated and closed

$Q = 35.79$ cfs $\quad s = 9.1\%$

SOLUTION FOR MANNING'S EQUATION: OPEN CHANNEL FLOW

24 HOUR STORM FREQUENCY (years)	10
INPUT PARAMETERS	
SLOPE (ft/ft)	.091
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	4.00
OUTPUT VALUES	
FLOWRATE (cfs)	35.79
VELOCITY (fps)	6.26
DEPTH OF FLOW (ft)	.96
FLOW AREA (sf)	5.72
WETTED PERIMETER (ft)	8.31
HYDRAULIC RADIUS (ft)	.69
ACTUAL MANNINGS N	.057
D50 RIPRAP SIZE (in)	8.00

Actual Channel Depth = 0.96 + 0.5 = 1.46 ft say 1.5 ft

Freeboard = 0.54 ft

riprap lined

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 6-13-91 CHKD BY: RMW DATE: 6/17/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 3 OF 3

DESCRIPTION Intermediate Stage (Temporary)
Surface drainage

Outlet Ditch 3

This ditch will carry outflow from the principle spillway of sediment pond 3A into sediment pond 3B. This needs only to be designed for the maximum flow from the spillway since it will be abbandoned with the pond when the pile is vegitated and dosed

$Q = 40.46\ cfs$ $S = 16.7\%$

SOLUTION FOR MANNING'S EQUATION: OPEN CHANNEL FLOW

24 HOUR STORM FREQUENCY (years)	10
INPUT PARAMETERS	
SLOPE (ft/ft)	.167
ROUGHNESS COEFFICIENT (Manning's n)	.06
SLOPE: LEFT BANK (horizontal/vertical)	2.00
SLOPE: RIGHT BANK (horizontal/vertical)	2.00
BOTTOM WIDTH (ft)	3.00
OUTPUT VALUES	
FLOWRATE (cfs)	40.46
VELOCITY (fps)	8.26
DEPTH OF FLOW (ft)	.99
FLOW AREA (sf)	4.90
WETTED PERIMETER (ft)	7.41
HYDRAULIC RADIUS (ft)	.66
ACTUAL MANNINGS N	.056
D50 RIPRAP SIZE (in)	8.00

Actual Channel Depth = 0.99 + 0.5 = 1.49 feet

Say 1.5 feet

Freeboard = 0.51 feet

riprap lined

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: SP DATE: June 3 1991
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 1 OF 5
DESCRIPTION Design of Underdrains

Determination of Seepage

The top flow line has been constructed assuming:

1. The maximum crest El. 640
2. The average water El. 632 for this stage
3. no underdrains are installed
4. The effect due to the settled fine refuse on the total discharge is neglected.

The preceeding assumption will lead to a conservative design

Determine q:

$$q = KS$$

where

q = unit discharge per foot of dam section

K = permeability of the dam material

$S = \sqrt{d^2 + h_2^2} - d$ (see attached drawing)

$= 10.0$ ft

assuming $K = 10^{-3}$ cm/sec (very conservative, actual test shows 1.5×10^{-2} cm/s)

$$q = KS = (10^{-3}\ \text{cm/sec})(10\ \text{ft})\left(\frac{1\ \text{ft}}{30.48\ \text{cm}}\right)\left(\frac{86400\ \text{sec}}{\text{Day}}\right)$$

$$= 28.3\ \text{ft}^2/\text{day}/\text{ft}$$

Ref.: Fundamentals of Soil Mechanics by DW Taylor, 1948, p 178

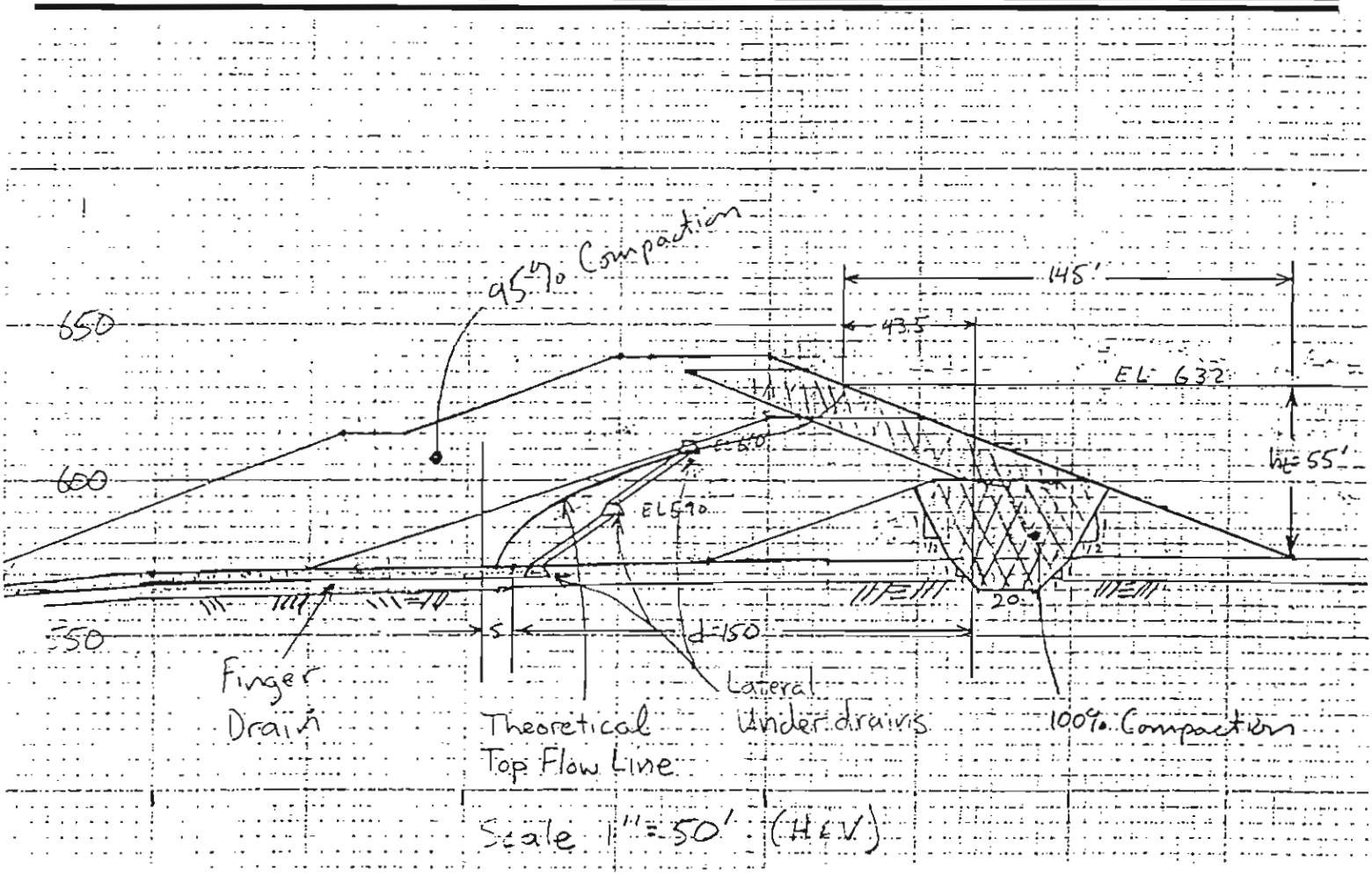
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: _____ DATE: _____

PROJECT NAME: Concord

PROJECT NO. 90-55-17 SHEET 2 OF 5

DESCRIPTION Design of Underdrains



$$s = \sqrt{d^2 + h^2} - d = \sqrt{150^2 + 55^2} - 150 = 9.78 \text{ ft} \quad \text{say } 10.0 \text{ ft}$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: _____ DATE: _____

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 3 OF 5

DESCRIPTION Design of Underdrains

Lateral Underdrains and Finger Drains

Total number of lateral underdrains = 3

$q = 28.3$ ft²/day/ft

Max discharge per underdrain = $\frac{28.3}{3} = 9.4$ ft²/day/ft

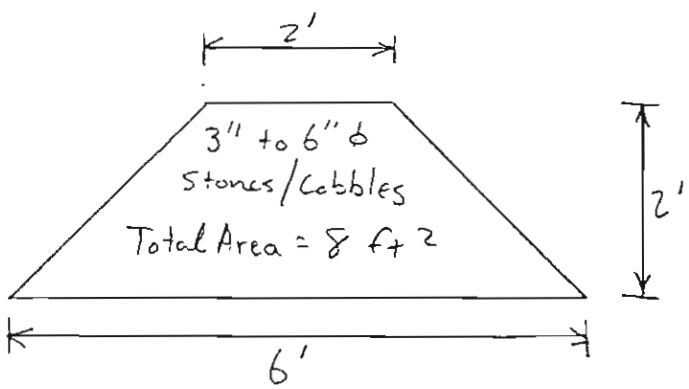
Max length of underdrain sloping to finger drain = 200 ft

Max discharge through lateral underdrain =

$= 9.4 \times 200$

$= 1880$ ft³/Day

The lateral underdrains are laid at 2% (min) slope of the size shown below:



Estimation of Permeability of 3" to 6" ϕ Stones

From Seepage, Drainage, and Flow Nets by H. R. Cedergren, 2nd Ed, 1972

Effective Diameter = $\frac{D}{6.5}$ where D = diameter of particle (p 180)

Avg. Diameter = $(3+6)/2 = 4.5$ in

Deff = $\frac{4.5}{6.5} = 0.69$ say 0.7 in

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-30-91 CHKD BY: ? DATE: ?

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 4 OF 5

DESCRIPTION Design of Underdrains

From Fig 2, the minimum permeability of 3" to 6" ϕ Stone
= 300 cm/sec

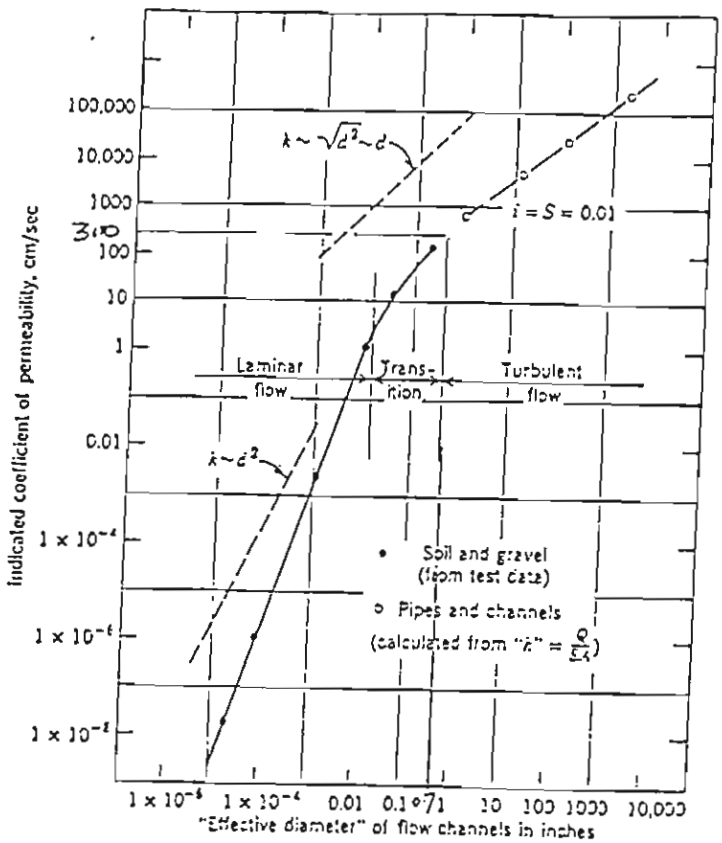


FIG. 2. Variations in "permeability" with size of flow channels.

(From Seepage Drainage & Flownets by Cedergren)

Also, from Hazen formula $K = C_1 D_{10}^2$

where

D_{10} = the effective size in cm

C_1 varies from about 90 to 120 (100 is often used)

so. $K = C_1 D_{10}^2 = (100)(0.7 \times 2.54)^2 = 316$ cm/sec ≈ 300 cm/sec

Assume $K = 300$ cm/sec or 850,394 ft/day

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DM/ DATE: 5-30-91 CHKD BY: JP DATE: 5/31/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 5 OF 5
DESCRIPTION Design of Underdrains

Capacity of Lateral Underdrains

$Q = K i A$ where:

Q = Total discharge in cfs
i = min gradient (2%)
A = Area of Underdrain = 8 ft²
K = permeability = 850,394 ft/day

$Q = (850,394)(0.02)(8) = 136,063$

$F.S. = \frac{136,063}{1880} = 72$ ok

Capacity of Finger Drains

A maximum of 6 200 ft Lateral Underdrains will drain into each Finger Drain

$Q_{finger} = Q_{under} \times 6$

$= 1880 \text{ ft}^3/\text{D} \times 6 = 11280 \text{ ft}^3/\text{D}$

$FS = \frac{136,063 \text{ ft}^3/\text{D}}{11280 \text{ ft}^3/\text{D}} = 12$ ok

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: U D DATE: 6/5/91 CHKD BY: ZDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 1 OF 8
DESCRIPTION Geotextile Design

Design Calculations to varify the obility of the geotextile to resist piping and Clogging

Following are the design Criterion recommended by various organizations
Reference: Designing with Geosynthetics by R. M. Koerner, Prentice Hall, 1990

(A) AASHTO -- Task Force #25

1. Soil ≤ 50% passing the No. 200 sieve
   AOS of the fabric ≥ No. 30 sieve (i.e., O_{95} < 0.59 mm)
2. Soil > 50% passing the No. 200 sieve
   AOS of the fabric ≥ No. 50 sieve (i.e., O_{95} < 0.297 mm)

AOS - The number of the U.S. Standard sieve having openings closest in size to the largest openings in a filter fabric

In the most recent publication "Designing With Geosynthetics" by R. M. Koerner Published by Prentice Hall 2nd Ed. 1990 beside the Task Force #25 following slightly more conservative recommendations are also given

(B) $O_{95} < (2 \text{ to } 3)\, d_{85}$ (Slight more conservative)

where d_{85} = particle size in millimeters for which 85% of the sample is finer

(C) - The most conservative method is after Giroud (1982), who presents a table for recommended O_{95} values (i.e. the opening size in millimeters corresponding to AOS value) in terms of relative density (D_R), coefficient of uniformity (CU) and average particle size (d_{50}) (see table on the next page)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Corinne
PROJECT NO. 90-[illegible]-97 SHEET 2 OF 8
DESCRIPTION Geotextile Design

(C) (Continued)

TABLE 2.14 RELATIONSHIPS USED TO OBTAIN FABRIC OPENING SIZE TO PREDICT EXCESSIVE LOSS OF FINES DURING FILTRATION*

Relative density	$1 < CU < 3$	$CU > 3$
Loose ($D_R < 50\%$)	$O_{95} < (CU)\,(d_{50})$	$O_{95} < (9d_{50})/CU$
Intermediate ($50\% < D_R > 80\%$)	$O_{95} < 1.5(CU)\,(d_{50})$	$O_{95} < (13.5d_{50})/CU$
Dense ($D_R > 80\%$)	$O_{95} < 2(CU)\,(d_{50})$	$O_{95} < (18d_{50})/CU$

Source: After Giroud [42]

*d_{50}, Soil particle size corresponding to 50% finer; CU, coefficient of uniformity ($=d_{60}/d_{10}$); d_{10}, soil particle size corresponding to 10% finer; d_{60}, soil particle size corresponding to 60% finer; O_{95}, apparent opening size of geotextile (if data are not given by the manufacturer, this value is approximately the AOS sieve value in millimeters).

(D) U.S. Army Corps of Engineer (1) REF. NO: 1 "GEOTEXTILE ENGINEERING MANUAL COURSE TEXT PREPARED FOR THE FEDERAL HIGHWAY ADMIN., PREPARED BY T. CONSULTANTS LTD, DATED MARCH, 198

a. for natural soils containing 50% or less by weight passing the U.S. No. 200 (0.074 mm) sieve:

$$\frac{D_{85}\text{ soil (mm)}}{\text{EOS geotextile (mm)}} \geq 1$$

b. all other soil types:

EOS of geotextile $\leq$ U.S. No. 70 (0.211 mm) sieve. Note: a geotextile should not be used where D_{85} is less than U.S. No. 200 (0.074 mm) sieve.

c. no geotextile should be specified with an EOS less than U.S. No. 100 (0.149 mm) sieve.

d. specify a fabric with openings as large as allowed by the criteria.

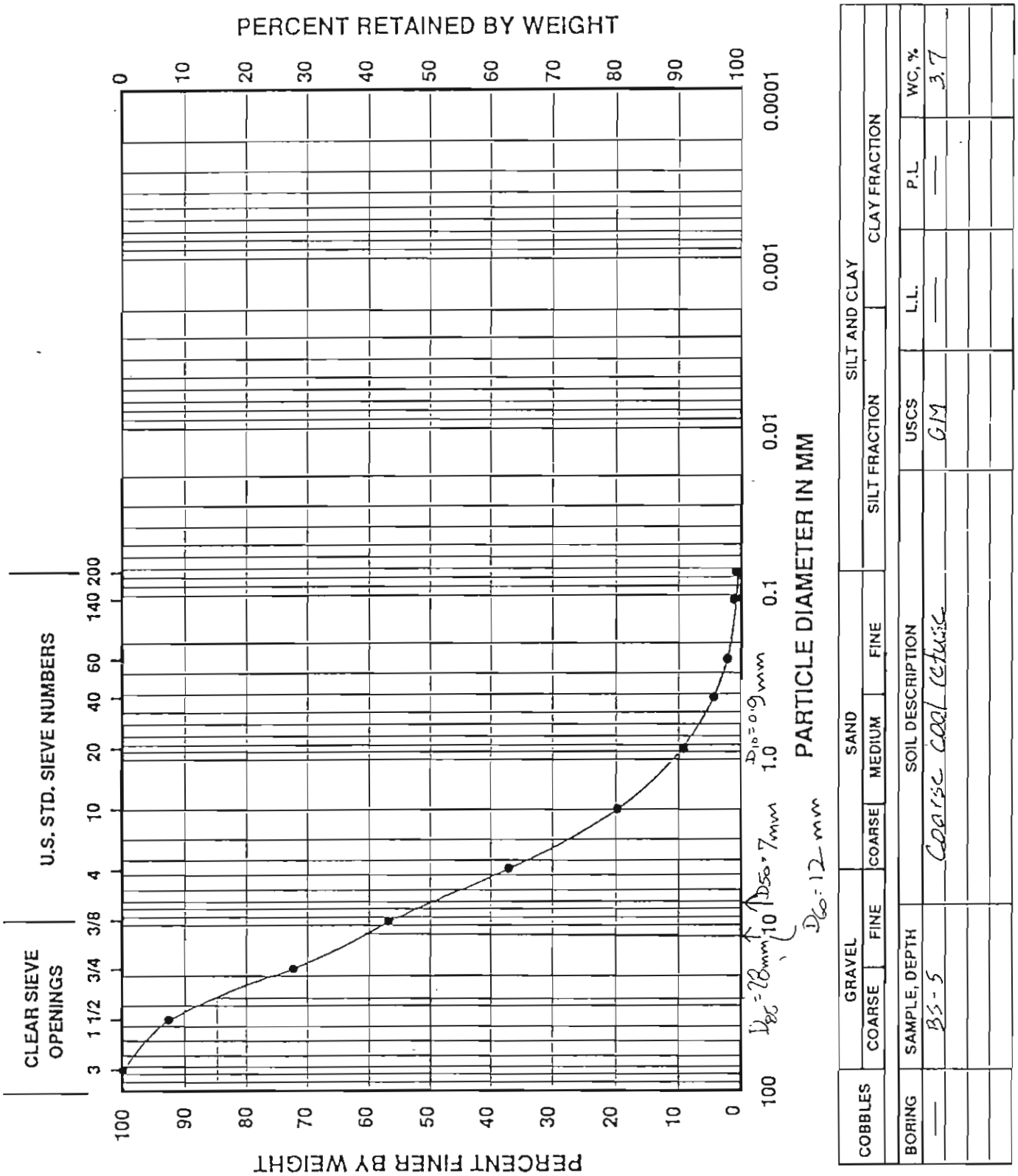
The grain size distribution of the coarse coal refuse which may cause the piping and clogging of the geotextile is shown on the next page.

Geotechnical Design
Sheet 3 of 8
EDC 6/6/91

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT NAME: U.S.S. CONCORD
PROJECT NO.: 90-55-27
BORING NUMBER: -
PLOTTED BY: RLF
CHECKED BY: WS 3/11/91

GRAIN SIZE ANALYSIS



COBBLES	GRAVEL		SAND			SILT AND CLAY					
	COARSE	FINE	COARSE	MEDIUM	FINE	SILT FRACTION	CLAY FRACTION	USCS	L.L.	P.L.	WC, %
BORING	SAMPLE, DEPTH		SOIL DESCRIPTION								
—	B5 - 5		Coarse coal detritus					GM	—	—	3.7

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: U D DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 4 OF 8
DESCRIPTION Geotextile Design

The coarse coal refuse grain size has following characteristics:
Less than 50% material passes through #200 sieve

$D_{85} = 28$ mm

$D_{60} = 12$ mm

$D_{50} = 7$ mm

$D_{10} = 0.9$ mm

$$C_u = \frac{D_{60}}{D_{10}} = \frac{12}{0.9} = 13.3 > 3$$

Criterion (A)

For less than 50% material passing the #200 sieve

$O_{95} < 0.59$ mm

Criterion (B)

$O_{95} < (2 \text{ to } 3) D_{85} = (2 \text{ to } 3)\, 20$

$O_{95} < 56 \text{ to } 84$ mm

Criterion (C)

For Dense compacted soil ($D_R > 80\%$) and $C_u > 3$

$$O_{95} < \frac{18\, D_{50}}{C_u}$$

$$< \frac{18 \times 7}{13.3}$$

< 9.5 mm

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 5 OF 8
DESCRIPTION Geotextile Design

Criterion (4)

(a) $\frac{D_{85}}{O_{95}} \geq 1$

$D_{85} \geq O_{95}$

$O_{95} \leq D_{85}$

$O_{95} \leq 28$ mm

(b) Not Applicable

(c) $O_{95} >$ U.S. No. 100 (0.149 mm)

(d) Specify a fabric as large as allowed by the criteria

Based on above criteria the O_{95} opening should be restricted to following size

$0.15\text{mm} < O_{95} > 0.6$ mm

SUPAC 3½ NP has following properties:

Structure	woven needlepunched
Thickness, mils	30
EOS	50 to 80 Sieve Size (0.3 to 0.18 mm)
Permittivity (sec^{-1})	2.3
Puncture Strength (lbs)	55
Mullen Burst Strength (psi)	158
Trapezoidal Tear Strength (lbs)	90
Elongation	110

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Colcord
PROJECT NO. 90-55-27 SHEET 6 OF 8
DESCRIPTION Geotextile Design

Required Minimum Puncture Resistance

Reference: "Designing with Geosynthetics" by R. M. Koerner, Prentice Hall, 2nd Ed. 1990 page 131.

The vertical force exerted on the geotextile is as follows:

$$F_{vert} = [(\pi d_h)(h_h)p']S' \qquad (2.26)$$

where

F_{vert} = the total vertical force imposed on the fibers adjacent to the puncture;
d_h = the average diameter of the hole, where d_h (maximum) = d_a = average diameter of the aggregate (or stump, etc.);
h_h = the propagation height ($\approx d_a$);
p' = the pressure exerted on the geotextile (usually 75% to 100% of tire inflation pressure at the ground surface); and
S' = the shape factor varying from 0 for rounded blunt objects to 1.0 for sharp angular objects (for aggregate particles, the shape factor can be assumed to be (1.0 − S), where S is the sphericity, from $S = A_p/A_c$, where A_p is the projected area of the particle and A_c is the area of the smallest circumscribing circle around the particle; typical values of S are 0.8 for Ottawa sand, 0.7 for run-of-bank gravel, 0.4 for crushed rock, and 0.3 for shot rock).

This vertical force must now be converted into a tensile force in the fibers of the geotextile. This is indeed a complex problem, since both radial friction and axial rotation of the fibers against the protrusion are involved. As an approximation, however, we can use

$$\frac{F_{vert}}{T_{reqd}} = \frac{d_a}{d_i} \qquad (2.27)$$

where

F_{vert} = the total vertical force on fibers,
T_{reqd} = the required tensile force in fibers,
d_a = the average diameter of the stone, and
d_i = the initial average void diameter of geotextile.

Combining equations, with the assumptions noted above, one obtains

$$T_{reqd}\left(\frac{d_a}{d_i}\right) = (\pi d_a^2 p')S'$$

$$T_{reqd} = (\pi d_i d_a)\, p'S' \qquad (2.28)$$

This value of T_{reqd} can be compared to the puncture test (if the object is blunt, causing puncture) or to the tear test (if the object is sharp, causing tear).

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: DC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 7 OF 8
DESCRIPTION Geotable Design

For Concord Site
Maximum height of fill = 70 ft
Density of fill = 120 pcf
Average size of rock in underdrain = 2" to 8" Assumed average size 6"
S = 0.3 for shot rock

d_i = 0.3 mm = 0.0118 in

$p' = \frac{120 \times 70}{144}$ = 58.3 psi say 60 psi (neglecting arching effect)

$T_{reqd} = \pi \times 0.0118 \times 6 \times 60 \times (1-0.3)$

= 9.34 lbs

Required Factor of Safety

Required Factor of Safety

$$T_{allow} = T_{ult}\left(\frac{1}{FS_{ID} \times FS_{CR} \times FS_{CD} \times FS_{BD}}\right)$$

where

T_{allow} = the allowable tensile strength, or T_{reqd}
T_{ult} = the ultimate tensile strength,
FS_{ID} = the factor of safety for installation damage, $= \frac{1.1+2.5}{2} = 1.8$
FS_{CR} = the factor of safety for creep, $\frac{1+1.2}{2} = 1.1$
FS_{CD} = the factor of safety for chemical degradation, and $\frac{1+1.5}{2} = 1.25$
FS_{BD} = the factor of safety for biological degradation. $\frac{1+1.2}{2} = 1.1$

See attached table on next page

$T_{reqd} = T_{ult.}\left(\frac{1}{1.8 \times 1.1 \times 1.25 \times 1.1}\right) = \frac{T_{ult.}}{2.72}$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: UD DATE: 6/5/91 CHKD BY: EDC DATE: 6/6/91
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 8 OF 8
DESCRIPTION Geotextile Design

TABLE 2.12 RECOMMENDED PARTIAL FACTOR OF SAFETY VALUES FOR USE IN EQUATION 2.18

Application area	Various partial factors of safety			
	Installation damage	Creep*	Chemical degradation	Biological degradation
separation	1.1 to 2.5	1.0 to 1.2	1.0 to 1.5	1.0 to 1.2
cushioning	1.1 to 2.0	1.2 to 1.5	1.0 to 2.0	1.0 to 1.2
unpaved roads	1.1 to 2.0	1.5 to 2.5	1.0 to 1.5	1.0 to 1.2
walls	1.1 to 2.0	2.0 to 4.0	1.0 to 1.5	1.0 to 1.3
embankments	1.1 to 2.0	2.0 to 3.0	1.0 to 1.5	1.0 to 1.3
bearing capacity	1.1 to 2.0	2.0 to 4.0	1.0 to 1.5	1.0 to 1.3
slope stabilization	1.1 to 1.5	1.5 to 2.0	1.0 to 1.5	1.0 to 1.3
pavement overlays	1.1 to 1.5	1.0 to 1.2	1.0 to 1.5	1.0 to 1.1
railroads	1.5 to 3.0	1.0 to 1.5	1.5 to 2.0	1.0 to 1.2
flexible forms	1.1 to 1.5	1.5 to 3.0	1.0 to 1.5	1.0 to 1.1
silt fences	1.1 to 1.5	1.5 to 2.5	1.0 to 1.5	1.0 to 1.1

*The low end of the range refers to results that have been compensated for creep in the performance of the tests.

$T_{ult.} = T_{reqd} \times 2.72$

For $d_i = 0.3$ mm $T_{reqd} = 9.34$ lbs

$T_{ult.} = 2.72 \times 9.34$

$= 25.4$ lbs for SUPAC 3½ NP Puncture resistance is 55 lbs O.K.

The recommended geotechile should have EOS between 0.15 & 0.6 mm with minimum puncture resistance of 26 lbs

SUPAC 3½ or equivalent which satisfy the above minimum requirement should be used at Concord disposal site.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DHC DATE: [illegible] CHKD BY: UD DATE: 6/7/91

PROJECT NAME: Concord

PROJECT NO. 90-55-27 SHEET 1 OF 2

DESCRIPTION Filter Fabric Permeability Design

The purpose of this calculation is to check the selected filter fabric from the plugging / piping calculation for sufficient permeability. The selected fabric is Supac 3.5N nonwoven needlepunched polyester. It has the following properties:

thickness = t = 0.8 mm or 30 mils

permittivity = Ψ = 2.3 sec^{-1}

This fabric will be used to wrap all buried underdrains. The permeability of the fabric is given by the equation:

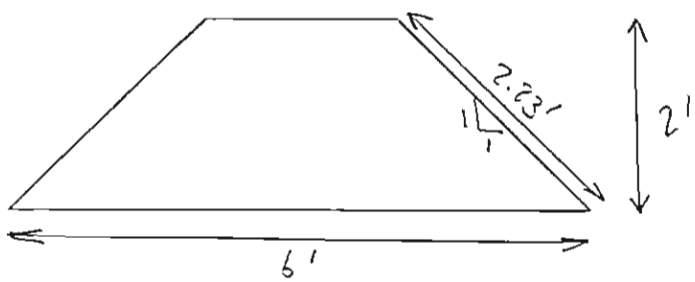
$$K = \Psi t$$

$$= (2.3\ sec^{-1})(0.8\ mm) = 1.84\ mm/s$$

$$= (1.84\ mm/s)\left(\frac{1\ cm}{10\ mm}\right) = 0.184\ cm/s$$

The maximum flow rate into the lateral drains was determined in the underdrain design to be 27.3 ft^2/day/ft. The 3 lateral drains are spaced 20' apart vertically, and 25' apart horizontally so the gradient acting on the drain is 20' ÷ 25' = 0.8

The typical dimensions of a lateral drain are:



ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: EMC DATE: 5-6-91 CHKD BY: UD DATE: 6/7/91
PROJECT NAME: Concord
PROJECT NO. 90-55.27 SHEET 2 OF 2
DESCRIPTION Filter Fabric Permeability Design

Using Darcy's Law, and assuming flow enters the underdrain only along its front face, we can determine the flow rate through the fabric.

$Q = kAi$ (Darcy Law)

where Q = flow rate
k = permeability = 0.184 cm/s
A = area = 2.83 ft x 1 ft
i = gradient = 0.2 ft/ft

$$Q = \left(0.184 \frac{cm}{sec}\right)\left(2.83\ ft^2\right)\left(0.2 \frac{ft}{ft}\right)\left(\frac{3.28\ ft}{10^2\ cm}\right)\left(\frac{86400\ sec}{1\ Day}\right)$$

$$= 1170.5\ ft^3/D \quad \text{or} \quad 1180.5\ ft^2/D/ft$$

So.

$$FS = \frac{1180.5\ ft^2/day/ft}{\frac{28.3\ ft^2/day/ft}{3\ drains}} = 125.1 \quad \underline{ok}$$

U.S. STEEL: CONCORD REFUSE SITE

SEDIMENTATION POND SPECIFICATIONS:

The following is a summary of the sedimentation pond characteristics:

SEDIMENTATION POND NO. 1

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 520 ft.
- Crest of Embankment: 540.58 ft.
- Inside Height of Embankment: 20.58 ft.
- Width of Embankment Crest: 20 ft.
- Design Sediment Level Elevation: 533 ft.
- Sediment Clean-out Elevation (80% sediment volume): 531.5 ft.

Principal Spillway Riser:
- Diameter: 18 in.
- Crest Elevation: 536 ft.
- Bottom Elevation: 530 ft.
- Height: 6 ft.
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16
- Concrete Foundation: 4 ft. x 4 ft. square x 1.5 ft. deep

Riser Perforations:

invert elevation	number of orifices	orifice size
534.0 ft.	1	6 in.
534.5 ft.	1	6 in.
535.0 ft.	1	6 in.
535.5 ft.	1	6 in.

Principal Spillway Barrel:
- Diameter: 18 in.
- Inlet Invert Elevation: 530 ft.
- Outlet Invert Elevation: 518 ft.
- Length of Barrel: 140 ft.
- Slope of Barrel: 8.6 %
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 537 ft.
- Spillway Width: 10 ft.
- Side Slopes: 1:1
- Control Section Length: 30 ft.
- Control Section Slope: 6%
- Exit Section Length: 48 ft.
- Exit Section Slope: 15%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

SEDIMENTATION POND NO. 2

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 520 ft.
- Crest of Embankment: 540 ft.
- Inside Height of Embankment: 20 ft.
- Width of Embankment Crest: 20 ft.
- Design Sediment Level Elevation: 528.5 ft.
- Sediment Clean-out Elevation (80% sediment volume): 527.5 ft.

Principal Spillway Riser:
- Diameter: 18 in.
- Crest Elevation: 532.5 ft.
- Bottom Elevation: 525.5 ft.
- Height: 7 ft.
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16
- Concrete Foundation: 4 ft. x 4 ft. square x 1.5 ft. deep

Riser Perforations:

invert elevation	number of orifices	orifice size
529.5 ft.	3	3 in.
530.0 ft.	3	3 in.
530.5 ft.	3	3 in.
531.0 ft.	3	3 in.
531.5 ft.	3	3 in.

Principal Spillway Barrel:
- Diameter: 18 in.
- Inlet Invert Elevation: 525.5 ft.
- Outlet Invert Elevation: 495 ft.
- Length of Barrel: 200 ft.
- Slope of Barrel: 15.3 %
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 533.5 ft.
- Spillway Width: 10 ft.
- Side Slopes: 1:1
- Control Section Length: 70 ft.
- Control Section Slope: 6%
- Exit Section Length: 85 ft.
- Exit Section Slope: 22.7%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

SEDIMENTATION POND NO. 3A

Pond 3A discharges through an outlet pipe into a channel which discharges into Pond 3B.

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 600 ft.
- Crest of Embankment: 620 ft.
- Inside Height of Embankment: 20 ft.
- Width of Embankment Crest: 12 ft.
- Design Sediment Level Elevation: 611 ft.
- Sediment Clean-out Elevation (80% sediment volume): 609.5 ft.

There is no Principal Spillway Riser in this Pond.

Principal Spillway Barrel:
- Diameter: 12 in.
- Inlet Invert Elevation: 615 ft.
- Outlet Invert Elevation: 612.5 ft.
- Length of Barrel: 50 ft.
- Slope of Barrel: 5%
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 617 ft.
- Spillway Width: 15 ft.
- Side Slopes: 2:1
- Control Section Length: 40 ft.
- Control Section Slope: 6%
- Exit Section Length: 60 ft.
- Exit Section Slope: 27.7%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

SEDIMENTATION POND NO. 3B

Pond Characteristics:
- Inside Slopes : 3:1
- Outside Slopes: 3:1
- Bottom of Pond Elevation: 540 ft.
- Crest of Embankment: 560 ft.
- Inside Height of Embankment: 20 ft.
- Width of Embankment Crest: 20 ft.
- Design Sediment Level Elevation: 546 ft.
- Sediment Clean-out Elevation (80% sediment volume): 545 ft.

Principal Spillway Riser:
- Diameter: 18 in.
- Crest Elevation: 550 ft.
- Bottom Elevation: 543 ft.
- Height: 7 ft.
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16
- Concrete Foundation: 4 ft. x 4 ft. square x 1.5 ft. deep

Riser Perforations:

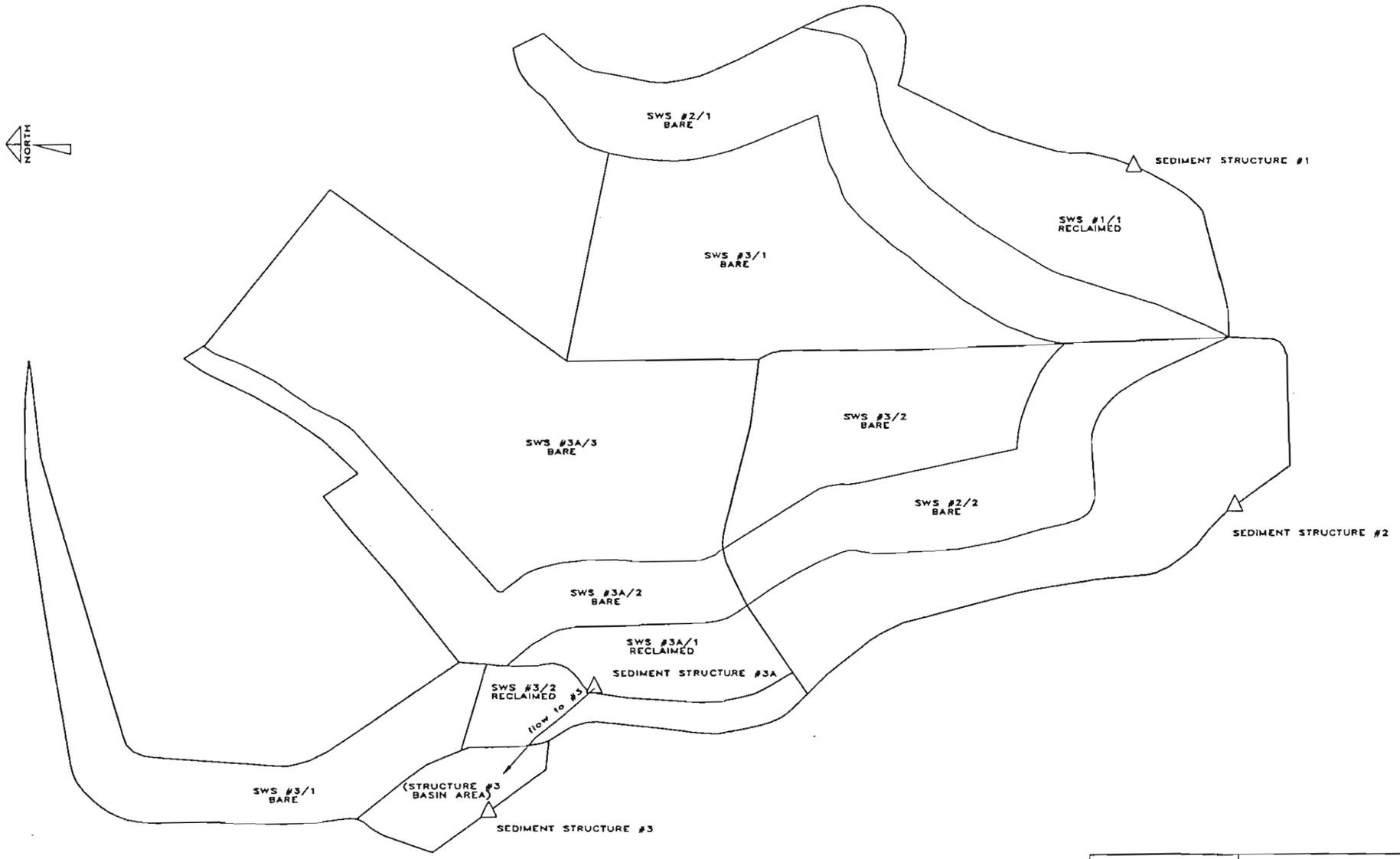
invert elevation	number of orifices	orifice size
547.0 ft.	1	0.5 in.
547.5 ft.	1	0.5 in.
548.0 ft.	1	0.5 in.
548.5 ft.	1	0.5 in.
549.0 ft.	1	0.5 in.

Principal Spillway Barrel:
- Diameter: 18 in.
- Inlet Invert Elevation: 543 ft.
- Outlet Invert Elevation: 523 ft.
- Length of Barrel: 240 ft.
- Slope of Barrel: 8.3 %
- Corrugations: 2 2/3 in. x 1/2 in.
- Gage: 16

Emergency Spillway:
- Invert Elevation: 551 ft.
- Spillway Width: 10 ft.
- Side Slopes: 1:1
- Control Section Length: 80 ft.
- Control Section Slope: 6%
- Exit Section Length: 70 ft.
- Exit Section Slope: 23%
- Both Control and Exit Sections Riprap Lined: D_{50}=6 inches

Please note that some of the above design characteristics are different from those used in the SEDCAD3 run performed by Challenge Engineering Consultants (ie: barrel inlet inverts, emergency spillway crest width, and emergency spillway exit section slopes).

These values were changed in order to maintain structural integrity and better conform to the site conditions. These changes will not affect the sediment discharge level due to the fact that the principal spillway is inlet controlled.



REVISIONS		
NO.	DATE	REMARKS

SUBWATERSHED DIAGRAM

U.S. STEEL MINING COMPANY

CONCORD REFUSE
DISPOSAL AREA

Challenge
ENGINEERING CONSULTANTS, INC.
181 EAST VINE STREET, FIFTH FLOOR, LEXINGTON, KENTUCKY 40507

SCALE:
DESIGNED BY:
DRAWN BY:
CHECKED BY:
DATE:
SHEET NO.
OF SHEETS
JOB NO.

U.S. Steel – Concord Refuse Area
Impoundment Structure Information

POND INFORMATION

Pond ID: Pond 1

	Stage/ Dimension	Elevation
Bottom of Impoundment.....	0 *Ft.*	520.00 *msl.*
Top of Impoundment.....	20.6 *Ft.*	540.58 *msl.*
Min Top Width.....	10.0 *Ft.*	
Upstream Slope.....	3 *: 1*	
Downstream Slope.....	3 *: 1*	
Sediment Depth *.....	13.00 *Ft.*	533.00 *msl.*
RISER SPILLWAY INFORMATION		
Riser Diameter	18 *In.*	
Riser Height **	3 *Ft.*	536.00 *msl.*
SLOTTED RISER INFORMATION		
Diameter	6 *In.*	
No. of Slots/Elevation	1	
Beginning Height **	1 *Ft.*	534.00 *msl.*
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	18 *In.*	
Slope	8.6 *%*	
Spillway Height **.....	–13.00 *Ft.*	520.00 *msl.*
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	10 *Ft.*	
Side Slopes	1 *: 1*	
Bed Slope	6 *%*	
Exit Slope	15 *%*	
Spillway Height **.....	4.00 *Ft.*	537.00 *msl.*
Flow In Sp'way – 10yr	1.60 *Ft.*	538.60 *msl.*
Flow In Sp'way – 25yr	1.40 *Ft.*	538.40 *msl.*

Notes:

* Above bottom of Pond
** Above sediment level
NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

Stage Storage Calculations and Graph

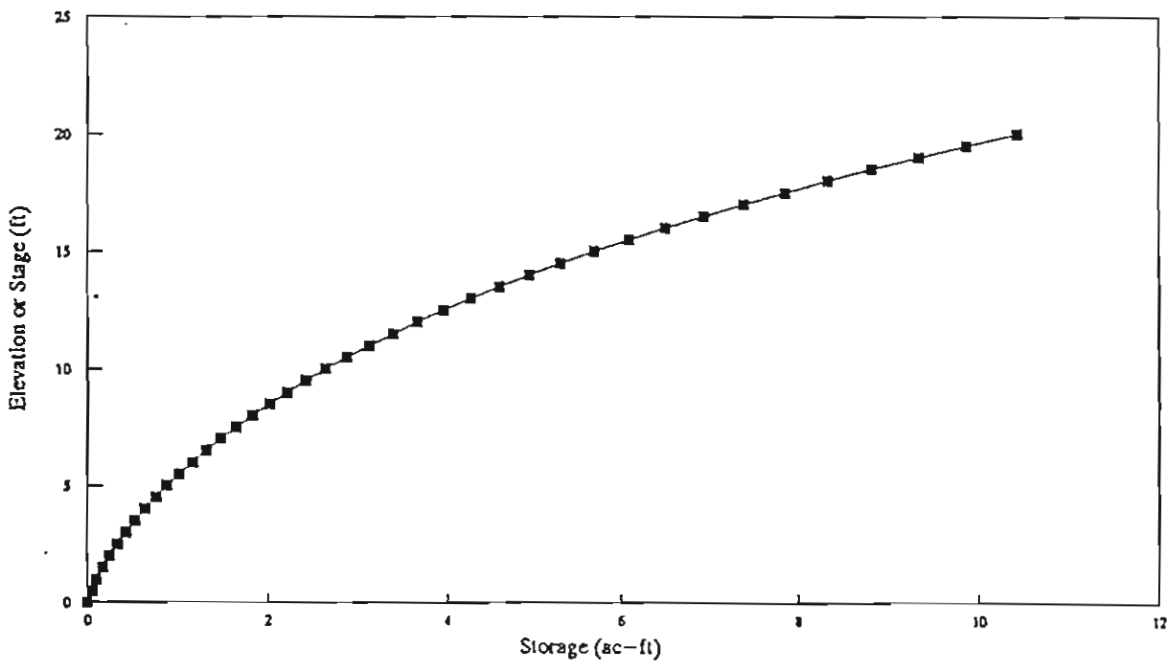
U.S. Steel – Concord Refuse Area

Pond Id: Pond 1

Stage	Area (acres)	Capacity (ac–ft)
0	0.09	0
0.5	0.1	0.05
1	0.12	0.1
1.5	0.14	0.17
2	0.16	0.24
2.5	0.17	0.33
3	0.19	0.42
3.5	0.21	0.52
4	0.23	0.63
4.5	0.25	0.75
5	0.26	0.87
5.5	0.28	1.01
6	0.3	1.16
6.5	0.32	1.31
7	0.34	1.47
7.5	0.35	1.65
8	0.37	1.83
8.5	0.39	2.02
9	0.41	2.22
9.5	0.43	2.42

Stage	Area (acres)	Capacity (ac–ft)
10	0.44	2.64
10.5	0.48	2.87
11	0.51	3.12
11.5	0.54	3.38
12	0.58	3.66
12.5	0.61	3.96
13	0.64	4.27
13.5	0.68	4.6
14	0.71	4.95
14.5	0.74	5.31
15	0.78	5.69
15.5	0.81	6.09
16	0.84	6.51
16.5	0.88	6.94
17	0.91	7.38
17.5	0.95	7.85
18	0.98	8.33
18.5	1.01	8.83
19	1.05	9.34
19.5	1.08	9.87
20	1.11	10.42

Stage Storage



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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 1

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL1

Date: 06-10-1991

Civil Software Design -- SEDCAD+ Version 3
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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Refuse Area % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	12.64*	74	M	0.028	0.000	0.000	0.0	3.36	22.98
111	2	17.14*	75	M	0.011	0.029	0.377	0.0	4.69	31.83
111	3	21.09*	75	S	0.193	0.029	0.377	0.0	5.77	28.42
		Type: Pond Label: Pond 1								
111	Structure	50.88							13.81	
111	Total IN	50.88							13.81	83.23
111	Total OUT								13.79	67.16

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	27.6				
R	111	2	0.22	30.0	40.0	0.800	0.029	1	947.5				
R	111	3	0.22	50.0	3.0	0.800	0.029	1	85.0				
			Type: Pond Label: Pond 1										
	111	Structure							1059.2				
	111	Total IN							1059.2	99420	78.04	42.83	13.70
	111	Total OUT							18.4	1607	0.28	0.17	0.09

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========
LAST POND ONLY TABLE
==========

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.81	83.23	1059.2	99420	78.04	42.83	13.70
OUT	13.79	67.16	18.4	1607	0.28	0.17	0.09

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.6	98.26	2.68

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.81	83.23	1059.2	99420	78.04	42.83	13.70
OUT	13.79	67.16	18.4	1607	0.28	0.17	0.09

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.6	98.26	2.68

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>6.00	0.0	0.0
1.50	0.7>6.00	0.0	0.7
2.00	1.6>6.00	0.0	1.6
2.50	2.8>6.00	0.0	2.8
3.00	4.1	0.0	4.1
3.50	5.2	0.0	5.2
4.00	8.5	0.0	8.5
4.50	10.4	8.4	18.9
4.70	11.1	11.8	22.9
4.80	11.4	15.3	26.7
4.90	11.7	18.9	30.7
5.00	12.0	23.1	35.1
5.50	13.5	48.9	62.4
6.00	14.7	80.7	95.5
6.50	15.9	120.2	136.1
7.00	17.0	167.3	184.3
7.50	18.0	221.3	239.3
8.00	19.0	282.1	301.1
8.50	20.0	349.9	369.9
9.00	20.8	424.8	445.6
9.50	21.7	506.7	528.4
10.00	22.5	596.0	618.5
10.50	23.1	692.6	715.7
11.00	23.3	796.7	820.0
11.50	23.4	908.5	932.0

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:57:06
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.7	0.33	0.00	
1.0	1.0	0.7	0.67	0.00	Low Orifice of SW#1
1.5	1.5	0.8	1.04	0.67	
2.0	2.0	0.8	1.42	1.61	
2.5	2.5	0.8	1.83	2.77	
3.0	3.0	0.9	2.25	4.11	Stage of SW#1
3.5	3.5	0.9	2.69	5.16	
4.0	4.0	0.9	3.15	8.51	Stage of SW#2
4.5	4.5	1.0	3.63	18.86	
4.7	4.7	1.0	3.83	22.88	
4.8	4.8	1.0	3.93	26.71	
4.9	4.9	1.0	4.03	30.65	
5.0	5.0	1.0	4.13	35.10	
5.5	5.5	1.0	4.64	62.35	
5.6	5.6	1.0	4.72	67.16	Peak Stage
6.0	6.0	1.1	5.18	95.46	
6.5	6.5	1.1	5.73	136.13	
7.0	7.0	1.2	6.30	184.34	
7.5	7.5	1.2	6.89	239.33	
8.0	8.0	1.2	7.50	301.15	
8.5	8.5	1.3	8.13	369.87	
9.0	9.0	1.3	8.78	445.59	
9.5	9.5	1.4	9.44	528.43	
10.0	10.0	1.4	10.12	618.49	
10.5	10.5	1.4	10.81	715.69	
11.0	11.0	1.4	11.51	820.01	
11.5	11.5	1.4	12.22	931.97	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 1

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL1

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Refuse Area % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	12.64*	74	M	0.028	0.000	0.000	0.0	2.49	25.70
111	2	17.14*	75	M	0.011	0.029	0.377	0.0	3.50	35.69
111	3	21.09*	75	S	0.193	0.029	0.377	0.0	4.31	29.01
		Type: Pond Label: Pond 1								
111	Structure	50.88							10.30	
111	Total IN	50.88							10.30	88.99
111	Total OUT								10.29	56.14

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
111	1	0.22	30.0	27.0	0.050	0.000	2	24.8				
111	2	0.22	30.0	40.0	0.800	0.029	1	857.6				
111	3	0.22	50.0	3.0	0.800	0.029	1	73.0				
				Type: Pond Label: Pond 1								
111	Structure							954.7				
111	Total IN							954.7	108269	84.98	52.12	6.93
111	Total OUT							16.3	1743	0.30	0.20	0.12

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.10	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	10.30	88.99	954.7	108269	84.98	52.12	6.93
OUT	10.29	56.14	16.3	1743	0.30	0.20	0.12

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.4	98.29	2.46

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	16.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	140.00	----
Barrel Slope (%)	8.60	----
Manning's n of Pipe	0.025	----
Spillway Elevation	3.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
phon Outlet Elevation	----	----
Emergency Spillway Elevation	----	4.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.67	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	10.30	88.99	954.7	108269	84.98	52.12	6.93
OUT	10.29	56.14	16.3	1743	0.30	0.20	0.12

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.4	98.29	2.46

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.5 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>6.00	0.0	0.0
1.50	0.7>6.00	0.0	0.7
2.00	1.6>6.00	0.0	1.6
2.50	2.8>6.00	0.0	2.8
3.00	4.1	0.0	4.1
3.50	5.2	0.0	5.2
4.00	8.5	0.0	8.5
4.50	10.4	8.4	18.9
4.70	11.1	11.8	22.9
4.80	11.4	15.3	26.7
4.90	11.7	18.9	30.7
5.00	12.0	23.1	35.1
5.50	13.5	48.9	62.4
6.00	14.7	80.7	95.5
6.50	15.9	120.2	136.1
7.00	17.0	167.3	184.3
7.50	18.0	221.3	239.3
8.00	19.0	282.1	301.1
8.50	20.0	349.9	369.9
9.00	20.8	424.8	445.6
9.50	21.7	506.7	528.4
10.00	22.5	596.0	618.5
10.50	23.1	692.6	715.7
11.00	23.3	796.7	820.0
11.50	23.4	908.5	932.0

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL1 User: Herb Goff
Date: 06-10-1991 Time: 21:58:36
U.S. Steel - Concord Refuse Area - Pond 1
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 1

Drainage Area from J1, B1, S1, SWS(s)1-3: 50.9 acres
Total Contributing Drainage Area: 50.9 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.7	0.33	0.00	
1.0	1.0	0.7	0.67	0.00	Low Orifice of SW#1
1.5	1.5	0.8	1.04	0.67	
2.0	2.0	0.8	1.42	1.61	
2.5	2.5	0.8	1.83	2.77	
3.0	3.0	0.9	2.25	4.11	Stage of SW#1
3.5	3.5	0.9	2.69	5.16	
4.0	4.0	0.9	3.15	8.51	Stage of SW#2
4.5	4.5	1.0	3.63	18.86	
4.7	4.7	1.0	3.83	22.88	
4.8	4.8	1.0	3.93	26.71	
4.9	4.9	1.0	4.03	30.65	
5.0	5.0	1.0	4.13	35.10	
5.4	5.4	1.0	4.52	56.14	Peak Stage
5.5	5.5	1.0	4.64	62.35	
6.0	6.0	1.1	5.18	95.46	
6.5	6.5	1.1	5.73	136.13	
7.0	7.0	1.2	6.30	184.34	
7.5	7.5	1.2	6.89	239.33	
8.0	8.0	1.2	7.50	301.15	
8.5	8.5	1.3	8.13	369.87	
9.0	9.0	1.3	8.78	445.59	
9.5	9.5	1.4	9.44	528.43	
10.0	10.0	1.4	10.12	618.49	
10.5	10.5	1.4	10.81	715.69	
11.0	11.0	1.4	11.51	820.01	
11.5	11.5	1.4	12.22	931.97	

U.S. Steel – Concord Refuse Area Impoundment Structure Information

POND INFORMATION

Pond ID: Pond 2

	Stage/ Dimension	Elevation
Bottom of Impoundment	0 *Ft.*	520.00 *msl.*
Top of Impoundment	16.3 *Ft.*	536.28 *msl.*
Min Top Width	10.0 *Ft.*	
Upstream Slope	3 *: 1*	
Downstream Slope	3 *: 1*	
Sediment Depth *	8.50 *Ft.*	528.50 *msl.*
RISER SPILLWAY INFORMATION		
Riser Diameter	18 *In.*	
Riser Height **	4 *Ft.*	532.50 *msl.*
SLOTTED RISER INFORMATION		
Diameter	3 *In.*	
No. of Slots/Elevation	3	
Beginning Height **	1 *Ft.*	529.50 *msl.*
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	18 *In.*	
Slope	15.3 *%*	
Spillway Height **	–8.50 *Ft.*	520.00 *msl.*
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	10 *Ft.*	
Side Slopes	1 *: 1*	
Bed Slope	6 *%*	
Exit Slope	9 *%*	
Spillway Height **	5.00 *Ft.*	533.50 *msl.*
Flow In Sp'way – 10yr	1.00 *Ft.*	534.50 *msl.*
Flow In Sp'way – 25yr	0.80 *Ft.*	534.30 *msl.*

Notes:

* Above bottom of Pond

** Above sediment level

NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

Stage Storage Calculations and Graph

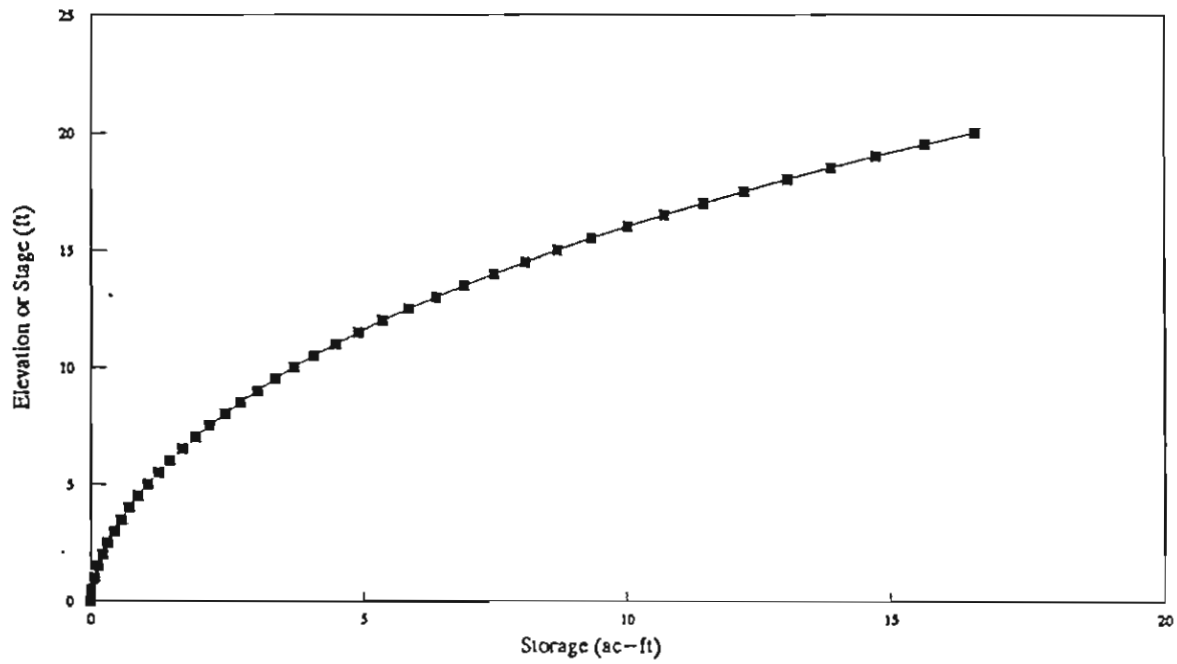
U. S. Steel – Concord Refuse Area

Pond Id: Pond 2

Stage	Area (acres)	Capacity (ac–ft)
0	0.04	0
0.5	0.08	0.03
1	0.11	0.08
1.5	0.14	0.14
2	0.17	0.22
2.5	0.21	0.31
3	0.24	0.42
3.5	0.27	0.55
4	0.31	0.7
4.5	0.34	0.86
5	0.37	1.04
5.5	0.4	1.23
6	0.44	1.44
6.5	0.47	1.67
7	0.5	1.91
7.5	0.54	2.17
8	0.57	2.45
8.5	0.6	2.74
9	0.64	3.05
9.5	0.67	3.38

Stage	Area (acres)	Capacity (ac–ft)
10	0.7	3.72
10.5	0.76	4.08
11	0.82	4.48
11.5	0.88	4.9
12	0.93	5.35
12.5	0.99	5.83
13	1.05	6.34
13.5	1.11	6.88
14	1.17	7.45
14.5	1.22	8.05
15	1.28	8.68
15.5	1.34	9.33
16	1.4	10.02
16.5	1.46	10.73
17	1.52	11.48
17.5	1.57	12.25
18	1.63	13.05
18.5	1.69	13.88
19	1.75	14.74
19.5	1.81	15.63
20	1.86	16.55

Stage Storage



File: usteel2s

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 2

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL2

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Rerfuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.00*	74	M	0.323	0.000	0.000	0.0	5.04	29.60
111	2	12.42*	75	F	0.009	0.312	0.273	0.0	3.40	23.07
111	3	12.08*	75	S	0.165	0.038	0.382	0.0	3.31	17.05
		Type: Pond Label: Pond 2								
111	Structure	43.51							11.75	
111	Total IN	43.51							11.75	68.28
111	Total OUT								11.68	35.79

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	39.9				
R	111	2	0.22	30.0	40.0	0.800	0.312	1	660.6				
R	111	3	0.22	50.0	3.0	0.800	0.038	1	46.7				
				Type: Pond Label: Pond 2									
	111	Structure							741.6				
	111	Total IN							741.6	80181	62.04	34.95	11.51
	111	Total OUT							21.5	1926	0.33	0.24	0.17

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	11.75	68.28	741.6	80181	62.04	34.95	11.51
OUT	11.68	35.79	21.5	1926	0.33	0.24	0.17

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.11	4.37

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	11.75	68.28	741.6	80181	62.04	34.95	11.51
OUT	11.68	35.79	21.5	1926	0.33	0.24	0.17

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.11	4.37

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>3.00	0.0	0.0
1.50	0.5>3.00	0.0	0.5
2.00	1.2>3.00	0.0	1.2
2.50	2.1>3.00	0.0	2.1
3.00	3.1>3.00	0.0	3.1
3.50	4.2	0.0	4.2
4.00	4.3	0.0	4.3
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	19.0	282.1	301.1
9.50	20.0	349.9	369.9
10.00	20.8	424.8	445.6
10.50	21.7	506.7	528.4
11.00	22.5	596.0	618.5
11.50	23.3	692.6	715.9

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Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:46:42
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.6	0.31	0.00	
1.0	1.0	0.7	0.63	0.00	Low Orifice of SW#1
1.5	1.5	0.7	0.98	0.50	
2.0	2.0	0.8	1.34	1.21	
2.5	2.5	0.8	1.74	2.08	
3.0	3.0	0.9	2.16	3.08	
3.5	3.5	0.9	2.62	4.20	
4.0	4.0	1.0	3.10	4.31	Stage of SW#1
4.5	4.5	1.0	3.61	5.16	
5.0	5.0	1.1	4.15	8.51	Stage of SW#2
5.5	5.5	1.2	4.71	18.86	
5.7	5.7	1.2	4.95	22.88	
5.8	5.8	1.2	5.07	26.71	
5.9	5.9	1.2	5.19	30.65	
6.0	6.0	1.2	5.31	35.10	
6.0	6.0	1.2	5.33	35.79	Peak Stage
6.5	6.5	1.3	5.94	62.35	
7.0	7.0	1.3	6.59	95.46	
7.5	7.5	1.4	7.27	136.13	
8.0	8.0	1.5	7.99	184.34	
8.5	8.5	1.5	8.73	239.33	
9.0	9.0	1.6	9.50	301.15	
9.5	9.5	1.6	10.30	369.87	
10.0	10.0	1.7	11.13	445.59	
10.5	10.5	1.7	11.99	528.43	
11.0	11.0	1.8	12.88	618.49	
11.5	11.5	1.9	13.80	715.91	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U.S. STEEL - CONCORD REFUSE AREA - POND 2

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL2

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Rerfuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	19.00*	74	M	0.323	0.000	0.000	0.0	3.74	30.67
111	2	12.42*	75	F	0.009	0.312	0.273	0.0	2.54	25.87
111	3	12.08*	75	S	0.165	0.038	0.382	0.0	2.47	17.49
		Type: Pond Label: Pond 2								
111	Structure	43.51							8.75	
111	Total IN	43.51							8.75	71.55
111	Total OUT								8.73	27.16

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
111	1	0.22	30.0	27.0	0.050	0.000	2	34.4				
111	2	0.22	30.0	40.0	0.800	0.312	1	597.9				
111	3	0.22	50.0	3.0	0.800	0.038	1	40.2				
				Type: Pond Label: Pond 2								
111	Structure							667.5				
111	Total IN							667.5	85972	66.52	42.35	5.77
111	Total OUT							18.9	2063	0.36	0.28	0.21

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

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NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	8.75	71.55	667.5	85972	66.52	42.35	5.77
OUT	8.73	27.16	18.9	2063	0.36	0.28	0.21

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.8	97.17	4.32

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
Date: 06-10-1991 Time: 20:48:13
U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
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J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	12.50	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	200.00	----
Barrel Slope (%)	15.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	3	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.63	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	8.75	71.55	667.5	85972	66.52	42.35	5.77
OUT	8.73	27.16	18.9	2063	0.36	0.28	0.21

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
5.8	97.17	4.32

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 0.7 days

****

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Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>3.00	0.0	0.0
1.50	0.5>3.00	0.0	0.5
2.00	1.2>3.00	0.0	1.2
2.50	2.1>3.00	0.0	2.1
3.00	3.1>3.00	0.0	3.1
3.50	4.2	0.0	4.2
4.00	4.3	0.0	4.3
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	19.0	282.1	301.1
9.50	20.0	349.9	369.9
10.00	20.8	424.8	445.6
10.50	21.7	506.7	528.4
11.00	22.5	596.0	618.5
11.50	23.3	692.6	715.9

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Filename: D:\SEDCAD3\USTEEL2 User: Herb Goff
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U.S. Steel - Concord Refuse Area - Pond 2
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 2

Drainage Area from J1, B1, S1, SWS(s)1-3: 43.5 acres
Total Contributing Drainage Area: 43.5 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.6	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.6	0.31	0.00	
1.0	1.0	0.7	0.63	0.00	Low Orifice of SW#1
1.5	1.5	0.7	0.98	0.50	
2.0	2.0	0.8	1.34	1.21	
2.5	2.5	0.8	1.74	2.08	
3.0	3.0	0.9	2.16	3.08	
3.5	3.5	0.9	2.62	4.20	
4.0	4.0	1.0	3.10	4.31	Stage of SW#1
4.5	4.5	1.0	3.61	5.16	
5.0	5.0	1.1	4.15	8.51	Stage of SW#2
5.5	5.5	1.2	4.71	18.86	
5.7	5.7	1.2	4.95	22.88	
5.8	5.8	1.2	5.07	26.71	
5.8	5.8	1.2	5.08	27.16	Peak Stage
5.9	5.9	1.2	5.19	30.65	
6.0	6.0	1.2	5.31	35.10	
6.5	6.5	1.3	5.94	62.35	
7.0	7.0	1.3	6.59	95.46	
7.5	7.5	1.4	7.27	136.13	
8.0	8.0	1.5	7.99	184.34	
8.5	8.5	1.5	8.73	239.33	
9.0	9.0	1.6	9.50	301.15	
9.5	9.5	1.6	10.30	369.87	
10.0	10.0	1.7	11.13	445.59	
10.5	10.5	1.7	11.99	528.43	
11.0	11.0	1.8	12.88	618.49	
11.5	11.5	1.9	13.80	715.91	

U.S. Steel – Concord Refuse Area Impoundment Structure Information

POND INFORMATION

Pond ID: Pond 3

	Stage/ Dimension	Elevation
Bottom of Impoundment	0 *Ft.*	540.00 *msl.*
Top of Impoundment	13.9 *Ft.*	553.86 *msl.*
Min Top Width	10.0 *Ft.*	
Upstream Slope	3 *: 1*	
Downstream Slope	3 *: 1*	
Sediment Depth *	6.00 *Ft.*	546.00 *msl.*

RISER SPILLWAY INFORMATION

Riser Diameter	18 *In.*	
Riser Height **	4 *Ft.*	550.00 *msl.*

SLOTTED RISER INFORMATION

Diameter	0.5 *In.*	
No. of Slots/Elevation	1	
Beginning Height **	1 *Ft.*	547.00 *msl.*

PRINCIPAL SPILLWAY INFORMATION

Spillway Diameter	18 *In.*	
Slope	8.3 *%*	
Spillway Height **	–6.00 *Ft.*	540.00 *msl.*

EMERGENCY SPILLWAY INFORMATION

Spillway Width	10 *Ft.*	
Side Slopes	1 *: 1*	
Bed Slope	6 *%*	
Exit Slope	15 *%*	
Spillway Height **	5.00 *Ft.*	551.00 *msl.*
Flow In Sp'way – 10yr	1.20 *Ft.*	552.20 *msl.*
Flow In Sp'way – 25yr	1.00 *Ft.*	552.00 *msl.*

Notes:

* Above bottom of Pond

** Above sediment level

NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

Stage Storage Calculations and Graph

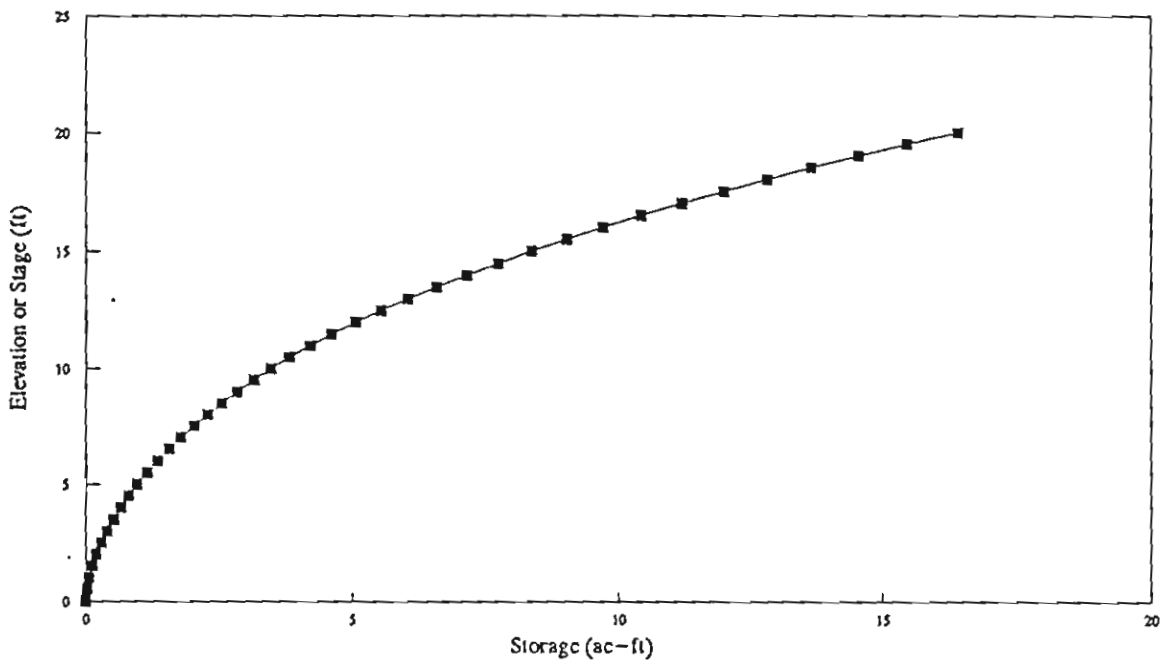
U. S. Steel – Concord Refuse Area

Pond Id: Pond 3

Stage	Area (acres)	Capacity (ac–ft)
0	0.04	0
0.5	0.07	0.03
1	0.1	0.07
1.5	0.13	0.13
2	0.16	0.2
2.5	0.19	0.29
3	0.23	0.4
3.5	0.26	0.52
4	0.29	0.66
4.5	0.32	0.81
5	0.35	0.97
5.5	0.38	1.16
6	0.41	1.35
6.5	0.44	1.57
7	0.47	1.79
7.5	0.5	2.04
8	0.53	2.3
8.5	0.56	2.57
9	0.59	2.86
9.5	0.63	3.17

Stage	Area (acres)	Capacity (ac–ft)
10	0.66	3.49
10.5	0.72	3.83
11	0.78	4.21
11.5	0.85	4.61
12	0.91	5.05
12.5	0.97	5.53
13	1.04	6.03
13.5	1.1	6.56
14	1.17	7.13
14.5	1.23	7.73
15	1.29	8.36
15.5	1.36	9.02
16	1.42	9.71
16.5	1.48	10.44
17	1.55	11.2
17.5	1.61	11.99
18	1.67	12.81
18.5	1.74	13.66
19	1.8	14.55
19.5	1.86	15.46
20	1.93	16.41

Stage Storage



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U.S. Steel – Concord Refuse Area

Impoundment Structure Information

POND INFORMATION Pond ID: Pond 3A

	Stage/ Dimension	Elevation
Bottom of Impoundment	0 Ft.	600.00 msl.
Top of Impoundment	20.0 Ft.	619.95 msl.
Min Top Width	11.0 Ft.	
Upstream Slope	2.5 : 1	
Downstream Slope	2.5 : 1	
Sediment Depth *	11.00 Ft.	611.00 msl.
PRINCIPAL SPILLWAY INFORMATION		
Spillway Diameter	12 In.	
Slope	5 %	
Spillway Height **	4.00 Ft.	615.00 msl.
EMERGENCY SPILLWAY INFORMATION		
Spillway Width	15 Ft.	
Side Slopes	2 : 1	
Bed Slope	6 %	
Exit Slope	9 %	
Spillway Height **	6.00 Ft.	617.00 msl.
Flow In Sp'way – 10yr	1.00 Ft.	618.00 msl.
Flow In Sp'way – 25yr	1.00 Ft.	618.00 msl.
Flow In Sp'way – 100yr	0.00 Ft.	617.00 msl.

Notes:

* Above bottom of Pond

** Above sediment level

NOTE: Total Depth = Maximum Stage + 1' freeboard + 5% for settling

File: usteel3a

Stage Storage Calculations and Graph

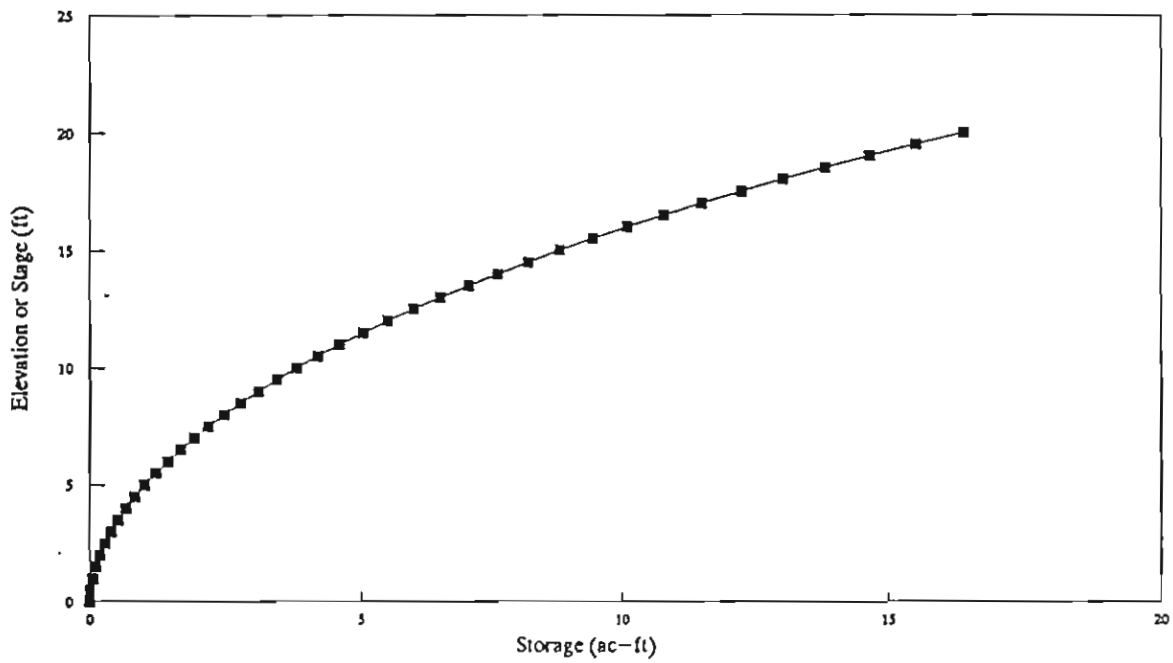
U. S. Steel – Concord Refuse Area

Pond Id: Pond 3A

Stage	Area (acres)	Capacity (ac–ft)
0	0.02	0
0.5	0.06	0.02
1	0.09	0.06
1.5	0.13	0.11
2	0.16	0.19
2.5	0.2	0.28
3	0.24	0.39
3.5	0.27	0.51
4	0.31	0.66
4.5	0.34	0.82
5	0.38	1
5.5	0.42	1.2
6	0.45	1.42
6.5	0.49	1.66
7	0.52	1.91
7.5	0.56	2.18
8	0.6	2.47
8.5	0.63	2.78
9	0.67	3.1
9.5	0.7	3.44

Stage	Area (acres)	Capacity (ac–ft)
10	0.74	3.81
10.5	0.79	4.19
11	0.84	4.6
11.5	0.9	5.03
12	0.95	5.49
12.5	1	5.98
13	1.05	6.49
13.5	1.1	7.03
14	1.15	7.59
14.5	1.21	8.18
15	1.26	8.8
15.5	1.31	9.44
16	1.36	10.11
16.5	1.41	10.8
17	1.46	11.52
17.5	1.52	12.27
18	1.57	13.04
18.5	1.62	13.83
19	1.67	14.66
19.5	1.72	15.51
20	1.77	16.38

Stage Storage



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CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U S STEEL - CONCORD REFUSE AREA - POND 3

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL3

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Refuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	5.01*	74	M	0.076	0.000	0.000	0.0	1.33	9.11
111	2	11.00*	75	F	0.011	0.014	0.394	0.0	3.01	20.42
111	3	33.00*	75	S	0.251	0.045	0.382	0.0	9.03	40.97
		Type: Pond Label: Pond 3-A								
111	Structure	49.01							13.36	
111	Total IN	49.01							13.36	68.59
111	Total OUT								13.24	40.46
2	1	0.01	73	F	0.001	0.000	0.000	0.0	0.00	0.02
		Type: Null Label: Null Structure								
211	Structure	0.01							13.37	
211	Total IN/OUT	49.02							13.37	40.46
111	to 211 Routing					0.014	0.394			
221	1	12.81*	75	F	0.335	0.000	0.000	0.0	3.50	22.18
221	2	3.91*	73	M	0.179	0.000	0.000	0.0	1.01	6.62
		Type: Null Label: Null 2								
221	Structure	16.73							4.51	
221	Total IN/OUT	16.73							4.51	28.37
311	1	0.00	75	F	0.335	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: Pond 3								
311	Structure	0.00							17.88	
311	Total IN	65.75							17.88	63.64
311	Total OUT								16.19	47.43
211	to 311 Routing					0.000	0.000			

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	9.8				
R	111	2	0.22	30.0	40.0	0.800	0.014	1	576.4				
R	111	3	0.22	50.0	3.0	0.800	0.045	1	134.0				
					Type: Pond			Label:	Pond 3-A				
	111	Structure							719.8				
	111	Total IN							719.8	97406	76.85	30.43	10.54
	111	Total OUT							8.0	561	0.10	0.08	0.06
R	211	1	0.22	100.0	40.0	0.800	0.000	1	0.4				
					Type: Null			Label:	Null Structure				
	211	Structure							8.4				
	211	Total IN/OUT							8.4	2060	0.42	0.10	0.08
	111	to 211 Routing					0.014						
R	221	1	0.22	30.0	40.0	0.800	0.000	1	657.5				
R	221	2	0.22	30.0	27.0	0.050	0.000	2	7.0				
					Type: Null			Label:	Null 2				
	21	Structure							664.5				
	221	Total IN/OUT							664.5	171354	135.35	80.42	26.71
R	311	1	0.22	40.0	40.0	0.800	0.000	1	0.0				
					Type: Pond			Label:	Pond 3				
	311	Structure							672.9				
	311	Total IN							672.9	129658	101.46	21.98	10.07
	311	Total OUT							14.4	1826	0.31	0.12	0.05
	211	to 311 Routing					0.000						

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

==========

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Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

LAST POND ONLY TABLE

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	17.88	63.64	672.9	129658	101.46	21.98	10.07
OUT	16.19	47.43	14.4	1826	0.31	0.12	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.2	97.86	1.25

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

DISCHARGE OPTIONS:

	Trickle Tube	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	50.00	----
Barrel Slope (%)	5.00	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	0.9	----
Tailwater Depth (ft)	0.0	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	6.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	2 2
Bottom Width (ft)	----	15.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm

0.00 4.20 20.00 CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.36	68.59	719.8	97406	76.85	30.43	10.54
OUT	13.24	40.46	8.0	561	0.10	0.08	0.06

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
7.0	98.90	3.89

****

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----

Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
P tom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage* (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

*Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	17.88	63.64	672.9	129658	101.46	21.98	10.07
OUT	16.19	47.43	14.4	1826	0.31	0.12	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.2	97.86	1.25

D atering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

Elevation	Trickle Tube (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0	0.0	0.0
1.50	0.0	0.0	0.0
2.00	0.0	0.0	0.0
2.50	0.0	0.0	0.0
3.00	0.0	0.0	0.0
3.50	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	0.8	0.0	0.8
5.00	2.1	0.0	2.1
5.50	3.4	0.0	3.4
6.00	4.2	0.0	4.2
6.50	4.5	12.8	17.3
6.70	4.7	17.9	22.6
6.80	4.7	23.3	28.0
6.90	4.8	28.8	33.6
7.00	4.9	35.2	40.1
7.50	5.1	75.3	80.5
8.00	5.4	125.5	130.9
8.50	5.6	188.5	194.1
9.00	5.9	264.5	270.4

****

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)

0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>0.50	0.0	0.0
1.50	0.0>0.50	0.0	0.0
2.00	0.0>0.50	0.0	0.0
2.50	0.0>0.50	0.0	0.0
3.00	0.0>0.50	0.0	0.0
3.50	0.0	0.0	0.0
0.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	18.7	282.1	300.8
9.50	18.9	349.9	368.8
10.00	19.0	424.8	443.7
10.50	19.1	506.7	525.9
11.00	19.3	596.0	615.3
11.50	19.4	692.6	712.0
12.00	19.6	796.7	816.3
12.50	19.7	908.5	928.2
13.00	19.8	1028.1	1047.9
13.50	20.0	1155.5	1175.5
14.00	20.1	1291.0	1311.1

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:38:55
U S Steel - Concord Refuse Area - Pond 3
Storm: 6.00 inches, 10 year-24 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

SW#1: Trickle Tube
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.8	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.9	0.43	0.00	
1.0	1.0	0.9	0.89	0.00	
1.5	1.5	1.0	1.38	0.00	
2.0	2.0	1.0	1.89	0.00	
2.5	2.5	1.1	2.43	0.00	
3.0	3.0	1.1	2.99	0.00	
3.5	3.5	1.2	3.58	0.00	
4.0	4.0	1.3	4.20	0.00	Stage of SW#1
4.5	4.5	1.3	4.84	0.82	
5.0	5.0	1.4	5.51	2.09	
5.5	5.5	1.4	6.20	3.42	
6.0	6.0	1.5	6.92	4.16	Stage of SW#2
6.5	6.5	1.5	7.66	17.31	
6.7	6.7	1.5	7.97	22.57	
6.8	6.8	1.5	8.12	28.01	
6.9	6.9	1.6	8.28	33.64	
7.0	7.0	1.6	8.43	40.05	
7.0	7.0	1.6	8.44	40.46	Peak Stage
7.5	7.5	1.6	9.23	80.47	
8.0	8.0	1.7	10.05	130.85	
8.5	8.5	1.7	10.90	194.08	
9.0	9.0	1.8	11.77	270.37	

****

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.4	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.4	0.21	0.00	
1.0	1.0	0.5	0.44	0.00	Low Orifice of SW#1
1.5	1.5	0.5	0.68	0.00	
2.0	2.0	0.5	0.94	0.01	
2.5	2.5	0.6	1.21	0.02	
3.0	3.0	0.6	1.50	0.03	
3.5	3.5	0.6	1.80	0.04	
0.0	0.0	0.4	0.07	0.00	
4.0	4.0	0.7	2.12	0.04	Stage of SW#1
4.5	4.5	0.7	2.46	5.16	
5.0	5.0	0.8	2.84	8.51	Stage of SW#2
5.5	5.5	0.8	3.24	18.86	
5.7	5.7	0.9	3.41	22.88	
5.8	5.8	0.9	3.50	26.71	
5.9	5.9	0.9	3.59	30.65	
6.0	6.0	0.9	3.68	35.10	
6.2	6.2	0.9	3.89	47.43	Peak Stage
6.5	6.5	1.0	4.15	62.35	
7.0	7.0	1.0	4.65	95.46	
7.5	7.5	1.1	5.19	136.13	
8.0	8.0	1.2	5.76	184.34	
8.5	8.5	1.2	6.36	239.33	
9.0	9.0	1.3	6.99	300.84	
9.5	9.5	1.4	7.65	368.77	
10.0	10.0	1.4	8.34	443.75	
10.5	10.5	1.5	9.07	525.87	
11.0	11.0	1.5	9.83	615.25	
11.5	11.5	1.6	10.62	712.02	
12.0	12.0	1.7	11.44	816.30	
12.5	12.5	1.7	12.29	928.22	
13.0	13.0	1.8	13.17	1047.90	
13.5	13.5	1.9	14.09	1175.49	
14.0	14.0	1.9	15.04	1311.12	

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

U S STEEL - CONCORD REFUSE AREA - POND 3

by

Name: Herb Goff

Company Name: Challenge Engineering Consultants
File Name: D:\SEDCAD3\USTEEL3

Date: 06-10-1991

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

Specific Gravity: 2.50
Submerged Bulk Specific Gravity: 1.25

Particle Size Distribution(s):

Size (mm)	Coal Refuse % Finer	Reclaimed Are % Finer
9.5000	56.71	100.00
4.7500	37.43	99.80
2.0000	19.74	99.60
0.8500	9.67	99.00
0.4250	4.62	97.60
0.2500	2.49	79.30
0.1060	1.13	60.80
0.0750	0.97	54.10
0.0000	0.00	0.00

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	5.01*	74	M	0.076	0.000	0.000	0.0	0.99	10.19
111	2	11.00*	75	F	0.011	0.014	0.394	0.0	2.25	22.90
111	3	33.00*	75	S	0.251	0.045	0.382	0.0	6.74	41.22
		Type: Pond Label: Pond 3-A								
111	Structure	49.01							9.97	
111	Total IN	49.01							9.97	71.39
111	Total OUT								9.94	32.45
211	1	0.01	73	F	0.001	0.000	0.000	0.0	0.00	0.02
		Type: Null Label: Null Structure								
211	Structure	0.01							9.97	
211	Total IN/OUT	49.02							9.97	32.45
111	to 211 Routing					0.014	0.394			
221	1	12.81*	75	F	0.335	0.000	0.000	0.0	2.61	23.88
221	2	3.91*	73	M	0.179	0.000	0.000	0.0	0.74	7.08
		Type: Null Label: Null 2								
221	Structure	16.73							3.36	
221	Total IN/OUT	16.73							3.36	30.23
311	1	0.00	75	F	0.335	0.000	0.000	0.0	0.00	0.00
		Type: Pond Label: Pond 3								
311	Structure	0.00							13.33	
311	Total IN	65.75							13.33	47.92
311	Total OUT								11.65	36.14
211	to 311 Routing					0.000	0.000			

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Sedimentology-

SED: Sediment
SCp: Peak Sediment Concentration
SSp: Peak Settleable Concentration
24VW: Volume Weighted Average Settleable Concentration - Peak 24 hours
24AA: Arithmetic Average Settleable Concentration - Peak 24 hours

	JBS	SWS	K	L (ft)	S (%)	CP	Tt (hrs)	PS #	SED (tons)	SCp (mg/l)	SSp (ml/l)	24VW (ml/l)	24AA (ml/l)
R	111	1	0.22	30.0	27.0	0.050	0.000	2	8.8				
R	111	2	0.22	30.0	40.0	0.800	0.014	1	521.7				
R	111	3	0.22	50.0	3.0	0.800	0.045	1	114.1				
					Type: Pond		Label:		Pond 3-A				
	111 Structure								644.3				
	111 Total IN								644.3	95979	75.71	36.59	5.79
	111 Total OUT								6.6	568	0.10	0.09	0.07
R	211	1	0.22	100.0	40.0	0.800	0.000	1	0.4				
					Type: Null		Label:		Null Structure				
	211 Structure								7.0				
	211 Total IN/OUT								7.0	4944	1.02	0.11	0.10
	111 to 211 Routing						0.014						
R	221	1	0.22	30.0	40.0	0.800	0.000	1	581.7				
R	221	2	0.22	30.0	27.0	0.050	0.000	2	6.1				
					Type: Null		Label:		Null 2				
	21 Structure								587.8				
	221 Total IN/OUT								587.8	175215	138.36	95.23	13.20
R	311	1	0.22	40.0	40.0	0.800	0.000	1	0.0				
					Type: Pond		Label:		Pond 3				
	311 Structure								594.8				
	311 Total IN								594.8	139604	109.27	25.41	5.99
	311 Total OUT								12.5	2144	0.37	0.14	0.05
	211 to 311 Routing						0.000						

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

DETAILED SUBWATERSHED INPUT/OUTPUT TABLE

Civil Software Design -- SEDCAD+ Version 3
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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========

NON-POND STRUCTURE INPUT/OUTPUT TABLE

==========

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

==========
LAST POND ONLY TABLE
==========

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
Bottom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.33	47.92	594.8	139604	109.27	25.41	5.99
OUT	11.65	36.14	12.5	2144	0.37	0.14	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.90	1.25

Dewatering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

POND INPUT/OUTPUT TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

DISCHARGE OPTIONS:

	Trickle Tube	Emergency Spillway
Riser Diameter (in)	----	----
Riser Height (ft)	----	----
Barrel Diameter (in)	12.0	----
Barrel Length (ft)	50.00	----
Barrel Slope (%)	5.00	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	----	----
# of Holes/Elevation	----	----
Entrance Loss Coefficient	0.9	----
Tailwater Depth (ft)	0.0	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----
Emergency Spillway Elevation	----	6.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	2 2
Bottom Width (ft)	----	15.0

'D RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm

0.00 4.20 20.00 CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	9.97	71.39	644.3	95979	75.71	36.59	5.79
OUT	9.94	32.45	6.6	568	0.10	0.09	0.07

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.9	98.97	3.84

****

CAUTION: THE STAGE OF YOUR PRINCIPLE SPILLWAY MAY CAUSE BED SCOUR.
YOUR OBSERVED EFFLUENT MAY NOT MEET THE DESIRED EFFLUENT STANDARD.
INCREASE THE STAGE OF YOUR PRINCIPAL SPILLWAY.

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

DISCHARGE OPTIONS:

	Perf. Riser	Emergency Spillway
Riser Diameter (in)	18.0	----
Riser Height (ft)	10.00	----
Barrel Diameter (in)	18.0	----
Barrel Length (ft)	240.00	----
Barrel Slope (%)	8.30	----
Manning's n of Pipe	0.025	----
Spillway Elevation	4.0	----
Lowest Elevation of Holes	1.0	----
# of Holes/Elevation	1	----
Entrance Loss Coefficient	----	----
Tailwater Depth (ft)	----	----
Notch Angle (degrees)	----	----
Weir Width (ft)	----	----
Siphon Crest Elevation	----	----
Siphon Tube Diameter (in)	----	----
Siphon Tube Length (ft)	----	----
Manning's n of Siphon	----	----
Siphon Inlet Elevation	----	----
Siphon Outlet Elevation	----	----

Emergency Spillway Elevation	----	5.0
Crest Length (ft)	----	25.0
Z:1 (Left and Right)	-- --	1 1
tom Width (ft)	----	10.0

POND RESULTS:

Sediment Storage½ (ac-ft)	Permanent Pool (ac-ft)	Dead Space (%)	Sediment Algorithm
0.00	0.44	20.00	CSTRS

½Sediment Capacity based on NO INPUT

	Runoff Volume (ac-ft)	Peak Discharge (cfs)	Sediment (tons)	Peak Sediment Concentration (mg/l)	Peak Settleable Concentration (ml/l)	24VW (ml/l)	24AA (ml/l)
IN	13.33	47.92	594.8	139604	109.27	25.41	5.99
OUT	11.65	36.14	12.5	2144	0.37	0.14	0.05

Peak Elevation	Trap Efficiency (%)	Hydrograph Detention Time (hrs)
6.0	97.90	1.25

' atering Time (Max. Perf. Riser Elev to Lowest Orifice): 54.1 days

****

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

Elevation	Trickle Tube (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)
0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0	0.0	0.0
1.50	0.0	0.0	0.0
2.00	0.0	0.0	0.0
2.50	0.0	0.0	0.0
3.00	0.0	0.0	0.0
3.50	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	0.8	0.0	0.8
5.00	2.1	0.0	2.1
5.50	3.4	0.0	3.4
6.00	4.2	0.0	4.2
6.50	4.5	12.8	17.3
6.70	4.7	17.9	22.6
6.80	4.7	23.3	28.0
6.90	4.8	28.8	33.6
7.00	4.9	35.2	40.1
7.50	5.1	75.3	80.5
8.00	5.4	125.5	130.9
8.50	5.6	188.5	194.1
9.00	5.9	264.5	270.4

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

Elevation	Perf. Riser (cfs)	Emergency Spillway (cfs)	Total Discharge (cfs)

0.00	0.0	0.0	0.0
0.50	0.0	0.0	0.0
1.00	0.0>0.50	0.0	0.0
1.50	0.0>0.50	0.0	0.0
2.00	0.0>0.50	0.0	0.0
2.50	0.0>0.50	0.0	0.0
3.00	0.0>0.50	0.0	0.0
3.50	0.0	0.0	0.0
0.00	0.0	0.0	0.0
4.00	0.0	0.0	0.0
4.50	5.2	0.0	5.2
5.00	8.5	0.0	8.5
5.50	10.4	8.4	18.9
5.70	11.1	11.8	22.9
5.80	11.4	15.3	26.7
5.90	11.7	18.9	30.7
6.00	12.0	23.1	35.1
6.50	13.5	48.9	62.4
7.00	14.7	80.7	95.5
7.50	15.9	120.2	136.1
8.00	17.0	167.3	184.3
8.50	18.0	221.3	239.3
9.00	18.7	282.1	300.8
9.50	18.9	349.9	368.8
10.00	19.0	424.8	443.7
10.50	19.1	506.7	525.9
11.00	19.3	596.0	615.3
11.50	19.4	692.6	712.0
12.00	19.6	796.7	816.3
12.50	19.7	908.5	928.2
13.00	19.8	1028.1	1047.9
13.50	20.0	1155.5	1175.5
14.00	20.1	1291.0	1311.1

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Company Name: Challenge Engineering Consultants
Filename: D:\SEDCAD3\USTEEL3 User: Herb Goff
Date: 06-10-1991 Time: 20:42:43
U S Steel - Concord Refuse Area - Pond 3
Storm: 5.00 inches, 25 year- 6 hour, SCS Type III
Hydrograph Convolution Interval: 0.1 hr

ELEVATION-AREA-CAPACITY-DISCHARGE TABLE

J1, B1, S1
Pond 3-A

Drainage Area from J1, B1, S1, SWS(s)1-3: 49.0 acres
Total Contributing Drainage Area: 49.0 acres

SW#1: Trickle Tube
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.8	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.9	0.43	0.00	
1.0	1.0	0.9	0.89	0.00	
1.5	1.5	1.0	1.38	0.00	
2.0	2.0	1.0	1.89	0.00	
2.5	2.5	1.1	2.43	0.00	
3.0	3.0	1.1	2.99	0.00	
3.5	3.5	1.2	3.58	0.00	
4.0	4.0	1.3	4.20	0.00	Stage of SW#1
4.5	4.5	1.3	4.84	0.82	
5.0	5.0	1.4	5.51	2.09	
5.5	5.5	1.4	6.20	3.42	
6.0	6.0	1.5	6.92	4.16	Stage of SW#2
6.5	6.5	1.5	7.66	17.31	
6.7	6.7	1.5	7.97	22.57	
6.8	6.8	1.5	8.12	28.01	
6.9	6.9	1.5	8.24	32.45	Peak Stage
6.9	6.9	1.6	8.28	33.64	
7.0	7.0	1.6	8.43	40.05	
7.5	7.5	1.6	9.23	80.47	
8.0	8.0	1.7	10.05	130.85	
8.5	8.5	1.7	10.90	194.08	
9.0	9.0	1.8	11.77	270.37	

****

J3, B1, S1
Pond 3

Drainage Area from J3, B1, S1, SWS(s)1: 0.0 acres
Total Contributing Drainage Area: 65.7 acres

SW#1: Perforated Riser
SW#2: Emergency Spillway

Elev	Stage (ft)	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	
0.0	0.0	0.4	0.00	0.00	Top of Sediment Storage (0 Stage)
0.5	0.5	0.4	0.21	0.00	
1.0	1.0	0.5	0.44	0.00	Low Orifice of SW#1
1.5	1.5	0.5	0.68	0.00	
2.0	2.0	0.5	0.94	0.01	
2.5	2.5	0.6	1.21	0.02	
3.0	3.0	0.6	1.50	0.03	
3.5	3.5	0.6	1.80	0.04	
0.0	0.0	0.4	0.07	0.00	
4.0	4.0	0.7	2.12	0.04	Stage of SW#1
4.5	4.5	0.7	2.46	5.16	
5.0	5.0	0.8	2.84	8.51	Stage of SW#2
5.5	5.5	0.8	3.24	18.86	
5.7	5.7	0.9	3.41	22.88	
5.8	5.8	0.9	3.50	26.71	
5.9	5.9	0.9	3.59	30.65	
6.0	6.0	0.9	3.68	35.10	
6.0	6.0	0.9	3.70	36.14	Peak Stage
6.5	6.5	1.0	4.15	62.35	
7.0	7.0	1.0	4.65	95.46	
7.5	7.5	1.1	5.19	136.13	
8.0	8.0	1.2	5.76	184.34	
8.5	8.5	1.2	6.36	239.33	
9.0	9.0	1.3	6.99	300.84	
9.5	9.5	1.4	7.65	368.77	
.0.0	10.0	1.4	8.34	443.75	
10.5	10.5	1.5	9.07	525.87	
11.0	11.0	1.5	9.83	615.25	
11.5	11.5	1.6	10.62	712.02	
12.0	12.0	1.7	11.44	816.30	
12.5	12.5	1.7	12.29	928.22	
13.0	13.0	1.8	13.17	1047.90	
13.5	13.5	1.9	14.09	1175.49	
14.0	14.0	1.9	15.04	1311.12	

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: ADW DATE: 6/12/91 CHKD BY: EMC DATE: 6-13-91
PROJECT NAME: CONCORD REFUSE
PROJECT NO. 90-55-27 SHEET ____ OF ____
DESCRIPTION ____

FOUNDATION DESIGN FOR RISERS

VOLUME OF RISER = $\pi \left(\frac{D}{2}\right)^2 h$

PONDS 2 AND 3 HAVE 7 ft 18"ø RISERS ⇐ DESIGN FOR THIS
POND 1 HAS 6 ft 18"ø RISERS

$$\pi \left(\frac{1.5 ft}{2}\right)^2 (7 ft) = 12.37 ft^3$$

BUOYANCY FORCE = $62.4 \frac{lb}{ft^3} \times 12.37 ft^3 = 771.89$ lbs

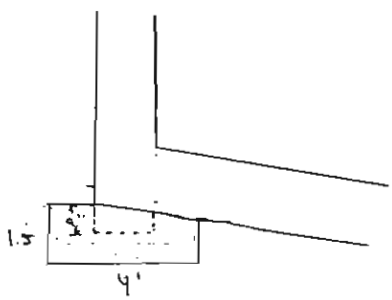
REQUIRED SAFETY FACTOR = 1.5

$771.89 lbs \times 1.5 = 1157.84$ lbs

FOUNDATION SIZING

1 ft^3 OF CONCRETE IS 150 lbs

$$\frac{1157.84 lbs}{150 lb/ft^3} = 7.72 ft^3$$



USE 4' x 4' x 1.5' SQUARE CONCRETE PAD

CORRUGATIONS
BARREL : $2\frac{2}{3} \times \frac{1}{2}$ 16 GAGE
RISER : $2\frac{2}{3} \times \frac{1}{2}$ 16 GAGE

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-6-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	1AASTC1.DAT
Output Filename:	1AASTC1.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION A-A, STATIC

BOUNDARY COORDINATES

11 Top Boundaries
24 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	568.00	345.00	568.00	2
2	345.00	568.00	370.00	572.00	2
3	370.00	572.00	490.00	617.00	1
4	490.00	617.00	520.00	614.00	2
5	520.00	614.00	535.00	619.00	2
6	535.00	619.00	565.00	630.00	1
7	565.00	630.00	585.00	630.00	1
8	585.00	630.00	710.00	675.00	1
9	710.00	675.00	1015.00	675.00	1
10	1015.00	675.00	1065.00	651.00	1
11	1065.00	651.00	1410.00	651.00	3
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	535.00	619.00	820.00	642.00	2
15	820.00	642.00	825.00	638.00	2
16	825.00	638.00	910.00	638.00	2
17	910.00	638.00	945.00	651.00	2
18	945.00	651.00	1065.00	651.00	2
19	1065.00	651.00	1210.00	556.00	2
20	.00	568.00	335.00	560.00	4
21	335.00	560.00	1210.00	556.00	4
22	335.00	560.00	870.00	544.00	4
23	870.00	544.00	1240.00	540.00	4
24	1240.00	540.00	1410.00	542.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	558.00
2	740.00	558.00
3	1020.00	618.00
4	1065.00	551.00
5	1410.00	651.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1410.00	524.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 450.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =531.00 ft.

30.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	350.00	568.80
2	379.98	567.73
3	409.98	568.12
4	439.92	569.95
5	469.74	573.22
6	499.37	577.93
7	528.74	584.06
8	557.77	591.61
9	586.41	600.54
10	614.59	610.85
11	642.23	622.50
12	669.28	635.48
13	695.67	649.75
14	721.34	665.27
15	735.81	675.00

Circle Center At X = 387.1 ; Y = 1189.1 and Radius, 621.4

*** 2.212 ***
(Runs 2 through 10 ranged from 2.236 to 2.328)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-7-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	1AADYC1.DAT
Output Filename:	1AADYC1.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION A-A, DYNAMIC

BOUNDARY COORDINATES

11 Top Boundaries
24 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	568.00	345.00	568.00	2
2	345.00	568.00	370.00	572.00	2
3	370.00	572.00	490.00	617.00	1
4	490.00	617.00	520.00	614.00	2
5	520.00	614.00	535.00	619.00	2
6	535.00	619.00	565.00	630.00	1
7	565.00	630.00	585.00	630.00	1
8	585.00	630.00	710.00	675.00	1
9	710.00	675.00	1015.00	675.00	1
10	1015.00	675.00	1065.00	651.00	1
11	1065.00	651.00	1410.00	651.00	3
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	535.00	619.00	820.00	642.00	2
15	820.00	642.00	825.00	638.00	2
16	825.00	638.00	910.00	638.00	2
17	910.00	638.00	945.00	651.00	2
18	945.00	651.00	1065.00	651.00	2
19	1065.00	651.00	1210.00	556.00	2
20	.00	568.00	335.00	560.00	4
21	335.00	560.00	1210.00	556.00	4
22	335.00	560.00	870.00	544.00	4
23	870.00	544.00	1240.00	540.00	4
24	1240.00	540.00	1410.00	542.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	558.00
2	740.00	558.00
3	1020.00	618.00
4	1065.00	551.00
5	1410.00	651.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1410.00	524.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 450.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =531.00 ft.

30.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	350.00	568.80
2	379.98	567.73
3	409.98	568.12
4	439.92	569.95
5	469.74	573.22
6	499.37	577.93
7	528.74	584.06
8	557.77	591.61
9	586.41	600.54
10	614.59	610.85
11	642.23	622.50
12	669.28	635.48
13	695.67	649.75
14	721.34	665.27
15	735.81	675.00

Circle Center At X = 387.1 ; Y = 1189.1 and Radius, 621.4

*** 1.586 ***

(Runs 2 through 10 ranged from 1.597 to 1.654)

C:\CONCORD\TYPE 1CCSTC1.D 0 2.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	3-4-91
Time of Run:	RUN2
Run By:	DMC
Input Data Filename:	1CCSTC1.DAT
Output Filename:	1CCSTC2.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION C-C, STATIC

BOUNDARY COORDINATES

16 Top Boundaries
36 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	580.00	135.00	580.00	2
2	135.00	580.00	175.00	582.00	2
3	175.00	582.00	370.00	582.00	2
4	370.00	582.00	380.00	585.00	2
5	380.00	585.00	430.00	587.00	2
6	430.00	587.00	450.00	582.00	3
7	450.00	582.00	535.00	577.00	3
8	535.00	577.00	635.00	572.00	3
9	635.00	572.00	725.00	575.00	3
10	725.00	575.00	875.00	630.00	1
11	875.00	630.00	895.00	630.00	1
12	895.00	630.00	1030.00	675.00	1
13	1030.00	675.00	1225.00	675.00	1
14	1225.00	675.00	1255.00	657.00	1
15	1255.00	657.00	1268.00	650.00	2
16	1268.00	650.00	1615.00	650.00	3
17	725.00	575.00	743.00	563.00	3
18	828.00	563.00	848.00	573.00	3
19	848.00	573.00	950.00	577.00	3
20	950.00	577.00	975.00	590.00	2
21	975.00	590.00	1000.00	595.00	2
22	1000.00	595.00	1130.00	660.00	2
23	1130.00	660.00	1255.00	657.00	2
24	1268.00	650.00	1435.00	565.00	2
25	950.00	577.00	1305.00	580.00	3
26	430.00	587.00	470.00	567.00	2
27	470.00	567.00	743.00	563.00	2
28	743.00	563.00	828.00	563.00	2

29	828.00	563.00	925.00	563.00	2
30	925.00	565.00	1140.00	560.00	2
31	1140.00	560.00	1305.00	560.00	2
32	.00	555.00	710.00	560.00	4
33	710.00	560.00	895.00	555.00	4
34	895.00	555.00	1140.00	560.00	4
35	1140.00	560.00	1435.00	555.00	4
36	1435.00	555.00	1615.00	553.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	570.00
2	975.00	570.00
3	1268.00	650.00
4	1615.00	650.00

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 700.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	655.56	572.63
2	704.53	582.61
3	754.51	564.08
4	802.81	577.00
5	846.85	600.68
6	879.30	630.00

Circle Center At X = 723.2 ; Y = 777.7 and Radius, 215.3

*** 1.838 ***

(Run 2 through 10 ranged from 1.899 to 2.004)

C:\CONCORD>TYPE 1CCDYC2.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	3-4-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	1CCDYC1.DAT
Output Filename:	1CCDYC2.OUT

PROBLEM DESCRIPTION STAGE 1, SECTION C-C, DYNAMIC

BOUNDARY COORDINATES

16 Top Boundaries
36 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	580.00	135.00	580.00	2
2	135.00	580.00	175.00	582.00	2
3	175.00	582.00	370.00	582.00	2
4	370.00	582.00	380.00	585.00	2
5	380.00	585.00	430.00	587.00	2
6	430.00	587.00	450.00	582.00	3
7	450.00	582.00	535.00	577.00	3
8	535.00	577.00	635.00	572.00	3
9	635.00	572.00	725.00	575.00	3
10	725.00	575.00	875.00	630.00	1
11	875.00	630.00	895.00	630.00	1
12	895.00	630.00	1030.00	675.00	1
13	1030.00	675.00	1225.00	675.00	1
14	1225.00	675.00	1255.00	657.00	1
15	1255.00	657.00	1268.00	650.00	2
16	1268.00	650.00	1615.00	650.00	3
17	725.00	575.00	743.00	563.00	3
18	828.00	563.00	848.00	573.00	3
19	848.00	573.00	950.00	577.00	3
20	950.00	577.00	975.00	590.00	2
21	975.00	590.00	1000.00	595.00	2
22	1000.00	595.00	1130.00	660.00	2
23	1130.00	660.00	1255.00	657.00	2
24	1268.00	650.00	1435.00	555.00	2
25	950.00	577.00	1305.00	580.00	3
26	430.00	587.00	470.00	567.00	2
27	470.00	567.00	743.00	563.00	2
28	743.00	563.00	828.00	563.00	2

29	828.00	563.00	925.00	563.00	2
30	925.00	565.00	1140.00	560.00	2
31	1140.00	560.00	1305.00	530.00	2
32	.00	555.00	710.00	560.00	4
33	710.00	560.00	835.00	555.00	4
34	835.00	555.00	1140.00	560.00	4
35	1140.00	560.00	1435.00	555.00	4
36	1435.00	555.00	1615.00	553.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	570.00
2	975.00	570.00
3	1288.00	650.00
4	1615.00	650.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 700.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	633.33	572.08
2	682.51	563.06
3	732.51	563.66
4	781.46	573.67
5	827.53	593.30
6	869.00	621.23
7	877.75	630.00

Circle Center At X = 704.4 ; Y = 630.9 and Radius, 258.8

*** 1.390 ***

(Run 2 through 10 ranged from 1.407 to 1.447

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	3FFSTC1.DAT
Output Filename:	3FFSTC2.OUT

PROBLEM DESCRIPTION STAGE 3. SECTION F-F, STATIC

BOUNDARY COORDINATES

11 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	575.00	188.00	579.00	2
2	188.00	579.00	380.00	630.00	1
3	380.00	630.00	400.00	630.00	1
4	400.00	630.00	415.00	635.00	1
5	415.00	635.00	455.00	635.00	1
6	455.00	635.00	580.00	680.00	1
7	580.00	680.00	600.00	680.00	1
8	600.00	680.00	625.00	692.00	1
9	625.00	692.00	680.00	692.00	1
10	680.00	692.00	698.00	680.00	1
11	698.00	680.00	1040.00	680.00	3
12	698.00	680.00	730.00	660.00	1
13	188.00	579.00	210.00	580.00	2
14	210.00	580.00	260.00	585.00	2
15	260.00	585.00	280.00	585.00	2
16	280.00	585.00	385.00	620.00	2
17	385.00	620.00	420.00	620.00	2
18	420.00	620.00	435.00	630.00	2
19	435.00	630.00	465.00	630.00	2
20	465.00	630.00	570.00	660.00	2
21	570.00	660.00	730.00	660.00	2
22	730.00	660.00	890.00	560.00	2
23	.00	570.00	390.00	570.00	4
24	390.00	570.00	890.00	560.00	4
25	890.00	560.00	1040.00	560.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	580.00
2	270.00	580.00
3	698.00	680.00
4	1040.00	680.00

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	560.00	390.00	560.00
2	390.00	560.00	890.00	550.00
3	890.00	550.00	1040.00	550.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 300.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =550.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	166.67	578.55
2	215.63	568.42
3	265.28	562.54
4	315.26	560.95
5	365.18	563.66
6	414.69	570.66
7	463.41	581.89
8	510.99	597.27
9	557.07	616.69
10	601.30	640.00
11	643.37	667.02
12	675.75	692.00

Circle Center At X = 308.7 ; Y = 1141.7 and Radius, 580.8

*** 1.880 ***

(Runs 2 through 10 ranged from 1.887 to 1.902)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 1
Run By: DMC
Input Data Filename: 3FFDYC1.DAT
Output Filename: 3FFDYC1.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION F-F, DYNAMIC

BOUNDARY COORDINATES

11 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	575.00	188.00	579.00	2
2	188.00	579.00	380.00	630.00	1
3	380.00	630.00	400.00	630.00	1
4	400.00	630.00	415.00	635.00	1
5	415.00	635.00	455.00	635.00	1
6	455.00	635.00	580.00	680.00	1
7	580.00	680.00	600.00	680.00	1
8	600.00	680.00	625.00	692.00	1
9	625.00	692.00	680.00	692.00	1
10	680.00	692.00	698.00	680.00	1
11	698.00	680.00	1040.00	680.00	3
12	698.00	680.00	730.00	660.00	1
13	188.00	579.00	210.00	580.00	2
14	210.00	580.00	260.00	585.00	2
15	260.00	585.00	280.00	585.00	2
16	280.00	585.00	385.00	620.00	2
17	385.00	620.00	420.00	620.00	2
18	420.00	620.00	435.00	630.00	2
19	435.00	630.00	465.00	630.00	2
20	465.00	630.00	570.00	660.00	2
21	570.00	660.00	730.00	660.00	2
22	730.00	660.00	890.00	560.00	2
23	.00	570.00	390.00	570.00	4
24	390.00	570.00	890.00	560.00	4
25	890.00	560.00	1040.00	560.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1.PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	580.00
2	270.00	580.00
3	698.00	680.00
4	1040.00	680.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	560.00	390.00	560.00
2	390.00	560.00	890.00	550.00
3	890.00	550.00	1040.00	550.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 100.00 ft.
and X = 300.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 800.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =550.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	122.22	577.60
2	171.37	568.40
3	221.02	562.54
4	270.96	560.04
5	320.95	560.92
6	370.77	565.16
7	420.19	572.76
8	468.99	583.67
9	516.93	597.85
10	563.82	615.23
11	609.42	635.74
12	653.53	659.27
13	692.57	683.62

Circle Center At X = 283.0 ; Y = 1300.7 and Radius, 740.8

*** 1.280 ***

(Runs 2 through 10 ranged from 1.280 to 1.291)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 4
Run By: DMC
Input Data Filename: 3GGSTC1.DAT
Output Filename: 3GGSTC4.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION G-G, STATIC

BOUNDARY COORDINATES

14 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	572.00	122.00	560.00	2
2	122.00	560.00	140.00	555.00	2
3	140.00	555.00	210.00	580.00	1
4	210.00	580.00	230.00	580.00	1
5	230.00	580.00	370.00	630.00	1
6	370.00	630.00	460.00	630.00	1
7	460.00	630.00	500.00	645.00	1
8	500.00	645.00	540.00	645.00	1
9	540.00	645.00	625.00	680.00	1
10	625.00	680.00	645.00	680.00	1
11	645.00	680.00	670.00	690.00	1
12	670.00	690.00	720.00	690.00	1
13	720.00	690.00	745.00	680.00	1
14	745.00	680.00	1010.00	680.00	3
15	745.00	680.00	795.00	660.00	1
16	140.00	555.00	180.00	545.00	2
17	180.00	545.00	210.00	545.00	2
18	210.00	545.00	330.00	580.00	2
19	330.00	580.00	420.00	625.00	2
20	420.00	625.00	430.00	620.00	2
21	430.00	620.00	480.00	620.00	2
22	480.00	620.00	525.00	642.50	2
23	525.00	642.50	530.00	640.00	2
24	530.00	640.00	550.00	640.00	2
25	550.00	640.00	590.00	660.00	2
26	590.00	660.00	795.00	660.00	2
27	795.00	660.00	1010.00	550.00	2
28	.00	515.00	190.00	510.00	4
29	190.00	510.00	335.00	492.00	4
30	335.00	492.00	390.00	520.00	4
31	390.00	520.00	470.00	540.00	4
32	470.00	540.00	585.00	550.00	4
33	585.00	550.00	1010.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	520.00
2	190.00	515.00
3	335.00	492.00
4	745.00	680.00
5	1010.00	680.00

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	505.00	190.00	500.00
2	190.00	500.00	335.00	482.00
3	335.00	482.00	390.00	510.00
4	390.00	510.00	470.00	530.00
5	470.00	530.00	580.00	540.00
6	580.00	540.00	1010.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 540.00 ft.

Each Surface Terminates Between X = 670.00 ft.
and X = 710.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =482.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	540.00	645.00
2	589.70	650.51
3	637.17	666.22
4	677.89	690.00

Circle Center At X = 538.6 ; Y = 884.7 and Radius, 239.7

*** 1.975 ***

(Runs 2 through 10 ranged from 2.062 to 2.204)

nd of input file

:\PCSTABL5\CONCORD)TYPE 3GGDYC1.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	3GGDYC1.DAT
Output Filename:	3GGDYC1.OUT

PROBLEM DESCRIPTION STAGE 3, SECTION G-G. DYNAMIC

BOUNDARY COORDINATES

14 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	572.00	122.00	560.00	2
2	122.00	560.00	140.00	555.00	2
3	140.00	555.00	210.00	580.00	1
4	210.00	580.00	230.00	580.00	1
5	230.00	580.00	370.00	630.00	1
6	370.00	630.00	460.00	630.00	1
7	460.00	630.00	500.00	645.00	1
8	500.00	645.00	540.00	645.00	1
9	540.00	645.00	625.00	680.00	1
10	625.00	680.00	645.00	680.00	1
11	645.00	680.00	670.00	690.00	1
12	670.00	690.00	720.00	690.00	1
13	720.00	690.00	745.00	680.00	1
14	745.00	680.00	1010.00	680.00	3
15	745.00	680.00	795.00	660.00	1
16	140.00	555.00	180.00	545.00	2
17	180.00	545.00	210.00	545.00	2
18	210.00	545.00	330.00	580.00	2
19	330.00	580.00	420.00	625.00	2
20	420.00	625.00	430.00	620.00	2
21	430.00	620.00	480.00	620.00	2
22	480.00	620.00	525.00	642.50	2
23	525.00	642.50	530.00	640.00	2
24	530.00	640.00	550.00	640.00	2
25	550.00	640.00	590.00	660.00	2
26	590.00	660.00	795.00	660.00	2
27	795.00	660.00	1010.00	550.00	2
28	.00	515.00	190.00	510.00	4
29	190.00	510.00	335.00	492.00	4
30	335.00	492.00	390.00	520.00	4
31	390.00	520.00	470.00	540.00	4
32	470.00	540.00	585.00	550.00	4
33	585.00	550.00	1010.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	520.00
2	190.00	515.00
3	335.00	492.00
4	745.00	680.00
5	1010.00	680.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	505.00	190.00	500.00
2	190.00	500.00	335.00	482.00
3	335.00	482.00	390.00	510.00
4	390.00	510.00	470.00	530.00
5	470.00	530.00	580.00	540.00
6	580.00	540.00	1010.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 500.00 ft.
and X = 540.00 ft.

Each Surface Terminates Between X = 670.00 ft.
and X = 710.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =482.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 4 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	540.00	645.00
2	589.70	650.51
3	637.17	666.22
4	677.89	690.00

Circle Center At X = 538.6 ; Y = 884.7 and Radius, 239.7

*** 1.465 ***

(Runs 2 through 10 ranged from 1.536 to 1.639)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: LMC DATE: 5-3-92 CHKD BY: RMW DATE: 5/6/92
PROJECT NAME: Concord
PROJECT NO. 90-55-27 SHEET 1 OF 8
DESCRIPTION: Stability Analysis

Purpose

The purpose of this calculation is to determine the stability of the slope in cross section A-A, during Stage 4 construction using a worst case phreatic surface. It will be assumed that both the existing and proposed impoundments will be impounding water and will create a phreatic surface directly connecting the water levels in each impoundment.

Results

Upon performing both seismic and static analyses using the program PCSTABL5 (Modified Bishop Method), the following factors of safety were calculated:

Static F.S. = 1.7 ≥ 1.5

Seismic F.S. = 1.2 ≥ 1.2

Conclusions

The slope meets the MSHA criteria for slope stability. This analysis is felt to be very conservative because the phreatic surface does not take into account effects from the underdrain that will be installed in the embankment.

** POSTAEL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	4-11-92
Time of Run:	3
Run By:	DMC
Input Data Filename:	4AASTC1.DAT
Output Filename:	4AASTC3.OUT

PROBLEM DESCRIPTION STAGE 4, SECTION A-A, STATIC

BOUNDARY COCRDINATES

8 Top Boundaries
28 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	820.00	710.00	1
6	820.00	710.00	955.00	710.00	1
7	955.00	710.00	1000.00	680.00	1
8	1000.00	680.00	1290.00	680.00	3
9	1000.00	680.00	1070.00	653.00	1
10	.00	568.00	345.00	568.00	2
11	345.00	568.00	370.00	572.00	2
12	370.00	572.00	490.00	617.00	1
13	370.00	572.00	425.00	569.00	2
14	425.00	569.00	490.00	617.00	2
15	490.00	617.00	520.00	614.00	2
16	520.00	614.00	535.00	619.00	2
17	535.00	619.00	555.00	630.00	1
18	535.00	619.00	820.00	642.00	2
19	820.00	642.00	825.00	638.00	2
20	825.00	638.00	910.00	636.00	2
21	910.00	638.00	945.00	651.00	2
22	945.00	651.00	1065.00	651.00	2
23	1065.00	651.00	1210.00	556.00	1
24	.00	568.00	335.00	560.00	4
25	335.00	560.00	370.00	556.00	4
26	335.00	560.00	870.00	544.00	4
27	870.00	544.00	1240.00	540.00	4
28	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	30.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	880.00	630.00
3	1000.00	680.00
4	1290.00	680.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1290.00	529.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 100.00 ft.
and X = 801.00 ft.

Each Surface Terminates Between X = 801.00 ft.
and X = 1100.00 ft.

At Which A Surface Extends Is Y =810.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	477.78	630.00
2	523.69	610.20
3	572.41	598.96
4	622.36	596.66
5	671.91	603.36
6	719.45	618.86
7	763.43	642.63
8	802.43	673.93
9	833.69	710.00

Circle Center At X = 610.1 ; Y = 873.7 and Radius, 277.3

*** 1.745 ***

Runs 2 through 10 ranged from 1.750 to 1.848

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 4-11-92
Time of Run: 1
Run By: DMC
Input Data Filename: 4AADYC1.DAT
Output Filename: 4AADYC1.OUT

PROBLEM DESCRIPTION STAGE 4, SECTION A-A, ~~STATIC~~ Seismic

BOUNDARY COORDINATES

8 Top Boundaries
28 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	820.00	710.00	1
6	820.00	710.00	955.00	710.00	1
7	955.00	710.00	1000.00	680.00	1
8	1000.00	680.00	1290.00	680.00	3
9	1000.00	680.00	1070.00	653.00	1
10	.00	568.00	345.00	568.00	2
11	345.00	568.00	370.00	572.00	2
12	370.00	572.00	490.00	617.00	1
13	370.00	572.00	425.00	559.00	2
14	425.00	559.00	490.00	617.00	2
15	490.00	617.00	520.00	614.00	2
16	520.00	614.00	535.00	619.00	2
17	535.00	619.00	565.00	630.00	1
18	535.00	619.00	820.00	642.00	2
19	820.00	642.00	835.00	638.00	2
20	835.00	638.00	910.00	638.00	2
21	910.00	638.00	945.00	651.00	2
22	945.00	651.00	1065.00	651.00	2
23	1065.00	651.00	1290.00	656.00	2
24	.00	568.00	535.00	568.00	4
25	535.00	568.00	565.00	555.00	4
26	565.00	555.00	870.00	544.00	4
27	870.00	544.00	1240.00	540.00	4
28	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	580.00	630.00
3	1000.00	680.00
4	1290.00	680.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

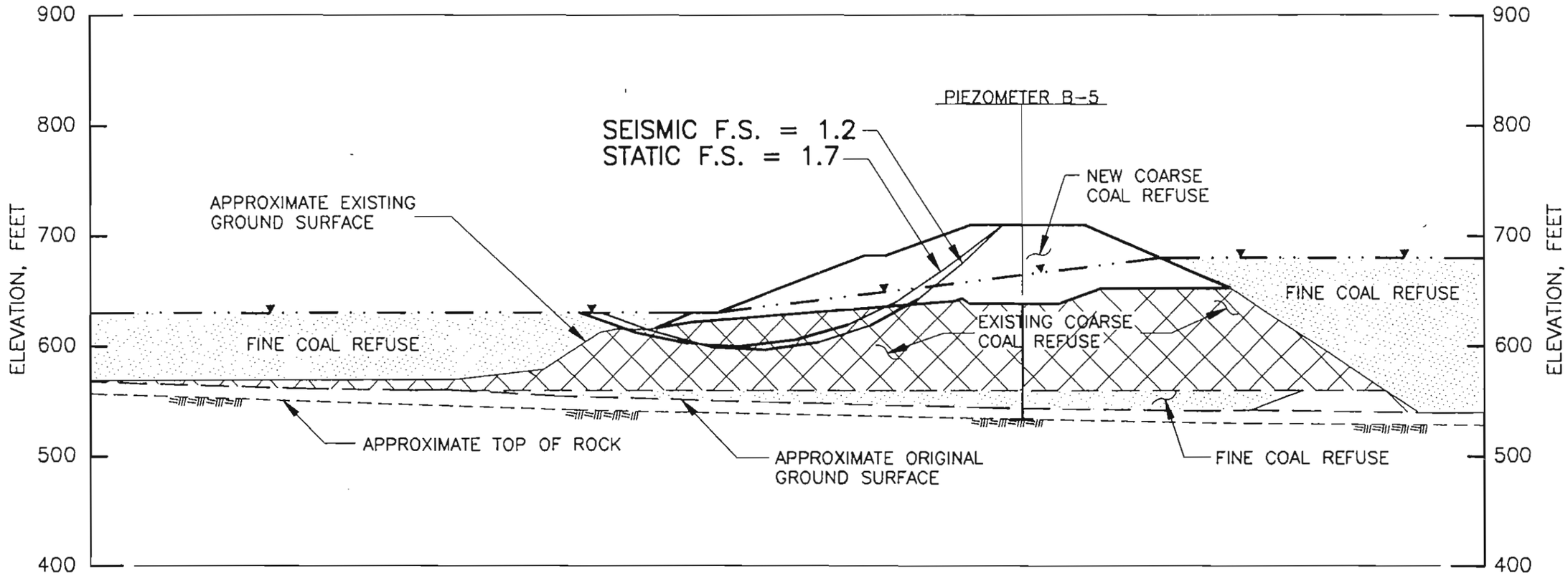
A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	580.00	570.00	630.00
2	570.00	630.00	1290.00	680.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.



STABILITY SECTION A_1-A_1, STAGE 4

SCALE
100 0 100 FEET

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS
PITTSBURGH, PA. BECKLEY, WV.

STABILITY SECTION A_1-A_1, STAGE 4
PREPARED FOR
U.S.STEEL MINING COMPANY, INC.
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY	MEL	05/14/92
CHECKED BY	DMC	6-5-92
APPROVED BY	RMN	6/9/92

EXHIBIT
DRAWING NO. 90-55-B3

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 300.00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X = 800.00 ft.
and X = 900.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =529.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	455.56	630.00
2	502.26	612.16
3	551.22	602.01
4	601.17	599.81
5	650.83	605.63
6	698.93	619.32
7	744.21	640.51
8	785.53	668.67
9	821.81	703.07
10	827.10	710.00

Circle Center At X = 589.8 ; Y = 911.4 and Radius, 311.8

*** 1.224 ***

Runs 2 through 10 ranged from 1.226 to 1.249

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-10-91
Time of Run: RUN 5
Run By: DMC
Input Data Filename: SAASTC1.DAT
Output Filename: SAASTC5.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION A-A, STATIC

BOUNDARY COORDINATES

6 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	880.00	730.00	1
6	880.00	730.00	1290.00	730.00	1
7	1000.00	680.00	1290.00	680.00	3
8	1000.00	680.00	1070.00	653.00	1
9	.00	568.00	345.00	568.00	2
10	345.00	568.00	370.00	572.00	2
11	370.00	572.00	490.00	617.00	1
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	490.00	617.00	520.00	614.00	2
15	520.00	614.00	535.00	619.00	2
16	535.00	619.00	565.00	630.00	1
17	535.00	619.00	820.00	642.00	2
18	820.00	642.00	825.00	638.00	2
19	825.00	638.00	910.00	638.00	2
20	910.00	638.00	945.00	651.00	2
21	945.00	651.00	1065.00	651.00	2
22	1065.00	651.00	1210.00	556.00	2
23	.00	568.00	335.00	560.00	4
24	335.00	560.00	1210.00	556.00	4
25	335.00	560.00	870.00	544.00	4
26	870.00	544.00	1240.00	540.00	4
27	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	560.00	630.00
3	620.00	590.00
4	1015.00	557.00
5	1290.00	552.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1290.00	529.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 550.00 ft.
and X = 650.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =529.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	627.78	647.06
2	676.51	658.24
3	724.82	671.14
4	772.63	685.76
5	819.90	702.08
6	866.55	720.07
7	889.79	730.00

Circle Center At X = 339.1 ; Y = 2018.1 and Radius, 1401.1

*** 2.062 ***

(Runs 2 through 10 range from 2.144 to 2.254)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-10-91
Time of Run:	RUN 4
Run By:	DMC
Input Data Filename:	5AADYC1.DAT
Output Filename:	5AADYC4.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION A-A, DYNAMIC

BOUNDARY COORDINATES

6 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	630.00	560.00	630.00	3
2	560.00	630.00	580.00	630.00	1
3	580.00	630.00	720.00	680.00	1
4	720.00	680.00	740.00	680.00	1
5	740.00	680.00	880.00	730.00	1
6	880.00	730.00	1290.00	730.00	1
7	1000.00	680.00	1290.00	680.00	3
8	1000.00	680.00	1070.00	653.00	1
9	.00	568.00	345.00	568.00	2
10	345.00	568.00	370.00	572.00	2
11	370.00	572.00	490.00	617.00	1
12	370.00	572.00	425.00	569.00	2
13	425.00	569.00	490.00	617.00	2
14	490.00	617.00	520.00	614.00	2
15	520.00	614.00	535.00	619.00	2
16	535.00	619.00	565.00	630.00	1
17	535.00	619.00	820.00	642.00	2
18	820.00	642.00	825.00	638.00	2
19	825.00	638.00	910.00	638.00	2
20	910.00	638.00	945.00	651.00	2
21	945.00	651.00	1065.00	651.00	2
22	1065.00	651.00	1210.00	556.00	2
23	.00	568.00	335.00	560.00	4
24	335.00	560.00	1210.00	556.00	4
25	335.00	560.00	870.00	544.00	4
26	870.00	544.00	1240.00	540.00	4
27	1240.00	540.00	1290.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	630.00
2	560.00	630.00
3	620.00	590.00
4	1015.00	557.00
5	1290.00	552.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	558.00	870.00	531.00
2	870.00	531.00	1290.00	529.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 550.00 ft.
and X = 650.00 ft.

Each Surface Terminates Between X = 850.00 ft.
and X = 950.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =529.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	627.78	647.06
2	676.51	658.24
3	724.82	671.14
4	772.63	685.76
5	819.90	702.08
6	866.55	720.07
7	889.79	730.00

Circle Center At X = 339.1 ; Y = 2018.1 and Radius, 1401.1

*** 1.519 ***

(Runs 2 through 10 ranged from 1.583 to 1.656)

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	SCCSTC1.DAT
Output Filename:	SCCSTC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION C-C. STATIC

BOUNDARY COORDINATES

7 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	577.00	110.00	577.00	2
2	110.00	577.00	250.00	630.00	1
3	250.00	630.00	270.00	630.00	1
4	270.00	630.00	400.00	680.00	1
5	400.00	680.00	420.00	680.00	1
6	420.00	680.00	545.00	730.00	1
7	545.00	730.00	1615.00	730.00	1
8	1210.00	680.00	1615.00	680.00	3
9	1210.00	680.00	1255.00	660.00	1
10	110.00	577.00	190.00	580.00	2
11	190.00	580.00	370.00	580.00	2
12	370.00	580.00	430.00	585.00	2
13	430.00	585.00	460.00	580.00	3
14	460.00	580.00	530.00	577.00	3
15	530.00	577.00	725.00	574.00	3
16	725.00	574.00	745.00	562.00	3
17	745.00	562.00	930.00	562.00	2
18	930.00	562.00	950.00	579.00	3
19	950.00	579.00	970.00	590.00	2
20	970.00	590.00	1000.00	593.00	2
21	1000.00	593.00	1130.00	660.00	2
22	1130.00	660.00	1255.00	660.00	2
23	1255.00	660.00	1435.00	555.00	2
24	430.00	585.00	470.00	565.00	2
25	470.00	565.00	745.00	562.00	2
26	950.00	579.00	1305.00	580.00	3
27	930.00	562.00	1145.00	560.00	2
28	1145.00	560.00	1305.00	580.00	2
29	.00	555.00	720.00	558.00	4
30	720.00	558.00	905.00	556.00	4
31	905.00	556.00	1145.00	560.00	4
32	1145.00	560.00	1430.00	555.00	4
33	1430.00	555.00	1615.00	555.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	575.00
2	130.00	575.00
3	270.00	580.00
4	1105.00	588.00
5	1615.00	558.00

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 400.00 ft.
and X = 700.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	577.00
2	92.86	564.49
3	142.29	557.02
4	192.24	554.67
5	242.16	557.45
6	291.53	565.35
7	339.83	578.27
8	386.55	596.09
9	431.20	618.60
10	473.29	645.58
11	512.40	676.74
12	548.09	711.75
13	563.22	730.00

Circle Center At X = 190.1 ; Y = 1041.0 and Radius, 486.4

*** 1.937 ***

(Runs 2 through 10 ranged from 1.943 to 1.968)

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	SCCDYC1.DAT
Output Filename:	SCCDYC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION C-C, DYNAMIC

BOUNDARY COORDINATES

7 Top Boundaries
33 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	577.00	110.00	577.00	2
2	110.00	577.00	250.00	630.00	1
3	250.00	630.00	270.00	630.00	1
4	270.00	630.00	400.00	680.00	1
5	400.00	680.00	420.00	680.00	1
6	420.00	680.00	545.00	730.00	1
7	545.00	730.00	1615.00	730.00	1
8	1210.00	680.00	1615.00	680.00	3
9	1210.00	680.00	1255.00	660.00	1
10	110.00	577.00	190.00	580.00	2
11	190.00	580.00	370.00	580.00	2
12	370.00	580.00	430.00	585.00	2
13	430.00	585.00	460.00	580.00	3
14	460.00	580.00	530.00	577.00	3
15	530.00	577.00	725.00	574.00	3
16	725.00	574.00	745.00	562.00	3
17	745.00	562.00	930.00	562.00	2
18	930.00	562.00	950.00	579.00	3
19	950.00	579.00	970.00	590.00	2
20	970.00	590.00	1000.00	593.00	2
21	1000.00	593.00	1130.00	660.00	2
22	1130.00	660.00	1255.00	660.00	2
23	1255.00	660.00	1435.00	555.00	2
24	430.00	585.00	470.00	565.00	2
25	470.00	565.00	745.00	562.00	2
26	950.00	579.00	1305.00	580.00	3
27	930.00	562.00	1145.00	560.00	2
28	1145.00	560.00	1305.00	580.00	2
29	.00	555.00	720.00	558.00	4
30	720.00	558.00	905.00	556.00	4
31	905.00	556.00	1145.00	560.00	4
32	1145.00	560.00	1430.00	555.00	4
33	1430.00	555.00	1615.00	555.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	575.00
2	130.00	575.00
3	270.00	580.00
4	1105.00	588.00
5	1615.00	558.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 3 Boundaries
Of Which The First 3 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	545.00	470.00	550.00
2	470.00	550.00	980.00	545.00
3	980.00	545.00	1615.00	545.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 300.00 ft.
and X = 500.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =545.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	577.00
2	92.23	562.28
3	141.86	556.18
4	191.78	558.91
5	240.45	570.37
6	286.35	590.20
7	328.04	617.79
8	364.24	652.29
9	378.50	671.73

Circle Center At X = 151.4 ; Y = 839.4 and Radius, 283.3

*** 1.420 ***

(Runs 2 through 10 ranged from 1.421 to 1.436)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
\PCSTABL5\CONCORD>A: or Spencer's Method of Slices

Run Date:	5-8-91
Time of Run:	RUN 6
Run By:	DMC
Input Data Filename:	SDDSTC1.DAT
Output Filename:	SDDSTC6.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION D-D, STATIC

BOUNDARY COORDINATES

11 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	574.00	145.00	602.00	2
2	145.00	602.00	265.00	614.00	2
3	265.00	614.00	315.00	636.00	2
4	315.00	636.00	340.00	632.00	2
5	340.00	632.00	380.00	632.00	2
6	380.00	632.00	420.00	656.00	2
7	420.00	656.00	440.00	656.00	2
8	440.00	656.00	510.00	681.00	1
9	510.00	681.00	530.00	681.00	1
10	530.00	681.00	670.00	730.00	1
11	670.00	730.00	1100.00	730.00	1
12	740.00	680.00	1100.00	680.00	3
13	740.00	680.00	780.00	658.00	1
14	440.00	656.00	590.00	658.00	2
15	590.00	658.00	780.00	658.00	2
16	780.00	658.00	1030.00	550.00	2
17	.00	560.00	1030.00	550.00	4
18	1030.00	550.00	1100.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	566.00
2	1100.00	557.00

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	550.00	615.00	547.00
2	615.00	547.00	1100.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 380.00 ft.
and X = 380.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 700.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =540.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	380.00	632.00
2	427.56	647.43
3	475.11	662.90
4	522.64	678.42
5	570.15	693.99
6	617.65	709.61
7	665.13	725.27
8	679.43	730.00

Circle Center At X = ****** ; Y = ****** and Radius, ******

*** 1.900 ***

(Runs 2 through 10 ranged from 1.901 to 2.012)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-10-91
Time of Run:	RUN 3
Run By:	DMC
Input Data Filename:	5DDDYC1.DAT
Output Filename:	5DDDYC3.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION D-D, DYNAMIC

BOUNDARY COORDINATES

11 Top Boundaries
18 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	574.00	145.00	602.00	2
2	145.00	602.00	265.00	614.00	2
3	265.00	614.00	315.00	636.00	2
4	315.00	636.00	340.00	632.00	2
5	340.00	632.00	380.00	632.00	2
6	380.00	632.00	420.00	656.00	2
7	420.00	656.00	440.00	656.00	2
8	440.00	656.00	510.00	681.00	1
9	510.00	681.00	530.00	681.00	1
10	530.00	681.00	670.00	730.00	1
11	670.00	730.00	1100.00	730.00	1
12	740.00	680.00	1100.00	680.00	3
13	740.00	680.00	780.00	658.00	1
14	440.00	656.00	590.00	658.00	2
15	590.00	658.00	780.00	658.00	2
16	780.00	658.00	1030.00	550.00	2
17	.00	560.00	1030.00	550.00	4
18	1030.00	550.00	1100.00	550.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 2 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	566.00
2	1100.00	557.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 2 Boundaries
Of Which The First 2 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	550.00	615.00	547.00
2	615.00	547.00	1100.00	540.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 300.00 ft.
and X = 400.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 700.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =540.00 ft.

50.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	388.89	637.33
2	437.32	649.78
3	485.44	663.34
4	533.24	678.01
5	580.69	693.78
6	627.76	710.65
7	674.42	728.61
8	677.81	730.00

Circle Center At X = -124.1 ; Y = 2734.5 and Radius, 2159.0

*** 1.488 ***

(Runs 2 through 10 ranged from 1.510 to 1.618)

PCSTABL5\CONCORD> TYPE SHHSTC2.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 2
Run By: DMC
Input Data Filename: SHHSTC1.DAT
Output Filename: SHHSTC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION H-H, STATIC

BOUNDARY COORDINATES

16 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	425.00	180.00	440.00	4
2	180.00	440.00	270.00	480.00	2
3	270.00	480.00	340.00	500.00	2
4	340.00	500.00	360.00	500.00	2
5	360.00	500.00	430.00	530.00	2
6	430.00	530.00	460.00	533.00	2
7	460.00	533.00	570.00	580.00	1
8	570.00	580.00	590.00	580.00	1
9	590.00	580.00	710.00	630.00	1
10	710.00	630.00	730.00	630.00	1
11	730.00	630.00	840.00	680.00	1
12	840.00	680.00	860.00	680.00	1
13	860.00	680.00	890.00	690.00	1
14	890.00	690.00	930.00	690.00	1
15	930.00	690.00	1020.00	730.00	1
16	1020.00	730.00	1140.00	730.00	1
17	460.00	533.00	530.00	540.00	2
18	530.00	540.00	950.00	550.00	2
19	950.00	550.00	1140.00	572.00	2
20	180.00	440.00	290.00	450.00	4
21	290.00	450.00	560.00	500.00	4
22	560.00	500.00	640.00	520.00	4
23	640.00	520.00	753.00	527.00	4
24	753.00	527.00	860.00	520.00	4
25	860.00	520.00	985.00	490.00	4
26	985.00	490.00	1080.00	520.00	4
27	1080.00	520.00	1140.00	530.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	420.00
2	180.00	435.00
3	675.00	530.00
4	1140.00	550.00

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	415.00	290.00	440.00
2	290.00	440.00	560.00	490.00
3	560.00	490.00	640.00	510.00
4	640.00	510.00	860.00	510.00
5	860.00	510.00	983.00	480.00
6	982.00	480.00	1080.00	510.00
7	1080.00	510.00	1140.00	520.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 900.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =415.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 9 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.89	432.41
2	188.89	431.81
3	288.51	440.44
4	386.92	458.24
5	483.26	485.04
6	576.71	520.63
7	666.48	564.70
8	751.79	616.87
9	830.69	675.77

Circle Center At X = 145.4 ; Y = 1512.7 and Radius, 1081.8

*** 1.715 ***

(Runs 2 through 10 ranged from 1.717 to 1.733)

\PCSTABL5\CONCORD> TYPE SHHDYC1.OUT

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-8-91
Time of Run: RUN 1
Run By: DMC
Input Data Filename: SHHDYC1.DAT
Output Filename: SHHDYC1.OUT

PROBLEM DESCRIPTION STAGE 5. SECTION H-H. DYNAMIC

BOUNDARY COORDINATES

16 Top Boundaries
27 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	425.00	180.00	440.00	4
2	180.00	440.00	270.00	480.00	2
3	270.00	480.00	340.00	500.00	2
4	340.00	500.00	360.00	500.00	2
5	360.00	500.00	430.00	530.00	2
6	430.00	530.00	460.00	533.00	2
7	460.00	533.00	570.00	580.00	1
8	570.00	580.00	590.00	580.00	1
9	590.00	580.00	710.00	630.00	1
10	710.00	630.00	730.00	630.00	1
11	730.00	630.00	840.00	680.00	1
12	840.00	680.00	860.00	680.00	1
13	860.00	680.00	890.00	690.00	1
14	890.00	690.00	930.00	690.00	1
15	930.00	690.00	1020.00	730.00	1
16	1020.00	730.00	1140.00	730.00	1
17	460.00	533.00	530.00	540.00	2
18	530.00	540.00	950.00	550.00	2
19	950.00	550.00	1140.00	572.00	2
20	180.00	440.00	290.00	450.00	4
21	290.00	450.00	560.00	500.00	4
22	560.00	500.00	640.00	520.00	4
23	640.00	520.00	753.00	527.00	4
24	753.00	527.00,	860.00	520.00	4
25	860.00	520.00	985.00	490.00	4
26	985.00	490.00	1080.00	520.00	4
27	1080.00	520.00	1140.00	530.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	420.00
2	180.00	435.00
3	675.00	530.00
4	1140.00	550.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	415.00	290.00	440.00
2	290.00	440.00	560.00	490.00
3	560.00	490.00	640.00	510.00
4	640.00	510.00	860.00	510.00
5	860.00	510.00	983.00	480.00
6	982.00	480.00	1080.00	510.00
7	1080.00	510.00	1140.00	520.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 200.00 ft.

Each Surface Terminates Between X = 600.00 ft.
and X = 900.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =415.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	111.11	434.26
2	211.11	433.47
3	310.57	443.87
4	408.24	465.33
5	502.90	497.57
6	593.35	540.20
7	678.48	592.68
8	726.12	630.00

Circle Center At X = 168.1 ; Y = 1325.3 and Radius, 892.8

*** 1.278 ***

(Runs 2 through 10 ranged from 1.278 to 1.287)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-31-91
Time of Run: RUN 1
Run By: DMC
Input Data Filename: SIISTC1.DAT
Output Filename: SIISTC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION I-I, STATIC

BOUNDARY COORDINATES

13 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	430.00	280.00	505.00	4
2	280.00	505.00	290.00	505.00	4
3	290.00	505.00	380.00	545.00	2
4	380.00	545.00	420.00	545.00	2
5	420.00	545.00	505.00	582.00	2
6	505.00	582.00	525.00	582.00	2
7	525.00	582.00	660.00	635.00	2
8	660.00	635.00	680.00	635.00	2
9	680.00	635.00	750.00	660.00	2
10	750.00	660.00	805.00	682.00	1
11	805.00	682.00	815.00	682.00	1
12	815.00	682.00	960.00	730.00	1
13	960.00	730.00	1100.00	730.00	1
14	750.00	660.00	1100.00	660.00	2
15	290.00	505.00	450.00	520.00	4
16	450.00	520.00	610.00	540.00	4
17	610.00	540.00	930.00	540.00	4
18	930.00	540.00	1040.00	527.00	4
19	1040.00	527.00	1100.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	425.00
2	280.00	500.00
3	610.00	445.00
4	1100.00	555.00

1

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	420.00	280.00	495.00
2	280.00	495.00	450.00	510.00
3	450.00	510.00	610.00	530.00
4	610.00	530.00	930.00	530.00
5	930.00	530.00	1040.00	515.00
6	1040.00	515.00	1100.00	530.00

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 250.00 ft.
and X = 250.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 750.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =420.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	250.00	496.96
2	348.51	514.19
3	445.20	539.69
4	539.39	573.28
5	630.40	614.72
6	666.48	635.00

Circle Center At X = 96.1 ; Y = 1667.4 and Radius, 1180.5

*** 1.762 ***

(Runs 2 through 10 ranged from 1.767 to 1.782)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-31-91
Time of Run: RUN 1
Run By: DMC
Input Data Filename: 5IIDYC1.DAT
Output Filename: 5IIDYC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION I-I, ~~STATIC~~ Seismic

BOUNDARY COORDINATES

13 Top Boundaries
19 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	430.00	280.00	505.00	4
2	280.00	505.00	290.00	505.00	4
3	290.00	505.00	380.00	545.00	2
4	380.00	545.00	420.00	545.00	2
5	420.00	545.00	505.00	582.00	2
6	505.00	582.00	525.00	582.00	2
7	525.00	582.00	660.00	635.00	2
8	660.00	635.00	680.00	635.00	2
9	680.00	635.00	750.00	660.00	2
10	750.00	660.00	805.00	682.00	1
11	805.00	682.00	815.00	682.00	1
12	815.00	682.00	960.00	730.00	1
13	960.00	730.00	1100.00	730.00	1
14	750.00	660.00	1100.00	660.00	2
15	290.00	505.00	450.00	520.00	4
16	450.00	520.00	610.00	540.00	4
17	610.00	540.00	930.00	540.00	4
18	930.00	540.00	1040.00	527.00	4
19	1040.00	527.00	1100.00	540.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	425.00
2	280.00	500.00
3	610.00	445.00
4	1100.00	555.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	420.00	280.00	495.00
2	280.00	495.00	450.00	510.00
3	450.00	510.00	610.00	530.00
4	610.00	530.00	930.00	530.00
5	930.00	530.00	1040.00	515.00
6	1040.00	515.00	1100.00	530.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 250.00 ft.
and X = 250.00 ft.

Each Surface Terminates Between X = 650.00 ft.
and X = 750.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =420.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 6 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	250.00	496.96
2	348.51	514.19
3	445.20	539.69
4	539.39	573.28
5	630.40	614.72
6	666.48	635.00

Circle Center At X = 96.1 ; Y = 1667.4 and Radius, 1180.5

*** 1.312 ***

(Runs 2 through 10 ranged from 1.315 to 1.325)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 5-9-91
Time of Run: RUN 2
Run By: DMC
Input Data Filename: SJJSTC1.DAT
Output Filename: SJJSTC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION J-J, STATIC

BOUNDARY COORDINATES

19 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	20.00	395.00	30.00	390.00	4
2	30.00	390.00	65.00	400.00	4
3	65.00	400.00	160.00	450.00	4
4	160.00	450.00	165.00	460.00	4
5	165.00	460.00	235.00	480.00	4
6	235.00	480.00	280.00	490.00	4
7	280.00	490.00	310.00	500.00	4
8	310.00	500.00	520.00	520.00	4
9	520.00	520.00	555.00	530.00	2
10	555.00	530.00	660.00	550.00	2
11	660.00	550.00	720.00	570.00	2
12	720.00	570.00	760.00	580.00	2
13	760.00	580.00	825.00	590.00	2
14	825.00	590.00	1000.00	630.00	2
15	1000.00	630.00	1000.00	650.00	2
16	1000.00	650.00	1142.00	680.00	1
17	1142.00	680.00	1162.00	680.00	1
18	1162.00	680.00	1290.00	730.00	1
19	1290.00	730.00	1500.00	730.00	1
20	1000.00	630.00	1385.00	640.00	2
21	1385.00	640.00	1450.00	660.00	2
22	1450.00	660.00	1500.00	660.00	2
23	520.00	520.00	740.00	530.00	4
24	740.00	530.00	1345.00	530.00	4
25	1345.00	530.00	1500.00	545.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	30.00	390.00
2	520.00	520.00
3	740.00	540.00
4	1345.00	540.00
5	1500.00	555.00

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	65.00	390.00	170.00	450.00
2	170.00	450.00	310.00	490.00
3	310.00	490.00	520.00	510.00
4	520.00	510.00	740.00	520.00
5	740.00	520.00	1345.00	520.00
6	1345.00	520.00	1500.00	535.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 450.00 ft.
and X = 550.00 ft.

Each Surface Terminates Between X =1200.00 ft.
and X =1400.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =390.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	494.44	517.57
2	594.39	514.25
3	694.31	518.32
4	793.65	529.76
5	891.88	548.51
6	988.45	574.46
7	1082.85	607.47
8	1174.54	647.36
9	1263.04	693.92
10	1320.82	730.00

Circle Center At X = 589.3 ; Y = 1867.3 and Radius, 1353.1

*** 2.181 ***

(Runs 2 through 10 ranged from 2.184 to 2.188)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	SJJDYC1.DAT
Output Filename:	SJJDYC2.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION J-J, DYNAMIC

BOUNDARY COORDINATES

19 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	20.00	395.00	30.00	390.00	4
2	30.00	390.00	65.00	400.00	4
3	65.00	400.00	160.00	450.00	4
4	160.00	450.00	165.00	460.00	4
5	165.00	460.00	235.00	480.00	4
6	235.00	480.00	280.00	490.00	4
7	280.00	490.00	310.00	500.00	4
8	310.00	500.00	520.00	520.00	4
9	520.00	520.00	555.00	530.00	2
10	555.00	530.00	660.00	550.00	2
11	660.00	550.00	720.00	570.00	2
12	720.00	570.00	760.00	580.00	2
13	760.00	580.00	825.00	590.00	2
14	825.00	590.00	1000.00	630.00	2
15	1000.00	630.00	1000.00	650.00	2
16	1000.00	650.00	1142.00	680.00	1
17	1142.00	680.00	1162.00	680.00	1
18	1162.00	680.00	1290.00	730.00	1
19	1290.00	730.00	1500.00	730.00	1
20	1000.00	630.00	1385.00	640.00	2
21	1385.00	640.00	1450.00	660.00	2
22	1450.00	660.00	1500.00	660.00	2
23	520.00	520.00	740.00	530.00	4
24	740.00	530.00	1345.00	530.00	4
25	1345.00	530.00	1500.00	545.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	30.00	390.00
2	520.00	520.00
3	740.00	540.00
4	1345.00	540.00
5	1500.00	555.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	65.00	390.00	170.00	450.00
2	170.00	450.00	310.00	490.00
3	310.00	490.00	520.00	510.00
4	520.00	510.00	740.00	520.00
5	740.00	520.00	1345.00	520.00
6	1345.00	520.00	1500.00	535.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 400.00 ft.
and X = 500.00 ft.

Each Surface Terminates Between X =1200.00 ft.
and X =1400.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =390.00 ft.

100.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 10 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	455.56	513.86
2	555.53	511.62
3	655.43	516.17
4	754.78	527.50
5	853.14	545.54
6	950.05	570.23
7	1045.05	601.44
8	1137.72	639.03
9	1227.62	682.83
10	1309.75	730.00

Circle Center At X = 538.5 ; Y = 1983.1 and Radius, 1471.5

*** 1.537 ***

(Runs 2 through 10 ranged from 1.538 to 1.541)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 3
Run By:	DMC
Input Data Filename:	5KKSTC1.DAT
Output Filename:	5KKSTC3.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION K-K, STATIC

BOUNDARY COORDINATES

7 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	560.00	125.00	565.00	4
2	125.00	565.00	260.00	615.00	1
3	260.00	615.00	280.00	615.00	1
4	280.00	615.00	350.00	640.00	1
5	350.00	640.00	400.00	640.00	1
6	400.00	640.00	425.00	632.00	1
7	425.00	632.00	570.00	632.00	3
8	425.00	632.00	570.00	575.00	1
9	125.00	565.00	200.00	570.00	4
10	200.00	570.00	420.00	575.00	4
11	420.00	575.00	465.00	575.00	4
12	465.00	575.00	468.00	568.00	4
13	492.00	568.00	495.00	575.00	4
14	495.00	575.00	570.00	575.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	24.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	555.00
2	200.00	568.00
3	320.00	570.00
4	360.00	590.00
5	375.00	610.00
6	425.00	632.00
7	570.00	632.00

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	552.00	200.00	562.00
2	200.00	562.00	420.00	567.00
3	420.00	567.00	468.00	568.00
4	468.00	568.00	470.00	565.00
5	470.00	565.00	490.00	565.00
6	490.00	565.00	492.00	568.00
7	492.00	568.00	570.00	568.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 50.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 250.00 ft.
and X = 350.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =552.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.78	566.03
2	152.38	570.46
3	176.56	576.84
4	200.15	585.11
5	223.00	595.24
6	244.98	607.16
7	253.12	612.45

Circle Center At X = 84.5 ; Y = 877.0 and Radius, 314.0

*** 1.792 ***

(Runs 2 through 10 ranged from 1.872 to 1.884)

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	5-9-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	SKKDYC1.DAT
Output Filename:	SKKDYC1.OUT

PROBLEM DESCRIPTION STAGE 5, SECTION K-K, ~~STATIC~~ Seismic

BOUNDARY COORDINATES

7 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	560.00	125.00	565.00	4
2	125.00	565.00	260.00	615.00	1
3	260.00	615.00	280.00	615.00	1
4	280.00	615.00	350.00	640.00	1
5	350.00	640.00	400.00	640.00	1
6	400.00	640.00	425.00	632.00	1
7	425.00	632.00	570.00	632.00	3
8	425.00	632.00	570.00	575.00	1
9	125.00	565.00	200.00	570.00	4
10	200.00	570.00	420.00	575.00	4
11	420.00	575.00	465.00	575.00	4
12	465.00	575.00	468.00	568.00	4
13	492.00	568.00	495.00	575.00	4
14	495.00	575.00	570.00	575.00	4

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	72.0	82.0	.0	18.0	.00	.0	1
4	130.0	140.0	.0	31.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	555.00
2	200.00	568.00
3	320.00	570.00
4	360.00	590.00
5	375.00	610.00
6	425.00	632.00
7	570.00	632.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 7 Boundaries
Of Which The First 7 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	552.00	200.00	562.00
2	200.00	562.00	420.00	567.00
3	420.00	567.00	468.00	568.00
4	468.00	568.00	470.00	565.00
5	470.00	565.00	490.00	565.00
6	490.00	565.00	492.00	568.00
7	492.00	568.00	570.00	568.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 50.00 ft.
and X = 150.00 ft.

Each Surface Terminates Between X = 250.00 ft.
and X = 350.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =552.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	127.78	566.03
2	152.38	570.46
3	176.56	576.84
4	200.15	585.11
5	223.00	595.24
6	244.98	607.16
7	253.12	612.45

Circle Center At X = 84.5 ; Y = 877.0 and Radius, 314.0

*** 1.361 ***

(Runs 2 through 10 ranged from 1.409 to 1.413)

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND3BST.DAT
Output Filename:	POND3BST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 1, STATIC CASE

BOUNDARY COORDINATES

5 Top Boundaries
9 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	33.00	514.00	3
2	33.00	514.00	171.00	560.00	1
3	171.00	560.00	185.00	560.00	1
4	185.00	560.00	244.00	540.00	1
5	244.00	540.00	337.00	560.00	3
6	33.00	514.00	160.00	528.00	3
7	160.00	528.00	171.00	517.00	3
8	184.00	517.00	198.00	533.00	3
9	198.00	533.00	245.00	540.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	497.00
2	216.00	550.00
3	320.00	550.00
4	337.00	554.00

Searching Routine Will Be Limited To An Area Defined By 5 Boundaries
Of Which The First 5 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	497.00	171.00	517.00
2	171.00	517.00	173.00	515.00
3	173.00	515.00	181.00	515.00
4	181.00	515.00	184.00	518.00
5	184.00	518.00	337.00	547.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 160.00 ft.
and X = 190.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =497.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	513.64
2	54.24	507.52
3	79.21	506.35
4	103.92	510.17
5	127.37	518.84
6	148.62	532.01
7	166.82	549.14
8	174.50	560.00

*** 1.768 ***

Runs 2 through 10 ranged from 1.773 to 1.791

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND3BDY.DAT
Output Filename:	POND3BDY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 1, SEISMIC CASE

BOUNDARY COORDINATES

5 Top Boundaries
9 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	33.00	514.00	3
2	33.00	514.00	171.00	560.00	1
3	171.00	560.00	185.00	560.00	1
4	185.00	560.00	244.00	540.00	1
5	244.00	540.00	337.00	560.00	3
6	33.00	514.00	160.00	528.00	3
7	160.00	528.00	171.00	517.00	3
8	184.00	517.00	198.00	533.00	3
9	198.00	533.00	245.00	540.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	497.00
2	216.00	550.00
3	320.00	550.00
4	337.00	554.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 5 Boundaries
Of Which The First 5 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	497.00	171.00	517.00
2	171.00	517.00	173.00	515.00
3	173.00	515.00	181.00	515.00
4	181.00	515.00	184.00	518.00
5	184.00	518.00	337.00	547.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 160.00 ft.
and X = 190.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =497.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	30.00	513.64
2	54.24	507.52
3	79.21	506.35
4	103.92	510.17
5	127.37	518.84
6	148.62	532.01
7	166.82	549.14
8	174.50	560.00

*** 1.302 ***

Runs 2 through 10 ranged from 1.306 to 1.319

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-12-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	POND1ST.DAT
Output Filename:	POND1ST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 2, Static

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	89.00	529.00	3
2	89.00	529.00	125.00	540.00	1
3	125.00	540.00	145.00	540.00	1
4	145.00	540.00	165.00	534.00	1
5	165.00	534.00	204.00	520.00	3
6	204.00	520.00	231.00	520.00	4
7	231.00	520.00	357.00	561.00	3
8	89.00	529.00	117.00	531.00	3
9	117.00	531.00	130.00	520.00	3
10	139.00	520.00	151.00	533.00	3
11	151.00	533.00	164.00	534.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	500.00
2	158.00	536.00
3	295.00	536.00
4	357.00	555.00

1

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries
Of Which The First 9 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	500.00	111.00	520.00
2	111.00	520.00	130.00	520.00
3	130.00	520.00	132.00	518.00
4	132.00	518.00	138.00	518.00
5	138.00	518.00	139.00	520.00
6	139.00	520.00	204.00	520.00
7	204.00	520.00	231.00	520.00
8	231.00	520.00	263.00	520.00
9	263.00	520.00	357.00	551.00

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = .00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 100.00 ft.
and X = 150.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y =500.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	519.49
2	69.32	521.96
3	93.79	527.11
4	117.55	534.87
5	128.90	540.00

*** 2.445 ***

Runs 2 through 10 ranged from 2.480 to 2.573

** PCSTABL5 **

By

Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-11-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND1DY.DAT
Output Filename:	POND1DY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 2, SEISMIC CASE

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	510.00	89.00	529.00	3
2	89.00	529.00	125.00	540.00	1
3	125.00	540.00	145.00	540.00	1
4	145.00	540.00	165.00	534.00	1
5	165.00	534.00	204.00	520.00	3
6	204.00	520.00	231.00	520.00	4
7	231.00	520.00	357.00	561.00	3
8	89.00	529.00	117.00	531.00	3
9	117.00	531.00	130.00	520.00	3
10	139.00	520.00	151.00	533.00	3
11	151.00	533.00	164.00	534.00	3

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	500.00
2	158.00	536.00
3	295.00	536.00
4	357.00	555.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries
Of Which The First 9 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	500.00	111.00	520.00
2	111.00	520.00	130.00	520.00
3	130.00	520.00	132.00	518.00
4	132.00	518.00	138.00	518.00
5	138.00	518.00	139.00	520.00
6	139.00	520.00	204.00	520.00
7	204.00	520.00	231.00	520.00
8	231.00	520.00	263.00	520.00
9	263.00	520.00	357.00	551.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = .00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 100.00 ft.
and X = 150.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =500.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	44.44	519.49
2	69.32	521.96
3	93.79	527.11
4	117.55	534.87
5	128.90	540.00

*** 1.710 ***

Runs 2 through 10 ranged from 1.721 to 1.761

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 2
Run By:	DMC
Input Data Filename:	POND2ST.DAT
Output Filename:	POND2ST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 3, STATIC CASE

BOUNDARY COORDINATES

7 Top. Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	497.00	38.00	500.00	3
2	38.00	500.00	144.00	540.00	1
3	144.00	540.00	161.00	540.00	1
4	161.00	540.00	228.00	520.00	1
5	228.00	520.00	260.00	520.00	1
6	260.00	520.00	439.00	540.00	3
7	439.00	540.00	490.00	560.00	3
8	38.00	500.00	138.00	508.00	3
9	138.00	508.00	149.00	498.00	3
10	158.00	498.00	170.00	511.00	3
11	170.00	511.00	260.00	520.00	3

1

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	486.00
2	36.00	489.00
3	188.00	533.50
4	435.00	533.50
5	490.00	552.00

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	486.00	149.00	498.00
2	149.00	498.00	151.00	496.00
3	151.00	496.00	157.00	496.00
4	157.00	496.00	158.00	498.00
5	158.00	498.00	456.00	531.00
6	456.00	531.00	490.00	544.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 130.00 ft.
and X = 160.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =486.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.67	499.11
2	50.81	492.60
3	75.81	492.54
4	99.97	498.94
5	121.67	511.35
6	139.44	528.95
7	145.90	540.00

*** 1.678 ***

Runs 2 through 10 ranged from 1.689 to 1.711

** PCSTABL5 **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 6-13-91
Time of Run: RUN 2
Run By: DMC
Input Data Filename: POND2DY.DAT
Output Filename: POND2DY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 3, SEISMIC CASE

BOUNDARY COORDINATES

7 Top Boundaries
11 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	497.00	38.00	500.00	3
2	38.00	500.00	144.00	540.00	1
3	144.00	540.00	161.00	540.00	1
4	161.00	540.00	228.00	520.00	1
5	228.00	520.00	260.00	520.00	1
6	260.00	520.00	439.00	540.00	3
7	439.00	540.00	490.00	560.00	3
8	38.00	500.00	138.00	508.00	3
9	138.00	508.00	149.00	498.00	3
10	158.00	498.00	170.00	511.00	3
11	170.00	511.00	260.00	520.00	3

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	486.00
2	36.00	489.00
3	188.00	533.50
4	435.00	533.50
5	490.00	552.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

Searching Routine Will Be Limited To An Area Defined By 6 Boundaries
Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	486.00	149.00	498.00
2	149.00	498.00	151.00	496.00
3	151.00	496.00	157.00	496.00
4	157.00	496.00	158.00	498.00
5	158.00	498.00	456.00	531.00
6	456.00	531.00	490.00	544.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 20.00 ft.
and X = 50.00 ft.

Each Surface Terminates Between X = 130.00 ft.
and X = 160.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y =486.00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	26.67	499.11
2	50.81	492.60
3	75.81	492.54
4	99.97	498.94
5	121.67	511.35
6	139.44	528.95
7	145.90	540.00

*** 1.267 ***

Runs 2 through 10 ranged from 1.270 to 1.286

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 3
Run By:	DMC
Input Data Filename:	POND3AST.DAT
Output Filename:	POND3AST.OUT

PROBLEM DESCRIPTION SEDIMENT POND 4, STATIC CASE

BOUNDARY COORDINATES

8 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	588.00	36.00	600.00	2
2	36.00	600.00	91.00	620.00	1
3	91.00	620.00	113.00	620.00	1
4	113.00	620.00	135.00	610.00	1
5	135.00	610.00	165.00	600.00	2
6	165.00	600.00	176.00	600.00	2
7	176.00	600.00	284.00	638.00	2
8	284.00	638.00	312.00	640.00	2
9	36.00	600.00	89.00	606.00	2
10	89.00	606.00	93.00	600.00	2
11	93.00	600.00	105.00	600.00	2
12	105.00	600.00	113.00	609.00	2
13	113.00	609.00	135.00	611.00	2

1

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 3 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	569.00
2	120.00	615.00
3	312.00	615.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced Along The Ground Surface Between X = 10.00 ft.
and X = 30.00 ft.

Each Surface Terminates Between X = 90.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

1

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.22	592.07
2	37.15	593.98
3	61.11	601.12
4	83.01	613.17
5	90.77	619.91

*** 1.720 ***

Runs 2 through 10 ranged from 1.723 to 1.766

** PCSTABL5 **

by
Purdue University

1

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date:	6-13-91
Time of Run:	RUN 1
Run By:	DMC
Input Data Filename:	POND3ADY.DAT
Output Filename:	POND3ADY.OUT

PROBLEM DESCRIPTION SEDIMENT POND 4, SEISMIC CASE

BOUNDARY COORDINATES

8 Top Boundaries
13 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	588.00	36.00	600.00	2
2	36.00	600.00	91.00	620.00	1
3	91.00	620.00	113.00	620.00	1
4	113.00	620.00	135.00	610.00	1
5	135.00	610.00	165.00	600.00	2
6	165.00	600.00	176.00	600.00	2
7	176.00	600.00	284.00	638.00	2
8	284.00	638.00	312.00	640.00	2
9	36.00	600.00	89.00	606.00	2
10	89.00	606.00	93.00	600.00	2
11	93.00	600.00	105.00	600.00	2
12	105.00	600.00	113.00	609.00	2
13	113.00	609.00	135.00	611.00	2

ISOTROPIC SOIL PARAMETERS

4 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	118.0	128.0	.0	33.0	.00	.0	1
2	115.0	125.0	.0	30.0	.00	.0	1
3	130.0	140.0	.0	31.0	.00	.0	1
4	150.0	150.0	1000.0	35.0	.00	.0	1

1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 3 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	569.00
2	120.00	615.00
3	312.00	615.00

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .000 Has Been Assigned

Cavitation Pressure = .0 psf

1

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 10 Points Equally Spaced
Along The Ground Surface Between X = 10.00 ft.
and X = 30.00 ft.

Each Surface Terminates Between X = 90.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

25.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	12.22	592.07
2	37.15	593.98
3	61.11	601.12
4	83.01	613.17
5	90.77	619.91

*** 1.299 ***

Runs 2 through 10 ranged from 1.299 to 1.333

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: [illegible] DATE: 4-25-92 CHKD BY: RMW DATE: 5/6/92

PROJECT NAME: [illegible]

PROJECT NO. [illegible] SHEET 1 OF 1

DESCRIPTION [illegible] for [illegible]

The purpose of this calculation is to determine if there is enough extra freeboard in the areas underlain by fines to contain the impoundment if liquefaction did occur. In order to be conservative, we assume total loss of strength of the fines during a liquefaction event. The greatest thickness of buried fines encountered during the exploration was 17 ft (Boring B-20). Therefore the crest of the impoundment [illegible] fines, [illegible] 17 ft above the maximum level of fines in each stage.

Stage 1

Crest Elev = 675

Max. Fine Elev = 658

675 - 658 = 17 ≥ 17 ft ok (No Free board)

Stage 2

Crest Elev. = 690

Max. Fine Elev. = 667

690 - 667 = 23 ft ≥ 17 ft ok

Stage 3

Crest Elev. = 710

Max Fine Elev = 678

710 - 678 = 32 ft ≥ 17 ft ok

Revised

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: DMC DATE: 5-5-91 CHKD BY: RMW DATE: 6/11/91

PROJECT NAME: Concord

PROJECT NO. 89-55-27 SHEET 1 OF 1

DESCRIPTION Liquefaction Calculations for Existing Impoundment

The purpose of this calculation is to determine if there is enough extra freeboard in the areas underlain by fines to contain the impoundment if liquefaction did occur. In order to be conservative, we will assume total disappearance of the fines during a liquefaction event. The greatest thickness of buried fines encountered during the exploration program was 20 ft. Therefore, the crest of the impoundment (underlain by fines) will always be at least 20 ft above the maximum level of fines in each stage.

Stage 1

Crest Elev = 675

Max. Fine Elev = 653

675 - 653 = 22 > 20 ft ok

Stage 2

Crest Elev. = 690

Max. Fine Elev. = 665

690 - 665 = 25 ft > 20 ft ok

Stage 3

Crest Elev. = 710

Max Fine Elev = 679

710 - 679 = 31 ft ok

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/23/91 CHKD BY: SAP DATE: 6-10-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 1 OF 3
DESCRIPTION DEEP MINE PERCENT COAL RECOVERY

CALCULATE PERCENT RECOVERY/EXTRACTION IN DEEP MINE AREAS UNDER DISPOSAL AREA*
(*-USING CONCORD DEEP MINE MAPS)

SEAM MINED: PRATT SEAM, POTTSVILLE FORMATION
ELEVATIONS: NORTH AREA OF SITE - 40 FEET BELOW MSL.
SOUTH AREA OF SITE - 90 FEET BELOW MSL.

PERCENT RECOVERY/EXTRACTION IN NORTH AREA BELOW DIKE IMPOUNDMENT EMBANKMENT:

- IN THIS AREA THE COAL WAS NOT MINED WITHIN APPROXIMATELY 600 FEET OF THE PREPARATION PLANT, AND ONLY PANELS 150' TO 300' WIDE WERE MINED UNDER THE DIKE IMPOUNDMENT AREA, LEAVING 200' TO 300' WIDE UNMINED PANELS.

PERCENT RECOVERY IN MINED PANEL

PANEL WIDTH = 292'
AVERAGE ENTRY WIDTH = 25'
NUMBER OF ENTRIES = 4
NUMBER OF PILLARS = 3

$$\text{PILLAR WIDTH} = \frac{292' - 4\ \text{ENTRIES}(25')}{3\ \text{PILLARS}} = 64\ \text{FEET}$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SHP DATE: 6-10-91
PROJECT NAME: US STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 2 OF 3
DESCRIPTION DEEP MINE PERCENT COAL RECOVERY

PANEL LENGTH = 1700'
AVERAGE CROSSCUT WIDTH = 25'
NUMBER OF CROSSCUTS = 18
NUMBER OF PILLARS = 19

$$\text{PILLAR LENGTH} = \frac{1700' - 18 \text{ CROSSCUTS}(25')}{19 \text{ PILLARS}} = 65.7 \text{ FEET}$$

USE 66 FEET

$$\text{PERCENT RECOVERY IN MINED PANEL} = 1 - \frac{(64')(66')}{(64'+25')(66'+25')} = 48\%$$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SAP DATE: 6-10-91
PROJECT NAME: US STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 3 OF 3
DESCRIPTION DEEP MINE PERCENT COAL RECOVERY

PERCENT RECOVERY/EXTRACTION IN SOUTHERN AREA BELOW MAIN EMBANKMENT AREA AND EXISTING IMPOUNDMENT

ALONG 1440 FOOT WIDTH OF MINED AREA, THERE ARE 18 ENTRIES (AVERAGE 25') AND 17 PILLARS

$$\text{PILLAR WIDTH} = \frac{1440' - 18 \text{ ENTRIES } (25')}{17} = 58.2'$$

USE 58 FEET

ALONG A 900 FOOT LENGTH OF MINED AREA, THERE ARE 10 CROSSCUTS (AVERAGE 25') AND 10 PILLARS

$$\text{PILLAR LENGTH} = \frac{900 - 10 \text{ CROSSCUTS } (25')}{10} = 65 \text{ FEET}$$

$$\text{PERCENT RECOVERY IN SOUTH AREA} = 1 - \frac{(58')(65')}{(58'+25')(65'+25')} = 49.5\%$$

USE 50%

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SAP DATE: 6-10-91

PROJECT NAME: U.S STEEL - CONCORD

PROJECT NO. 90-55-27 SHEET 1 OF 19

DESCRIPTION SUBSIDENCE CALCULATIONS

SUBSIDENCE EVALUATION
CONCORD REFUSE DISPOSAL AREA
U.S. STEEL MINING COMPANY, INC
HUEYTOWN, ALABAMA

OBJECTIVE: EVALUATE POTENTIAL SUBSIDENCE IMPACTS ON REFUSE DISPOSAL AREA

PART 1 - REVIEW EXISTING CONDITIONS

PART 2 - EVALUATE SINKHOLE SUBSIDENCE

PART 3 - EVALUATE TROUGH SUBSIDENCE

PART 4 - DETERMINE MAXIMUM PROFILE CHANGE

PART 5 - DETERMINE MAXIMUM STRAIN DUE TO MAXIMUM PROFILE CHANGE

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 2 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 1 - REVIEW OF EXISTING CONDITIONS

COAL SEAM THICKNESS - THE PRATT COAL SEAM IS THE ONLY SEAM KNOWN TO HAVE BEEN MINED BELOW THIS SITE. MINING ON THIS SEAM IN THE VICINITY OF THIS SITE HAS BEEN COMPLETED.

*AVERAGE SEAM THICKNESS = 7 FEET

*SEAM ELEVATION: 40 FEET BELOW MSL (NORTH SIDE)
90 FEET BELOW MSL (SOUTH SIDE)

(* PER MINE MAPS AND MINING RECORDS)

OVERBURDEN CONDITIONS

A COMPARISON OF TOPOGRAPHIC, GEOLOGIC AND DISPOSAL AREA MAPS INDICATE THE OVERBURDEN THICKNESS RANGES FROM APPROX. 620 FEET AT THE NORTH END OF THE SITE TO 670 FEET AT THE SOUTH END OF THE SITE.

MINING UNDER THE DIKE IMPOUNDMENT AREA AT THE NORTH WEST CORNER OF THE SITE WAS LIMITED TO 150' TO 300' WIDE PANELS, LEAVING 200' TO 300' WIDE UNMINED PANELS. THE AREAS BELOW THE COAL PREPARATION PLANT, AND AREAS WITHIN 600' WERE NOT MINED. PERCENT RECOVERY/EXTRACTION WITHIN THE MINED PANELS WAS ESTIMATED TO BE 48%.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: US STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 3 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

OVERBURDEN CONDITIONS (CONT.)

MINING UNDER THE MAIN DISPOSAL AREA AND EXISTING IMPOUNDMENT WAS GENERALLY BY ROOM AND PILLAR MINING. PERCENT COAL RECOVERY IN THESE AREAS WERE ESTIMATED TO BE 50%. NO AREAS UNDER THE EXISTING IMPOUNDMENT ARE INDICATED BY THE MINE MAPS TO HAVE BEEN RETREAT MINED (PILLARS MINED).

PART 2 - EVALUATE SINKHOLE SUBSIDENCE

SINKHOLE SUBSIDENCE IS COMMONLY ASSOCIATED WITH GOB FORMATION FROM ROOF COLLAPSE OR PILLAR FAILURE, BASED UPON KNOWLEDGE OF HISTORICAL OCCURRENCES, SEAM AND OVERBURDEN CONDITIONS THE POTENTIAL FOR SINKHOLE OCCURRENCE CAN BE ESTIMATED.

ESTIMATION OF GOB ZONE

a) ESTIMATE OF GOB ZONE BASED ON EMPIRICAL FACTORS (RULE OF THUMB) INDICATES GOB ZONE FORMATION AT TWO TO EIGHT TIMES THE EXTRACTED COAL SEAM THICKNESS.

- USING EIGHT TIMES SEAM HEIGHT,
GOB ZONE = 8 x 7 FEET = 56 FEET

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/24/91 CHKD BY: JAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 4 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 2 (CONTINUED)

b) ESTIMATE GOB ZONE USING GOB HEIGHT FORMULA OF JONES AND KOHLI, (1985) SUBSIDENCE ENGINEERING, WVU INSTITUTE OF TECHNOLOGY, MONTGOMERY, WEST VIRGINIA.

$$\text{GOB HEIGHT} = \frac{100\,H}{4.7\,H + 19} \pm 2.2$$

WHERE H IS IN METERS

PRATT SEAM $H = 7$ FEET $= \frac{7 \text{ FEET}}{3.28 \text{ FT/METERS}} = 2.13$ METERS

$$\text{GOB HEIGHT} = \frac{100\,(2.13\,m)}{4.7\,(2.13\,m) + 19} \pm 2.2$$

$$= 7.3 \pm 2.2 \text{ METERS}$$

USE 9.5 METERS = 31.3 FEET $\approx$ 31 FEET

CONCLUSION

TO MAINTAIN A REASONABLE MARGIN OF SAFTEY USE ESTIMATE OF GOB FORMATION BY EMPIRICAL METHOD (56 FEET) AND A FACTOR OF SAFTEY OF OF 2, WHICH YEILDS A VALUE OF 112 FEET. BASED UPON EXISTING SINK HOLE SUBSIDENCE THEORIES, IT IS CONCLUDED THAT SINKHOLE SUBSIDENCE OCCURRENCES IS HIGHLY UNLIKELY AT THIS SITE DUE TO THE LARGE OVERBURDEN THICKNESS.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 5/25/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S STEEL-CONCORD
PROJECT NO. 90-55-27 SHEET 5 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 3 - EVALUATION OF TROUGH SUBSIDENCE

DETERMINE THE HEIGHT OF THE POTENTIAL FRACTURED ZONE ABOVE THE DEEP MINE.

a) EMPIRICAL ESTIMATE

EMPIRICAL ESTIMATES OF FRACTURED ZONES ASSUME FRACTURED ZONE MAY EXTEND 20 TO 40 TIMES THE EXTRACTED COAL HEIGHT: (7 FEET)

FRACTURED ZONE = 20 X 7 FEET = 140 FEET
" " = 40 X 7 FEET = 280 FEET

b) FRACTURED ZONE FORMULA, JONES AND KOHLI (1985)

$$\text{FRACTURED ZONE FORMULA} = \frac{100\,H}{1.6\,H + 3.6} \pm 5.6$$

WHERE H IS IN METERS

$$\text{SEAM HEIGHT } H = 7 \text{ FEET} = \frac{7 \text{ FEET}}{3.28 \text{ FT/M}} = 2.13 \text{ METERS}$$

$$\text{FRACTURED ZONE} = \frac{100\,(2.13\text{M})}{1.6\,(2.13\text{M}) + 3.6\text{M}} \pm 5.6\text{M}$$

$$= 30.4 \pm 5.6\text{M} = 24.8 \rightarrow 36.0\text{M}$$

$$= 81.3 \longrightarrow 118.1 \text{ FEET}$$

CONCLUSION: SUBSIDENCE WILL NOT CAUSE OVERBURDEN TO RUBBELIZE (GOB) TO THE SURFACE AND THE FRACTURE ZONE WILL NOT REACH THE SURFACE IN THE AREA OF THE REFUSE DISPOSAL FACILITY.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 9055-27 SHEET 6 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 4 - DETERMINE POST MINING PROFILE CHANGE

FROM WARDELL (1969) FOR ROOM AND PILLAR MINING AREAS, MAXIMUM POSSIBLE SUBSIDENCE, S_M, CAN BE EXPRESSED AS: $S_M = ta$

WHERE S_M = MAXIMUM POSSIBLE SUBSIDENCE

t = AVERAGE VOID HEIGHT

a = SUBSIDENCE COEFFICIENT REPRESENTING THE PERCENT OF MAXIMUM SUBSIDENCE AS A FUNCTION OF DEPTH, RATIO OF EXTRACTION, PILLAR LOADING AND HEIGHT TO WIDTH RATIO OF PILLARS.

FOR AREA 1, NORTHWEST PORTION OF SITE (DIKE AREA)

$t = H$ = VOID HEIGHT = 7 FEET

R = EXTRACTION RATIO = 48%
W = PILLAR WIDTH = 64 FEET
D = DEPTH = 620 FEET
S = ROOM WIDTH = 25 FEET
L_{MAX} = PILLAR LOAD = $\frac{D}{1-R}$ (FROM WARDELL, 1969)

FROM FIGURE 2, (WARDELL 1969)

WHERE $L_{MAX} \times \frac{H}{W} = \left(\frac{D}{1-R}\right)\left(\frac{H}{W}\right) = 130$

$a = 0.065$

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: R.MIN DATE: 6/6/91 CHKD BY: SAP DATE: 6-10-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 7 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

CALCULATE MAXIMUM SUBSIDENCE

$S_M = t\,a$ WHERE $t = 7$ FEET
$a = 0.065$

$S_M = (7')(0.065)$
$= 0.46$ FEET $= 0.14$ METERS

USING NCB METHOD, REF: PENG, S. 1985
COAL MINE GROUND CONTROL
WILEY + SONS, N.Y.

DEVELOP SUBSIDENCE PROFILE

1. Subsidence % as s/s	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
2. Subsidence (S max)	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.07	0.10	0.13	0.14
3. Subsidence (d/h)	0.94	0.47	0.33	0.28	0.23	0.20	0.17	0.15	0.12	0.08	0.00
4. Distance (d meters)	177.66	88.83	62.37	52.92	43.47	37.80	32.13	28.35	22.68	15.12	0.00
5. Subsidence (s feet)	0.00	0.00	0.00	0.01	0.03	0.07	0.14	0.23	0.33	0.41	0.46
6. Distance (d feet)	582.72	291.36	204.57	173.58	142.58	123.98	105.39	92.99	74.39	49.59	0.00

1. PERCENT OF MAX. SUBSIDENCE = S/S %
2. SUBSIDENCE (METERS) = S_{MAX} X S/S = 0.14m x S/S
3. DISTANCE d/h FROM TABLE 13.4.2, PENG, S. 1986.
4. DISTANCE d(METER) = d/h x h = d/h X 189 METERS
5. SUBSIDENCE = S (FEET)
6. DISTANCE = d (FEET)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMN DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 8 OF 19
DESCRIPTION SUBSIDENCE CALC's

FOR AREA 2, MAIN DISPOSAL AREA (EXISTING AREA)
ROOM AND PILLAR MINING AREA

ASSUME $t = H =$ VOID HEIGHT = 7 FEET
$R =$ EXTRACTION RATIO = 50%
$W =$ PILLAR WIDTH = 58 FEET
$D =$ DEPTH = 670 FEET
$S =$ ROOM WIDTH = 25 FEET
L_{MAX} = PILLAR LOAD = $\frac{D}{1-R}$ (FROM WARDELL 1969)

FROM FIGURE 2, (WARDELL, 1969)
WHERE $L_{MAX} * \frac{H}{W} = \left(\frac{D}{1-R}\right)\left(\frac{H}{W}\right) = 161.$

USE

$a = 0.085$

CALCULATE MAXIMUM SUBSIDENCE FOR AREA 2,

$S_{max} = t a$ WHERE $t = 7$ FEET
$a = 0.085$

$S_{MAX} = (7')(0.085) = 0.595$ FEET $= 0.18$ METER

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91

PROJECT NAME: U.S. STEEL - CONCORD

PROJECT NO. 90-55-27 SHEET 9 OF 19

DESCRIPTION SUBSIDENCE CALC's

DEVELOP SUBSIDENCE PROFILE; USING NCB METHOD (REF: PENG, S., 1985)

1. Subsidence % as s/s	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
2. Subsidence (S max)	0.00	0.00	0.00	0.00	0.01	0.03	0.05	0.09	0.13	0.16	0.18
3. Subsidence (d/h)	1.70	1.09	0.99	0.94	0.90	0.86	0.82	0.78	0.73	0.65	0.16
4. Distance (d meters)	346.80	222.36	201.96	191.76	183.60	175.44	167.28	159.12	148.92	132.60	32.64
5. Subsidence (s feet)	0.00	0.00	0.00	0.01	0.04	0.09	0.18	0.30	0.43	0.53	0.59
6. Distance (d feet)	1137.50	729.34	662.43	628.97	602.21	575.44	548.68	521.91	488.46	434.93	107.06

1. PERCENT OF MAXIMUM SUBSIDENCE - s/s%
2. SUBSIDENCE (METERS) = $S_{MAX} \times s/s = 0.18 \times s/s$
3. DISTANCE d/h FROM TABLE 13.4.2 (PENG, S. 1985) *
4. DISTANCE d (METERS) = $d/h \times h = d/h \times 204$ METERS
5. SUBSIDENCE - s (FEET)
6. DISTANCE - d (FEET)

* w - WIDTH OF MINED AREA = 1400 FEET
h - DEPTH OF MINED SEAM = 670 FEET

$$w/h = \frac{1400'}{670} = 2.08$$ USE 2.0 IN TABLE 13.4.4

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: SAP DATE: 6/10/91
PROJECT NAME: U.S. STEEL – CONCORD
PROJECT NO. 90-55-27 SHEET 10 OF 19
DESCRIPTION SUBSIDENCE CALC's

CALCULATE MAXIMUM POTENTIAL SUBSIDENCE FOR AREA 3, EAST SIDE OF MAIN DISPOSAL AREA WHERE PILLAR EXTRACTION OCCURED

ASSUME W = WIDTH OF MINED AREA = 1000 FEET
m = VOID HEIGHT = 7 FEET = 2.13 METERS
h = DEPTH OF MINING = 670 FEET

USING NCB METHOD (PENG, S., 1985)

$S/m = 0.89$ FROM FIGURE 13.4.2

$S = 0.89\ (2.13) = 1.89$ METERS $= 6.22$ FEET

$W/h = \frac{1000'}{670'} = 1.49$ USE 1.5

DEVELOP SUBSIDENCE PROFILE:

1. Subsidence % as s/s	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00
2. Subsidence (S max)	0.00	0.00	0.01	0.03	0.11	0.29	0.57	0.95	1.36	1.70	1.89
3. Subsidence (d/h)	1.50	0.90	0.80	0.74	0.70	0.66	0.62	0.58	0.53	0.45	0.05
4. Distance (d meters)	306.00	183.60	163.20	150.96	142.80	134.64	126.48	118.32	108.12	91.80	10.20
5. Subsidence (s feet)	0.00	0.00	0.02	0.11	0.37	0.94	1.87	3.12	4.46	5.58	6.20
6. Distance (d feet)	1003.68	602.21	535.30	495.15	468.38	441.62	414.85	388.09	354.63	301.10	33.46

1. PERCENT OF MAXIMUM SUBSIDENCE – s/s %
2. SUBSIDENCE (METERS) – $S_{MAX} \times s/s = 2.13 \times s/s$
3. DISTANCE d/h FROM TABLE 13.4.2 (PENG, S., 1985)
4. DISTANCE d (METERS) = $d/h \times h = d/h \times 204$
5. SUBSIDENCE (FEET)
6. DISTANCE (FEET)

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: DML DATE: 6-13-91
PROJECT NAME: U.S. STEEL CONCORD
PROJECT NO. 90-55-27 SHEET 11 OF 19
DESCRIPTION SUBSIDENCE CALCULATIONS

PART 5 - DETERMINE MAXIMUM STRAIN DUE TO TROUGH SUBSIDENCE (REF. PENG, S., 1985 FIGURE 13.4.4)

$$E_{MAX} = K_3 \left(\frac{S}{h}\right)$$

FOR AREA 1, NORTHWEST AREA, (DIKE IMPOUNDMENT)

WHERE K_3 = CONSTANT FROM FIG 13.4.4, DEPENDING ON PANEL WIDTH, W, AND EXTRACTED SEAM DEPTH, h.

S = MAXIMUM SETTLEMENT DUE TO SUBSIDENCE.

$W/h = 300'/620' = 0.48$

FROM FIG. 13.4.4, $K_3 = +1.4$ (EXTENSION)
-0.63 (COMPRESSION)

MAXIMUM TENSILE STRAIN

$$E_+ = 1.4\left(\frac{0.46}{620}\right) = +0.001\ FT/FT$$

MAXIMUM COMPRESSIVE STRAIN

$$E_- = -0.63\left(\frac{0.46}{620}\right) = -0.00046\ FT/FT$$

USING NCB METHOD, DEVELOP STRAIN PROFILE

e/E	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
Strain, E x 10^{-3}	0.00	0.04	0.19	0.48	0.80	1.00	0.80	0.00	- 0.02	- 0.09	- 0.22	- 0.37	- 0.46	- 0.37	- 0.22	- 0.09	- 0.02	- 0.00
Distance, % h (ft)	0.94	0.60	0.51	0.43	0.38	0.31	0.27	0.20	0.18	0.15	0.12	0.08	0.01	0.00	0.00	0.00	0.00	0.00
Distance (ft)	630	402	342	288	255	208	181	134	121	101	80	54	7	0	0	0	0	0

e/E - PERCENT OF STRAIN FROM CENTER OF MINED AREA
STRAIN - STRAIN AT DISTANCE h FROM CENTER OF MINED AREA
h - DISTANCE FROM CENTER OF MINED AREA

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: DML DATE: 6-13-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 12 OF 19
DESCRIPTION SUBSIDENCE CALC'S

FOR AREA 2, MAIN DISPOSAL AREA

DETERMINE MAXIMUM STRAIN

$$E_{MAX} = K_3 \left(\frac{S}{h}\right)$$

WHERE K_3 = STRAIN CONSTANT = +0.65 FROM 13.4.4 (PENG, S, 1985)
-0.5

S = MAX. SUBSIDENCE = 0.59 FEET

h = DEPTH = 670 FEET

$W/h = \frac{1400'}{670} = 2.08$ USE 2.0 IN TABLE 13.4.4

MAXIMUM TENSILE STRAIN

$$E+ = 0.65\left(\frac{0.59}{670}\right) = +0.00057 \text{ FT/FT}$$

MAXIMUM COMPRESSIVE STRAIN

$$E- = -0.5\left(\frac{0.375}{670}\right) = -0.00046 \text{ FT/FT}$$

USING NCB METHOD, DEVELOP STRAIN PROFILE TABLE 13.4.4

e/E	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
Strain, E x 10^{-4}	0.00	0.22	1.09	2.74	4.56	5.70	4.56	0.00	-0.18	-0.90	-2.26	-3.76	-4.70	-3.76	-2.26	-0.90	-0.18	0.00
Distance, % h (ft)	1.70	1.28	1.17	1.11	1.05	1.00	0.96	0.86	0.84	0.81	0.78	0.75	0.69	0.60	0.53	0.47	0.40	0.20
Distance (ft)	1139	794	725	688	651	620	595	533	521	502	484	465	428	372	329	291	248	124

e/E = PERCENT OF STRAIN FROM CENTER OF MINED AREA

STRAIN - STRAIN AT DISTANCE h FROM CENTER OF MINED AREA

h - DISTANCE FROM CENTER OF MINED AREA.

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: RMW DATE: 6/6/91 CHKD BY: DNL DATE: 6-13-91
PROJECT NAME: U.S. STEEL - CONCORD
PROJECT NO. 90-55-27 SHEET 13 OF 19
DESCRIPTION SUBSIDENCE CALC's

FOR AREA 3, EAST SIDE OF MAIN DISPOSAL AREA
(PILLAR EXTRACTION AREA)

DETERMINE MAXIMUM STRAIN

WHERE K_3 = STRAIN CONSTANT = +0.65
= -0.5

S = MAX SUBSIDENCE = 6.2 FEET

h = DEPTH = 670 FEET

$W/h = \frac{1000'}{670'} = 1.49$, USE 1.5 IN TABLE 13.4.4

MAXIMUM TENSILE STRAIN

$E+ = 0.65\left(\frac{6.2''}{670'}\right) = +0.006$ FT/FT

MAXIMUM COMPRESSIVE STRAIN

$E- = -0.5\left(\frac{6.2''}{670}\right) = -0.0046$ FT/FT

USING NCB METHOD, DEVELOP STRAIN PROFILE TABLE 13.4.4

e/E	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.00	0.20	0.40	0.60	0.80	1.00	0.80	0.60	0.40	0.20	0.00
Strain, E x 10	0.00	0.23	1.15	2.88	4.80	6.00	4.80	0.00	-0.18	-0.88	-2.21	-3.68	-4.60	-3.68	-2.21	-0.88	-0.18	0.00
Distance, % h (ft)	1.50	1.08	0.97	0.91	0.85	0.80	0.76	0.66	0.63	0.61	0.58	0.55	0.49	0.40	0.33	0.27	0.20	0.03
Distance (ft)	1005	724	650	610	570	536	509	442	422	409	389	369	328	268	221	181	134	20

e/E - PERCENT OF STRAIN FROM CENTER OF MINED AREA

STRAIN - STRAIN AT DISTANCE h FROM CENTER OF MINED AREA

h - DISTANCE FROM CENTER OF MINED AREA

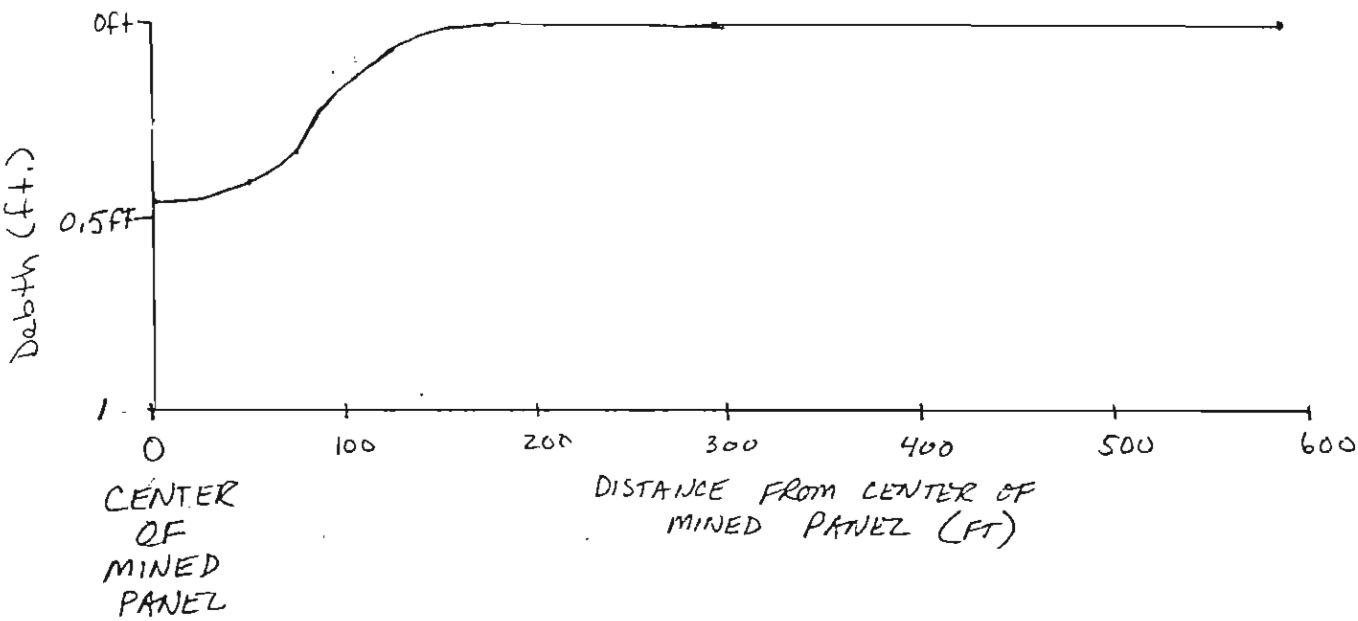
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: U.S. Steel - Concord

PROJECT NO. 90-55-27 SHEET 14 OF 19

DESCRIPTION SUBSIDENCE PROFILE



AREA 1 MINING ON the PRATT Seam

U.S. Steel - Concord Refuse Disposal Area

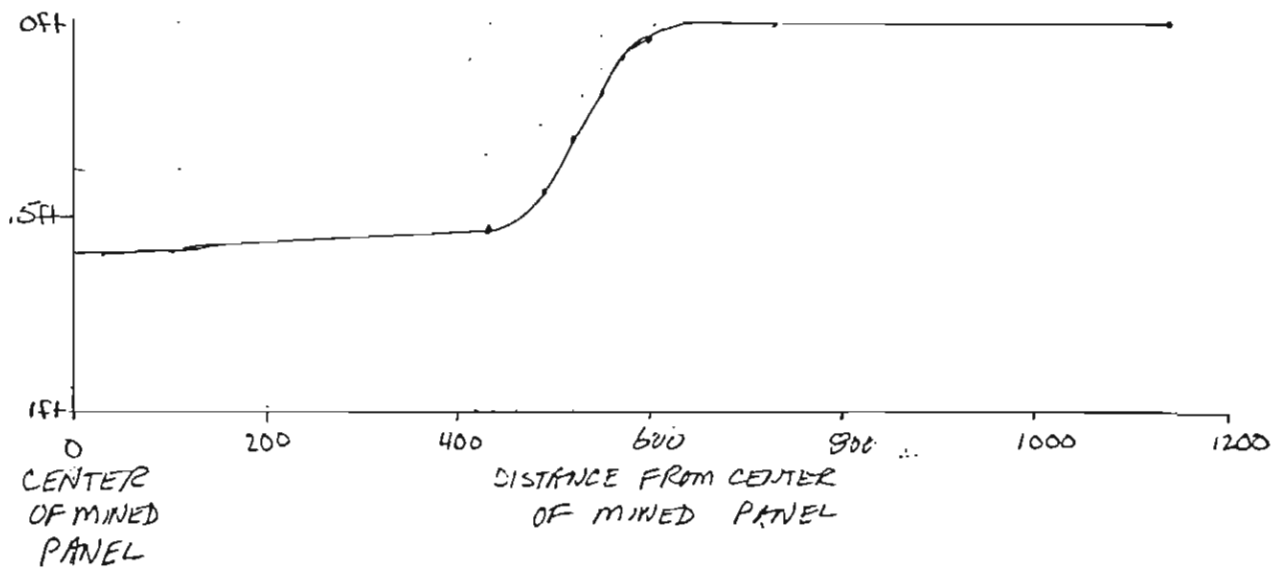
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: U.S. Steel - Concord

PROJECT NO. 90-55-27 SHEET 15 OF 19

DESCRIPTION Area 2 mining on the Pratt Seam SUBSIDENCE PROFILE



Area 2 mining on the Pratt Seam
US Steel - Concord Refuse Disposal Area

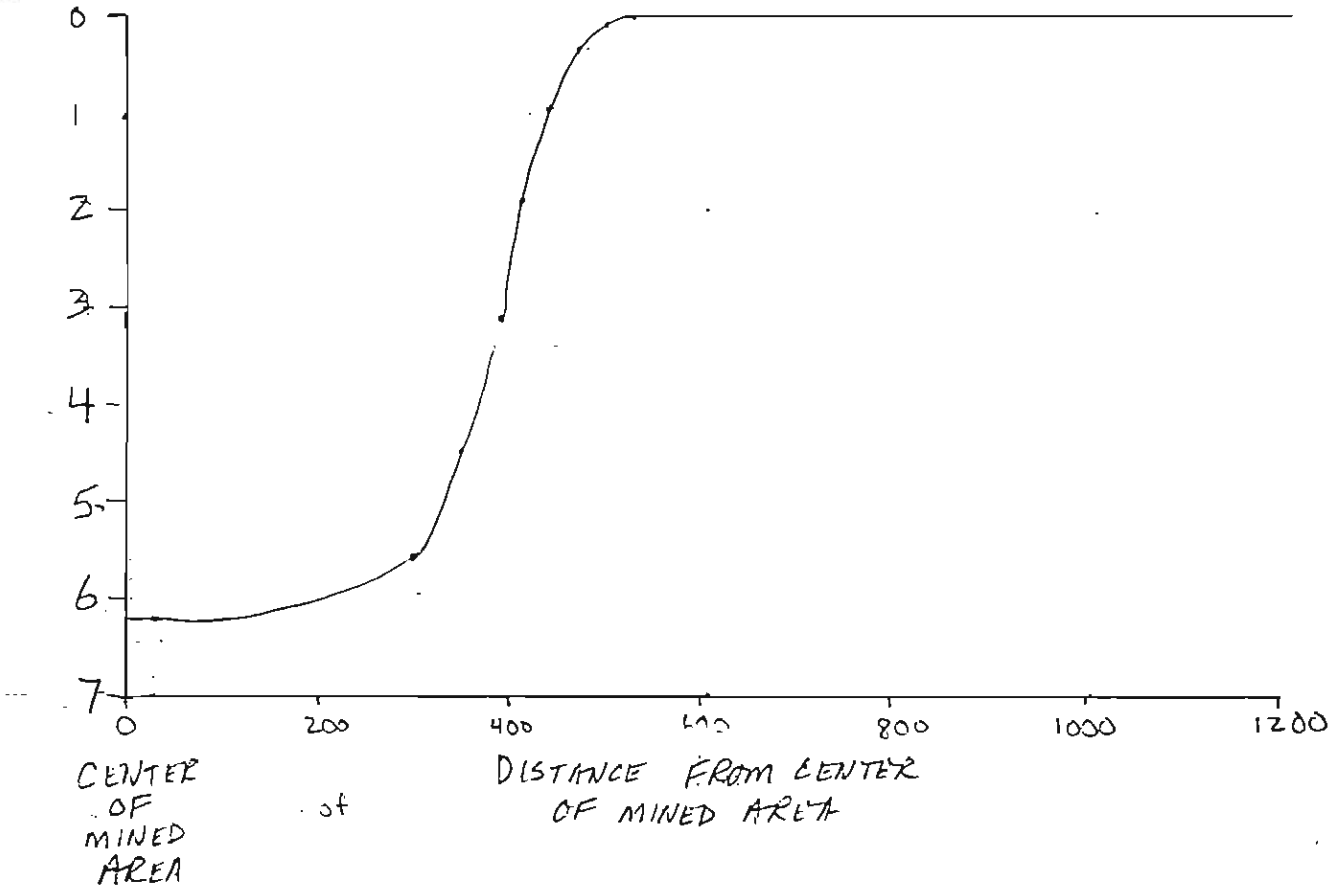
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/13/91

PROJECT NAME: US Steel - CONCORD

PROJECT NO. 90-55-27 SHEET 16 OF 19

DESCRIPTION SUBSIDENCE PROFILE



Area 3 mining on the Concord Seam
Us Steel - Concord Refuse disposal Area

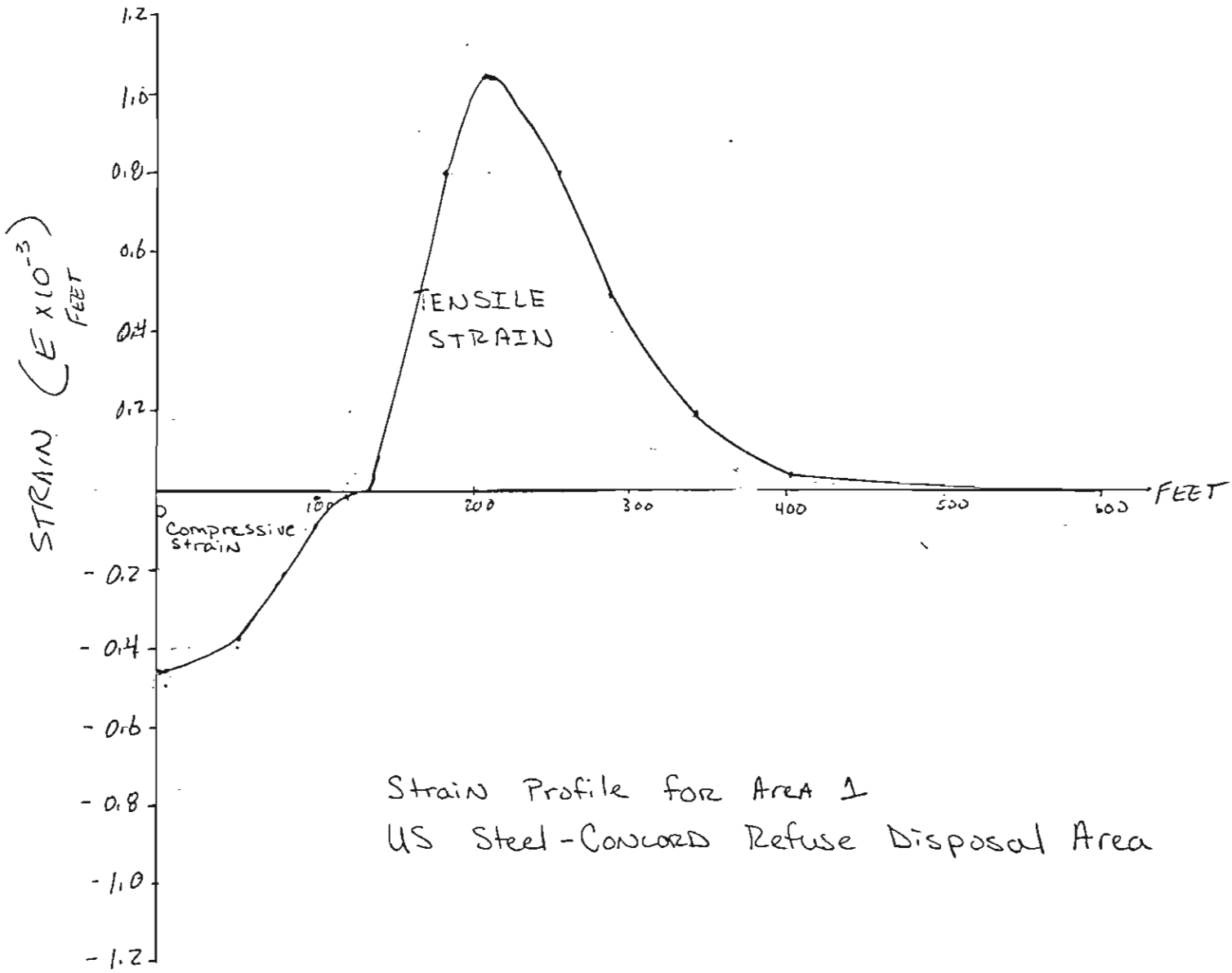
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: US. Steel - Concord

PROJECT NO. 90-55-27 SHEET 17 OF 19

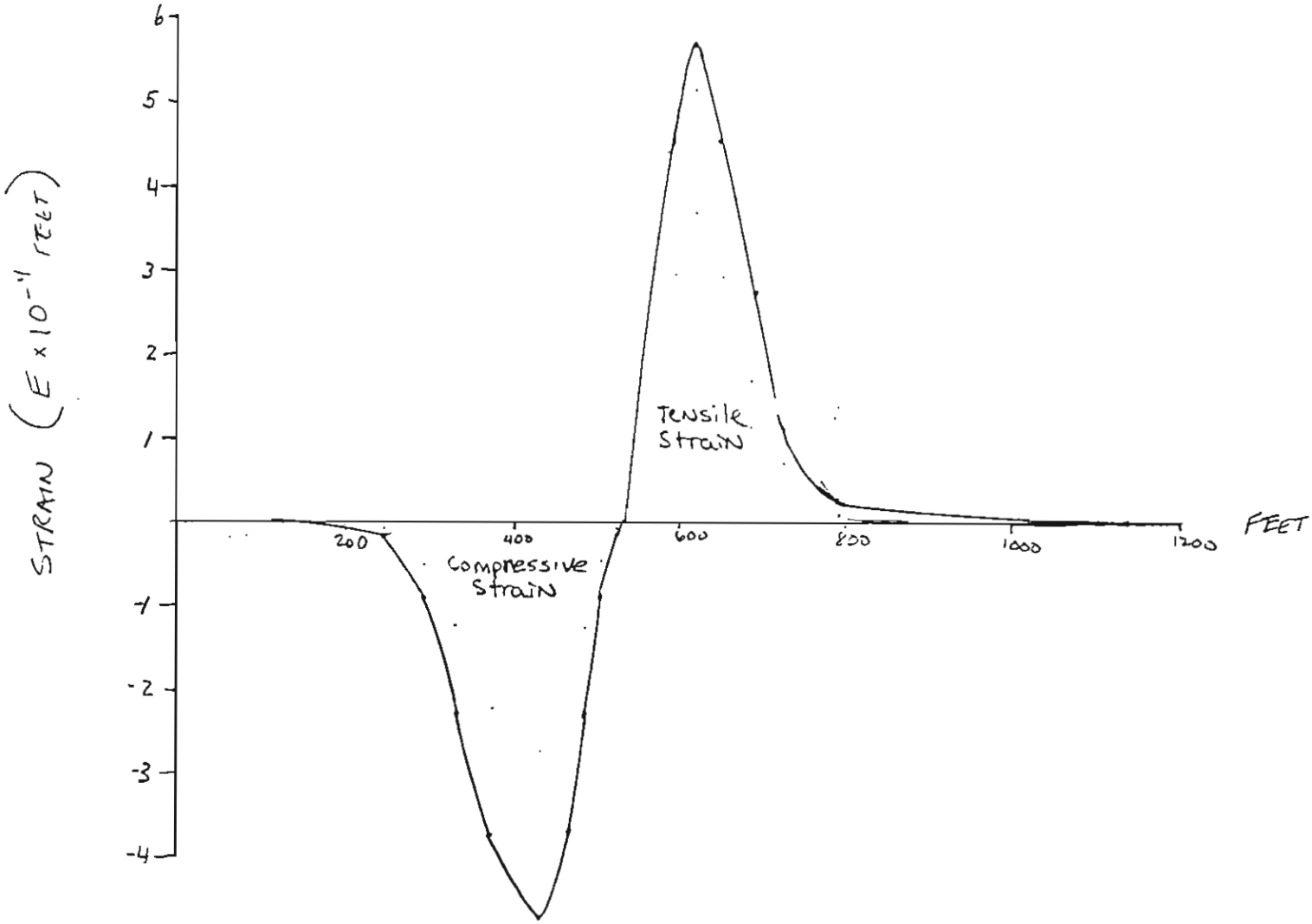
DESCRIPTION US Steel-Concord Refuse Disposal Area, Strain Profile for Area 1



Strain Profile for Area 1
US Steel-Concord Refuse Disposal Area

ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91
PROJECT NAME: US Steel Concord
PROJECT NO. 90-55-27 SHEET 18 OF 19
DESCRIPTION US Steel - Concord Refuse Disposal Area. Strain Profile for Area 2



STRAIN PROFILE FOR AREA 2

U.S. STEEL CONCORD REFUSE DISPOSAL AREA

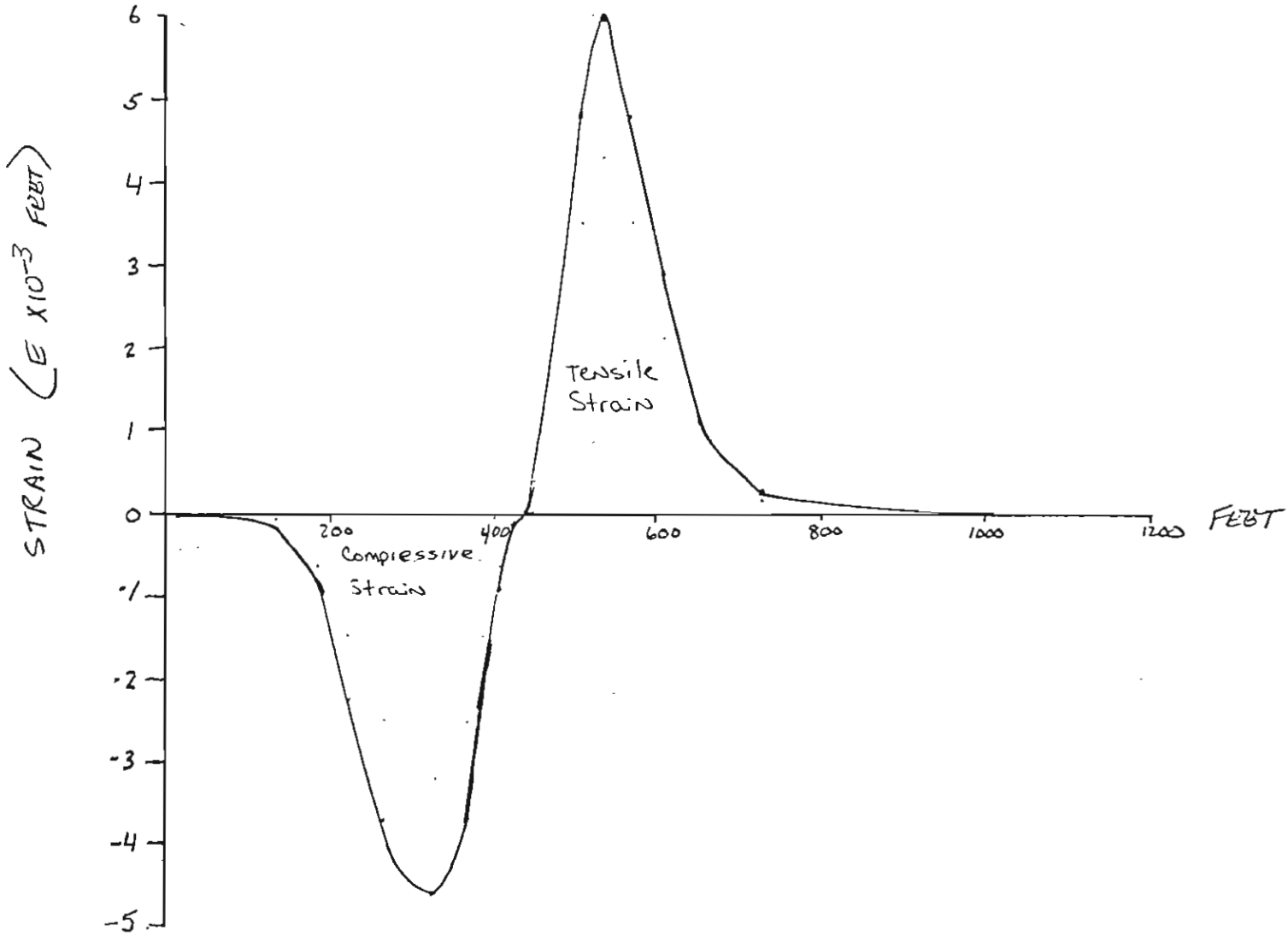
ALMES & ASSOCIATES INC.
CONSULTING ENGINEERS

BY: SAP DATE: 6/10/91 CHKD BY: RMW DATE: 6/10/91

PROJECT NAME: US Steel Concord

PROJECT NO. 90-55-27 SHEET 19 OF 19

DESCRIPTION US Steel Refuse Disposal Area Strain profile for Area 3



STRAIN PROFILE FOR AREA 3

U.S. STEEL - CONCORD REFUSE DISPOSAL AREA

APPENDIX B

BORING LOGS

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-1	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-23-91
				DATE COMPLETED:	1-23-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% ⊗ — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 584.7	
	S-1	1.5	100	-	LOOSE TO MEDIUM DENSE, BLACK COARSE, COAL REFUSE	
5	S-2	1.5	100	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, SEVERELY WEATHERED	
10	ST-1	2.3	92	-	SANDY CLAY WITH SOME REFUSE	
	S-3	0.95	63	-	STIFF, ORANGE AND RED, SANDY CLAY, MOIST, TRACE COARSE, MOIST	
15	S-4	1.5	100	-	VERY STIFF, ORANGE AND RED SANDY CLAY, TRACE SANDSTONE FRAGMENTS, MOIST	
20	S-5	1.5	100	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED, MOIST	
25	S-6	0.9	60	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED, MOIST	
	1	0.9	90	0	SANDSTONE - MEDIUM GRAINED, LIGHT GRAY, SOFT, VERY BROKEN, SEVERELY WEATHERED TO RED AND ORANGE, SOME CLAY LENSES	
30	2	7.8	82	73	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, MASSIVE, FRESH, TRACE COAL STRINGERS	
35					INTERBEDDED GRAY SANDSTONE AND CARBONEOUS SHALE, HARD, BROKEN, FRESH	
40					BOTTOM OF BORING AT 37.9 FEET	

50/5

AUGER REFUSAL AT 28 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

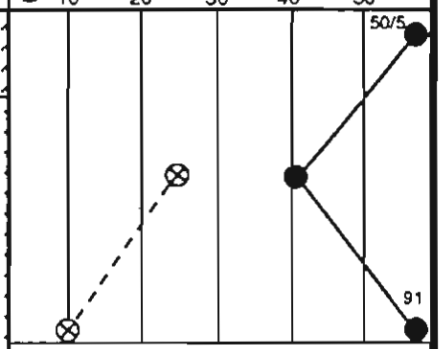
BORING NUMBER	B-2	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN			FIELD ENGINEER:	DOUG CLARK
				CHECKED BY: R. WOOD	DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK QUD. [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.9	
	S-1	0.9	60	-	VERY DENSE, LIGHT GRAY SLAG	
5	S-2	1.5	100	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO RED AND ORANGE	
10	S-3	1.2	80	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO RED AND ORANGE	
15	1	2.75	55	9	SANDSTONE - CLAYEY, LIGHT GRAY, SOFT TO MEDIUM HARD, VERY BROKEN, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
20	2	5	100	42		
25	3	4.55	92	52	BRECCIA - QUARTZ AND SHALE FRAGMENTS, GRAY AND WHITE, HARD, BROKEN, SLIGHTLY WEATHERED	
					SANDSTONE - FINE GRAINED, GRAY, HARD, BROKEN, FRESH, TRACE COAL STRINGERS	
30					BOTTOM OF BORING AT 26 FEET	
35						
40						



AUGER REFUSAL AT 11 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

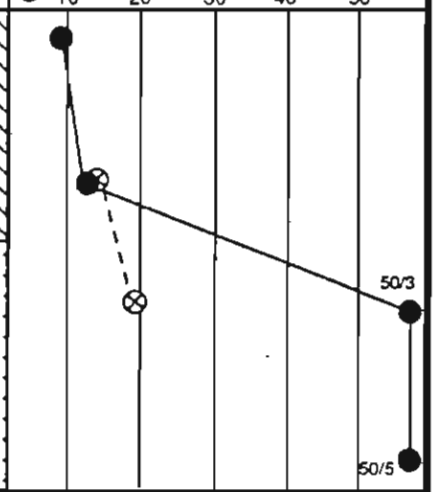
BORING NUMBER	B-3	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.7	
0	S-1	0.9	60	-	VERY STIFF, RED AND ORANGE, SANDY CLAY, MOIST	
5	S-2	1.5	100	-	STIFF, RED AND ORANGE, SANDY CLAY, MOIST	
10	S-3	0.6	40	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
15	S-4	0.4	27	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
16.6					BOTTOM OF BORING AT 16.6 FEET	
20						
25						
30						
35						
40						

UNCONFINED COMPRESSIVE STRENGTH TSF
○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



AUGER REFUSAL AT 16.6 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-3A	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-8-91
				DATE COMPLETED:	2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% ⊗ — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT ● : 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.7	
5	ST-1	2.5	100	-	ORANGE, SANDY CLAY	
					BOTTOM OF BORING AT 5.5 FEET	

10 15 20 25 30 35 40

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-4	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 1-28-91
				DATE COMPLETED: 1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING			

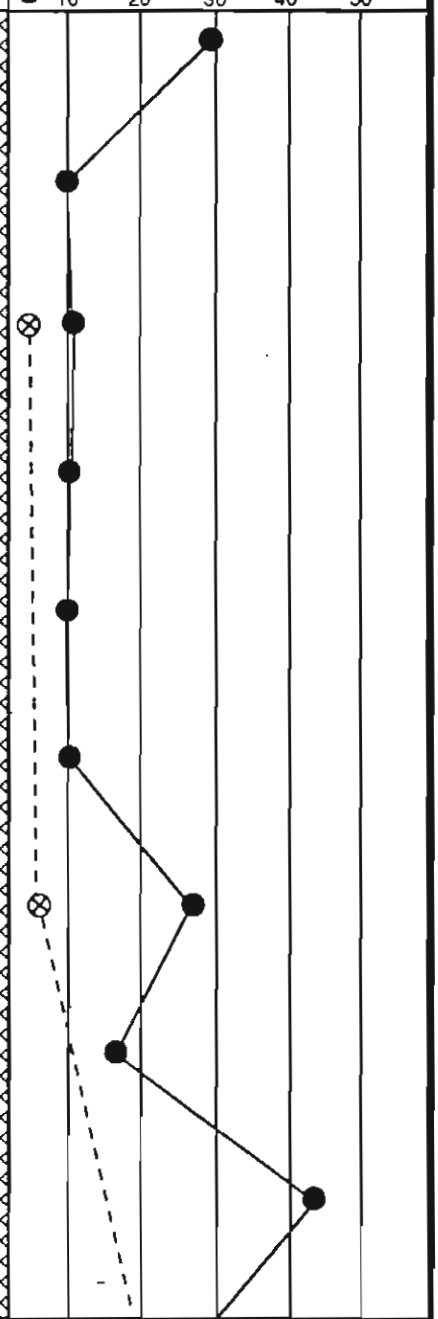
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%

10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 614.7	
	S-1	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE	
5	S-2	1.1	73	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
10	S-3	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
15	S-4	1.4	93	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
20	S-5	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
25	S-6	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
30	S-7	1.5	100	-	MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
35	S-8	1.5	100	-	MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
40	S-9	1.5	100	-	DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 2

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-4	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-28-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-10	1.5	100	-	MEDIUM STIFF, BROWN TO ORANGE, SANDY CLAY, MOIST	
50	S-11	1.5	100	-	VERY DENSE, RED AND ORANGE, CLAYEY SAND	
55					BOTTOM OF BORING AT 54.5 FEET	
60						
65						
70						
75						
80						
85						

AUGER REFUSAL AT 54.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

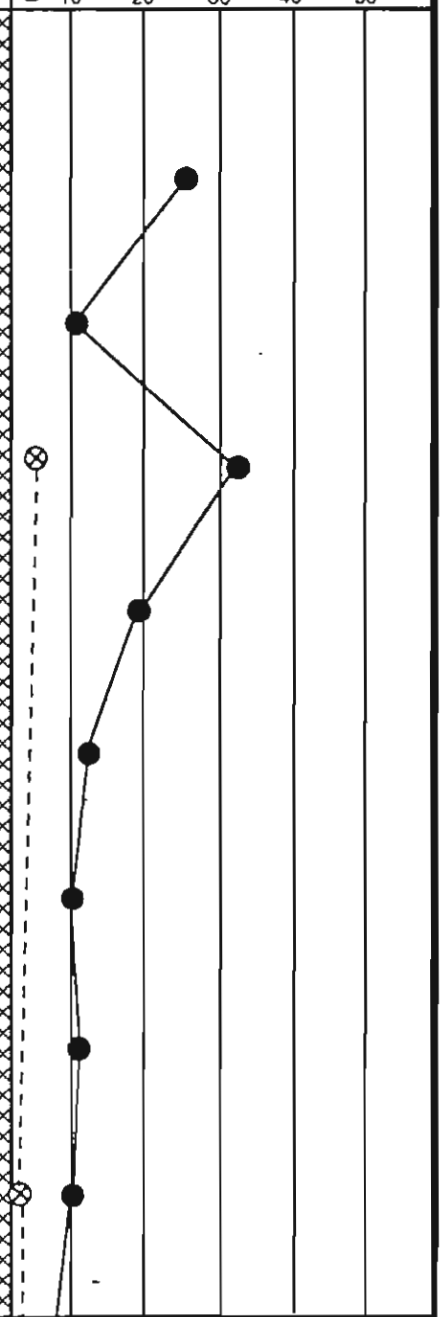
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 641.31
5	S-1	1.4	93	-	MEDIUM DENSE TO DENSE, GRAY, COARSE , COAL REFUSE, DRY
10	S-2	1.3	87	-	LOOSE TO MEDIUM DENSE, COARSE, COAL REFUSE, DRY
15	S-3	1.2	80	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.3	87	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
35	S-7	0.9	60	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
40	S-8	0.7	47	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

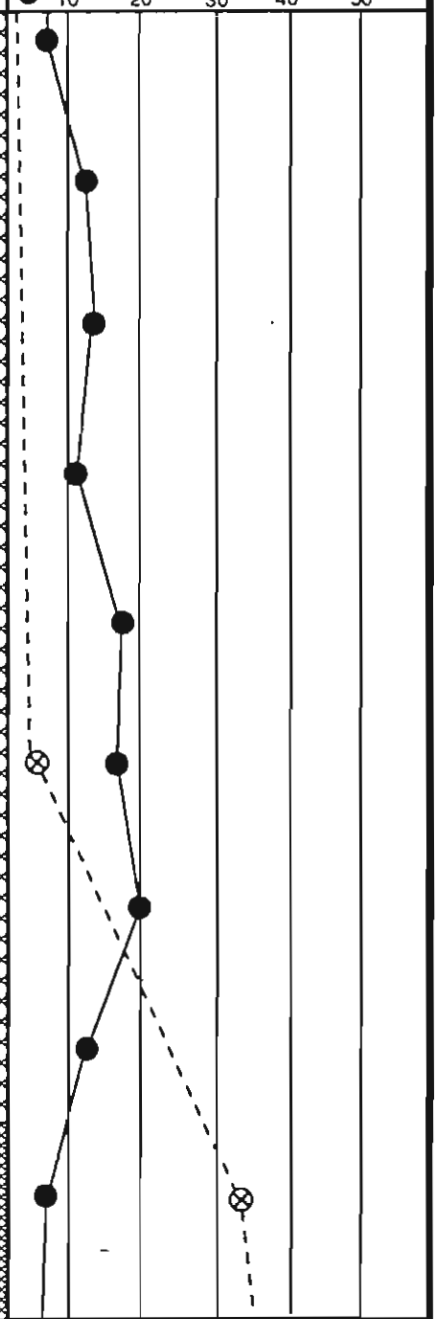
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.1	73	-	LOOSE, GRAY, COARSE COAL REFUSE, DRY
50	S-10	0.9	60	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, DRY
55	S-11	0.6	40	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, DRY
60	S-12	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-13	0.9	60	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
75	S-15	0.9	60	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
80	S-16	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, WET
85	S-17	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET
	ST-1	1.8	90	-	BLACK, FINE, COAL REFUSE

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91

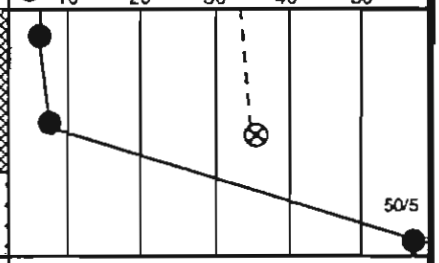
DRILLING METHOD: HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-18	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET	
	ST-2	0	0	-		
	S-19	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET	
	S-20	0.4	100	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOLTLED TO RED AND ORANGE	
100					BOTTOM OF BORING AT 98.4 FEET	
105						
110						
115						
120						
125						
130						



SPOON REFUSAL AT 98.4 FEET

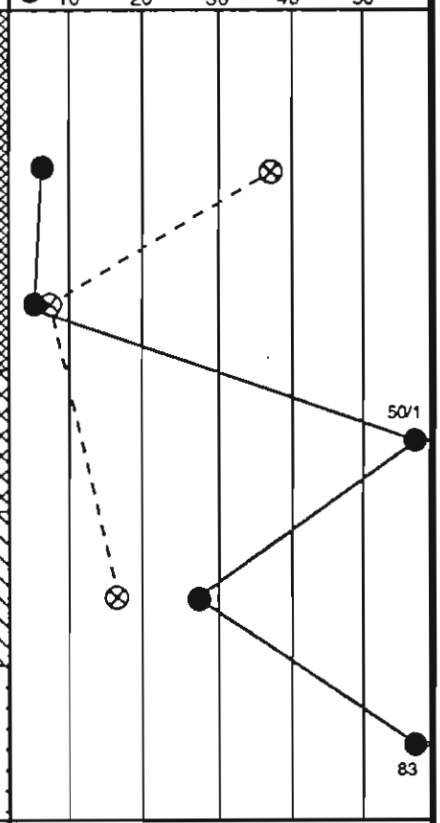
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-6	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-31-91
				DATE COMPLETED:	1-31-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 578.6	
5	S-1	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, WET	
	ST-1	1.5	75	-	BLACK, FINE, COAL REFUSE	
10	S-2	1.5	100	-	VERY SOFT, BLACK, FINE, COAL REFUSE, WET	
15	S-3	0.5	100	-	DENSE, GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST	
20	S-4	1.5	100	-	MEDIUM DENSE, RED AND ORANGE, SANDY CLAY	
25	S-5	1.4	93	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED	
					BOTTOM OF BORING AT 28 FEET	
30						
35						
40						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-7	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-24-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

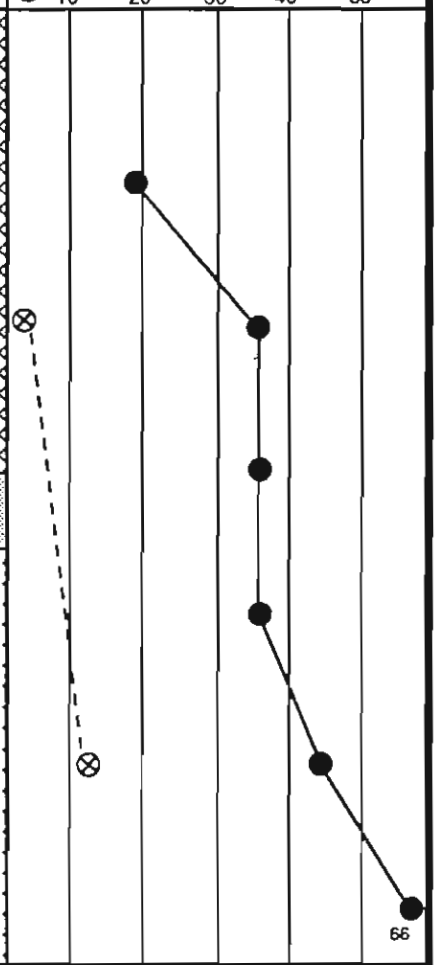
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 585.1
5	S-1	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
10	S-2	1.0	67	-	DENSE, BLACK, COARSE, COAL REFUSE, DRY
15	S-3	1.4	93	-	DENSE, GRAY, COARSE, COAL REFUSE; MEDIUM DENSE, LIGHT BROWN, CLAYEY SAND AT BOTTOM OF SAMPLE
20	S-4	1.5	100	-	SANDSTONE - ORANGE AND BROWN, VERY SOFT, SEVERELY WEATHERED,
25	S-5	1.3	87	-	SANDSTONE - ORANGE AND RED, VERY SOFT, SEVERELY WEATHERED,
30	S-6	1.1	73	-	SANDSTONE - CLAYEY, RED AND ORANGE, VERY SOFT, SEVERELY WEATHERED
35					BOTTOM OF BORING AT 33.4 FEET
40					

PROFILE



AUGER REFUSAL AT 33.4 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

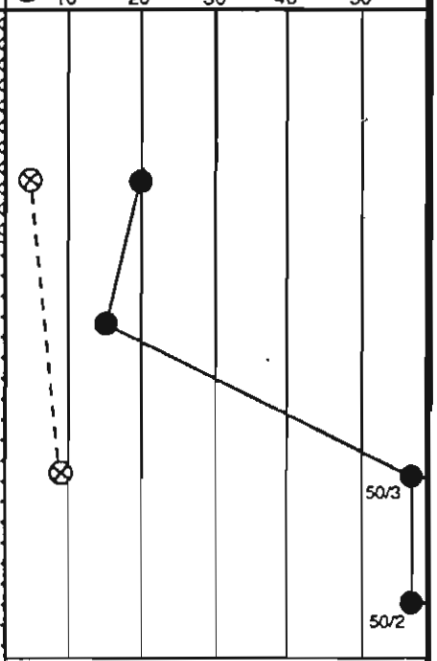
BORING NUMBER	B-8	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-24-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 551.8	
5	S-1	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY	
10	S-2	0.9	60	-	SANDSTONE - CLAYEY VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
15	S-3	1.0	67	-	SANDSTONE - CLAYEY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
20	S-4	0.2	100	-	SANDSTONE - VERY SOFT, SEVERELY WEATHERED TO ORANGE AND BROWN	
	1	1.7	74	71	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, BROKEN TO MASSIVE, SLIGHTLY WEATHERED AND STAINED ORANGE, TRACE IRONSTONE LAYERS AND COAL STRINGERS	
25	2	4.05	100	47	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, MASSIVE, FRESH	
30	3	4.7	100	94	CONGLOMERATE - ROCK FRAGMENT PEBBLES, GRAY HARD, SLIGHTLY BROKEN TO BROKEN, SLIGHTY WEATHERED TO ORANGE, TRACE COAL STRINGERS	
35					BOTTOM OF BORING AT 32.8 FEET	
40						



AUGER REFUSAL AT 27.35 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

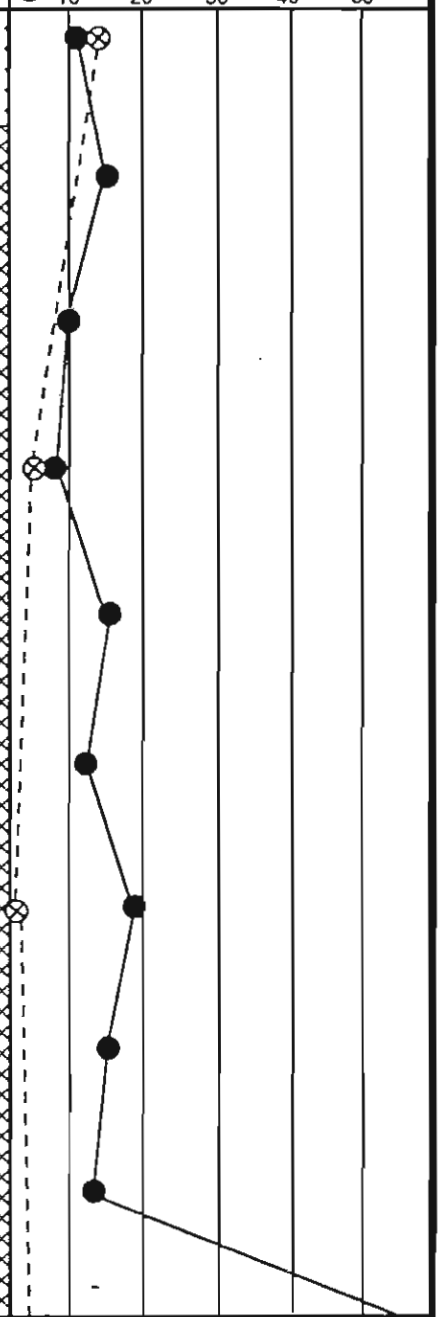
BORING NUMBER	B-9	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-29-91
				DATE COMPLETED:	1-30-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 536.3	
	S-1	1.5	100	-	MEDIUM DENSE, ORANGE AND RED, CLAYEY, SAND AND SANDSTONE FRAGMENTS, MOIST	
5	S-2	0.6	40	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
10	S-3	0.4	27	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE	
15	S-4	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN	
20	S-5	1.5	100	-	MEDIUM DENSE, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN	
25	S-6	1.5	100	-	MEDIUM DENSE, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN	
30	S-7	1.3	87	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE	
35	S-8	0.9	60	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
40	S-9	1.0	67	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-9	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-29-91
				DATE COMPLETED:	1-30-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

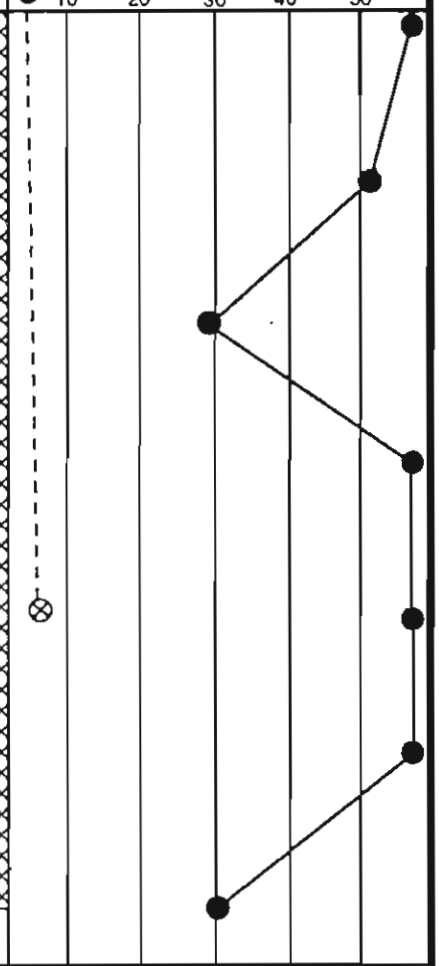
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
50	S-10	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
	S-11	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
55	S-12	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
60	S-13	0.5	71	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
65	S-14	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
70	S-15	0.4	80	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
75	S-16	1.3	87	-	DENSE, SEVERELY WEATHERED, COARSE, REFUSE WITH LIGHT GRAY SANDSTONE AT BOTTOM OF SAMPLE
80					BOTTOM OF BORING AT 78 FEET
85					

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



AUGER REFUSAL AT 78 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

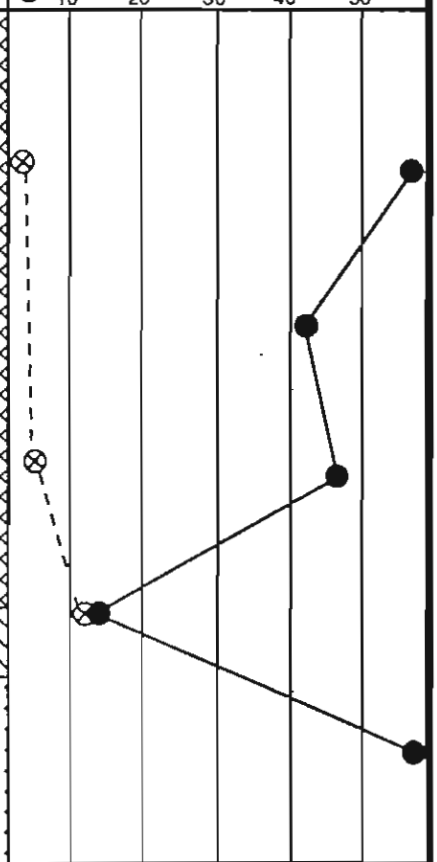
BORING NUMBER	B-10	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-25-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% □ LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT ● : 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 549.59
	S-1	-	-	-	NOT SAMPLED
5	S-2	0.9	100	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE
10	S-3	1.3	87	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE
15	S-4	1.5	100	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE
20	S-5	1.0	67	-	COARSE, COAL REFUSE AND STIFF, ORANGE SANDY CLAY
	ST-1	1.9	95	-	
25	S-6	0.35	100	-	SANDSTONE - RED, VERY SOFT, SEVERELY WEATHERED
30	1	0.3	14	0	SANDSTONE - RED AND ORANGE, VERY SOFT, VERY BROKEN, SOME INTERBEDDED CLAY
35	2	4.45	89	35	SANDSTONE - GRAY AND BROWN, MEDIUM HARD, BROKEN TO SLIGHTLY BROKEN WITH ANGULAR CLAY FILLED FRACTURES, SLIGHTLY WEATHERED TO ORANGE
					SANDSTONE - GRAY, SEVERELY WEATHERED TO ORANGE, SOFT TO MEDIUM HARD, VERY BROKEN TO BROKEN
40	3	4.5	90	50	SANDSTONE AND CONGLOMERATE - COARSE GRAINED AND PEBBLES, DARK GRAY, HARD, SLIGHTLY BROKEN, SLIGHTLY WEATHERED, TRACE COAL STRINGERS
					BOTTOM OF BORING AT 41.6 FEET



AUGER REFUSAL AT 29.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 658.3
5	S-1	1.2	80	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.7	47	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
15	S-3	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.0	67	-	VERY LOOSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.4	93	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, SOME SAND, MOIST
35	S-7	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
40	S-8	1.3	87	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST

PROFILE

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

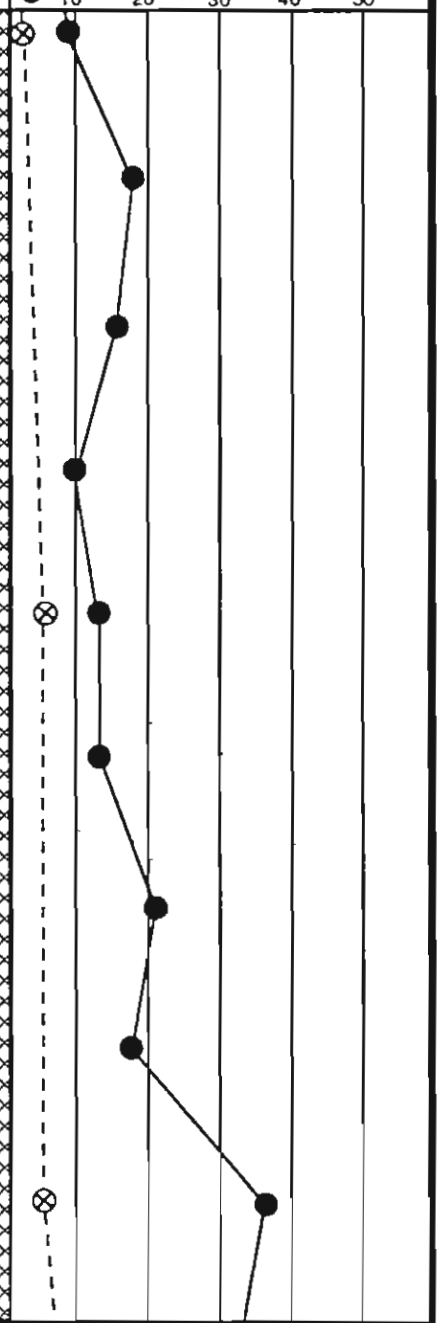
BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.2	80	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
50	S-10	1.3	87	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
55	S-11	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-13	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
70	S-14	1.5	100	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
75	S-15	0	0	-	
80	S-16	1.3	87	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
85	S-17	1.1	73	-	DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
95	S-18	1.0	67	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN, DRY TO MOIST
	S-19	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
100	S-20	1.0	67	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
105	S-21	0.4	27	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
110	S-22	-	-	-	SAMPLE NOT RECOVERED
					BOTTOM OF BORING AT 111.5 FEET
115					
120					
125					
130					

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50

AUGER REFUSAL AT 111.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91
				DATE COMPLETED: 2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING			

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% ⊗ — LIQUID LIMIT%: 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 657.4	
5	S-1	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
10	S-2	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
15	S-3	0.7	47	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
20	S-4	1.2	80	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
25	S-5	1.1	73	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
30	S-6	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
35	S-7	0.9	60	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
40	S-8	0.8	53	-	LOOSE, BLACK AND BROWN, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

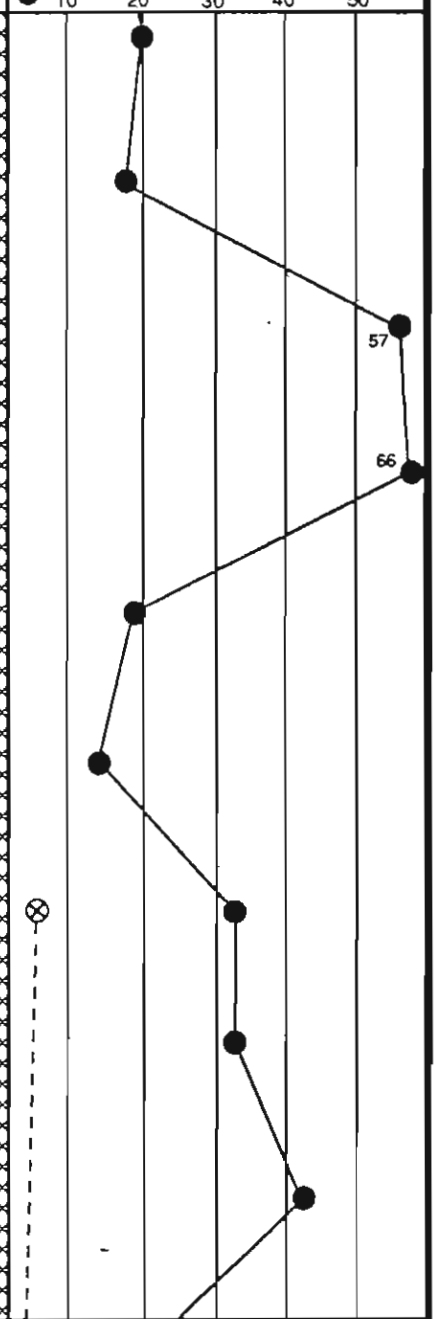
BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91	
				DATE COMPLETED: 2-8-91	
BORING LOCATION	REFER TO PLAN		FIELD ENGINEER: DOUG CLARK		
			CHECKED BY: R. WOOD	DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-9	0.7	47	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
50	S-10	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
55	S-11	1.5	100	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST	
60	S-12	1.3	87	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST	
65	S-13	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY	
70	S-14	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY	
75	S-15	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST TO WET	
80	S-16	1.3	87	-	DENSE, BLACK AND GRAY, COARSE COAL REFUSE, DRY	
85	S-17	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

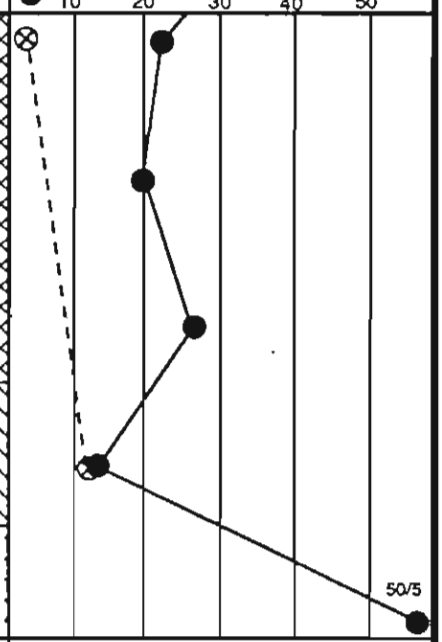
SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91
				DATE COMPLETED: 2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING			

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
95	S-18	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
	S-19	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
100	S-20	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, MOIST
105	S-21	1.1	73	-	STIFF, LIGHT BROWN, SANDY CLAY, MOIST
110	S-22	0.9	60	-	SANDSTONE- VERY SOFT, SEVERELY WEATHERED TO RED AND YELLOW
					BOTTOM OF BORING AT 110.9 FEET
115					
120					
125					
130					

PROFILE



SPOON REFUSAL AT 120.9 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91
				DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD	DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING			

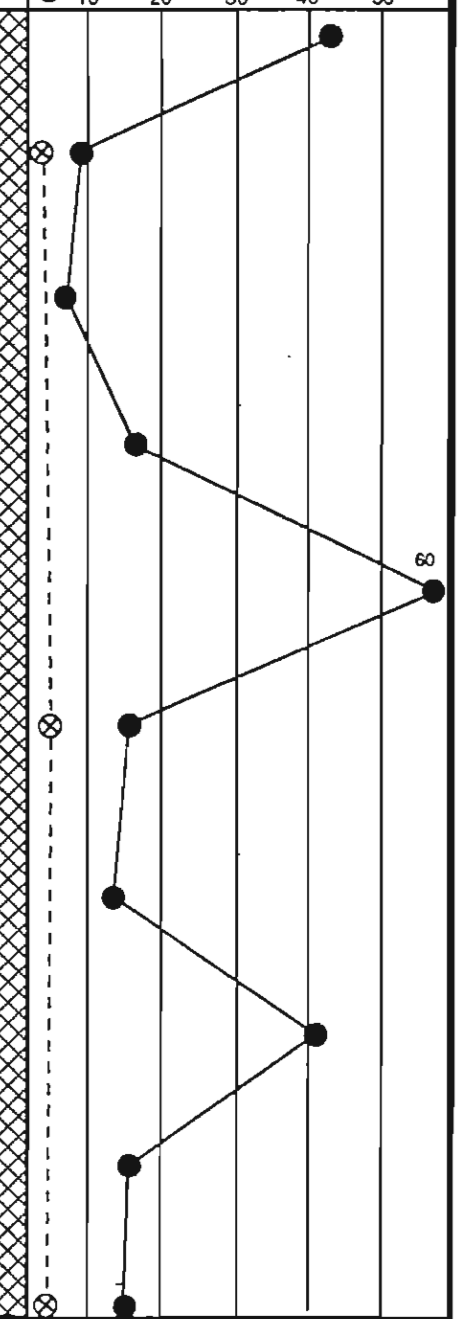
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, (FT.)	RECOVERY, (%)	ROCK ROD, (%)	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 632.82
	S-1	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY
5	S-2	-	-	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-3	-	-	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
15	S-4	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-5	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-6	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
30	S-7	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
35	S-8	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
40	S-9	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
	S-10	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

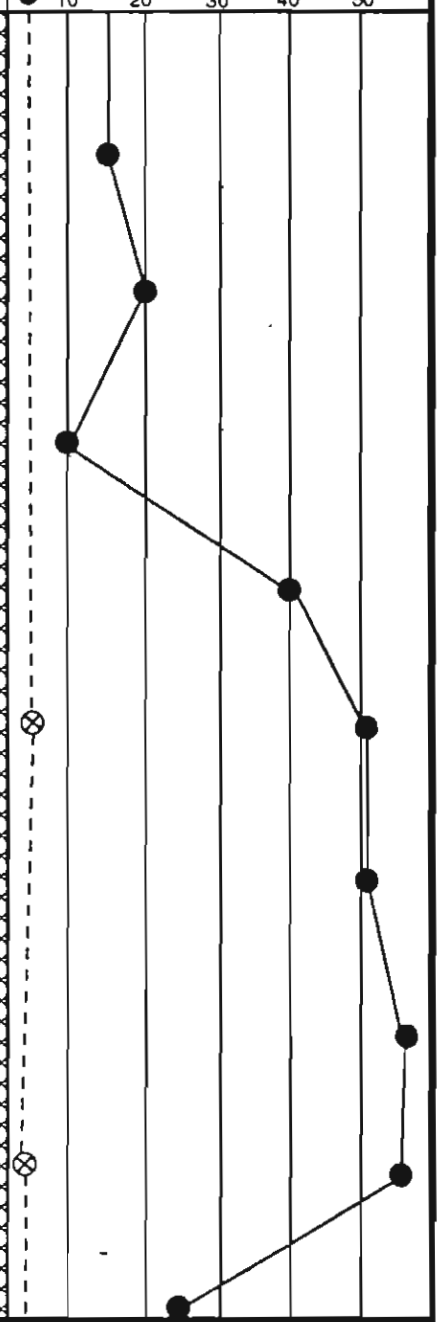
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% | WATER CONTENT% ⊗ | LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-10	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
50	S-11	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
55	S-12	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
60	S-13	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
65	S-14	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
70	S-15	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
75	S-16	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
80	S-17	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
85	S-18	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST
	S-19	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE	STANDARD PENETRATION BLOWS/FT
	S-19	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY		
95	S-20	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE		97
100	S-21	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST		
105	S-22	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE DRY TO MOIST		
110	S-23	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN		50/5
115	S-24	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN		
120	S-25	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN		50/5.5
125	S-26	-	-	-	VERY SOFT, SEVERELY WEATHERED, LIGHT BROWN SANDSTONE		79
	S-27	-	-	-	SANDSTONE-LIGHT BROWN, VERY SOFT, SEVERELY WEATHERED		50/2.5
130					BOTTOM OF BORING AT 129.3 FEET		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

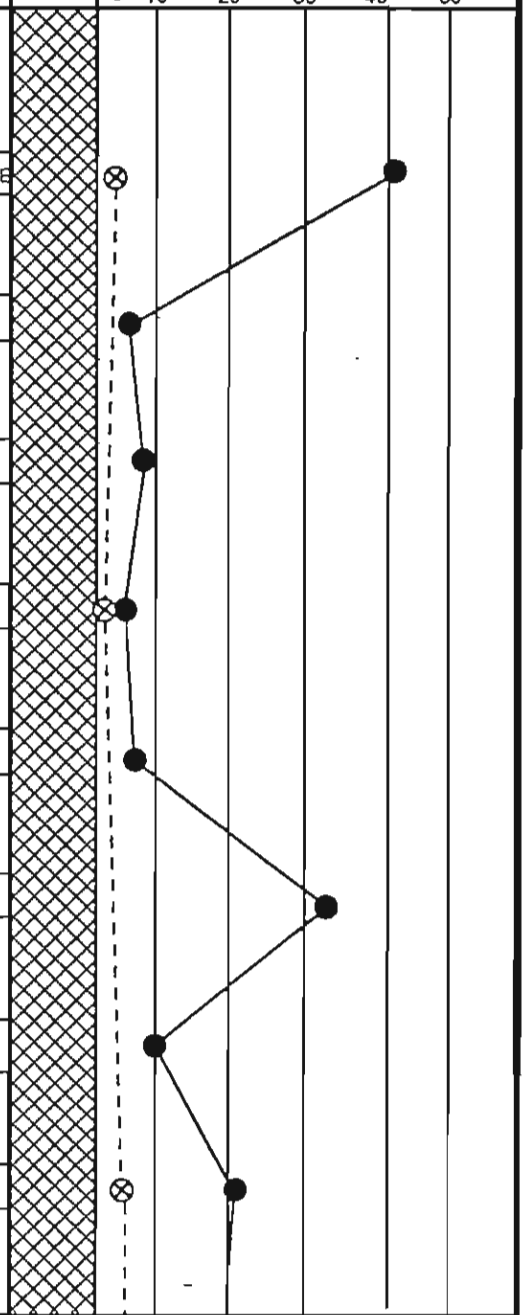
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					APPROXIMATE SURFACE ELEVATION: 658
5	S-1	1.3	87	-	DENSE, GRAY AND BLACK, COARSE , COAL REFUSE
10	S-2	0.8	53	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
15	S-3	1.0	67	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
20	S-4	0.9	60	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
25	S-5	1.3	87	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
30	S-6	1.3	87	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
35	S-7	1.2	80	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE , COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, MOIST
40	S-8	1.4	93	-	MEDIUM DENSE, BLACK AND GRAY COARSE COAL REFUSE, MOIST

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

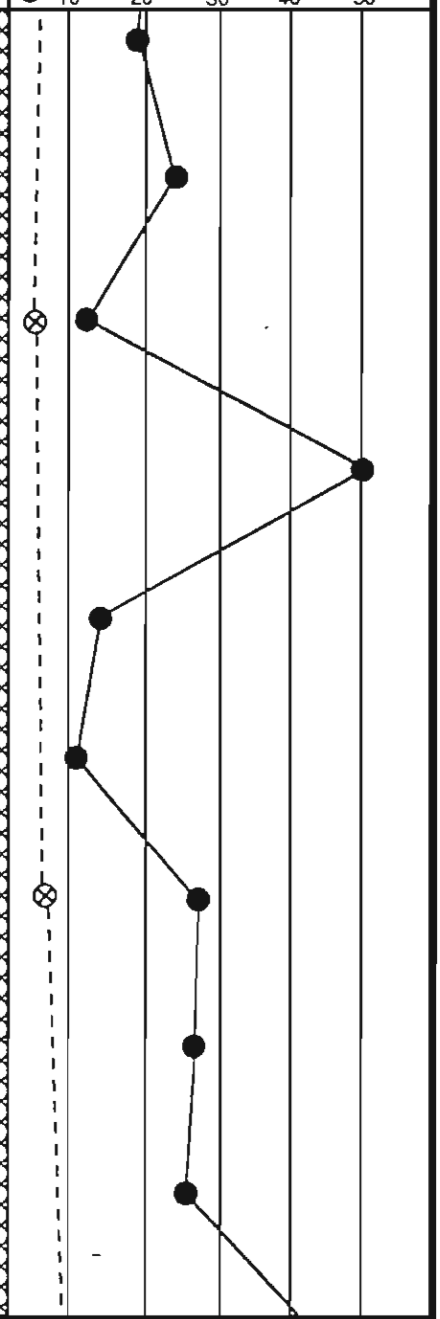
BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN			FIELD ENGINEER:	DOUG CLARK
				CHECKED BY: R. WOOD	DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
50	S-10	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO ORANGISH BROWN, MOIST
55	S-11	1.1	73	-	MEDIUM DENSE, GRAY, COARSE COAL, REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN, MOIST
60	S-12	1.3	87	-	DENSE TO VERY DENSE, GRAY AND BLACK, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
70	S-14	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
75	S-15	1.5	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
80	S-16	1.3	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
85	S-17	1.5	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

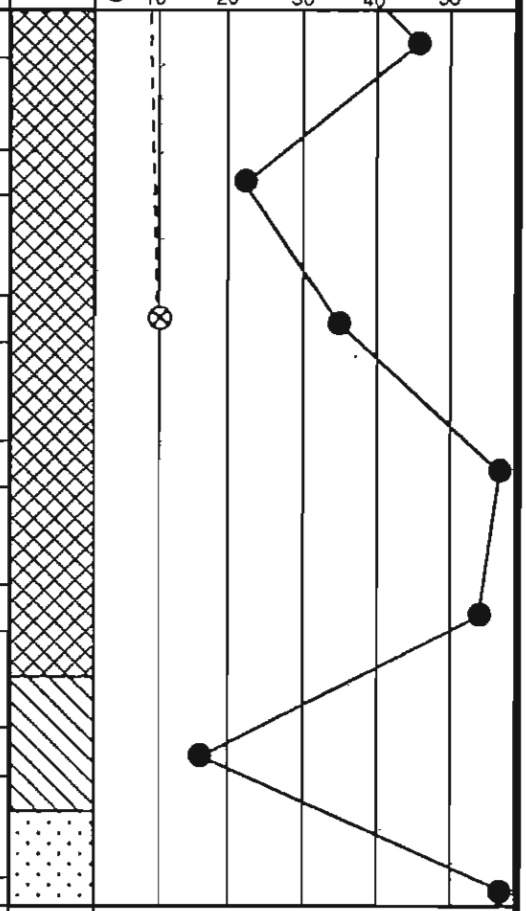
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
95	S-18	0.8	53	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE
	S-19	0.9	60	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE
100	S-20	0.7	47	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE
105	S-21	0.9	60	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED
110	S-22	0.8	53	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED
115	S-22	0.8	53	-	STIFF, LIGHT BROWN, SANDY CLAY, MOIST
120	S-24	0.9	60	-	SANDSTONE - VERY SOFT, SEVERELY WEATHERED AND MOTTLED RED AND ORANGE
125					BOTTOM OF BORING AT 120.9 FEET
130					SPOON REFUSAL AT 120.9 FEET

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

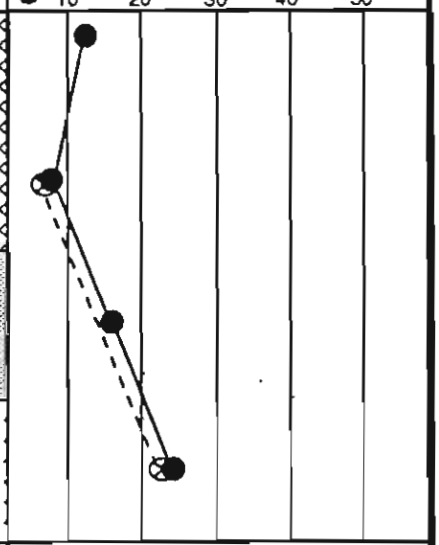
SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-15	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-21-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGER WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 568.0
	S-1	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REGUSE, DRY
5	S-2	0.5	33	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE
10	S-3	1.5	100	-	MEDIUM DENSE, ORANGE, CLAYEY SAND, MOIST
15	S-4	1.5	100	-	SANDSTONE, ORANGE AND BROWN VERY SOFT, SEVERELY WEATHERED,
20					BOTTOM OF BORING AT 18.5 FEET
25					
30					
35					
40					

PROFILE



AUGER REFUSAL AT 18.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

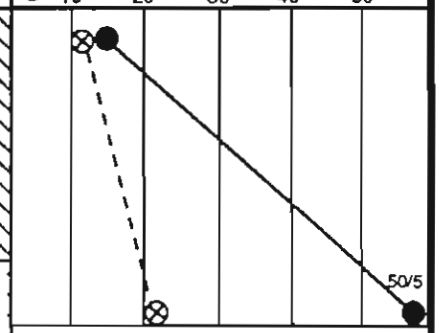
BORING NUMBER	B-16	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGER WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 573.6	
	S-1	1.5	100	-	VERY STIFF, ORANGE, SANDY CLAY WITH SOME REFUSE FRAGMENTS, MOIST	
5	ST-1	1.85	74	-	ORANGE, SANDY CLAY	
10	S-2	0.9	-	-	VERY SOFT, SANDSTONE - LT. GRAY, SEVERLY WEATHERED, TO ORANGE AND RED	
	1	1.8	36	0	SANDSTONE - LIGHT GRAY, SOFT, VERY BROKEN, SEVERLY WEATHERED TO RED AND ORANGE	
15						
20	2	7.55	100	100	SANDSTONE - GRAY,HARD, MASSIVE, FRESH, TRACE COAL STRINGERS	
25	3	1.85	100	100		
					BOTTOM OF BORING AT 26.25 FEET	
30						
35						
40						



AUGER REFUSAL AT 11.85 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

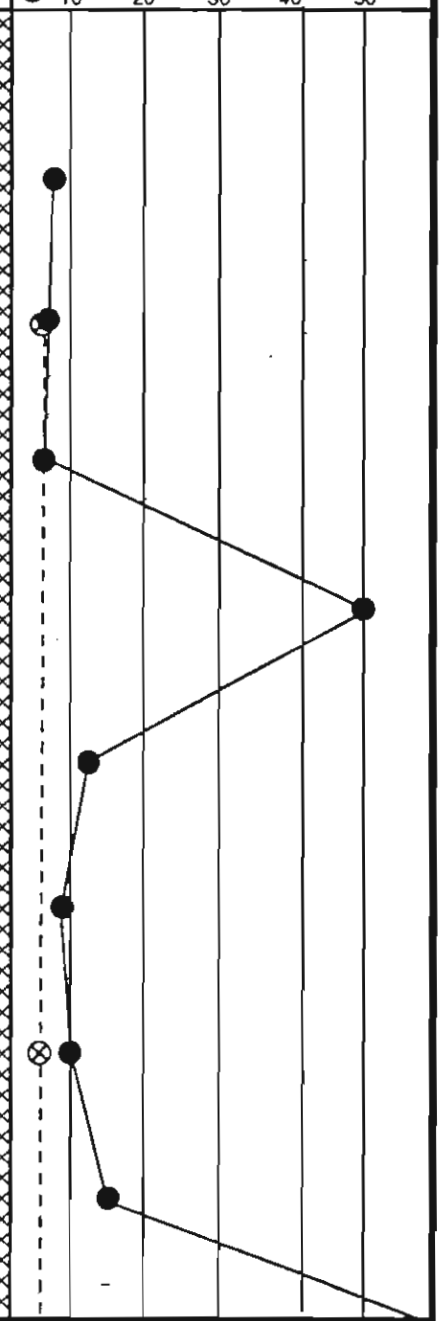
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 634.7
5	S-1	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.8	53	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
15	S-3	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.2	80	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.1	73	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
35	S-7	1.3	87	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, DRY TO MOIST
40	S-8	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

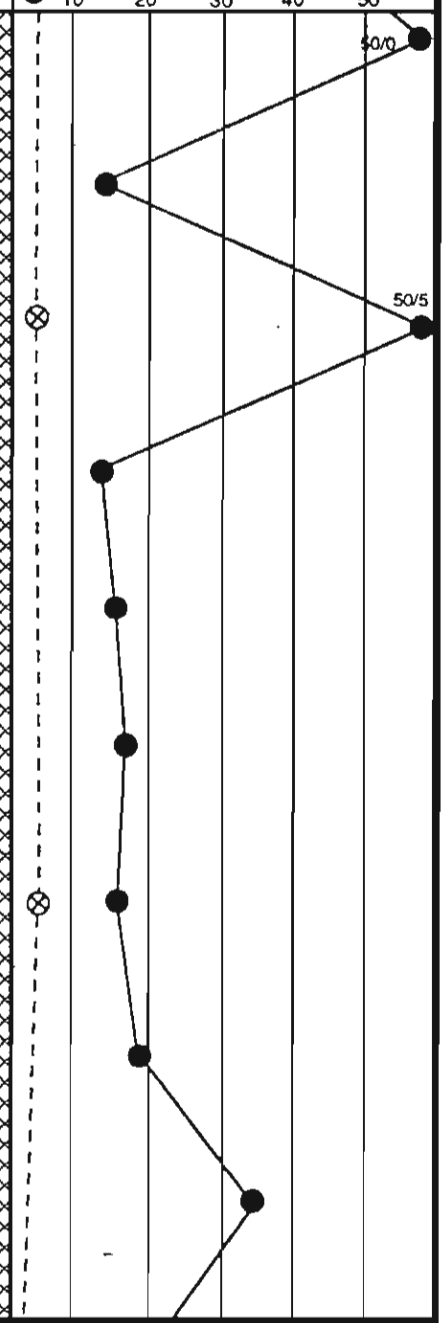
BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
50	S-10	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
55	S-11	0.8	53	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.2	80	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
85	S-17	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-18	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
	S-19	1.3	87	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
100	S-20	1.4	93	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
105	S-21	1.2	80	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
110	S-22	1.2	80	-	DENSE, LIGHT BROWN CLAYEY SAND, MOIST	
					VERY SOFT, SEVERELY WEATHERED RED AND ORANGE SANDSTONE	
	S-23	0.2	100	-		
115					BOTTOM OF BORING AT 113.7 FEET	
120						
125						
130						

50/2

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

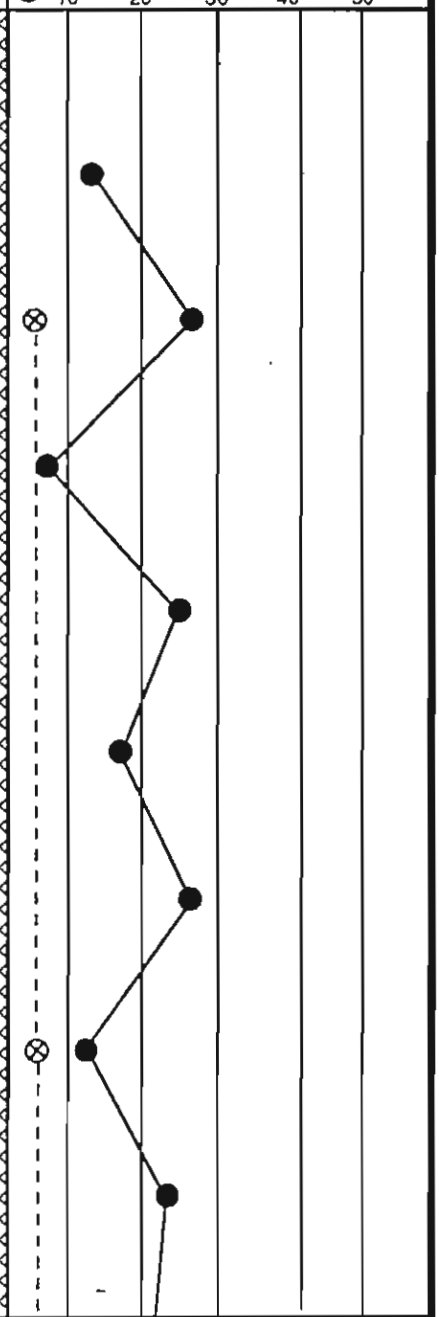
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 656.8
5	S-1	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-2	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
15	S-3	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
20	S-4	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
25	S-5	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
30	S-6	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
35	S-7	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
40	S-8	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

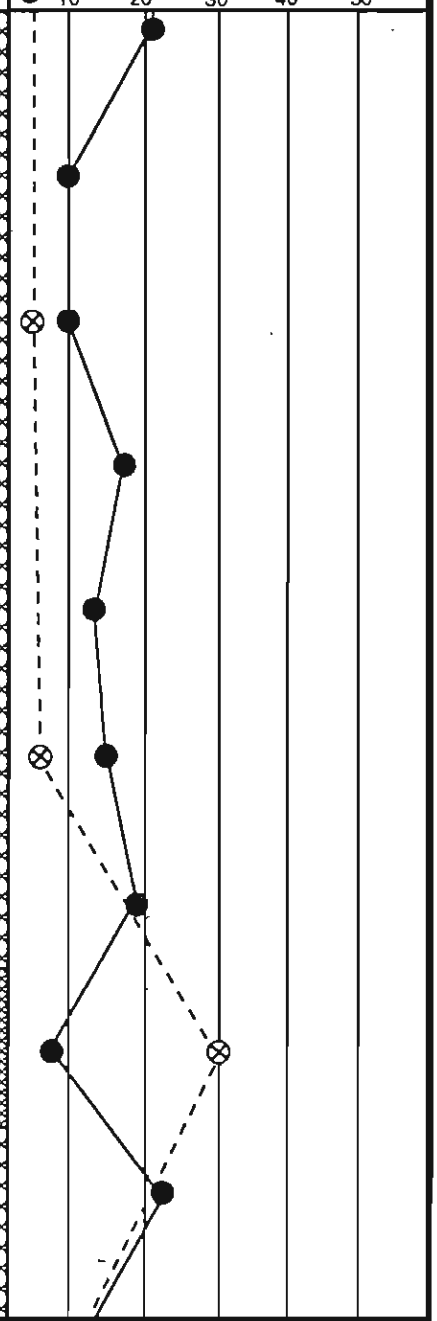
PLASTIC LIMIT% | WATER CONTENT% ⊗ | LIQUID LIMIT%

10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
50	S-10	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
55	S-11	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
65	S-13	0.8	53	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.0	67	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST
85	S-17	0.8	53	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, WET

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

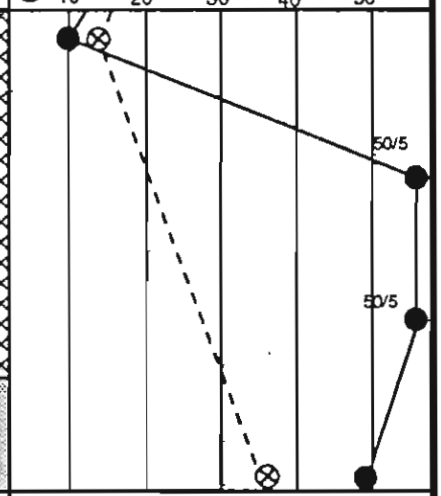
BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN			FIELD ENGINEER:	DOUG CLARK
				CHECKED BY: R. WOOD	DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-18	-	-	-	LOOSE TO MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, WET	
95	S-19	0.7	47	-	DENSE TO VERY DENSE, BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
100	S-20	0.4	27	-	VERY DENSE, BLACK, COARSE, COAL REFUSE, MOIST	
105	S-21	1.1	73	-	DENSE, ORANGE, CLAYEY SAND, MOIST	
					BOTTOM OF BORING AT 106.5 FEET	
110						
115						
120						
125						
130						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

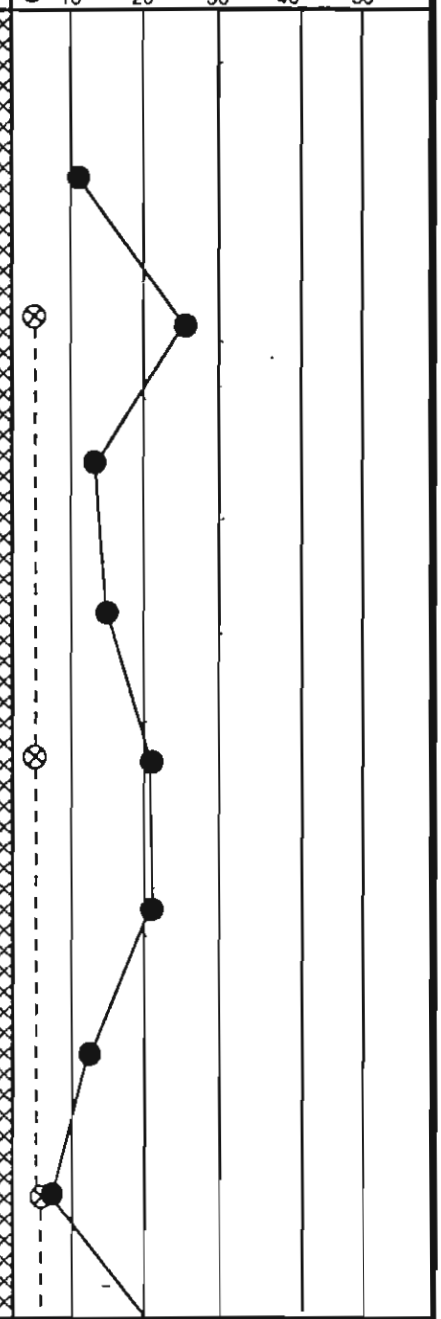
BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 658.1	
5	S-1	-	-	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, MOIST	
10	S-2	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
15	S-3	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST	
20	S-4	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
25	S-5	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
30	S-6	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
35	S-7	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
40	S-8	-	-	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

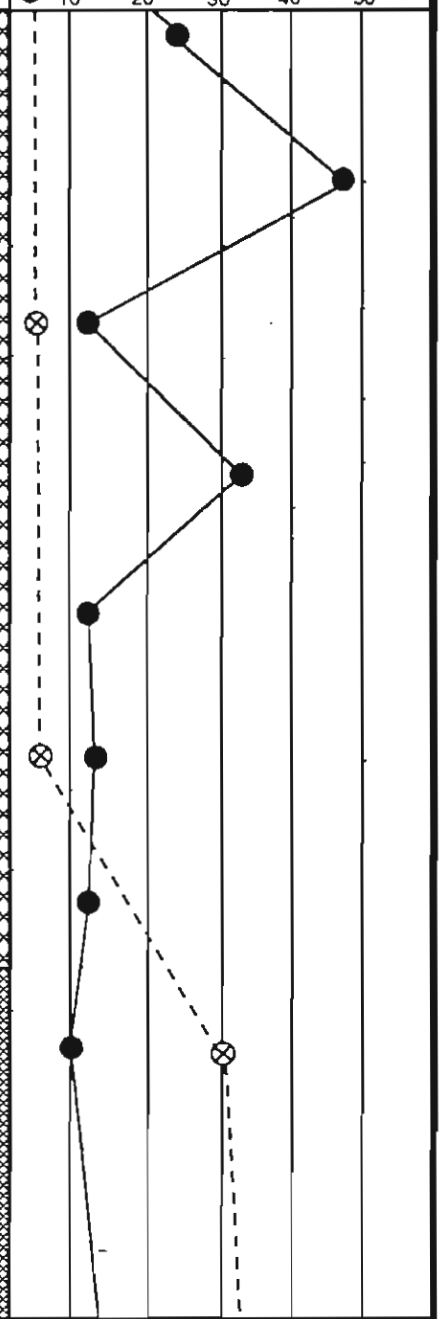
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
50	S-9	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
	S-10	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
55	S-11	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
60	S-12	-	-	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
70	S-14	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.5	100	-	MEDIUM STIFF TO STIFF, BLACK, FINE, COAL REFUSE, MOIST
85	ST-1	2.5	100	-	BLACK, FINE, COAL REFUSE

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91
				DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91

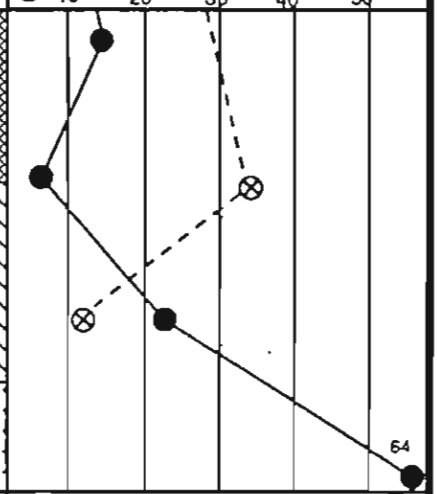
DRILLING METHOD: HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% ⊗ — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-17	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE WITH SOME COARSE, MOIST TO WET	
	S-18	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET. LIGHT BROWN CLAY IN BOTTOM OF SPOON	
100	S-19	1.3	87	-	STIFF TO VERY STIFF, LIGHT BROWN, SANDY CLAY, MOIST	
105	S-20	1.5	100	-	SANDSTONE-LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED RED AND ORANGE	
					BOTTOM OF BORING AT 106.5 FEET	
110						
115						
120						
125						
130						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-20	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-11-91
				DATE COMPLETED:	2-12-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

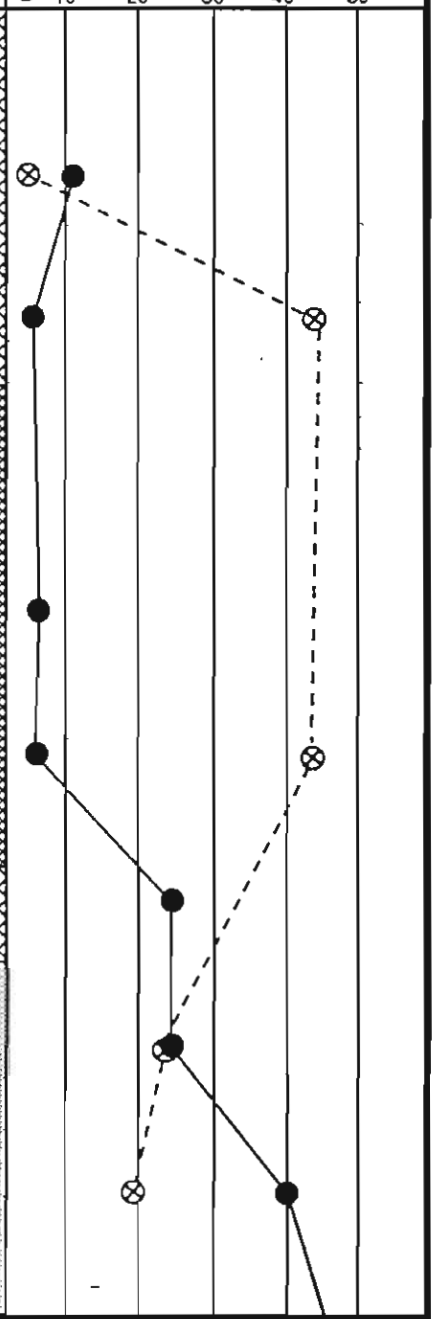
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 592.4
5	S-1	1.5	100		MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.7	100		VERY LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
15	ST-1	2.5	100		BLACK, FINE, COAL REFUSE
20	S-3	1.0	67		VERY SOFT, BLACK, FINE, COAL REFUSE, WET
25	S-4	1.5	100		VERY SOFT, BLACK, FINE, COAL REFUSE, WET
	ST-2	2.5	100		BLACK, FINE, COAL REFUSE
30	S-5	1.5	100		MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
35	S-6	1.5	100		MEDIUM DENSE, BROWNISH ORANGE, CLAYEY SAND, MOIST
40	S-7	1.5	100		DENSE, BROWNISH ORANGE, CLAYEY SAND, MOIST

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 2

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-20	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-11-91
				DATE COMPLETED:	2-12-91
BORING LOCATION	REFER TO PLAN		FIELD ENGINEER: DOUG CLARK		
			CHECKED BY: R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-8	1.1	73		SANDSTONE-LIGHT GRAY VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO ORANGE AND RED	
					BOTTOM OF BORING AT 46.5 FEET	
50						
55						
60						
65						
70						
75						
80						
85						

UNCONFINED COMPRESSIVE STRENGTH TSF
O 1 3 4 5

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

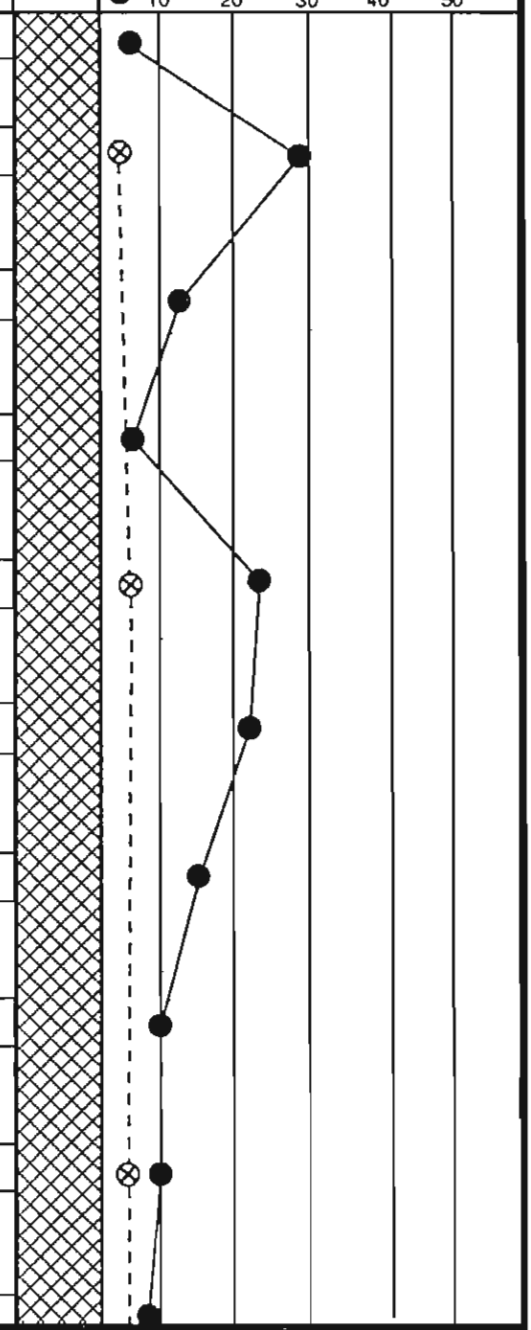
BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91
				DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK		
		CHECKED BY: R. WOOD		DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING			

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 655.8
	S-1	-	-	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
5	S-2	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-3	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
15	S-4	-	-	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
20	S-5	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
25	S-6	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
30	S-7	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
35	S-8	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
40	S-9	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
	S-10	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

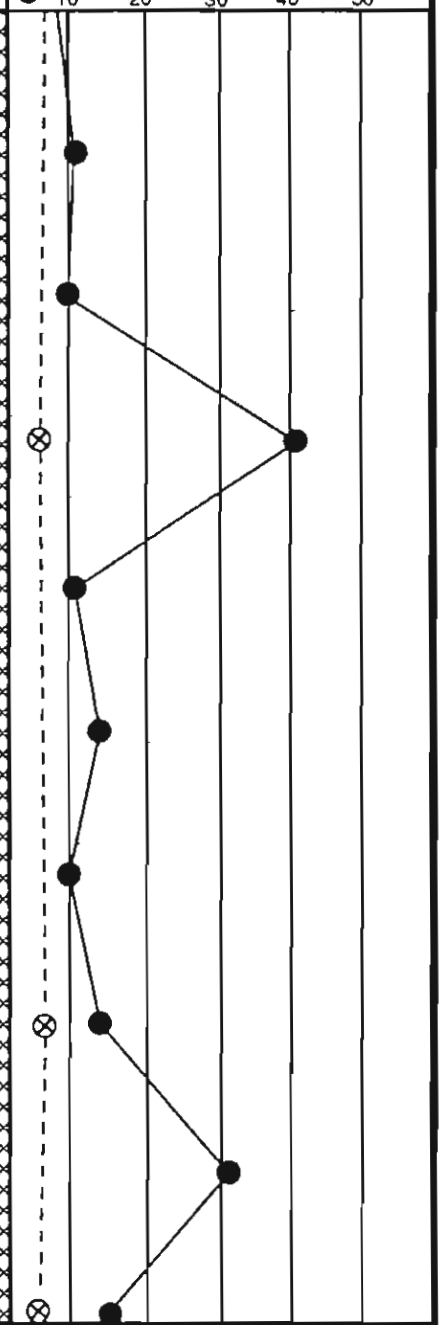
BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: 1 3 4 5

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-10	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE COAL REFUSE, MOIST	
50	S-11	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST	
55	S-12	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST	
60	S-13	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST	
65	S-14	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
70	S-15	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
75	S-16	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
80	S-17	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
85	S-18	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST	
	S-19	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED, MOIST	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK	CHECKED BY: R. WOOD	DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

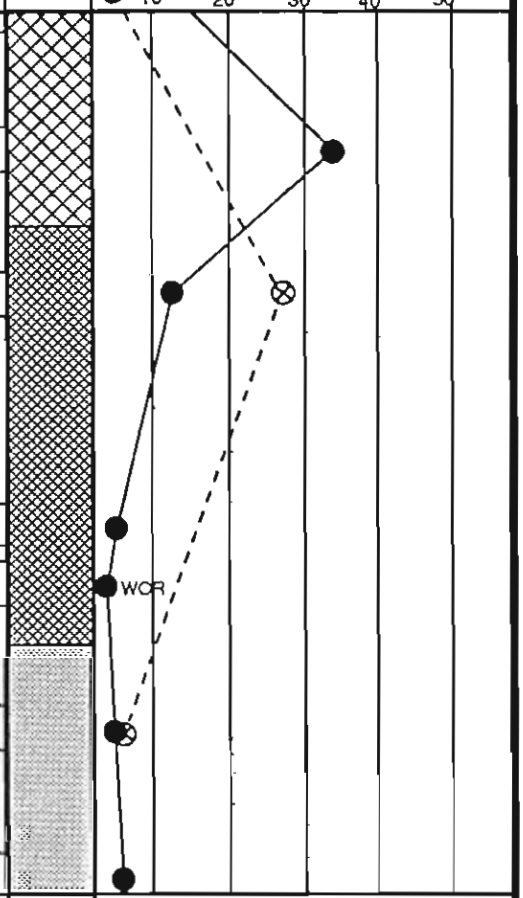
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
	S-19	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
95	S-20	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, WET TO MOIST
100	S-21	-	-	-	VERY STIFF, BLACK, FINE, COARSE, COAL REFUSE, MOIST
	ST-1	0	0	-	
105	ST-2	0	0	-	
	S-22	-	-	-	HARD, BLACK, FINE, COAL REFUSE, MOIST
110	S-23	-	-	-	MEDIUM STIFF, FINE, COAL REFUSE, WET
115	S-24	-	-	-	LOOSE, LIGHT BROWN, CLAYEY SAND, WET
120	S-25	-	-	-	STIFF, ORANGE AND RED, SANDY CLAY, MOIST
					BOTTOM OF BORING AT 120.5 FEET
125					
130					

PROFILE



AUGER REFUSAL AT 120.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

APPENDIX A

GUIDELINE TECHNICAL SPECIFICATIONS

APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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APPENDIX A
GUIDELINE TECHNICAL SPECIFICATIONS
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

INTRODUCTION

These Guideline Technical Specifications (Specifications) have been prepared by Almes & Associates, Inc., Consulting Engineers (ALMES) for the proposed Concord coal refuse disposal facility expansion planned near Hueytown, in Jefferson County, Alabama. The facility will serve the Concord coal preparation plant located adjacent to the disposal area. The information contained herein is sufficiently detailed to provide U.S. Steel Mining Company, Inc. (USM) with technical guidance to perform coal refuse disposal operations in a manner consistent with the design assumptions and prudent engineering practice. It is noted that design recommendations, as used for a basis of construction, are particularly sensitive to the need for adjustment in the field, depending upon findings during construction that previously could only be assumed based on sampling and related procedures. In this regard, it is recommended that representatives of our firm or other qualified persons be present on site to monitor the construction of the facility and to verify that the conditions encountered are consistent with the design assumptions as described herein and in the report and drawings. These specifications are intended to be supplemented with regular site visits by persons knowledgeable of these design documents and operational requirements for disposal of coal refuse. ALMES waives any and all responsibility and liability for problems which may occur when its recommendations are not followed.

These Specifications are not of sufficient detail for use in subcontracting the work. Should any portion of the work be subcontracted by USM, more detailed specifications will be required.

The Concord refuse disposal facility will continue to be used for the disposal of coarse and fine coal refuse over the next 13 to 20 years based on refuse production rates supplied by USM. These Specifications pertain to the construction of the refuse disposal facility and associated sedimentation ponds. Major work items include the following:

1. Site Preparation - Prior to any construction activities, Sediment Pond 1 shall be constructed. All areas proposed for coal refuse disposal will be cleared and grubbed. Additionally, areas beneath the coarse coal refuse, impoundment dike embankment and sediment pond

embankments will be grubbed and stripped of all combustible, compressible, or unsuitable material. Buildings located within the northwest area of the proposed expansion shall be raised and all debris removed from the site and properly disposed.

2. Coarse Coal Refuse Disposal - Coarse coal refuse shall be used to raise the existing refuse embankment and enlarge the existing fine refuse impoundment to provide needed fine refuse disposal capacity and to provide storm storage and proper freeboard. Coarse refuse not needed in construction will be disposed of in adjacent embankments.

3. Embankment Construction - A new impoundment embankment will be constructed from coarse refuse to provide additional fine refuse disposal capacity and storm storage. The initial stage of the embankment will contain a highly compacted coarse refuse cutoff trench and core. Internal drains will be installed during subsequent embankment stages. The upstream face of the embankment and the southeast slope of the impoundment will contain a highly compacted zone. Subsequent embankment stages will be raised with coarse coal refuse placed downstream of the initial stage to provide additional fine coal refuse disposal capacity.

4. Haul Road Construction - Existing haul roads will be extended and relocated as necessary to provide access to the embankment area.

5. Subsurface Drainage - During the disposal operations, a series of internal drains, finger drains and a slope drain will be installed within the new slurry impoundment embankment.

6. Surface Drainage Facilities - To aid in stabilizing the refuse surface and to minimize erosion, a system of haul road gutters, bench gutters and perimeter ditches shall be constructed,as required. Sedimentation ponds are provided adjacent to the refuse embankment to collect runoff from the disturbed areas.

7. Revegetation - All completed embankment surfaces must be revegetated to provide erosion protection. The revegetation shall be performed concurrent with the embankment construction, and in accordance with the surface mining permit for the site.

8. Monitoring and Maintenance - A program for obtaining and reporting data on embankment performance is presented herein.

LIST OF DRAWINGS

The following drawings form part of these specifications:

Drawing No.	Title
90-55-E100	Title Sheet
90-55-E101	Existing Site Conditions
90-55-E102	Plan - Stage 1
90-55-E103	Plan - Stage 2
90-55-E104	Plan - Stage 3
90-55-E105	Plan - Stage 4
90-55-E106	Plan - Stage 5
90-55-E107	Cross-Section A-A, B-B and C-C
90-55-E108	Cross-Sections D-D and E-E
90-55-E109	Stability Cross-Sections Sheet 1 of 2
90-55-E110	Stability Cross-Sections Sheet 2 of 2
90-55-E111	Plan - Diked Impoundment
90-55-E112	Diked Impoundment and Embankment Profiles
90-55-E113	Details Sheet 1 of 3
90-55-E114	Details Sheet 2 of 3
90-55-E115	Details Sheet 3 of 3
90-55-E116	Erosion and Sediment Control Plan
90-55-E117	Sediment Pond Cross Sections and Profile
90-55-E118	Sediment Pond Details

1.0 SITE PREPARATION

1.1 CLEARING AND GRUBBING

In areas where coarse coal refuse is to be placed on natural ground or on revegetated refuse disposal areas, the areas shall be cleared and grubbed prior to refuse disposal. Outside of this zone, the area shall not be grubbed unless additional topsoil is needed to cover the completed embankment slope.

In areas beneath the proposed embankment stages, the natural ground surface shall be cleared, grubbed and stripped of all trees, brush, and combustible or compressible debris. All buildings, building foundations, and utilities shall be raised or excavated and all demolition waste removed and properly disposed.

The new slurry impoundment area shall be cleared and grubbed and all brush, fallen timber, loose debris, buildings, building materials and utilities removed. In no case shall any combustible material be disposed in the embankment.

1.2 TOPSOIL STRIPPING

Topsoil shall be stripped to a minimum depth of 18 inches or to the maximum possible depth designated by the engineer beneath the dike impoundment embankment.

1.3 GAS LINE RELOCATION

A natural gas pipeline is located adjacent to the new fine refuse disposal area. This pipeline will require relocation prior to the construction of Sediment Pond No. 1 and the new fine refuse impoundment embankment.

2.0 COAL REFUSE DISPOSAL, IMPOUNDMENT EMBANKMENT AND SEDIMENTATION POND EMBANKMENT CONSTRUCTION

2.1 GENERAL

The existing coarse refuse disposal site and impounding embankment will be enlarged and a new fine refuse storage impoundment will be constructed in five stages to provide disposal capacity for approximately 20 years of coarse refuse and 13 years of fine coal refuse and flood storage associated with the PMF design storm event. Stages 1 through 5 will be constructed using downstream construction with coarse coal refuse. Drawing Nos. 90-55-E102 through 90-55-E108 present the plans and sections of the Stage 1 through 5.

2.2 STAGE 1 KEY TRENCH

During Stage 1B, prior to raising the north buttress slope, a key trench will be constructed along the toe of this proposed stage. A trench approximately 85 feet wide by 900 feet long will be excavated through the existing fine refuse to original ground at the location as shown on Drawing No. 90-55-E102. The actual length and depth of the trench will be determined by the engineer in the field. The trench shall be excavated and backfilled with

compacted refuse in 50-foot by 85-foot increments. The coarse refuse shall be placed and compacted in accordance with Sections 2.4.3 and 2.4.4 of this specification.

2.3 IMPOUNDMENT EMBANKMENT

A new dike embankment shall be constructed northwest of the existing embankment. This embankment shall be constructed in three increments as shown in Drawing No. 90-55-E111. The initial embankment starter dike shall be constructed with compacted coarse refuse and shall contain a highly compacted core and key trench founded a minimum of 2 feet in bedrock. This core material shall be compacted in 1-foot lifts to a density of 100 percent maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698). The remainder of the dike embankment shall be constructed as structural fill in accordance with placement and compaction requirements in Sections 2.4.3 and 2.4.4.

The upstream slope face of the dike embankment between elevation 600 and 640, shall also be highly compacted. A zone 40 feet wide, measured horizontally from the slope face, shall be placed in 1-foot lifts and compacted to 100 percent maximum dry density, within -2 to +3 percent of the optimum water content, as determined by Standard Proctor compaction test (ASTM D698).

A field density testing program as specified in Section 2.4.4 shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction and structural fill zones.

The reconstruction of the existing coarse refuse embankment slope in Stage 1D, which forms the southeast side of the new fine refuse impoundment, shall be constructed in accordance with the structural zone specifications as detailed in Section 2.4.3 and 2.4.4. This compacted zone shall be at least 40 feet wide as measured horizontally from the slope face. The location and extent of this zone are shown on Drawing Nos. 90-55-E111 and 90-55-E112.

2.4 COARSE COAL REFUSE PLACEMENT AND CONSTRUCTION

2.4.1 Lines and Grades - Refuse shall be placed to the lines and grades shown on the drawings. Control for placement can be established from the control points and coordinate system provided on the drawings.

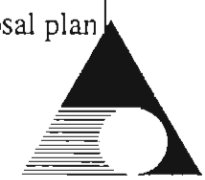
2.4.2 Material - Run-of-plant coarse coal refuse produced at the coal preparation plant shall be used for construction of Stages 1 through 5 and the sediment ponds.

2.4.3 Placement - Coarse coal refuse shall be spread in nearly horizontal lifts using a bulldozer or other earth-moving equipment. The maximum lift thickness shall not exceed 12 inches in the 100 percent compaction zone and structural zone of the impounding embankment and not more than 2 feet in the non-structural zone. The 100 percent compaction, structural and non-structural zones are delineated for each of the stages on Drawing Nos. 90-55-E102 through 90-55-E106. All lifts shall be placed parallel to the longitudinal axis of the embankment in continuous nearly horizontal lifts with each lift extending to its full length and width prior to the placement of subsequent lifts. The refuse shall be placed in the central portion of the embankment, away from the slopes during wet weather or when drainage is insufficient and near the inside or outside slopes during drier periods.

2.4.4 Compaction

- 100 Percent Compaction Zone - The coarse coal refuse material within the 100 percent compaction zone of the impounding embankments shall be compacted to a density greater than or equal to 100 percent of the maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction zone and structural zone. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan



may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2,000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed. Additional field density tests should be conducted any time there is a suspicion of the effectiveness of compaction. A supplementary Standard Proctor laboratory compaction test (ASTM D698) shall be performed for every 20 field density tests (approximately every 40,000 cubic yards).

Field tests shall be performed at random locations in the fill. Records of the test results, as well as the test locations, shall be kept at the mine.

Any time there is reason to suspect that the characteristics of the construction material have changed, reasons such as a change in preparation plant processing or unusual compaction test results, the material shall be further investigated. Grain-size compaction, shear-strength, and other tests shall be performed as warranted.

- Structural Zone - The coarse coal refuse material within the structural zone of the impounding embankments shall be compacted to a density greater than or equal to 95 percent of the maximum dry density, within -2 to +3 percent of the optimum water content, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved in the 100 percent compaction zone and structural zone. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A field density test shall be performed for every 2,000 cubic

yards placed. As a minimum, density testing shall be performed on each lift placed. Additional field density tests shall be conducted any time there is a suspicion of the effectiveness of compaction. A supplementary Standard Proctor laboratory compaction test (ASTM D698) shall be performed for every 20 field density tests (approximately every 40,000 cubic yards).

Field tests shall be performed at random locations in the fill. Records of the test results, as well as the test locations, shall be kept at the mine.

In cases where a record of consistent test results is established, or in cases involving low-hazard dams, less frequent testing may be acceptable if justification is provided. Any time there is reason to suspect that the characteristics of the construction material have changed, reasons such as a change in preparation plant processing or unusual compaction test results, the material shall be further investigated. Grain-size compaction, shear-strength, and other tests shall be performed as warranted.

- Non-Structural Zone - The coarse coal refuse material placed in the non-structural zone shall be compacted to a density greater than or equal to 90 percent maximum dry density, as determined by the Standard Proctor compaction test (ASTM D698).

  A field density testing program shall be established during disposal operations to determine the actual dry density being achieved. The number of passes by the compaction equipment shall be based on the densities obtained in relation to the minimum required density. If the density achieved is not consistent with these plans and specifications, modifications to the compaction procedure or to the disposal plan may be required. Field density tests shall be performed on each lift of coarse coal refuse placed and compacted in the structural zone of the impounding embankment. A density test shall be performed for every 10,000 cubic yards placed. As a minimum, density testing shall be performed on each lift placed.

2.4.5 Compaction Procedures - The coal refuse shall advance upward in nearly horizontal layers throughout the entire disposal area. To minimize infiltration of precipitation,

the coal refuse surface shall be sloped, backbladed and compacted as it is spread. Surface material too wet to support construction equipment must be removed to expose drier material prior to placement of the next coal refuse layer. After drying, these wet materials can be reused in the embankment. As the level of the embankment is raised, it shall be graded smoothly to the contours shown on the plans.

2.5 IMPOUNDMENT ABANDONMENT

2.5.1 Existing Impoundment - The existing fine refuse impoundment shall be abandoned by capping with coarse refuse. The impoundment shall be filled in approximate 100-foot wide sections from south to north. The top of the refuse piles should be graded away from the crest of the impoundment so that surface water runs off the pile and not into the impoundment.

2.5.2 Proposed Dike Impoundment - The diked impoundment shall be abandoned by eliminating the storm storage capacity. This shall be accomplished by excavating a channel through the crest of the embankment. The channel shall be large enough to convey peak runoff from a 100-year, 24-hour storm event. The fine coal refuse shall then be capped with a 3-foot layer of coarse coal refuse. The final abandonment plan shall be evaluated at least 5 years prior to abandonment using actual refuse production rates and the existing site conditions and embankment configurations.

2.6 SUBSURFACE DRAINS

2.6.1 General - To minimize the increase in the phreatic level as the impoundment level rises, an internal drainage system shall be installed within the embankment as shown on Drawing No. 90-55-E111. The internal drainage system consists of a slope underdrain, and internal drains connected by finger drains. The drains shall consist of sandstone cobbles and boulders wrapped entirely within filter cloth. Water collected by the slope and internal underdrains shall be conveyed to the perimeter ditch and routed through the sedimentation pond.

2.6.2 Rock Cobbles - Competent durable sandstone rock of 3 to 6 inches in diameter with a maximum size of 12 inches shall be used. Limestone or other calcareous rock materials are not acceptable. Larger rock cobbles and boulders are acceptable provided smaller stones (3 to 6 inches) are placed adjacent to the filter cloth.

2.6.3 Filter Cloth - The filter cloth shall be "Supac 3.5NP", manufactured by Phillips Petroleum Company, or an approved equivalent. The filter cloth material must be protected from ultra-voilet radiation prior to installation.

2.6.4 Installation - Details of the rock underdrains are shown on Drawing No. 90-55-E114. The rock cobble drain is wrapped entirely in filter cloth with a minimum 2-foot overlap and totally enclosed in soil or coarse coal refuse. as shown on the detail. At the discharge point for the finger drains, a 6-inch plastic pipe shall be incorporated to make the transition to the perimeter surface ditch, as shown in the detail on Drawing No. 90-55-E115. The drains shall be constructed to the dimensions shown on Drawing No. 90-55-E115. To protect the filter cloth, smaller sandstone cobbles shall be placed between the cloth and the larger boulders. The rock cobbles should be placed on the filter fabric with no dropping (zero drop height) to prevent damage to the filter fabric. The rock drains shall be immediately covered with a minimum of 4 feet of loose coarse coal refuse after construction. This coarse refuse cover shall protect the filter fabric from UV light exposure and heavy equipment traffic. All underdrains shall be constructed with a minimum 2 percent slope.

2.7 PIEZOMETERS

Piezometers installed at the locations shown on the plans and in detail on Drawing No. 90-55-E114 must be maintained and monitored on a routine schedule. Details of the piezometer installations are shown on the boring logs in Appendix B. The piezometers shall be extended as required. Details for the piezometer extension procedure are shown on Drawing No. 90-55-E114.

actual bedrock conditions. Where soil is encountered, the spillway side slope shall be 2H:1V and lined with erosion protection, as discussed in Section 4.2.

4.2 EROSION PROTECTION

Some areas of the sediment pond embankment may become susceptible to erosion damage because of the spillway construction, thus requiring erosion protection. The upstream portion of the embankment adjacent the spillway entrance shall be protected with a 3-foot thick layer of 12- to 24-inch diameter riprap. If adequate quality, the rock obtained from the spillway excavation may be used for this purpose.

In areas where any portion of the spillway channel is in natural soil, it shall be protected with a minimum 3-foot thick layer of 1-foot to 2-foot diameter hard, durable rock boulders. The soil shall be covered with a layer of Supac 3.5NP filter cloth (or approved equivalent) prior to placing the boulders. Large voids between the boulders shall be choked with smaller stones; however, sufficient void space for proper grout penetration shall be maintained. The boulders shall be grouted in accordance with Section 5.5.5 of these Specifications.

5.0 EMBANKMENT SURFACE DRAINAGE FACILITIES

5.1 GENERAL

During construction of the embankment, benches, bench gutters and perimeter ditches shall be constructed to control surface runoff and minimize erosion. The location of these facilities are shown on the stage drawings with details presented on Drawing No. 90-55-E113. All permanent ditches shall be lined with the erosion protection specified in the table on Drawing No. 90-55-E113 and discussed in these Specifications.

5.2 BENCHES AND BENCH GUTTERS

Benches shall slope at about 3 percent toward the bench gutter at their upstream edge and at about 1 percent toward the perimeter ditch or dropover ditch where the runoff will discharge. The direction of slope on the benches is shown on the drawings. All final gutters shall be lined with compacted soil and seeded to reduce erosion. At the abutments, the benches shall grade smoothly into the perimeter ditches to avoid abrupt changes in ditch alignment and slope.

5.3 PERIMETER DITCHES

Perimeter ditches shall be constructed at the abutments to collect runoff from the hillside and to convey runoff discharges from bench and haul road gutters on the face of the embankment to a point beyond the toe of the embankment. Details of the ditches are shown on Drawing No. 90-55-E113. All final ditches shall be appropriately lined to minimize erosion. In areas where the depth to bedrock is shallow, it may be more economical to construct the ditches by excavating into rock. The ditches are designed to convey the estimated discharge rates shown on Drawing No. 90-55-E113. In addition, the rock shall be capable of providing erosion protection for the expected flow velocities.

5.4 HAUL ROAD GUTTERS

Surface runoff intercepted by the haul road shall be kept off the road surface and in gutters on the uphill side. The roadway shall slope at three percent toward the gutter, with the gutter having the same gradient as the haul road.

5.5 ROCK RIPRAP

Where rock riprap protection is required in ditches and gutters because of high flow velocity, the riprap must have the following characteristics:

5.5.1 Material - Riprap shall be hard, durable cobbles and boulders of sandstone or limestone in the sizes specified on the details.

5.5.2 Size Gradation - Riprap size shall be predominantly in the range specified on the drawings.

5.5.3 Subgrade Preparation - The riprap subgrade shall be well compacted before riprap is placed. A layer of Supac 3.5NP filter cloth, or approved equivalent, shall be placed on the subgrade prior to the riprap placement.

5.5.4 Riprap Placement - Riprap shall be spread to the thickness required in a single lift.

5.5.5 Grouted Riprap - The grout shall be a sand-cement mixture proportioned to result in a minimum 28-day compressive strength of 2,000 pounds per square inch (psi). The grouted riprap lining shall be underlain by a layer of Supac 5NP filter cloth or approved equivalent.

The stones shall be placed on the prepared slope and thoroughly moistened. Any excess fines shall be sluiced to the underside of the stone blanket before grouting. The grout may be delivered to the site by any means that will assure uniformity and prevent segregation of the particles. If penetration of grout is to be obtained by gravity flow into the voids, the grout shall be spaded or rodded to completely fill the voids in the stone blanket. If pressure grouting is used, care shall be taken to avoid unseating the stones. Penetration of the grout shall be to the depth specified. For a smooth surface, grout shall fill the void spaces to within 1/2 inch of the surface. Weep holes shall be provided through the blanket.

Grout shall be placed only when the temperature is above 35 degrees Fahrenheit and rising. It shall be protected from freezing and cured the same as for concrete. After grouting is completed, no weight shall be placed on the grouted riprap until the grout has cured properly.

6.0 REVEGETATION OF COMPLETED AREAS

6.1 SOIL SLOPES

Final soil slopes and the soil linings in bench gutters shall be seeded and mulched to provide a continuous stand of vegetation.

6.2 COAL REFUSE SLOPES

Revegetation of coal refuse slopes can be accomplished by placing a cover of natural soil or other materials capable of supporting vegetation on the surface of all final coal refuse slopes and subsequently planting to establish a continuous stand of vegetation. Soil cover and vegetation shall be in accordance with the Alabama Surface Mine Commission regulations and the approved permit.

7.0 MONITORING AND MAINTENANCE

7.1 PIEZOMETER AND IMPOUNDMENT LEVEL

Water level readings from the piezometers and the impoundment level shall be recorded weekly and the data plotted on a suitable chart and reviewed. Table 5 showing maximum water elevations in each piezometer for each stage is included in the design report. Should the water surfaces reach these elevations, the engineer of record shall be contacted immediately to evaluate the effects on stability of the embankment. Should the piezometers become damaged during operations, they shall be repaired or replaced. Piezometer B-18 shall be decommissioned prior to the construction of Stage 2.

A gauging staff to determine fines levels within the impoundments shall be installed. The gauging staff shall be clearly marked in 1-foot increments and labeled every 5 feet. The gauging staff marks shall be surveyed relative to the embankment crest so that a quick determination of fines level elevation can be made, relative to each embankment stage.

7.2 SETTLEMENT MONUMENTS

Concrete settlement monuments shall be carefully surveyed semiannually, both in elevation and in plan, to assist in evaluating the integrity of the embankment. In addition, the monument at the governing crest shall be monitored monthly to assure that the crest is at the design elevation.

FIGURES

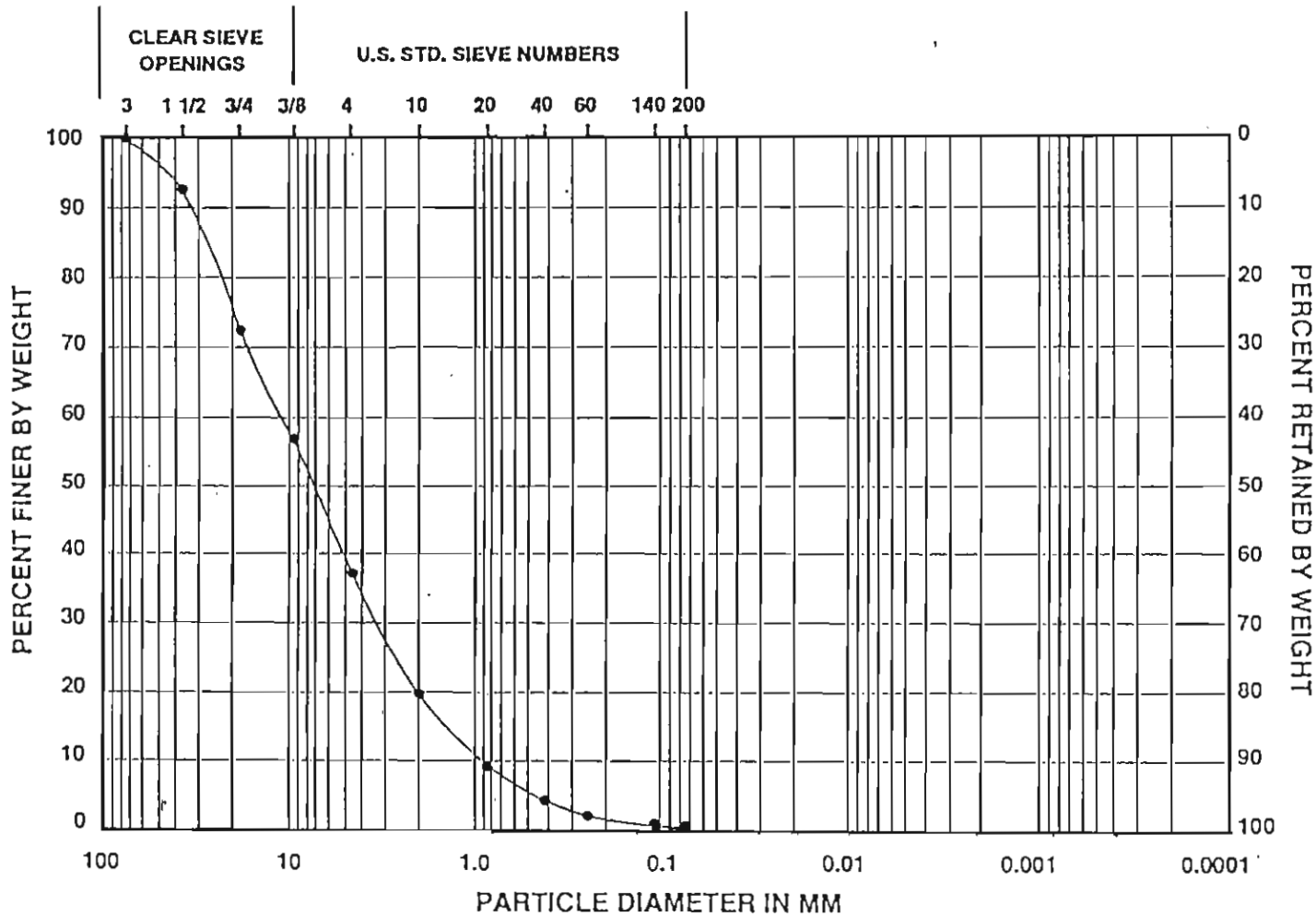


FIGURE 2
COARSE COAL REFUSE GRAIN SIZE DISTRIBUTION
CONCORD COAL REFUSE DISPOSAL AREA
U.S. STEEL MINING CO.

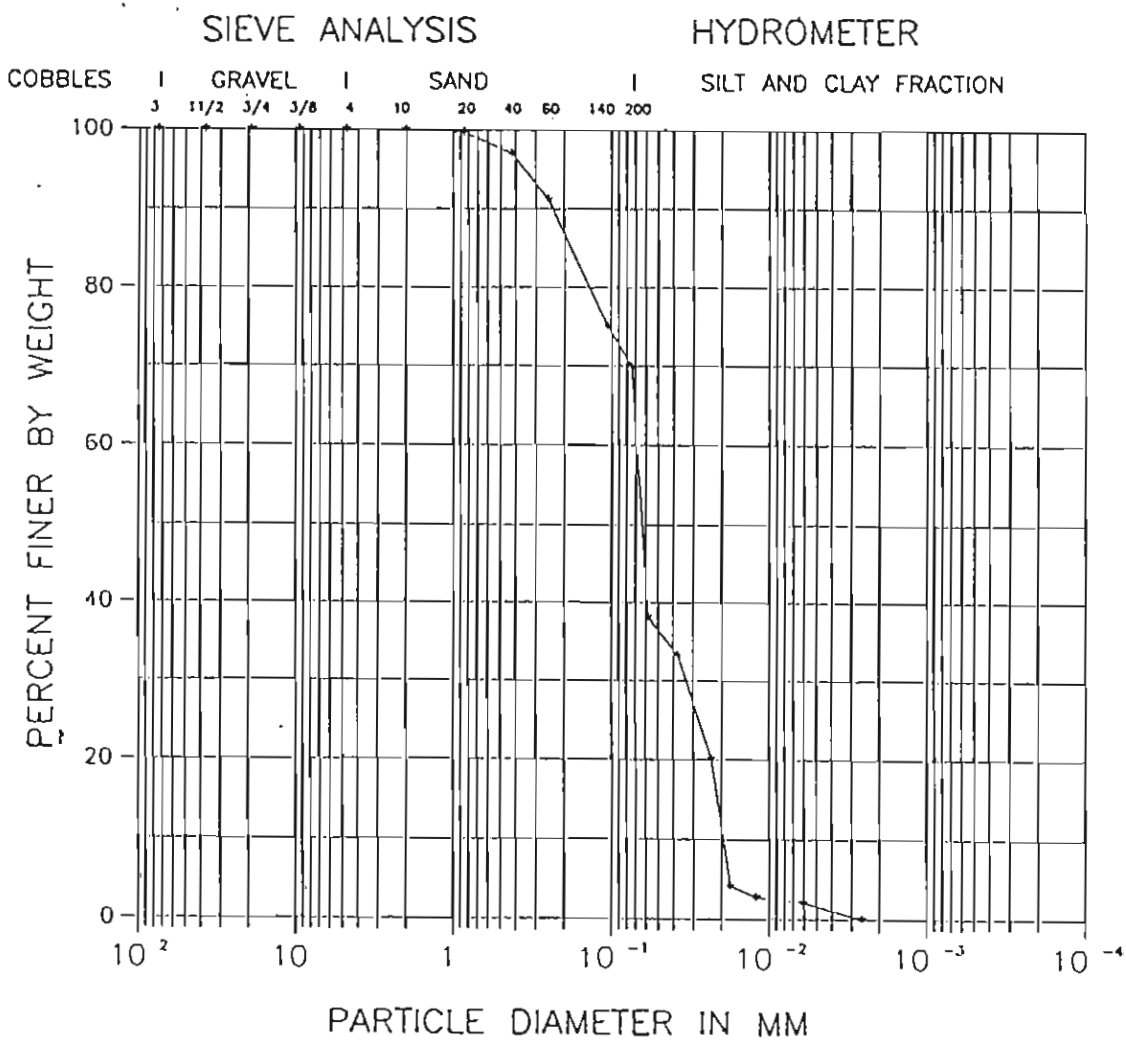
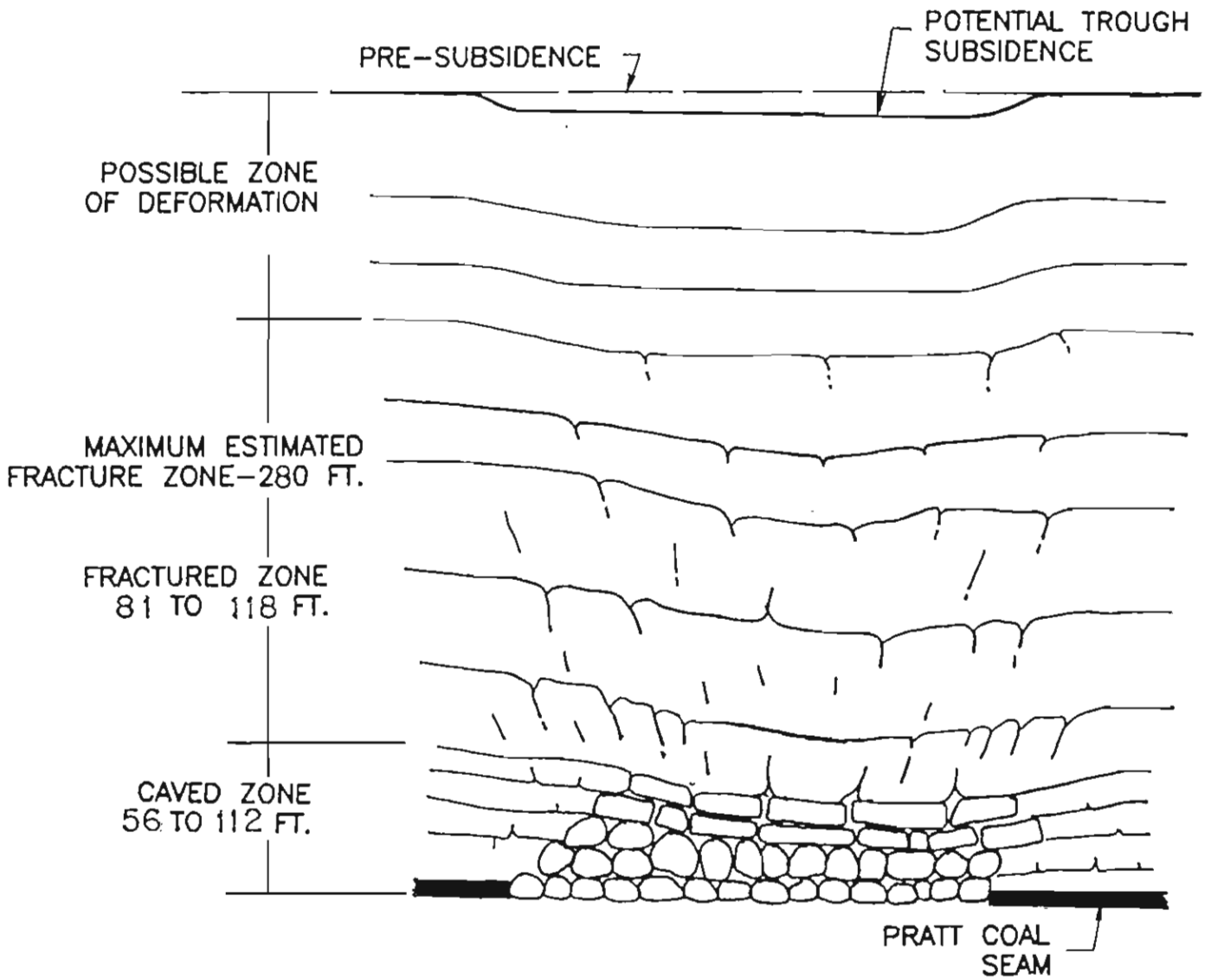


FIGURE 3
FINE COAL REFUSE GRAIN SIZE DISTRIBUTION
CONCORD COAL REFUSE DISPOSAL AREA
U.S. STEEL MINING CO.



PITTSBURGH, PA.
BECKLEY, WV.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

SCHEMATIC REPRESENTATION OF SUBSIDENCE

PREPARED FOR

U.S. STEEL MINING COMPANY
CONCORD REFUSE DISPOSAL AREA
JEFFERSON COUNTY, HUEYTOWN, ALABAMA

DRAWN BY		
CHECKED BY	RMW	9/12/91
APPROVED BY	RMW	9/12/91
SCALE N.T.S.	DRAWING NO. 90-55-A2	

FIGURE 4

TABLES

TABLE 1
SUMMARY OF EXPLORATION BORINGS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Boring Number	Total Depth (ft)	Soil Depth (ft)	Rock Coring (ft)	Undisturbed Samples (ea)	Piezometer Installation(1) (ft)	Comments
B-1	38	28	10	1	-	-
B-2	26	11	15	-	23.5	-
B-3	16.5	16.5	-	-	-	-
B-3A	5.5	5.5	-	1	-	-
B-4	54.5	54.5	-	-	53.0	-
B-5	98.5	98.5	-	1	98.0	Fine Coal Refuse 84'-96'
B-6	28	28	-	1	-	Fine Coal Refuse 0'-12'
B-7	33.5	33.5	-	-	-	-
B-8	33	23	10	-	-	-
B-9	78	78	-	-	78.0	-
B-10	42	30	12	1	-	-
B-11	111.5	111.5	-	-	111.0	-
B-12	111	111	-	-	110.0	-
B-13	129.3	129.3	-	-	129.3	-
B-14	121	121	-	-	-	-
B-15	18.5	18.5	-	-	-	-
B-16	26	12	14	1	-	-
B-17	113.5	113.5	-	-	113.5	-
B-18	106.5	106.5	-	-	105.0	Fine Coal Refuse 78'-83'
B-19	106.5	106.5	-	1	-	Fine Coal Refuse 78'-96'
B-20	46.5	46.5	-	2	-	Fine Coal Refuse 18'-30'
B-21	120.5	120.5	-	-	-	Fine Coal Refuse 97'-112'
Totals	**1,464.3**	**1,403.3**	**61**	**9**	**821.3**	

(1) Depth to the bottom of the monitoring zone.

TABLE 2
SUMMARY OF PIEZOMETERS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Boring Number	Total Depth (ft)	Depth of Piezometer (ft)	Surrounding Material	Static Water Level (ft)(1)	Water Level Elevation (MSL)	Date Measured	Comments
B-2	26	23.5	natural	17.30	553.60	2-15-91	
				16.10	557.60	4-15-91	measured from top of casing
B-4	54.5	53	coarse (0-45)	Dry	-	2-07-91	
			natural (45-54.5)	Dry	-	2-15-91	
				Dry	-	4-15-91	measured from top of casing
B-5	98.4	98	coarse (0-84)	78.30	563.00	2-07-11	measured immediately after bailing
			fine (84-96)	77.10	564.20	2-11-91	
			natural (96-98.4)	80.50	564.20	2-15-91	measured from top of casing
				78.15	566.55	4-15-91	measured from top of casing
B-9	78	78	coarse (0-76)	75.20	461.10	2-07-91	
			natural (76-78)	75.00	461.30	2-15-91	
				75.05	465.38	4-15-91	measured from top of casing
B-11	111.5	111	coarse (0-108)	107.50	550.80	2-07-91	
			natural (108-111.5)	106.75	551.55	2-11-91	
				107.00	551.30	2-15-91	
				111.00	550.23	4-15-91	measured from top of casing
B-12	110.9	110	coarse (0-105)	105.90	551.50	2-14-91	measured approx. 2 hrs after bailing
			natural (105-110.9)	105.90	551.50	2-15-91	
				103.00	558.34	4-15-91	measured from top of casing
B-13	129.3	129.3	coarse (0-124)	Dry	-	2-14-91	
			natural (124-129.3)	Dry	-	2-15-91	
				118.40	517.79	4-15-91	measured from top of casing
B-17	113.7	113.5	coarse (0-110)	103.50	531.20	2-14-91	measured before bailing; very muddy
			natural (110-113.7)	108.50	526.20	2-15-91	
				109.50	529.29	4-15-91	measured from top of casing
B-18	106.5	105	coarse (0-78)	81.25	577.55	2-15-91	measured from top of casing
			fine (78-83)	77.55	584.45	4-15-91	
			coarse (83-103)				
			natural (103-106.5)				

(1) Static water levels were measured from the ground surface except where noted.

TABLE 3

CONSTRUCTION STAGING SUMMARY
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Construction Stage	Time to Construct (Years)	Coarse Refuse Needed to Construct (cy)	Fine Refuse Disposal Capacity Created (cy)
Stage 1			
1A - Exist. Imp. to El. 670		83,300	669,000
1B - North Buttress to El. 675		957,000	
1C - East Butttess to El. 580		175,000	
1D - Northwest Embankment		112,000	
Stage 1 Sub Total	1.35	1,327,300	669,000
Cumulative Total	1.35	1,327,300	669,000
Stage 2			
2A - Exist. Imp. to El. 680		89,700	507,000
2B - N. Buttress to El. 690/660		1,711,000	
2C - East Berm to El. 630		257,000	
2D - Dike Embank. to El. 600		322,000	459,000
Stage 2 Sub Total	2.43	2,379,700	966,000
Cumulative Total	3.78	3,707,000	1,635,000
Stage 3			
3A - Exist. Imp. to El. 690		997,000	568,000
3B - N. Buttress to El. 710/690		34,000	
3C - Dike Embank. to El. 620		45,300	562,000
3D - South Area to El. 660		668,000	
Stage 3 Sub Total	1.78	1,744,300	1,130,000
Cumulative Total	5.56	5,451,300	2,765,000
Stage 4			
4A - Dike Embank. to El. 640		795,000	
4B - Close Exist. Imp.		620,000	738,000
4C - East Buttress to El. 690		403,000	
4D - South Area to El. 690		871,000	
Stage 4 Sub Total	2.74	2,689,000	738,000
Cumulative Total	8.30	8,140,300	3,503,000
Stage 5			
5A - East Area to El. 690		3,896,403	
5B - Main Area to El. 730		7,485,950	
Stage 5 Sub Total	11.61	11,382,353	0
Cumulative Total (Fine)	13.26		3,503,000
Cumulative Total (Coarse)	19.91	19,522,653	
Final Total (Fine)	13.41		3,503,000
Final Total (Coarse)	19.91	19,522,653	

TABLE 4

MAXIMUM FINE REFUSE ELEVATIONS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Stage	Substage	Maximum Fine Refuse Elevation (MSL)[1]	
		Existing Impoundment	Proposed Impoundment
1	A	658	-
	B	658	-
	C	658	-
	D	658	-
2	A	667	-
	B	667	-
	C	667	-
	D	667	591
3	A	678	591
	B	678	591
	C	678	611
	D	678	611
4	A	-	632
	B	-	632
	C	-	632
	D	-	632
5	A	-	632
	B	-	632

[1] The maximum fine refuse elevations are the maximum operating levels allowable at the associated stage in order to maintain required stormwater storage capacity and freeboard.

TABLE 5

MAXIMUM ALLOWABLE WATER LEVELS
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.

Piezometer[2]	Maximum Allowable Water Level[1]				
	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
B-2	NR	NR	575	575	575
B-4	NR	NR	575	575	575
B-5	590	655	665	665	665
B-9	NR	NR	NR	NR	485
B-11	655	665	675	675	675
B-12	590	600	610	610	610
B-13	NR	NR	550	550	550
B-17	NR	NR	550	550	550
B-18	650	[3]	NR	NR	NR

NR - Not Required

[1] The engineer should be notified immediately if the maximum allowable water level is reached in any piezometer.
[2] All piezometers should be maintained and monitored in accordance with the expansion plan Guideline Technical Specifications.
[3] Piezometer B-18 will be decommissioned prior to construction of Stage 2 of the expansion plan.

1211-AL7-00093-01

REPORT

PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN

CONCORD COAL REFUSE DISPOSAL FACILITY

HUEYTOWN, ALABAMA

REPORT
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

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REPORT
PROPOSED COAL REFUSE DISPOSAL AREA EXPANSION PLAN
CONCORD COAL REFUSE DISPOSAL FACILITY
U.S. STEEL MINING COMPANY, INC.
HUEYTOWN, ALABAMA

1.0 INTRODUCTION

U.S Steel Mining Company, Inc. (USM) currently operates a coal refuse disposal facility adjacent to their Concord coal preparation plant, located near Hueytown, Alabama. The Concord coal refuse disposal facility has been in operation since approximately 1946. This area, which covers approximately 300 acres, is a combination hilltop and head-of-hollow type facility used for disposal of both coarse and fine coal refuse. Coarse refuse is trucked from the Concord preparation plant to the refuse disposal area, where it is spread and compacted forming a fine coal refuse slurry impoundment within the interior portions of the coarse refuse embankment. The fine coal refuse slurry is delivered to the north end of the slurry impoundment by a pipeline. The current refuse disposal area configuration is shown on the "Existing Conditions" Drawing No. 90-55-E101.

The Concord refuse disposal area is approaching the currently approved limits and USM desires to expand the facility for continued coarse and fine coal refuse disposal operations. This expansion will provide fine and coarse refuse disposal capacity in support of mining operations at the Oak Grove mine located west of the facility.

A conceptual plan for the expansion of the Concord refuse disposal facility was submitted (by others) to the Mine Safety and Health Administration (MSHA) in 1988. MSHA's review of the conceptual plan resulted in a request for a thorough geotechnical investigation of the refuse area to support the expansion plans. The specific items discussed in the November 30, 1988 MSHA[1] letter were:

- Additional drilling and testing was requested to determine the subsurface conditions and strength of the foundation materials;

- Analysis of the liquefaction potential of the fine refuse materials;

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[1] Mine Safety and Health Administration letter dated November 30, 1988.

- Subsidence effects on the embankment;

- Determine the original ground surface under the pile to assist in the foundation evaluation;

- Determine the phreatic surface within the refuse pile and install monitoring devices; and

- Provide hydrology calculations for the new design.

In response to MSHA's letter, USM entered into a contract with Almes & Associates, Inc., Consulting Engineers (ALMES) to develop and execute a geotechnical study of the current refuse disposal area, prepare a plan for the expansion of the refuse disposal facility, and assist USM in obtaining approval for the expansion plan.

This report contains the results of the geotechnical explorations, design drawings, calculations and technical specifications for the expansion project at the Concord refuse disposal facility.

Included in this report are the results of field activities which included drilling, sampling and field material testing programs. During the field activities, samples were collected for laboratory testing to determine design properties of coarse refuse, fine refuse, and foundation materials.

The plans for the expansion of the refuse disposal facility includes five stages. The initial stages specify the enlargement of the existing slurry impoundment accompanied by selective coarse refuse placement to form buttresses which will improve the stability of the impoundment dikes. During subsequent stages of the expansion plan, a new fine refuse slurry disposal impoundment will be constructed.

Stage 1 of the proposed expansion plan was designed to provide needed fine refuse disposal capacity and to improve the stability of the embankment slopes by selective placement of coarse refuse to buttress the existing slopes. Stages 2 and 3 continue with this approach. During Stage 2, construction of the first stage of an embankment to form a new fine refuse disposal impoundment shall begin adjacent to the northwest side of the disposal area. Construction of the new embankment continues through Stages 3 and 4. During Stage 4, the new embankment will be raised to its final elevation while commencing closure of the old slurry impoundment. Stage 5, the

final stage of the proposed plan, continues with coarse refuse disposal on the main area and fine refuse slurry disposal in the new impoundment area.

2.0 SITE CONDITIONS

2.1 BACKGROUND

Development of the Concord refuse disposal site began concurrent with the construction and development of the Concord deep mine during 1946. The preparation plant was placed into service in 1950 and the refuse embankment has been operated and maintained continually since that time.

According to the USM facility files and permitting information, the original structure was constructed on a cleared and grubbed site by successive deposition of approximately one-foot layers of coarse refuse materials. Larger refuse rock, "plus 2 inches", was placed in the low areas to provide drainage for water seeping through the pile. In 1964, the height of the lifts was increased to 16 feet because of advances in the equipment available for transporting and compacting the refuse. In 1969 and 1970, the slurry pond located within the interior of the refuse pile was extended to the north to the configuration and size of the present slurry impoundment.

Because of the location of the disposal area and the materials used in the construction, the embankment does not impound or contain any water except slurry water pumped to or rainfall intercepted by the slurry pond. Therefore, there are no diversion channels or spillways associated with the refuse pile or slurry pond. Most of the water collected in the slurry pond is lost to seepage through the coarse refuse drains constructed in the valleys underlying the refuse pile or evaporation. The seepage emanates at several locations around the toe of the pile as shown on Drawing No. 90-55-E101. Collection ponds have been constructed to collect flows from the three seepage areas. To meet effluent limitations, this under drainage flow is pumped from the ponds to a treatment facility and treated prior to release.

The refuse embankment outslopes are 2.5H:1V (Horizontal:Vertical) or flatter. Most of the slopes have been covered with a minimum of 6 inches of soil and vegetated with grasses and pine seedlings. Several benches have been constructed around the perimeter of the pile at vertical intervals of 25 feet.

The Concord refuse area has been free of fire or signs of combustion except for one area in the southeast portion of the pile, which burned from 1958 to 1961. According to USM, this area was improperly constructed with an abnormally high bench height without surface sealing and properly sloped edges. The fire was extinguished by sealing the area with clay and sloping the edge. Subsequent to the extinguishing operation, the area was planted with pine trees to provide additional soil stability and to serve as a warning of reignition. No indication of heating in any area of the embankment has been observed since that time.

2.2 PHYSICAL CHARACTERISTICS OF THE SITE

The existing Concord refuse disposal area is located on the drainage divide between two unnamed tributaries to Lick Creek. A freshwater reservoir used as a water supply for the coal preparation plant, is located on the head waters of the unnamed tributary along the west side of the refuse disposal area as shown on Drawing No. 90-55-E101. The Concord coal preparation plant is located on the north side of the refuse area. A series of sedimentation ponds, water treatment ponds and associated features are located on the eastern side of the refuse area. Most of the older areas of the refuse pile support varying degrees of vegetation ranging from grasses to 30-foot pine trees. Areas adjacent to the refuse disposal area are primarily forested.

2.3 GEOLOGY

The Concord refuse disposal area is located on the southeast limb of the Coalburg syncline approximately 3,500 feet southeast of the synclinal axis and 5,000 feet northwest of the Warrior Basin. The area is characterized by moderate topographic relief composed of gently rolling to steep hillsides and deeply incised stream drainages. Stratigraphically, the bedrock in the area belongs to the Pennsylvanian aged Pottsville Formation.

The strata below the Concord permit area consists of sandstones and shales which contain occasional coal seams and fire clays. These strata are nearly flat lying with a regional dip of 50 feet per mile to the southwest. Several thin coal seams, the Thompson Mill, Upper Cobb and Lower Cobb occur in the upper 300 feet of rock strata below the site. These coal seams are thin and unmineable but are easily recognizable in drillhole logs and provide the basis for correlation of strata in the Concord permit area.

According to the surface mine permit, the Thompson Mill seam is generally not more than one foot thick and is rather discontinuous. However, two or three fire clay seams associated with the coal mark the Thompson Mill horizon where the coal is absent. These fire clays are apparently continuous beneath the site and are probably important as barriers to the downward movement of groundwater. The Thompson Mill seam and fire clays outcrop at approximately elevation 500 around the perimeter of the refuse pile.

The Upper and Lower Cobb coal seams occur about 150 to 200 feet below the Thompson Mill seam. The Lower Cobb occurs about 40 feet below the Upper Cobb Seam.

The Pratt coal seam, which occurs between 620 and 670 feet below the site, has been room and pillar mined below the refuse disposal area.

3.0 MINING OPERATIONS AND COAL REFUSE PRODUCTION

3.1 MINING OPERATIONS

The Concord deep mine, which is in the Pratt coal seam, underlies the refuse disposal area. Mining was by the room and pillar mining method. Based on a review of available deep mine maps, deep mining beneath the northwest portion of the refuse disposal facility, shown as Area 1 on Figure 1, was not as extensive as in adjacent areas. In this area, large blocks of coal were not mined to provide support for the slope shafts and coal preparation facility located to the north of the refuse disposal area. In the main refuse disposal area, Area 2, mining of the coal was to approximately 50 percent extraction. In Area 3, adjacent to the eastern side of the disposal area, the pillars were removed in a second mining effort which occurred in approximately 1964.

From the mine maps, it was determined that the base of the deep mined coal seam occurs between 620 and 670 feet below the base of the refuse embankment between approximate elevations -40 and -90 feet (below sea level). One of the slope entries associated with the deep mine daylights in the vicinity of the old mine buildings, located in the northwest portions of the project area, as shown on Drawing No. 90-55-E101. According to information provided by USM, the near surface portions of the slope were sealed with concrete and the shallow areas backfilled. Details of the slope shaft seal are shown on U.S. Steel Drawings 4854-1-1 and M226, which are included in Appendix E.

3.2 COAL REFUSE PRODUCTION

Current refuse production from the Concord preparation plant is produced from cleaning of coal from USM's Oak Grove mine. The Concord coal cleaning facility contains a wet process preparation plant with a coal washer and thickener, thermal drier and rail load-out facilities. Coarse coal refuse generated at the preparation plant will continue to be transported by conveyor to a refuse storage bin located adjacent to the plant and then trucked to the disposal area for final placement. The fine coal refuse is currently pumped in slurry form through surface pipelines to an existing slurry impoundment. During the initial stages of the proposed disposal area expansion, this method of fine refuse disposal will continue. In latter stages of the proposed disposal expansion plan, the existing slurry impoundment will be closed and a newly constructed slurry impoundment, located adjacent to the northwest side of the coarse refuse disposal area, will receive the pumped slurry discharge.

The slurry line discharge pipe into the new slurry impoundment will be located along the coarse refuse embankment slope (southeast side) and periodically relocated to promote a relatively uniform distribution of fine coal refuse along the coarse refuse embankment slope. This technique will create a delta of settled fines against the slope. This procedure for discharging slurry, coupled with the highly compacted coarse refuse blanket along the interior slopes, should minimize seepage losses into the coarse refuse.

The refuse production rates used for design of the expansion project were supplied by USM. The preparation plant production figures indicate total refuse production rates of approximately:

- Total Refuse 343.7 tons per hour
- Coarse Refuse 303.3 tons per hour
- Fine Refuse 40.4 tons per hour

Assuming the coal preparation plant operates 20 hours per day for 240 days per year, total annual coarse and fine refuse production is estimated to be:

- Coarse Refuse 1,455,840 tons per year
- Fine Refuse 193,920 tons per year

Using a mine life of 20 years, total coarse and fine refuse production is estimated at:

- Coarse Refuse 29,116,800 tons
- Fine Refuse 3,878,400 tons

To determine disposal volume requirements, the tonnages were converted to cubic yards using in-place dry densities of 55 pounds per cubic foot for the fine refuse and 110 pounds per cubic foot for the coarse refuse. Estimates of the total coarse and fine refuse disposal requirements are:

- Coarse Refuse 19,607,273 cubic yards
- Fine Refuse 5,223,434 cubic yards

4.0 SUBSURFACE EXPLORATION

Field studies at the Concord refuse disposal area were conducted in January and February of 1991. The field studies included drilling, sampling and field testing of the existing coarse and fine refuse disposal areas and adjacent areas. An important goal of the drilling program was to determine the original ground surface and bedrock elevation beneath the existing refuse embankment and the engineering characteristics of these materials as relates to constructing future embankment stages, and associated structures.

A total of 21 borings were completed at the site. Standard Penetration Test (SPT) split-spoon sampling was conducted in the borings at 5-foot intervals. Undisturbed 3-inch diameter Shelby tube samples of the fine refuse and natural soils were collected in the borings. A summary of the boring and sampling data are presented in Table 1.

Bulk samples of the coarse and fine refuse were collected from the surface of the refuse disposal areas for laboratory testing. In addition, in-place density testing was performed at 16 locations using a field density gauge (nuclear device).

Two-inch diameter open standpipe piezometers were installed in 9 of the boreholes. Seven of the piezometers were installed at locations around the perimeter of the existing slurry impoundment. Two of the piezometers were located in adjacent proposed expansion areas. All piezometers were developed and initial water level readings were obtained. Table 2 presents a summary of the piezometer installations and the static water level readings collected.

The location of the borings and test pits is depicted on Drawing No. 90-55-E101. Boring logs are included in Appendix B.

Generally, the soils encountered in the area adjacent the northwest side of the refuse area where the new impoundment embankment will be constructed consist of a brown sandy clay. The thickness of the soils in this area ranged from 5 to 10 feet. The underlying bedrock is classified as a soft to medium hard sandstone varying in color from reddish to gray.

5.0 FIELD AND LABORATORY TESTING

5.1 FIELD TESTING

In-place field density tests were performed at 16 locations on the surface of the coarse and fine refuse disposal areas and in the natural soils at the location shown on Drawing No. 90-55-E101. The testing was performed with a Troxler Nuclear device which determined total unit weight and in-place moisture. Oven-dried moisture contents were used to compute the dry densities. The results of the field density test are included in Appendix D - Test Data.

The field density data expressed as in-place dry unit weights in pounds per cubic foot (pcf) varied as follows:

- Coarse Coal Refuse - 103 to 122 pcf
- Fine Coal Refuse - 50 to 57 pcf
- Natural Soils - 90 to 134 pcf

5.2 LABORATORY TESTING

Samples of the coarse refuse, fine refuse and natural soils obtained from the SPT split spoons, Shelby tubes and test pits were used for laboratory testing. The scope of the testing is discussed below and the results are presented in Appendix D and on the boring logs (Appendix B).

The testing included the following:

- Classification Tests - This testing included determination of water content and visual classification of the samples. The results are summarized on the boring logs in Appendix B.

- Grain-Size Analyses - Grain-size analyses were performed on coarse and fine refuse samples. A plot showing the grain size distribution for both materials are presented on Figures 2 and 3.

- Permeability - Constant head permeability tests were performed on remolded samples to determine the permeability characteristics of the coarse refuse material which will be used for embankment construction. Results of the permeability test indicate the compacted coarse refuse to be used in construction of the embankment has a permeability of 1.51×10^{-7} cm/sec compacted to 95 percent of Standard Proctor.

- Shear Strength Tests - Consolidated, undrained triaxial tests with pore pressure measurements were performed on Shelby tube samples of fine refuse and natural soil. Shear strength tests were also performed on remolded samples of coarse refuse. Shear strength results on the in-place fine coal refuse in boring B-20 at 27.0 to 29.5 feet indicate a Φ angle of approximately 38 degrees. Shear strength results for the natural soils in borehole B-3A indicate a Φ value of approximately 31 degrees. Remolded samples of the coarse coal refuse to 95 percent of Standard Proctor resulted in Φ values of 35 degrees.

- Compaction Tests - A Standard Proctor compaction test (ASTM D 698) was performed on coarse refuse samples collected from the preparation plant and disposal areas. Maximum dry density for the fresh coarse refuse was determined to be 115.1 pcf at an optimum moisture content of 6.2 percent.

- Atterberg Limits Test - Both liquid and plastic limits testing (ASTM 4318) were performed on several coarse and fine refuse samples and a soil sample. Results of these tests are included in Appendix D - Test Data. Both the coarse and fine refuse were determined to be non-plastic. Test on soil samples obtained from sample location 3A indicated the soils to be mostly clay with a low plasticity (USCS type CL).

6.0 SITE DEVELOPMENT

The Concord coal refuse disposal facility is actively used for disposal of coarse coal refuse and fine coal refuse slurry. Implementation of the proposed disposal plan described herein will require a transition of certain aspects of the operations including phasing out of the existing slurry impoundment, construction of a new slurry impoundment, and restaging of the coarse refuse disposal areas. Other features include new sedimentation pond construction and routing of surface water runoff.

Site preparation activities to be conducted include clearing and grubbing of new construction and existing refuse disposal areas, in preparation for the sediment ponds and perimeter runoff collection ditches. The location, profiles and cross-sections for the sediment ponds and ditches are presented in the drawings. The following is a description of the site development and sediment pond construction requirements.

6.1 SEDIMENT PONDS

Four sediment ponds are proposed to control runoff and sediment load from the proposed refuse disposal expansion areas. Sediment Ponds 1 and 4, located adjacent to the new slurry impoundment, collect runoff from the northern refuse disposal area, dike embankment area and flow from the dike embankment subsurface drains prior to release to an unnamed tributary to Lick Creek. The location of these sediment ponds are shown on Drawing No. 90-55-E116. Sediment Ponds 2 and 3 are designed to control runoff from the southern half of the refuse area and discharge to existing collection ponds. The construction of the sediment ponds will be staged and will be constructed in the order as numbered. Scheduling for the construction of the sediment ponds is discussed in the refuse disposal plan presented in Section 7.0 of this report. The sediment ponds storage capacities are designed for the maximum disturbed area to occur at any one time, which is Stage 5 of this plan. Each sediment pond is designed to provide sediment storage capacity and meet settleable solids discharge criteria of the Alabama Surface Mine Commission. All sediment pond embankments are less than 20 feet high, measured from the upstream toe to the crest of the spillway invert, and have storage capacities less that 20 acre-feet and, therefore, will not be considered impounding structures under MSHA criteria.

The following criteria were used in the design of the sediment ponds:

- Sediment Storage - Each pond is designed with a capacity to store sediment based on a sediment loss of 0.1 acre-feet per acre for the largest disturbed area within the drainage area. The pond must be cleaned when less than 40 percent of the required storage volume remains.

- Principal Spillway - A fiber bonded, corrugated metal pipe (CMP) will be used as the principal spillway. The pipe spillway will consist of a horizontal and vertical riser section. The pipe will be coated and lined to provide corrosion protection due to possible deterioration in water quality. The riser inlet elevations for each pond are shown on Drawing No. 90-55-E117.

- Emergency Spillway - An emergency spillway has been provided for each pond to convey runoff from the 25-year, 6-hour design storm event around the embankment. The location and dimensions of the emergency spillway for each pond are shown on Drawing Nos. 90-55-E116 and 90-55-E117.

- Seepage Cutoff Trench - A minimum 8-foot wide seepage cutoff trench is required to reduce seepage losses through the foundation and embankment materials. The trench will be extended at least 5 feet into the foundation soils and embankment or as determined by the field engineer. The trench shall be backfilled with well compacted coarse refuse. Additional subsurface exploration may be required once the clearing and grubbing has been performed in the embankment and abutment areas to verify the design assumptions and construction requirements. All ponds constructed on refuse materials must be lined with soil or compacted coarse refuse.

7.0 COAL REFUSE DISPOSAL PLAN

The proposed coal refuse disposal expansion plan at the Concord facility provides additional disposal capacity of approximately 20 years of coarse refuse and 13 years of fine coal refuse based on production rates provided by USM.

The proposed coal refuse disposal plan has been developed in accordance with prudent engineering principles and practices and current MSHA and Alabama Surface Mine Commission criteria for

coal refuse disposal facilities. A summary of the construction staging is included in Table 3. A brief description of the disposal plan is presented below:

1) The initial phase of the disposal area expansion, Stage 1A, begins with the enlargement of the existing embankment to provide needed fine refuse disposal capacity. During Stage 1B, which follows immediately, a coarse refuse buttress with an excavated toe key trench is constructed along the northern end of the refuse embankment. Upon completion of Stages 1A and 1B, which should take approximately one year to construct, the disposal operation will meet or exceed MSHA hydrologic and stability criteria and provide approximately three years of fine refuse disposal capacity.

2) Prior to proceeding with the remaining stages of Stage 1, sediment pond 1 should be constructed. Upon completion of the sediment pond construction, coarse refuse material will be used to construct Stages 1C and 1D. The construction of Stage 2 through Stage 5 will follow with sediment pond 2, 3, and 4 being installed, as needed, to control surface runoff.

3) Under Stage 2D, construction of a new fine refuse disposal area begins with the construction of a starter dike adjacent the northwest side of the disposal area. The new fine refuse disposal area embankment will be enlarged in two stages using downstream construction techniques.

4) Perimeter ditches, haul road ditches, bench gutters and culverts will be installed to control surface runoff and minimize erosion. All final surfaces will be revegetated upon completion.

The plans and cross-sections for the five stages of the refuse disposal area expansion are presented in Drawing Nos. 90-55-E102 through 90-55-E108. Construction details are presented on Drawing Nos. 90-55-E111 through 90-55-E115. A discussion of the requirements for each stage of the disposal plan is presented below.

As an integral part of the design, the construction of the facility must be monitored by experienced persons, knowledgeable of the design, regulatory requirements, subsurface conditions, and the plans and specifications presented in this report, and in the design drawings and the Guideline Technical Specifications.

7.1 STAGE 1

Stage 1 is comprised of four substages. The first substage, Stage 1A, requires the enlargement of the existing slurry impoundment by raising the dike. Stage 1B enlarges and buttresses the northern embankment. Stage 1C begins construction on the eastern slope of the coarse refuse pile in preparation for future disposal area expansion. Stage 1D begins construction of a compacted structural fill along the northwestern slope in preparation for the future fine refuse impoundment. Stages 1A, 1B, 1C and 1D require approximately 1.35 years to construct and will provide approximately 3 years of slurry disposal capacity. Plans and cross sections depicting this phase of the expansion plan are presented on Drawing Nos. 90-55-E102, 90-55-E107 and 90-55-E108.

7.1.1 Stage 1A

Construction of Stage 1A specifies the raising of the existing slurry impoundment perimeter dike to elevation 670 and will require approximately 2 months to construct using coarse coal refuse. Construction of this embankment provides 3 years of slurry disposal capacity with 2 PMF storm storage capacity and 3 feet of freeboard. The coarse refuse material used to raise the embankment shall be placed on the existing embankment using downstream construction techniques. The coarse refuse shall be placed and compacted in uniform lifts in accordance with the structural fill requirements, as described in Section 2.4.4 of the Guideline Technical Specifications.

At the completion of Stage 1A, the slurry impoundment will provide 3 years of fine refuse disposal capacity with a maximum fines level at elevation 658. At this level, the impoundment will have the capacity to store two PMF storms plus 3 feet of freeboard. Dewatering capacity for one PMF will be provided by a portable dedicated pump system. Gasoline or diesel powered portable pumps capable of evacuating one PMF within 30 days will be maintained at the site. Details for the pump system are included in Section 3.2 of the Guideline Technical Specifications. The impoundment pool elevation should be maintained at the lowest practical level at all times.

7.1.2 Stage 1B

During Stage 1B, a coarse refuse buttress will be placed along the northern slope of the existing impoundment. Prior to increasing the height of the embankment, an 85-foot by 900-foot trench will be excavated to original ground through the fine refuse material and backfilled with compacted coarse refuse. This trench will be excavated and backfilled with compacted coarse in 50 feet by

85 feet (approximately) strips oriented perpendicular to the slope face, in order to minimize the undermining of the existing embankment slope. If signs of instability occur, the excavation areas will have to be decreased in size. Details regarding the cutoff trench excavation are included in Appendix A, Guideline Technical Specifications.

Compacted coarse refuse shall be used to backfill the key trench excavations. After completion of the key trench the north buttress shall be raised to elevation 675. This buttress will provide increased stability of the northern embankment slope and increased height to offset concern for liquefaction potential of the existing fine refuse (see discussions in Section 8.3, Liquefaction Analysis).

7.1.3 Stage 1C

During Stage 1C, coarse refuse will be placed along the east side of the refuse pile to elevation 580, as shown in plan and cross-section on Drawing Nos. 90-55-E107 and 90-55-E107. This substage begins the build up of the eastern refuse slope to enlarge and buttress the embankment.

7.1.4 Stage 1D

Stage 1D begins the reconstruction of the northwestern coarse refuse embankment slope in preparation for the new fine refuse impoundment. Compacted coarse refuse will be placed along this slope, in accordance with structural fill requirements, forming a minimum 40-foot wide blanket. This will minimize leakage through this area of the future impoundment and increase the stability by flattening the slope to an overall 3H:1V.

Prior to placement of the structural fill, a rock underdrain will be constructed along the toe of the existing slope to provide drainage and control the phreatic level in this area. The location and details for the rock underdrain for the northwest embankment slope is shown on Drawing Nos. 90-55-E112 and 90-55-E115.

7.2 STAGE 2

Stage 2 is composed of four substages. The initial substage, Stage 2A, increases the impoundment size by building upon Stage 1A. Stage 2B increases the elevation of the northern coarse refuse buttress. Stage 2C continues coarse refuse construction along the eastern slope of the existing

embankment. During substage 2D, construction of the new fine refuse impoundment embankment shall commence.

Stage 2 requires approximately 2.5 years to construct and provides an additional 2 years of fine refuse disposal capacity, in the main impoundment.

7.2.1 Stage 2A

Coarse refuse will be used to raise the main impoundment embankment to elevation 680. The coarse coal refuse used to construct the embankment will be placed in accordance with Section 2.4.4 of the Guideline Technical Specifications included in Appendix A.

At the end of Stage 2, the fine refuse impoundment will have a maximum fine refuse capacity to elevation 667. At this level, the impoundment provides storage for two PMF storms plus 3 feet of freeboard. The impoundment water level should be maintained at the lowest practical level at all times. Capacity to evacuate 1 PMF within 30 days from the impoundment will be provided by dedicated portable pumping equipment. Details for the pump system are included in Appendix A, Guideline Technical Specifications.

7.2.2 Stage 2B

Construction under Stage 2B will raise the coarse refuse embankment to elevation 690 along the north end of the impoundment and to elevation 660 in a second lift further to the north. This construction caps the old fine refuse area and develops the eastern side slope embankment for the new fine refuse impoundment. Raising the embankment provides massive support along the north slope of the embankment and provides additional height to mitigate settlement of the crest due to the unlikelihood of liquefaction of the fines beneath the embankment.

7.2.3 Stage 2C

Stage 2C continues with the development of the eastern area by raising the embankment with coarse refuse to elevation 630.

7.2.4 Stage 2D

Construction of the new fine refuse impoundment begins with the construction of a starter embankment during Stage 2D. During this stage, a dike is constructed to elevation 600 to form a new fine refuse impoundment area. The dike includes a highly compacted (100 percent Standard Proctor density) core and key trench. The new impoundment is capable of providing fine refuse disposal capacity to elevation 591 with one PMF of storm storage capacity plus 3 feet of freeboard. Storm dewatering capacity will be provided by a dedicated pump dewatering system. The pump dewatering system will have the capacity to evacuate the PMF from the impoundment in 10 days. Plans and cross-sections for the dike embankment are presented in Drawing Nos. 90-55-E103, 90-55-E107, 90-55-E111, and 90-55-E112. The pump dewatering system specifications are included in Appendix A, Guideline Technical Specifications.

7.3 STAGE 3

Stage 3 includes four substages of construction: Stage 3A raises the existing impoundment embankment to the final elevation of 690; Stage 3B continues the build up of the northern buttress area; Stage 3C continues with the construction of the dike impoundment embankment; and Stage 3D raises the southern end of the disposal area to elevation 660.

7.3.1 Stage 3A

Construction under Stage 3A will raise the main impoundment embankment to the final elevation of 690. At this elevation the impoundment provides an additional 2.7 years of fine refuse disposal capacity with a maximum fine refuse elevation of 678. At this stage the impoundment provides 2 PMF storm storage capacity and 3 feet of freeboard. A pump system to evacuate one PMF in 30 days will be maintained for the life of this impoundment.

7.3.2 Stage 3B

During Stage 3B, the northern area of the embankment will be raised to elevation 710 adjacent to the impoundment and elevation 690 in the northern part of this area. as shown on Drawing No. 90-55-E104.

7.3.3 Stage 3C

Construction of the dike impoundment embankment continues in Stage 3C with the raising of the embankment to elevation 620. Prior to this raising of the embankment, the finger drains and internal drains shall be constructed. Stage 3C of the embankment should be constructed in five increments to facilitate the installation of the internal drains and finger drain connection. The layout of the drains, plans and cross-sections for Stage 3C are presented in Drawing Nos. 90-55-E104, 90-55-E107, 90-55-E111, and 90-55-E112. After the internal drains are installed, the embankment can be raised to elevation 620. The embankment will be raised by placing compacted coarse refuse downstream of the starter embankment constructed in Stage 2D. The upstream face of the embankment shall be constructed with a 40-foot wide (measured horizontally from the slope face) 100 percent Standard Proctor compaction zone. This highly compacted zone shall extend from elevation 600 to 620. The location is shown in cross-section on Drawing No. 90-55-E112. Specifications are included in Appendix A.

At the completion of Stage 3C, the dike impoundment will have the capacity to store fine refuse to an elevation of 611 plus 1 PMF with 3 feet of freeboard. The dedicated pump dewatering system capable of evacuating 1 PMF in 10 days will be maintained for the life of the impoundment.

7.3.4 Stage 3D

Coarse refuse will be placed in the southern portion of the refuse disposal area during Stage 3D to elevation 660.

7.4 STAGE 4

Stage 4 of the refuse disposal plan includes four substages. Construction of the dike embankment to final elevation 640 will occur in Stage 4A. Closure of the main area impoundment , Stage 4B, will begin when the fine refuse level reaches elevation 678. Coarse refuse disposal occurs in the east and south areas of the embankment to elevation 690 during Stage 4C and 4D.

7.4.1 Stage 4A

Construction of the impoundment embankment to elevation 640 under Stage 4A of the disposal plan requires approximately one year to construct and provides approximately 3.2 years of

additional fine refuse disposal capacity. Coarse refuse will be placed downstream of the embankment constructed in Stage 3. A portion of the upstream slope of the embankment between elevation 620 and 640 shall be placed at 100 percent Standard Proctor maximum dry density, as shown on Drawing No. 90-55-E112 and specified in Appendix A.

Fine refuse will be pumped to the impoundment and discharged along the southeast impoundment slope to a maximum average elevation of 632. As determined by the operator, periodic relocation of the slurry discharge line may be necessary to promote a more uniform distribution of fines along the slope.

Surface drainage shall be provided on the final slopes with bench and gutters and haul road ditches as shown on Drawing Nos. 90-55-E111 and 90-55-E113.

7.4.2 Stage 4B

Fine refuse disposal will continue in the main impoundment until the fine refuse level reaches elevation 678. At this point closure and abandonment of the impoundment will begin. The impoundment will be closed by capping with coarse refuse to elevation 690. This will involve filling the impoundment with coarse coal refuse in 100-foot wide sections from north to south. The area on the crest of the impoundment will be graded to drain away from the impoundment. This will allow the impoundment to maintain proper storm storage (2 PMF) through abandonment.

7.4.3 Stage 4C

The east buttress area will be raised to elevation 690 with coarse refuse, under Stage 4C.

7.4.4 Stage 4D

The south area of the main refuse disposal area will be raised to elevation 690 during Stage 4D.

7.5 STAGE 5

Stage 5, the final stage of the proposed expansion plan, contains two construction substages. These two substages, Stage 5A and Stage 5B, are located in the east and main area of the pile. During Stage 5 fine refuse disposal continues in the diked impoundment area.

7.5.1 Stage 5A

Coarse refuse disposal in the east portion of the disposal area to elevation 690, provides approximately four years of capacity. At the completion of this stage the main refuse disposal area should be at an average elevation of 690.

7.5.2 Stage 5B

Coarse refuse disposal will continue in the coarse refuse area for the remainder of the proposed expansion plan. During disposal operations, the disposal area will be sloped approximately 2 percent to promote drainage off the pile. Coarse refuse disposal capacity at elevation 730 provides approximately 20 years of site life. Additional capacity beyond 20 years is available by increasing the embankment elevation. Upon reaching the final elevation of the coarse refuse disposal area, the pile should be sloped to drain towards the perimeter of the area.

7.6 ABANDONMENT

Due to the potential for additional coarse refuse disposal capacity, the final abandonment plan should be evaluated at least five years prior to abandonment using actual refuse production rates and the existing site conditions and embankment configuration. Based on this evaluation, a final abandonment plan will be developed and submitted to the MSHA District Manager for approval approximately two years prior to beginning the abandonment plan construction. The pertinent construction items in the abandonment plan include:

- Fine Coal Refuse Cover - Coarse coal refuse will be placed in the impoundment to provide at least a 3-foot cover above the settled fine coal refuse.

- Impoundment Elimination - To eliminate the impounding capacity of the diked impoundment, an abandonment channel will be excavated through the embankment crest. The channel should be sized to convey the peak runoff from a 100-year, 24-hour recurrence interval storm event.

- Revegetation - All final surfaces will be vegetated by planting with appropriate vegetation in accordance with the revegetation plan specified in the surface mine permit.

The general criteria and sequence of closing and abandoning the impoundments is included in Section 2.5 of the Guideline Technical Specifications.

8.0 ENGINEERING ANALYSES

The disposal plan described herein was developed in accordance with prudent engineering principles and our understanding of current MSHA and Alabama Surface Mine Commission design criteria. In support of the plan, engineering analyses included slope stability of the embankment staging and the hydrologic and hydraulic studies for the impoundment and surface drainage structures. In addition, evaluations of potential affects on the structures from liquefaction of settled fine coal refuse and mine subsidence were performed. The calculations describing the design assumptions, methodology and results are included in Appendix C.

8.1 HYDROLOGIC AND HYDRAULIC ANALYSES

The existing fine refuse disposal impoundment will be raised in increments during Stages 1, 2, and 3 to provide needed disposal capacity and additional site life. Each stage is designed to be operated at a maximum fines level with sufficient capacity to store 2 PMF of storm events plus 3 feet of freeboard. Storm storage evacuation capability for 1 PMF (within 30 days) will be provided by a dedicated portable pump system.

The proposed new fine refuse impoundment is designed to store the runoff associated with the PMF storm event (extended to 72 hours) and a dedicated pump system is provided to evacuate at least 90 percent of the PMF in 10 days or less. The pump system will have a minimum pumping capacity of 2,400 gallons per minute. Specifications for the pump system are included in Appendix A - Guideline Technical Specifications.

The hydrologic characteristics of the impoundment's watershed areas are summarized below:

Existing Impoundment

Stage	Drainage Area Acres	Runoff Curve No.*	Six-Hour All Season PMP Inches	Total PMF Runoff in Million Cubic Feet
1	34.7	--	31	11.5
2	37.7	--	31	12.5
3	39.9	--	31	13.3

Proposed Impoundment

Stage	Drainage Area Acres	Runoff Curve No.*	Six-Hour All Season PMP Inches	Total PMF Runoff in Million Cubic Feet
2	21.8	--	31	3.61
3	24.8	--	31	4.11
4	35.0	--	31	4.62

*Since nearly all of the drainage area of each impoundment is the impoundment itself, it was assumed that all rainfall in the area would be runoff.

The surface drainage facilities, including bench gutters, haul road ditches and perimeter ditches, have been sized to convey the 100-year, 24-hour recurrence interval storm event. The computed peak discharges were based on procedures outlined by the U. S. Soil Conservation Service. All permanent facilities have been provided with appropriate protection to minimize the potential for channel erosion.

8.2 SLOPE STABILITY ANALYSES

Slope stability analyses were performed for several embankment configurations using PCSTABL5, a computerized version of the modified Bishop Method of Slices developed by Purdue University and the Indiana State Highway Commission. The critical potential failure surfaces, minimum factors of safety and material properties used in the analyses are presented on Drawing Nos. 90-55-E109 and 90-55-E110.

Slope stability was analyzed for both static and seismic (pseudo-static) loading conditions. For the seismic analyses, a horizontal acceleration of 0.1g was used. Since no upstream coarse coal refuse

stages are planned for this facility and relatively large coarse coal refuse stages will be used to impound the slurry, a pseudo-static seismic stability analysis was considered appropriate for the design.

The phreatic level used in the static and seismic analyses for the various stages of the embankment were conservatively based on expected impoundment levels and the location of the proposed internal drains. The calculations include an analysis of the size and location of the drains for controlling the phreatic level. Piezometers installed during the exploration phase of this plan will be used to monitor the phreatic level to determine the adequacy of the system and the need for modifications during operations.

As shown on Drawing Nos. 90-55-E109 and 90-55-E110, the minimum factors of safety for the respective stages are summarized below:

Stage	Minimum Static F.S.	Minimum Seismic F.S.
Stage 1, A_1-A_1	2.2	1.6
Stage 1, C_1-C_1	1.9	1.4
Stage 3, F-F	1.9	1.3
Stage 3, G-G	2.0	1.5
Stage 4, A_1-A_1	1.7	1.2
Stage 5, D_1-D_1	1.9	1.5
Stage 5, A_1-A_1	2.1	1.5
Stage 5, C_1-C_1	1.9	1.4
Stage 5, H-H	1.7	1.3
Stage 5, I-I	1.7	1.3
Stage 5, J-J	2.2	1.5
Dike Embankment	1.8	1.4

Slope stability analyses were also performed for the proposed dike embankment. The critical failure surfaces, minimum factors of safety and material properties used in the analyses are presented on Drawing Nos. 90-55-E109 and 90-55-E110. The selected material properties were based on results from testing performed on the coarse refuse material.

8.3 LIQUEFACTION ANALYSIS

An analysis of the affects of liquefaction of the fines present under the northern portion of the existing embankment was conducted. Due to the limited extent and thickness of these fines, and the long-term consolidation of these fines, liquefaction is not anticipated to be a problem at this site. However, as a safeguard against the worst case scenario of liquefaction, the expansion plan incorporates several design features.

As described previously, staging of the coarse refuse embankment includes partial removal of the settled fines during Stage 1B. This will essentially eliminate any concern for potential of loss of shear strength of the fines due to an earthquake event. For the portion of the embankment that will overlay fines, an embankment elevation has been specified that will maintain impoundment integrity under normal operating conditions in the unlikely event of fines liquefaction. As shown, the maximum thickness of the fines based on borehole B-20 is 17 feet or less and, in our opinion, will have minimal impact on the integrity of the embankment stability even under a significant earthquake event. After the construction of Stage 2, impact of the potential liquefaction of fines on stability is negligible, due to the massive coarse refuse buttresses constructed.

8.4 SUBSIDENCE EVALUATIONS - UNDERGROUND COAL MINING

Subsidence prediction for any type of mine is extremely complex due to the large number of variables involved. Nevertheless, reasonably, accurate conclusions can be reached for specific geologic and mining conditions provided the limitations on the predictive methodologies are considered.

The strength and characteristics of the overlying and underlying strata will affect the way in which the overburden rocks respond to the stresses created by mine voids. Weak roof and floor rock conditions will tend to accelerate or increase subsidence, while hard rock may have a self-supporting action which could delay or reduce subsidence. The roof and floor rock for the Pratt seam within the study area can be characterized as somewhat fractured, medium to hard rock. This suggests that subsidence fracturing and deformation should develop in accordance with traditional subsidence prediction methodologies for the Appalachian coal fields.

Although many factors affect the extent and magnitude of subsidence, surface manifestations of subsidence are commonly broadly categorized as either sinkholes or troughs. The mode of

subsidence that could ultimately occur is closely related to mining method, seam depth, seam thickness, overburden composition and other factors. The maps of the mine workings and geologic structural information support the conclusion that there are no major faults within the study area, and that the geologic dip is relatively small. Accordingly, neither of these factors are expected to have a significant effect on subsidence or subsidence impacts.

Sinkholes (also known as "pits" or "caves") are discrete, occasionally abrupt depressions in the ground surface. Sinkholes are most frequently associated with shallow room-and-pillar mining, and in areas where the soil is very thick and there is little rock strata overlying the mine workings. The sinkhole occurs when the overburden collapses into an open space in the mine, such as an entry or room between pillars, and the collapse travels upward until the shift in the overburden reaches the surface. The name sinkhole comes from the discontinuous surface deformation observed on the surface where the rock and soil settled.

In areas where the overburden is thick, subsidence studies have indicated that similar formations within the Appalachian region will form rubble or gob in the area of caving. This gob, with its increase in volume due to swelling caused by displacement will, in turn, provide some support for the overlying rock structure.

Based upon established theories and research findings associated with subsidence in the northern Appalachian coal fields for conditions similar to those existing within the study area, it can be concluded that the surface effects can be related to the generalized fracture pattern which develops within the overburden above the mined-out area.

Above this level, the rock strata will experience some fracturing, but the premining stratigraphic integrity will be maintained. Accordingly, subsidence that may occur within the study area will be in the form of trough subsidence or subsidence with continuous surface deformation. Associated with the surface deformation, a potential exists for tensile and compressive strain to develop.

In considering the effects of mining subsidence on the overburden, three different zones have been defined. The first is the caved or "gob" zone with associated roof collapse and extensive overburden fracturing. The second is the fractured zone, where the overburden may be fractured and deformed but continues to retain some stratigraphic integrity. The final zone is the zone of deformation, where trough subsidence may occur.

The caved or gob zone has been reported in the literature, to range from 2 to 8 times the height of mineral extraction. In the caved zone, the zone breaks down into blocks or rubble. As rubble, it increases in volume (also referred to as "swelling"), and offers some support to the overlying strata.

Above the rubble or gob area, the rock strata will begin to exhibit "bridging" support that will tend to dampen or mask the subsidence effect. Subsidence in this zone will cause fracturing of the rock strata, but without breaking the rock into blocks or rubble. The fractured zone has been reported to range from 20 to 40 times the height of extraction.

The height of the caved and fractured zones for a particular mine under conditions found in the Appalachian coal fields can be estimated from the formula given by Jones and Kohli, 1985.(2) Based upon the geologic conditions, the overburden in the study area can be classified as medium to hard rock; thus, the maximum height of the caved zone and fractured zone can be determined as follows:

$$\frac{100\ H}{4.7\ H + 19} \pm 2.2 \qquad \text{Caved Zone}$$

$$\frac{100\ H}{1.6\ H + 3.6} \qquad \text{Fractured Zone}$$

Where H = mining height in meters.

At the Concord refuse disposal facility, this would yield, based upon the above formulas, a caved zone in the range of approximately 56 feet, and a fractured zone in the range of 81 to 118 feet, for a combined caved and fractured zone in the range of 137 to 174 feet. Figure 1 provides a schematic representation of potential subsidence occurrences within the study area. Conservative maximums based upon observations throughout the Appalachian coal field suggests the maximum caved zone could be as high as 112 feet, and the maximum fractured zone could be as high as 280 feet above the coal seam.

In most mined coal areas, potential for surface subsidence is often inevitable. The methods of controlling or mitigating subsidence impacts are as varied as the range of mining situations encountered. The most common and widespread methods of minimizing potential subsidence

(2) Jones, T.Z., and K. K. Kohli, 1985. "Subsidence Engineer," West Virginia Institute of Technology, Montgomery, West Virginia.

impacts include leaving sufficiently large mine roof support pillars and conducting mining in a planned manner. Based on review of the available mapping and records, both of these approaches were followed at the facility.

Geologic and mining conditions encountered in the Appalachian coal fields have been studied to allow the prediction of surface deformation over mined out areas. While specific occurrences of subsidence cannot be predicted utilizing these formulas due to uncertainties involved in defining the size, location, extent and timing of any area that may subside in the future, it is possible to make a reasonable prediction of the maximum amount of surface deformation that could occur from such a subsidence event.

Prediction of the maximum surface deformation has been conducted utilizing modeling techniques developed by England's National Coal Board and U. S. Bureau of Mines.(3)

For the purpose of calculating maximum trough subsidence and the maximum strains resulting from the surface deformation, the area can be divided into three distinct areas. The first area, Area 1, is the northwest area where the dike embankment will be built. Deep mining under Area 1, consisted of development panels 150 to 200 feet wide with 300-foot wide unmined panels of coal between. In Area 2, the main refuse disposal area, mining was by the room-and-pillar method. Area 3 underlies a portion of the east side of the refuse disposal area. From the mine maps it appears that Area 3 was room and pillar mined and the pillars were removed in approximately 1964.

The maximum surface subsidence predicted for Area 1 is 0.46 feet. Post-subsidence profiles generated from the maximum predicted subsidence indicate that a maximum subsidence event could create minor tensile stresses within the refuse disposal area caused by the change in the surface configuration. The maximum predicted strains resulting from surface deformation due to subsidence (assuming no previous subsidence) has been estimated to be 1.0×10^{-3} feet per foot of tensile strain and 4.6×10^{-4} feet per foot of compressive strain.

The maximum predicted surface subsidence for Area 2, is 0.59 feet. The maximum predicted strains resulting from the surface deformation due to the subsidence has been estimated to be 5.7×10^{-4} feet per foot of tensile strain and 4.7×10^{-4} feet per foot of compressive strain.

(3) Peng, S., 1985, Coal Mine Ground Control, Wiley and Sons, NY.

For Area 3 where pillar extraction occurred, the maximum predicted subsidence, assuming no subsidence has occurred, is 6.2 feet. Maximum strains resulting from this amount of subsidence is estimated to be 6×10^{-3} feet per foot of tensile strain and 4.6×10^{-3} feet per foot of compressive strain. However, all or most of the subsidence predicted for this area should have already occurred. Typically, roof collapse and subsidence deformation occur shortly after the roof support is removed. Therefore, it is anticipated that the majority of subsidence over Area 3 has already occurred. Any future subsidence potential would be in the form of minor settlements.

Based upon the foregoing discussion and related evaluations, the following conclusions and recommendations are made regarding potential subsidence and subsidence impacts within the study area at the Concord facility.

- Sinkhole subsidence or subsidence with discontinuous surface deformation will not occur within the study area. Subsidence that has occurred, and for which there is a future potential, will be in the form of trough subsidence or subsidence with continuous surface deformation.

- Subsidence within the study area will be accompanied by a gob or caved zone, predicted to be in the range of 56 feet, with a maximum of 112 feet. Above the caved zone a fractured zone may develop which is predicted to be in the range of 81 to 118 feet, extending a maximum of 280 feet above the mined seam.

- Based upon the subsidence analysis, the caved zone will not reach the surface within the study area.

- The maximum predicted surface deformation from possible future subsidence at the Concord facility can be reasonably estimated by using established subsidence models. Based upon the predicted post-subsidence profile, it can be concluded that maximum subsidence within Area 1 is negligible. In addition, tensile or compressive stress which may develop at the surface as a result of the subsidence in Area 1 is also negligible.

- The maximum subsidence and strains for the main refuse disposal area are small. Due to the flexibility of the coarse refuse materials, affects from subsidence will most likely be undiscernible.

- Future subsidence affects from Area 3 are unlikely since the majority of subsidence in this area has probably already occurred.

9.0 SUMMARY

The design plans for the expansion of the Concord coal refuse disposal facility are supported by the engineering analyses described herein. We trust that the plans, design calculations, and Guideline Technical Specifications, as presented herein, are acceptable to USM and the appropriate regulatory agencies. The only warranty or guarantee made by ALMES in connection with the services performed for this project is that such services were performed with care and skill ordinarily exercised by reputable members of the profession practicing under similar conditions at the same time and the same or similar locality. No other warranty, expressed or implied, is made or intended by rendition of these consulting services or by furnishing oral or written reports of the findings made.

If there are any questions, or if further clarification is required, please contact us.

Respectfully submitted,

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

Randy M. Wood, C.P.G.
Project Manager

Richard G. Almes, P.E.
Principal Engineer

RMW/RGA:nam/pkm
Enclosures

I, Richard G. Almes, P.E., certify[1] the expansion plan entitled "Proposed Coal Refuse Disposal Area Expansion Plan, Concord Coal Refuse Disposal Facility, U.S. Steel Mining Company, Inc., Hueytown, Alabama" was developed in accordance with prudent engineering principles and practices, and applicable Mine Safety and Health Administration (MSHA) design criteria.

SIGNED

Richard G. Almes, P.E.

ALMES & ASSOCIATES, INC.
CONSULTING ENGINEERS

[1] The term "certify," as used herein, is defined as follows: "An Engineer's certification of conditions is a declaration of professional judgement. It does not constitute a warranty or guarantee, either expressed or implied, nor does it relieve any other party of their responsibility to abide by contract documents, applicable codes, standards, regulations and ordinances."

OAK GROVE RESOURCES, LLC

CONCORD PREPARATION PLANT

P-3233

COARSE REFUSE DISPOSAL AREA EXPANSION

FOR

ALABAMA SURFACE MINING COMMISSION

BY

PERC ENGINEERING CO., INC.

P.O. BOX 1712

JASPER, AL 35502

Phone: (205)-384-5553

October 4, 2007

Mr. Michael Harrison, P.E.
Alabama Surface Mining Commission
Post Office Box 2390
Jasper, Alabama 35502-2390

RE: Oak Grove Resources, LLC
Concord Preparation Plant
P-3222

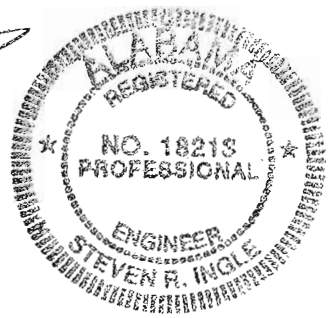
Dear Michael:

I hereby certify the attached detailed coarse refuse disposal area modification design plans for Coarse Refuse Disposal Area for the above referenced mine are in accordance with the Regulations of the Alabama Surface Mining Commission as adopted by Act 81-435 of December 18, 1981 and amended to date, and are true and correct to the best of my knowledge and belief.

If you have any questions or required additional information, please feel free to call.

Sincerely,

Steven R. Ingle, P.E.
Alabama Registration No. 18213



on the Concord U.S.G.S. Quadrangle Map. (See Map 1 of 5 for site location). The waste bank site will be located on land under control by Oak Grove Resources, LLC.

SITE GEOLOGY

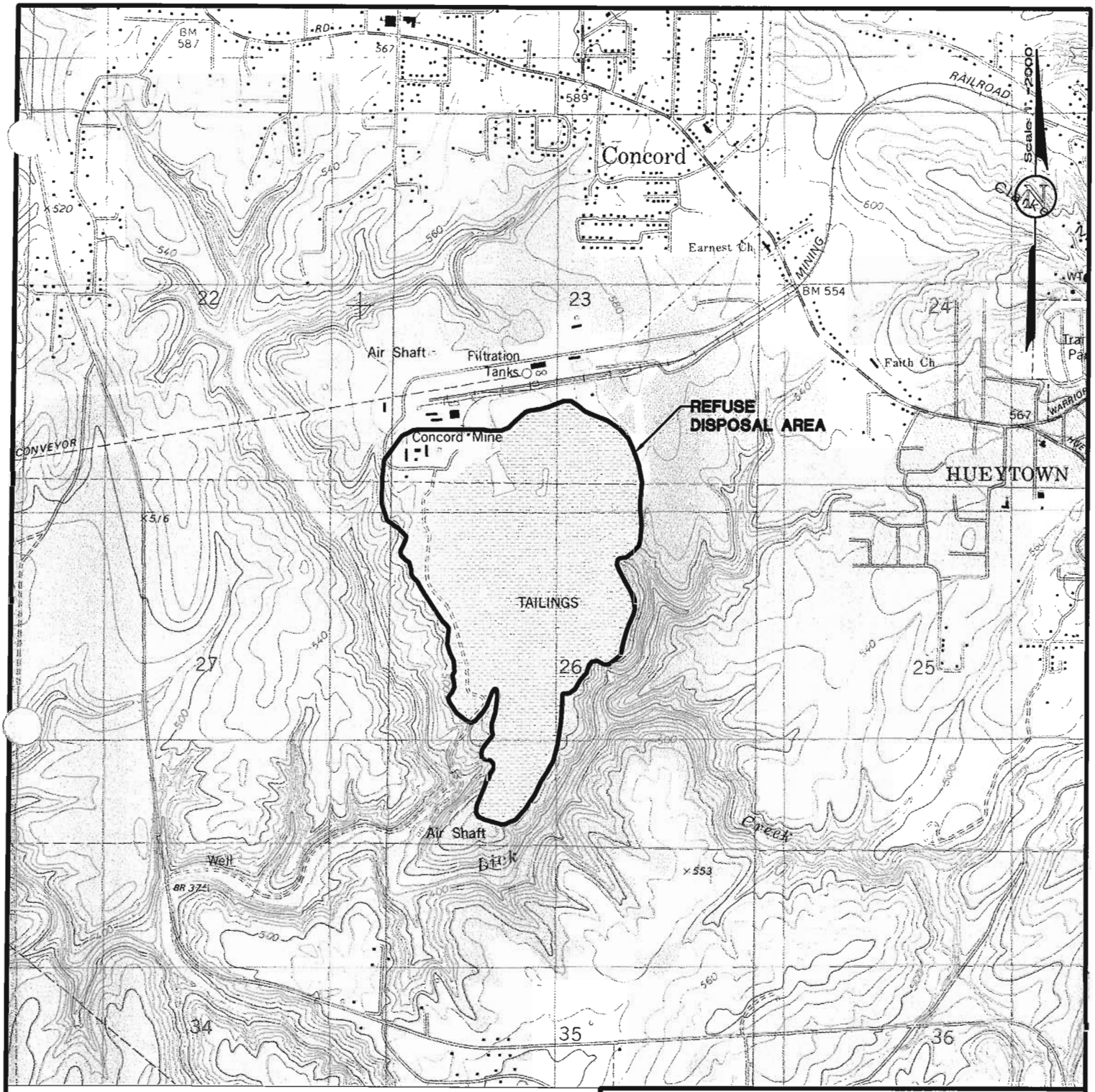
The disposal site is underlain by rocks of the Pottsville Formation of the Pennsylvania age. This strata consist primarily of alternating sandstones, shaley sandstones, shales, sandy shales, coal seams, and underclays. The strike of the Pottsville formations in the area is in the southeasterly direction. The formation dips to the southwest at a very small angle. The area is in the Appalachian Plateau physiographic province, and seismic zone 2. Faults were not found to exist at the proposed disposal site. Faults in the vicinity are not active and pose no imminent hazard to the waste bank.

UNDERGROUND MINE LOCATIONS

The Refuse Disposal Area is underlain by underground workings of the abandoned Concord Mine. These workings are in excess of 600 feet below the rock dump. With this cover and the age of the workings, in excess of 50 years, significant interaction of the rock dump and mine workings is not anticipated. See Map 2 of 5 for underground workings locations.

WASTE BANK DESCRIPTION

The waste bank will consist of an expansion of Concord Preparation Plant's existing waste bank to the northwest and northeast of Concord Preparation Plant's existing coarse refuse area located within the S ½ of the SW 1/4 and the SW 1/4 of the SE 1/4 of Section 23; and the NW 1/4 of the NW 1/4 and the NW 1/4 of the NE 1/4 of Section 26; all within Township 18 South, Range 5 West, Jefferson County, Alabama. The expansion areas consist of natural ground and the covering of existing Basin 019, Slurry Impoundment. Construction of areas may done concurrently to one another, depending upon the amount of coarse refuse produced at the Concord Preparation Plant. All other provisions of the original design plans and any subsequent modifications will be done as previously approved. Coarse refuse produced at the Concord Preparation Plant will be transported to the waste



Oak Grove Resources, LLC
Concord Preparation Plant
Jefferson County, Alabama
Vicinity Map
Concord, Alabama Quadrangle
Map 1 of 5

DRAWN BY: P.T.O. DWG. NAME: OCRCPPVCM	DATE: 10–09–07
APPROVED BY: S.R.I.	SCALE: 1"=2000'

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bank area using conveyors and mobile equipment. The coarse refuse will be spread in 24 inch (maximum) lifts and compacted to 90% of the standard proctor density.

FIELD TESTING AND SAMPLING

Field operations performed by Oak Grove Resources, LLC, PERC Engineering Co., Inc., and Almes & Associates, Inc., were conducted in accordance with ASTM standard specifications where applicable, as well as procedures adopted for the specific appraisal of conditions existing at the Concord Preparation Plant site.

BORING METHOD

Twenty one (21) borings were performed at the proposed disposal area site. All borings were made using Rotary Drills. This set up was rotated at high speeds and cuttings were brought to the surface by circulating air under high pressure, shelby tubes, or by core barrel.

BORING RESULTS

Resulting values and analysis of the borings indicate a solid foundation material. Foundation material at the waste bank site as indicated, by samples, are found to be competent sandstone overlain by existing coarse refuse produced at the Concord Preparation Plant overlying a sandy clay. These resulting investigations show the material to be of a sound and excellent nature. (See Map 3 of 5 for Boring Sites and Results).

LABORATORY TESTING

Laboratory testing was conducted by Perc Engineering Co., Inc., Jasper, Alabama and Ground Engineering and Testing Services, Birmingham, Alabama. The samples selected for the testing program and the procedures used for the various tests are presented in the following discussion.

Samples of the fill material, coarse refuse, were taken from the existing coarse refuse disposal site and samples of cover material were taken from the proposed waste bank site. Each sample underwent laboratory classification analyses which included the following tests:

1) Standard Proctor Compaction Tests,
2) Triaxial Shear Testing (consolidated undrained), and
3) Quality Analysis

Laboratory specimens of the proposed fill material from which triaxial shear testing was performed were remolded to a density equivalent to 90% of the maximum proctor density at a moisture content of optimum plus 3%.

The material selected to represent the fill material is coarse refuse consisting of grayish shale, silty clay, and sandstone produced at Jim Walter Resources, Inc.'s Mine No. 3 and 5. The mining and washing operations at Jim Walter Resources, Inc.'s Mines No. 3 and 5 are similar in nature and mine the same coal seams, Blue Creek Coal seam as those at the Concord Preparation Plant. Results of testing indicate an average wet density of 128.0 pounds per cubic foot. Triaxial shear testing resulted in an average angle of internal friction of 33.4 degrees, and an average effective cohesion of 120 pounds per square foot.

The material selected to represent the fine coal wash is coal fines produced at Boone Resources, Inc., Gholson Mine, Slurry Impoundment No. 5. The washing operations at Boone Resources, Inc., are similar in nature. Results of testing indicate an average wet

CHEMICAL ANALYSIS OF PLANT GROWTH MEDIA

As stated within the approved Alternate Soil Cover Plan within Revision R-14, soil cover and coarse refuse samples were taken from the Concord Preparation Plant area by qualified personnel of PERC Engineering in February of 2003. Three samples of coarse refuse (designated CRN-#) were collected along with three samples of 'intermediate' aged revegetation (designated CRI-#) on areas with soil cover, and three samples of 'old' aged revegetation (designated CRO-#) on areas with both soil cover and no soil cover. Note: CRO-1 was collected in an area with no soil cover while samples CRO-2&3 were collected in areas with soil. Each sample was selected as the most representative of the area in both texture and vegetative cover (which reflects chemical suitability). All samples were taken by digging a cylindrical to slightly conical shaped hole approximately 6 inches deep with a spade. All contents of this section were included in the sample.

The minus 2mm (or soil) fraction of all samples were separately placed in soil boxes and sent to the Auburn University Soil Testing Laboratory for the following analyses: Soil fertility, pH, recommendations for post mining revegetation, % sand, silt, and clay, CEC, available water capacity, neutralization potential, maximum potential acidity, % organic matter, and ppm of nitrate nitrogen in the soil. Results of this analysis are given in Appendix 1. Senders sample designations as listed in Appendix 1 are as follows:

5194 - CRN-1	5197 - CRI-1	5200 - CRO-1
5195 - CRN-2	5198 - CRI-2	5201 - CRO-2
5196 - CRN-3	5199 - CRI-3	5202 - CRO-3

COARSE REFUSE AND SOIL COVER COMPARISON

	CRN - # MEDIA (AVE.)	CRI - # MEDIA (AVE.)	CRO - # MEDIA (AVE.)
pH**	7.57	4.40	5.70
	Fertility ratings for P, K, & Mg:		
Phosphorus	13	21	30
Potassium	133	143	144
Magnesium	452	105	335
	Recommendations for Limestone, N, P_2O5, K_2O:		
Limestone (Tons/Acre)	0.00	3.17	1.17
N (Lbs./Acre)	60	60	60
P_2O5 (Lbs./Acre)	83	70	60
K_2O (Lbs./Acre)	33	27	40
Maximum Potential Acidity*	5.21	0.25	0.57
Neutralizing Potential*	12.75	0.75	15.83

	CRN - # MEDIA (AVE.)	CRI - # MEDIA (AVE.)	CRO - # MEDIA (AVE.)
Acid-Base Account*	+7.54	+0.50	+15.26
Percent Organic Matter	72.8	1.63	4.77
Nitrate Nitrogen (ppm)	1.13	0.63	2.97
Sand Percentage	85.83	49.58	58.75
Silt Percentage	8.33	33.75	27.92
Clay Percentage	5.84	16.67	13.33
Available Water Capacity (In. H_2O/In. Soil)	0.03	0.12	0.10
Clay Percentage	5.84	16.67	13.33
Available Water Capacity (In. H_2O/In. Soil)	0.03	0.12	0.10

*Tons CaCo3 Equivalent/1000 tons material
** median

APPENDIX 1

Auburn University

Auburn University, Alabama 36849-5411

College of Agriculture and
Agricultural Experiment Station System

Department of Agronomy and Soils
Telephone: 844-3958
Area Code: 334

Reply: Soil Testing Laboratory
Auburn University
Auburn University, AL 36849-5411

SURFACE MINE ANALYSIS REPORT

January 30,2003

NAME : Perc Engineering Co.,Inc
SAMPLE I.D.: U.S. Steele Mining Co.,LLC.
Concord Prep Plant/Soil Cover Report
LAB I.D. : D22-03 (4294-4296)
ANALYSIS : Special Mine Package
INCLUDES : Organic Matter, NO_3-N,Alkalinity,Potential Acidity
Particle Size,& Sulfur

Lab No.	Sample I.D.	Organic Matter -- % --	NO_3^-- N ppm	Neutralizing Potential Tons $CaCO_3$/1000 Tons	Maximum Potential Acidity
4294	5194	31.2	1.9	6.25	2.78
4295	5195	95.8	0.2	16.75	7.02
4296	5196	91.6	1.3	15.25	5.82

*maximum potential acidity values calculated from the average of four sulfur readings.

PARTICLE SIZE ANALYSIS:

Lab No.	Sample I.D.	PARTICLE SIZE % SAND	SILT	CLAY	TEXTURAL CLASS	H_2O AVAIL. cm/cm
4294	5194	90	5	5	SAND	0.02
4295	5195	77.5	15	7.5	LOAMY SAND	0 05
4296	5196	90	5	5	SAND	0.02

MULTIPLE SULFUR ANALYSES:

Lab No.	Sample I.D.	READINGS % 1st	2nd	3rd	4th	Avg.
4294	5194	0.0837	0.100	0.087	0.0857	0.0891
4295	5195	0.267	0.202	0.225	0.204	0.224
4296	5196	0.176	0.185	0.197	0.187	0.186

A LAND GRANT UNIVERSITY

SURFACE MINE ANALYSIS REPORT

January 30,2003

NAME : Perc Engineering Co.,Inc
SAMPLE I.D.: U.S. Steele Mining Co.,LLC.
Concord Prep Plant/Soil Cover Report
LAB I.D. : D22-03(4297-4302)
ANALYSIS : Routine Mine Package
INCLUDES : Sulfur,Organic Matter, NO_3 -N,Alkalinity,Particle Size

Lab No.	Sample I.D.	S	Organic Matter	NO_3- N	Neutralizing Potential
		------ % ------		ppm	Tons $CaCO_3$/1000 Tons
4297	5197	0.0112	1.3	0.2	Trace
4298	5198	0.0072	2.1	0.8	0.75
4299	5199	0.0057	1.5	0.9	1.50
4300	5200	0.0428	8.7	4.8	44.50
4301	5201	0.0042	3.0	2.8	1.75
4302	5202	0.0080	2.6	1.3	1.25

Trace values are below our detection limit

PARTICLE SIZE ANALYSIS:

Lab No.	Sample I.D.	----- PARTICLE SIZE ---- SAND	SILT	CLAY	TEXTURAL CLASS	H_2O AVAIL. cm/cm
		--------- % ---------				
4297	5197	53.75	26.25	20	SANDY LOAM	0.11
4298	5198	56.25	31.25	12.5	SANDY LOAM	0.1
4299	5199	38.75	43.75	17.5	LOAM	0.15
4300	5200	66.25	26.25	7.5	SANDY LOAM	0.08
4301	5201	60	27.5	12.5	SANDY LOAM	0.1
4302	5202	50	30	20	LOAM	0.12

APPENDIX 1

(26)

REPORT ON SOIL TESTS
AUBURN UNIVERSITY
SOIL TESTING LABORATORY
AUBURN UNIVERSITY, AL 36849-5411

NAME PERC ENGINEERING CO.
ADDRESS P O BOX 1712
CITY JASPER, AL 35502

COUNTY WALKER
DATE 12/19/02

LAB No.	SENDER'S SAMPLE DESIGNATION	CROP TO BE GROWN	SOIL* GROUP	SOIL TEST RESULTS					RECOMMENDATIONS			
				pH**	Phosphorus P***	Potassium K***	Magnesium Mg***	Calcium Ca***	LIME-STONE	N	P_2O_5	K_2O
					Pounds per acre				Tons/acre	Pounds per acre		
4294	5194 SEE COMMENT 5	REVEGETATION	4	7.1	VL 4	H 219	H 546	1980	0.0	60	90	0
4295	5195 SEE COMMENT 5	REVEGETATION	4	8.6	VL 3	L 109	H 616	3750	0.0	60	100	40
4296	5196 SEE COMMENT 5	REVEGETATION	4	7.0	L 32	L 71	H 193	2150	0.0	60	60	60
4297	5197 SEE COMMENT 224 SEE COMMENT 5	REVEGETATION	4	4.0	VL 13	L 113	H 58	130	4.5	60	80	40
4298	5198 SEE COMMENT 224 SEE COMMENT 5	REVEGETATION	4	4.6	M 37	H 204	H 130	530	2.5	60	50	0
4299	5199 SEE COMMENT 224 SEE COMMENT 5	REVEGETATION	4	4.6	VL 12	L 112	H 126	510	2.5	60	80	40
4300	5200 SEE COMMENT 5	REVEGETATION	4	7.0	M 50	M 170	H 280	13730	0.0	60	40	40

* 1. Sandy soils (CEC < 4.6 $cmol_c kg^{-1}$)
2. Loams & Light clays (CEC = 4.6-9.0 $cmol_c kg^{-1}$)
3. Clays and soils high in organic matter(CEC > 9.0 $cmol_c kg^{-1}$)
4. Clays of the Blackbelt(CEC > 9.0 $cmol_c kg^{-1}$)

** 7.4 or higher - Alkaline 6.6-7.3 - Neutral 6.5 or lower - Acid 5.5 or lower - Strongly Acid

*** Extractable nutrients in pounds per acre

APPROVED Thornton Bryant

APPENDIX 1

REPORT ON SOIL TESTS
AUBURN UNIVERSITY
SOIL TESTING LABORATORY
AUBURN UNIVERSITY, AL 36849-5411

NAME PERC ENGINEERING CO.
ADDRESS P O BOX 1712
CITY JASPER, AL 35502

COUNTY WALKER
DATE 12/19/02

LAB No.	SENDER'S SAMPLE DESIGNATION	CROP TO BE GROWN	SOIL* GROUP	SOIL TEST RESULTS pH**	Phosphorus P***	Potassium K***	Magnesium Mg***	Calcium Ca***	RECOMMENDATIONS LIME-STONE	N	P_2O_5	K_2O
					Pounds per acre				Tons/acre	Pounds per acre		
4301	5201 SEE COMMENT 5	REVEGETATION	4	5.9	L 27	M 126	H 482	1590	0.0	60	60	40
4302	5202 SEE COMMENT 224 SEE COMMENT 5	REVEGETATION	4	4.2	VL 14	M 136	H 242	710	3.5	60	80	40

COMMENT NO. 5: For perennial winter grass pasture, apply N, P, and K as recommended by September 1. Repeat N application in February.

COMMENT NO. 224: Soil acidity (low pH) can be corrected with either dolomitic or calcitic lime.

FINAL COMMENT: As a precautionary measure, consider applying 10 lb. sulfur per acre per year. Mixed fertilizers often contain enough sulfur to supply this amount

(27)

THE NUMBER OF SAMPLES PROCESSED IN THIS REPORT IS 9
FOR FURTHER INFORMATION CALL YOUR COUNTY AGENT: (205)221-3392

* 1. Sandy soils (CEC < 4.6 $cmol_c kg^{-1}$)
2. Loams & Light clays (CEC = 4.6-9.0 $cmol_c kg^{-1}$)
3. Clays and soils high in organic matter(CEC > 9.0 $cmol_c kg^{-1}$)
4. Clays of the Blackbelt(CEC > 9.0 $cmol_c kg^{-1}$)

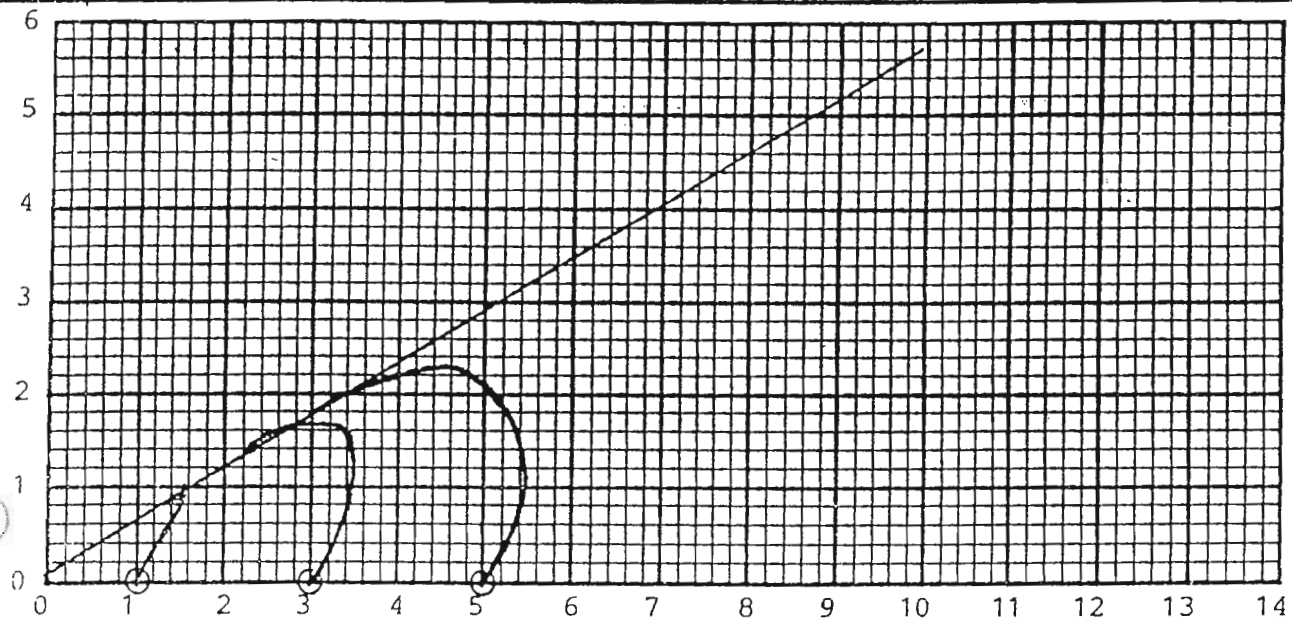
** 7.4 or higher - Alkaline 6.6-7.3 - Neutral 6.5 or lower - Acid 5.5 or lower - Strongly Acid

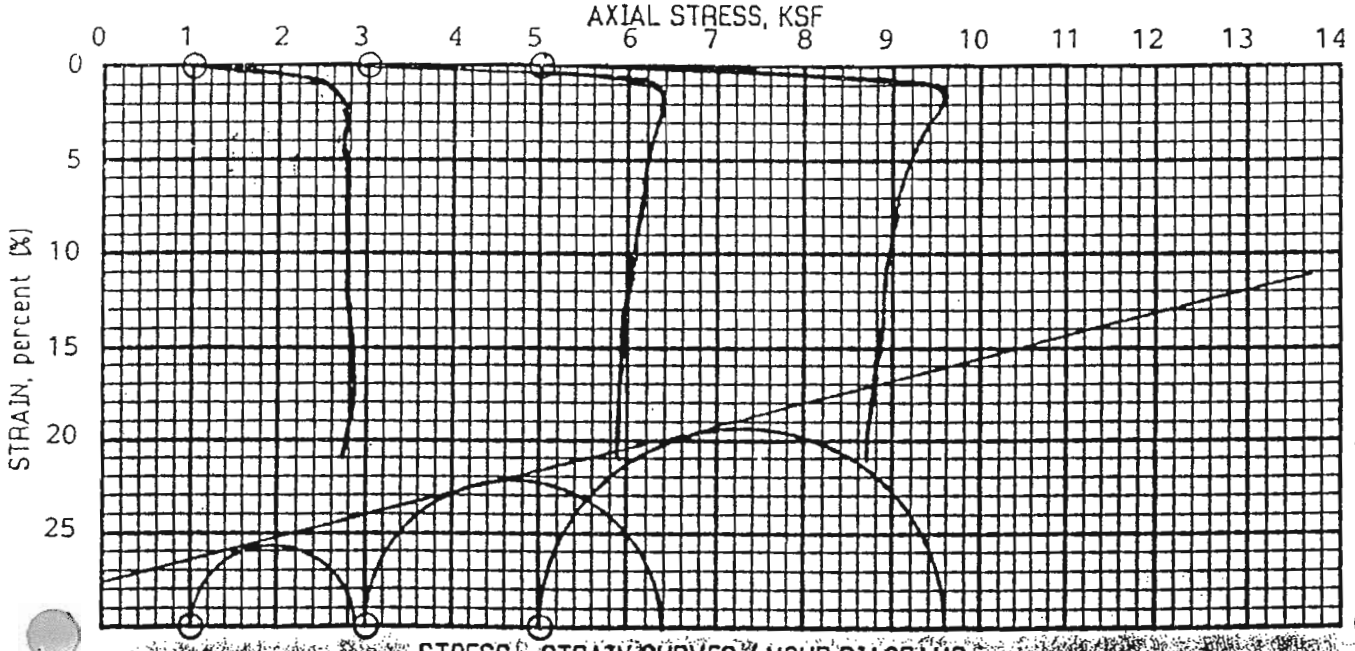
*** Extractable nutrients in pounds per acre

TRIAXIAL SHEAR TEST
CONSOLIDATED UNDRAINED / PORE PRESSURE

GROUND ENGINEERING & TESTING SERVICE, INC.

JOB NO. B1778-010	JOB NAME PERK ENGINEERING			BORING/PIT NO. N/A
REVIEWED	LOCATION			SAMPLE NO./TYPE Coarse Refuse 90% Compaction
DATE 9/95	TEST PROCEDURE SEE NOTE 1			DEPTH/ELEVATION N/A
SPECIMEN NO.	1	2	3	TOTAL Ø = 14.5°
CONFINING PRESSURE, KSF	1	3	5	TOTAL C = 0.5 KSF
INITIAL DRY DENSITY, PCF	91.7	91.7	91.7	EFF. Ø = 33.35°
INITIAL MOISTURE, %	6.5	6.5	6.5	EFF. C = 0.12 KSF
INITIAL VOID RATIO, e	.4706	.4699	.4699	Gs = 2.16
CONS. DRY DENSITY, PCF	94.6	95	95.4	
CONS. MOISTURE, %	19.7	19.4	19.1	
CONS. VOIDRATIO, e	.4250	.4182	.4121	

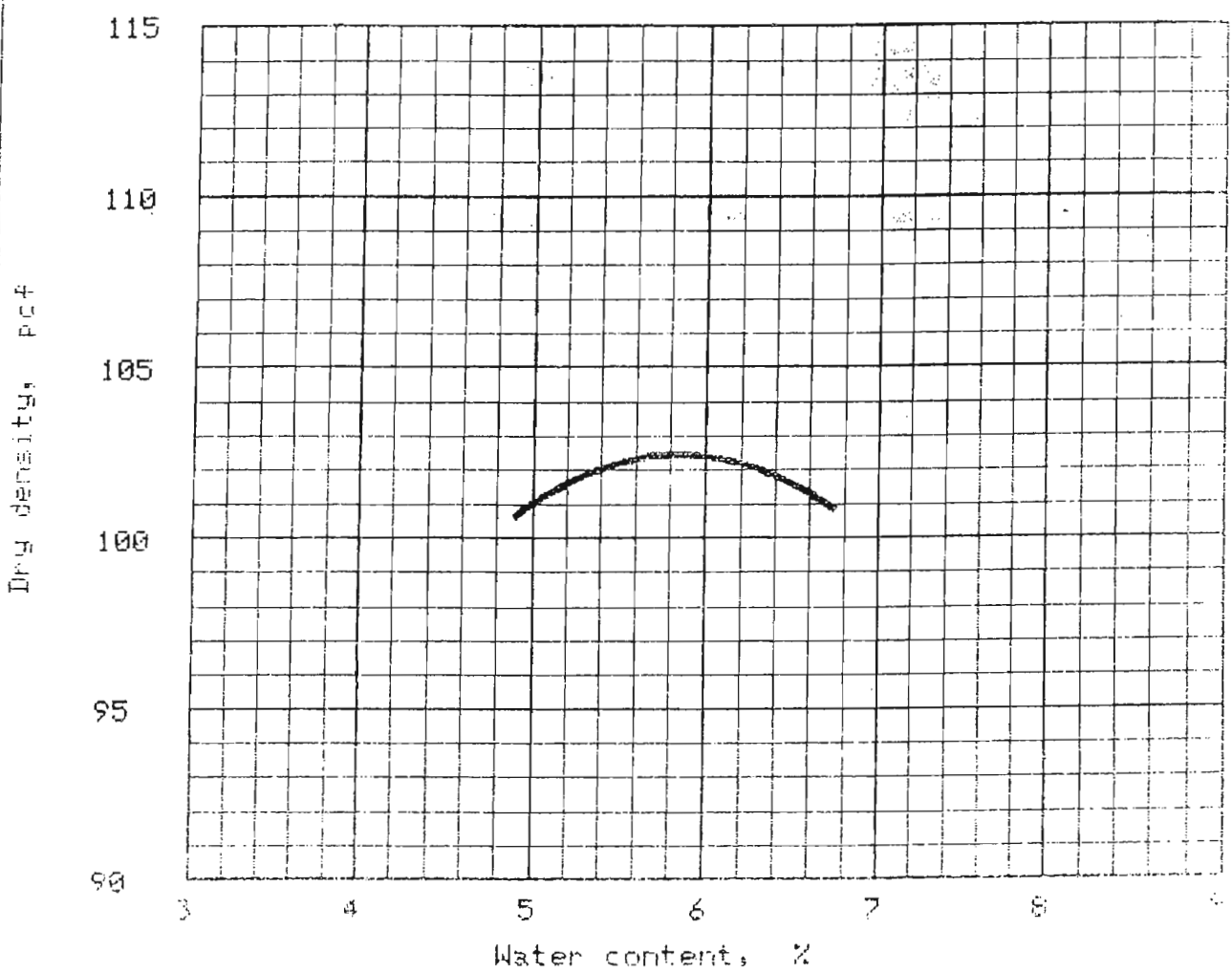




STRESS - STRAIN CURVES / MOHR DIAGRAMS

NOTE 1: REMOLDED TO 90% MOD PFC @ OPTM

PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method C

Elev/ Depth	Classification USCS	Classification AASHTO	Nat. Moist.	Sp.G.	LL	PI	% 3/4 in	% No. 200

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 5.8 % Maximum dry density = 102.4 pcf	Coarse Refuse

Project No.: 1798
Project: Jim Walter Resources
Location: Mine #5

Date: 8-30-1995

Remarks:

PROCTOR TEST REPORT

PERC ENGINEERING CO., INC.

Figure No._____

GROUND ENGINEERING AND TESTING SERVICE, INC.

Post-it® Fax Note 7671	Date 11/5/96	# of pages ▶ 5
To Steve Ingle	From Johnny Canfield	
Co./Dept.	Co. Ground Engineering	
Phone #	Phone # 321-1320	
Fax # 384-9491	Fax # 321-1321	

NOVEMBER 5, 1996

PERC ENGINEERING
1606 HIGHWAY 78 WEST
JASPER, AL 35501

ATTENTION: **STEVE INGLE**

SUBJECT: **TRIAXIAL SHEAR TEST**
COAL RESUSE
OUR JOB NO. B1778

Gentlemen:

The notes typed on the triaxial shear test performed by your project (9/95) should read remolded to (%) MDD not MOD. MDD indicates remolded to maximum dry density. Please accept our apology and this correction.

If you have any questions, please contact our office.

Very truly yours,

GROUND ENGINEERING AND TESTING SERVICE, INC.

Johnny Canfield
Vice-President

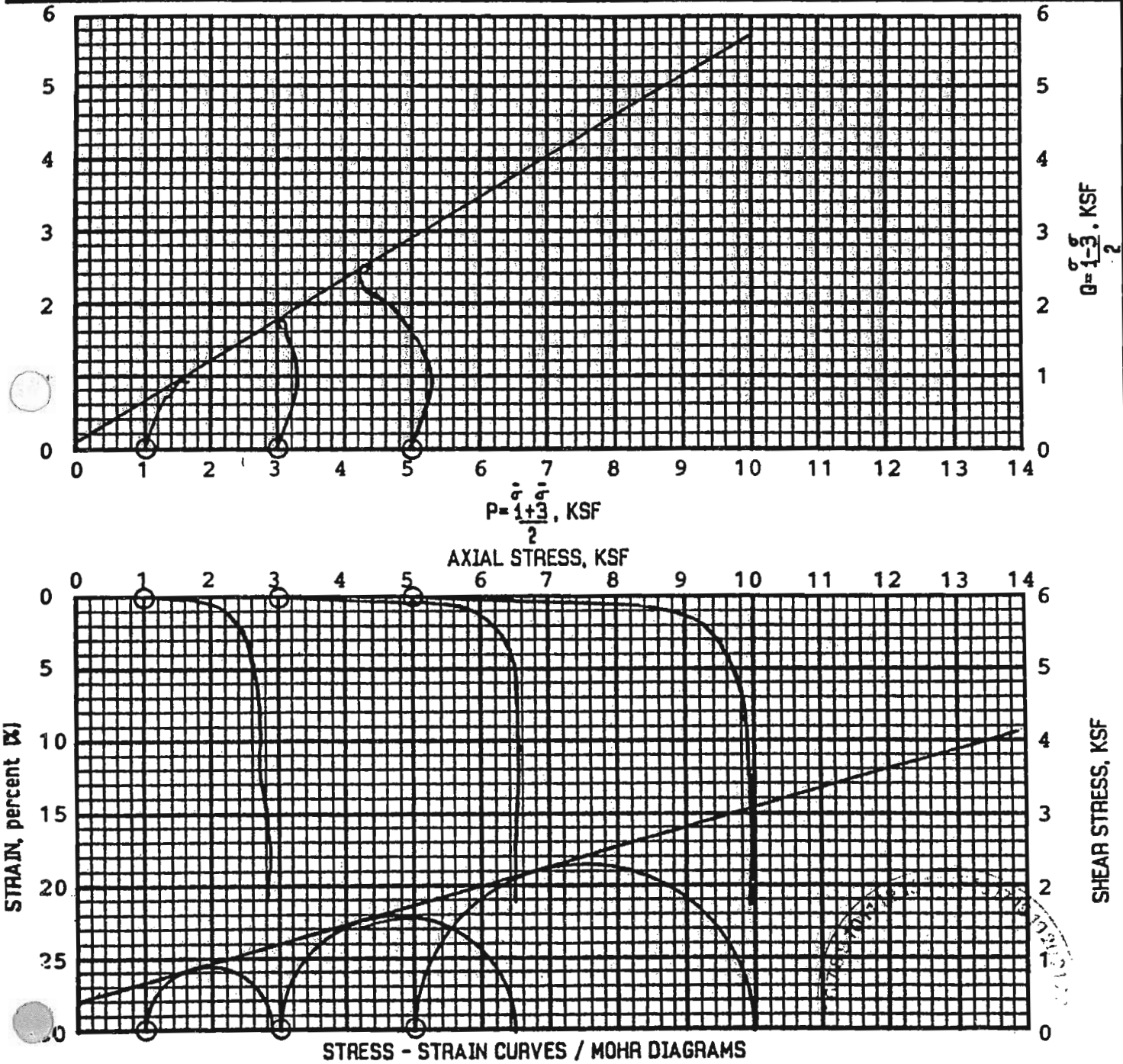
JFC/jmd

3608 7TH COURT SOUTH • BIRMINGHAM, ALABAMA 35222 • (205) 321-1320 • FAX (205) 321-1323

TRIAXIAL SHEAR TEST
CONSOLIDATED UNDRAINED / PORE PRESSURE

GROUND ENGINEERING & TESTING SERVICE, INC.

JOB NO. B8002-001	JOB NAME BOONE RESOURCES, INC.			BORING/PIT NO. N/A
REVIEWED	LOCATION SLURRY POND NO. 5			SAMPLE NO./TYPE UD SAMPLE
DATE 8-95	TEST PROCEDURE REMOLDED: note 1			DEPTH/ELEVATION N/A
SPECIMEN NO.	1	2	3	TOTAL Ø = 16.0°
CONFINING PRESSURE, KSF	1	3	5	TOTAL C = 0.4 KSF
INITIAL DRY DENSITY, PCF	53.6	53.6	53.6	EFF. Ø = 33.4°
INITIAL MOISTURE, %	15.7	15.7	15.7	EFF. C = 0.12 KSF
INITIAL VOID RATIO, e	.7451	.7451	.7451	Gs = 1.5
CONS. DRY DENSITY, PCF	54.3	55.5	56.5	
CONS. MOISTURE, %	48.2	45.9	43.7	
CONS. VOID RATIO, e	.7235	.6879	.6562	



Note 1: Samples remolded to undisturbed density and moisture content

density of 62.02 pounds per cubic foot. Triaxial shear testing resulted in an average angle of internal friction of 33.5 degrees, and an average effective cohesion of 120 pounds per square foot.

The foundation material is to be a sandstone and shale material. An effective cohesion of 10,000.0 pounds per square foot, a density of 170.0 pounds per cubic foot, and an angle of internal friction of 45.0 degrees were assumed.

Additional testing was performed on the proposed cover materials to be used during the abandonment of the waste bank. These test results are as follows.

SOIL PARAMETERS

The soil and foundation parameters selected for the design are shown below. These values used are the results of laboratory testing by PERC Engineering Co., Inc., Jasper, Alabama and Ground Engineering and Testing of Birmingham, Alabama.

MATERIAL	LOCATION	UNIT WEIGHT (WET) PCF	EFFECTIVE ANGLE OF FRICTION	EFFECTIVE COHESION PSF
Coarse Refuse	Waste Bank	128.0	33.4 degrees	120.0
Sandstone	Foundation	170.0	45.0 degrees	10,0000.0
Coal Fines	Foundation	62.02	33.4 degrees	120.0

METHODOLOGY

The proposed waste bank was evaluated under static loading conditions. A pore pressure ratio of 0.1 was utilized in the stability analyses. The stability analyses were performed using an approximate form of the limiting equilibrium approach as developed by Bishop. The location of the failure surface yielding the minimum safety factor was determined by allowing the computer to use a grid and search routine. The computer program used was the Reame Slope Stability program by Dr. Yang H. Huang, P.E. of the University of Kentucky.

RESULTS OF ANALYSES

Results of these stability analyses show that the Concord Preparation Plant's Coarse Refuse Disposal Area can be built safely. The attached map show the cross-sections locations upon which the stability analyses were performed. Tabular results of the analyses are as follows:

SECTION	STATIC SAFETY FACTOR
A-A' North	1.541
A-A' South	2.101
B-B' West	1.920
B-B' East	1.861

See Map 5 of 5 for Sections A-A' and B-B' locations.

* All calculations performed using simplified Bishop Method of Analysis.

DRAINAGE CONTROL

Drainage will be routed over, around, and under the waste bank through a series of diversions, slope benches, and downdrains. They are shown on the attached Grading Plan Map 4 of 5 and Abandonment Grading Plan Map 5 of 5. The specifications for the diversion ditches follows this section. See the original design plans for additional diversion, slope bench, and downdrain specifications.

Slope benches and downdrains will be constructed in the locations as shown and in accordance to the specifications described later. Slope benches (Terraces or Setbacks), diversions, and down drains will be rough graded as soon as possible and will be finish graded including the addition of 4 feet of non-toxic, non-acid forming, and non-combustible cover material and appropriate channel lining upon the completion of outslope grading and setback construction of the next slope bench. The outslopes below the slope benches and diversions will be finish graded including the addition of 4 feet of non-toxic, non-acid forming, and non-combustible cover material and vegetated upon the completion of the setback construction of the next slope bench and diversion. Typical design information for the slope benches and downdrains are attached.

SEDIMENT CONTROL

Sediment produced by the construction, use, maintenance, and reclamation of Coarse Refuse Disposal Area will be through Sediment Ponds 3A & 3B, Collection Ponds 1, 2, & 3, 017, and Basins 017 and 018. The basin locations are shown on the permit map.

SPECIFICATIONS FOR DIVERSION CHANNELS AND DIVERSION BERMS

1. Diversions shall be designed, constructed, and maintained in a manner which prevents additional contributions of suspended solids to stream flow and to runoff outside the permit area, to the extent possible, using the best technology currently available. Appropriate sediment control measures for these diversions may include, but not be limited to, maintenance of appropriate gradients, channel lining, revegetation, roughness structures, and detention basins.

2. No diversion shall be located so as to increase the potential for land slides and no diversion shall be constructed on existing land slides.

3. When no longer needed, each temporary diversion shall be removed and the affected land regraded, topsoiled, and revegetated in accordance with Rules 880-X-10C-.10, 880-X-10C-.11, 880-X-10C-.52 - 880-X-10C-.58, 880-X-10C-.60, and 880-X-10C-.62.

4. Channel linings, when slopes are between 1-3 percent shall consist of both perennial and annual grasses and when slopes are greater than 3 percent, shall consist of riprap or be cut into non-erodible material.

5. Freeboard shall provide protection for transition of flows and for critical areas such as swales and curves along the entire channel length.

6. Energy dissipators shall be installed, when necessary, at discharge points where natural streams and exit velocity of the diversion ditch flow is greater than that of the receiving stream.

7. Excess excavated material not necessary for diversion channel geometry or regrading of the channel shall be disposed of in accordance with Rule 880-X-10C-.36.

8. Topsoil removed from the diversion excavations shall be handled in accordance with Rule 880-X-10C-.07 through 880-X-10C-.11.

9. Diversions shall not be constructed or operated to divert water into underground mines.

10. The embankment or berm foundation area shall be cleared of all organic matter, all surfaces sloped to no steeper than lv:lh and the entire foundation surface scarified.

11. The entire embankment or berm shall be compacted to 90% density, based on standard proctor as outlined in ASTM.

12. The material placed in the berm shall be free of sod, roots, stones over 6 inches in diameter, and other objectionable materials. The fill material shall be placed and spread over the entire fill area, starting at the lowest point of the foundation, in layers not to exceed 12 inches in thickness. Construction of the fill shall be undertaken only at such times as the moisture content of the fill material will permit satisfactory compaction in accordance with paragraph 11.

13. The berm and all disturbed areas shall be seeded with both perennial and annual grasses in order to insure that erosion is minimized. Hay bales or riprap may be placed at the toe of the berm immediately upon completion of construction.

14. All berms shall be examined quarterly for structural weakness, instability, erosion, or other hazardous conditions and maintenance performed as necessary.

RIP-RAP CLASSIFICATION SPECIFICATIONS

CLASS 1 RIP-RAP

No more than 10% of the stone will have a diameter greater than twelve (12) inches; no more than 50% of the stone will have a diameter less than ten (10) inches; and no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than twelve (12) inches.

CLASS 2 RIP-RAP

No more than 10% of the stone will have a diameter greater than sixteen (16) inches; no more than 50% of the stone will have a diameter less than twelve (12) inches; and no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than sixteen (16) inches.

CLASS 3 RIP-RAP

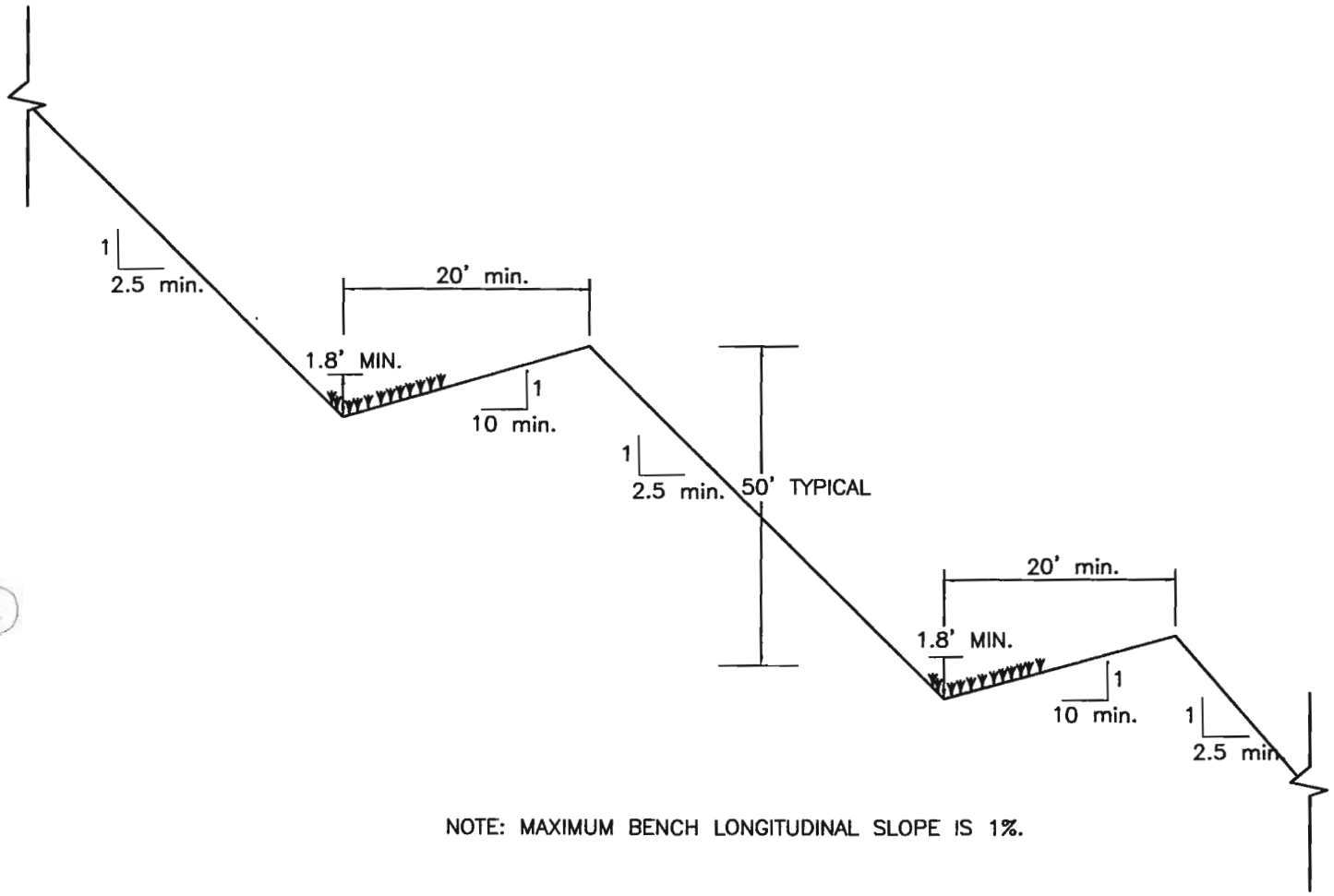
No more than 10% of the stone will have a diameter greater than twenty two (22) inches; no more than 50% of the stone will have a diameter less than sixteen (16) inches; and no more than 10% of the stone will have a diameter of less than eight (8) inches. The thickness of the rip-rap liner will be no less than twenty two (22) inches.

CLASS 4 RIP-RAP

No more than 10% of the stone will have a diameter greater than twenty seven (27) inches; no more than 50% of the stone will have a diameter less than twenty two (22) inches; and no more than 10% of the stone will have a diameter of less than ten (10) inches. The thickness of the rip-rap liner will be no less than twenty seven (27) inches.

CLASS 5 RIP-RAP

No more than 10% of the stone will have a diameter greater than thirty four (34) inches; no more than 50% of the stone will have a diameter less than twenty seven (27) inches; and no more than 10% of the stone will have a diameter of less than sixteen (16) inches. The thickness of the rip-rap liner will be no less than thirty four (34) inches.



NOTE: MAXIMUM BENCH LONGITUDINAL SLOPE IS 1%.

PERC ENGINEERING CO., INC.

Oak Grove Resources, LLC
Concord Prepartion Plant
P-3233
Coarse Refuse Disposal Area Expansion
Slope Typical Bench

DRAWN BY: S.A.E. DWG. NAME: OGCPESDA	DATE: 1-22-07
APPROVED BY: S.R.I.	SCALE: NONE

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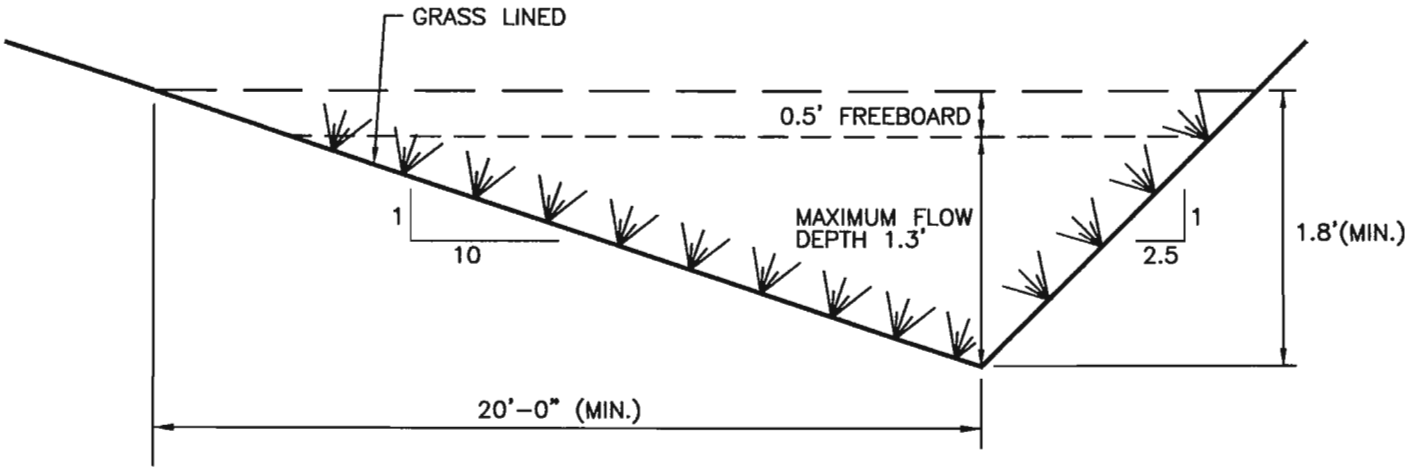

GRASS LINING TO CONSIST OF A MIXTURE OF FESCUE, BERMUDA, AND SERICEA GRASSES.

NOTE: MAXIMUM BENCH LONGITUDINAL SLOPE IS 1%.

PERC ENGINEERING CO., INC.

Oak Grove Resources, LLC
Concord Prepartion Plant
P-3233
Coarse Refuse Disposal Area Expansion
Slope Typical Bench

DRAWN BY: S.A.E. DWG. NAME: OGCPESDA	DATE: 1-22-07
APPROVED BY: S.R.I.	SCALE: NONE

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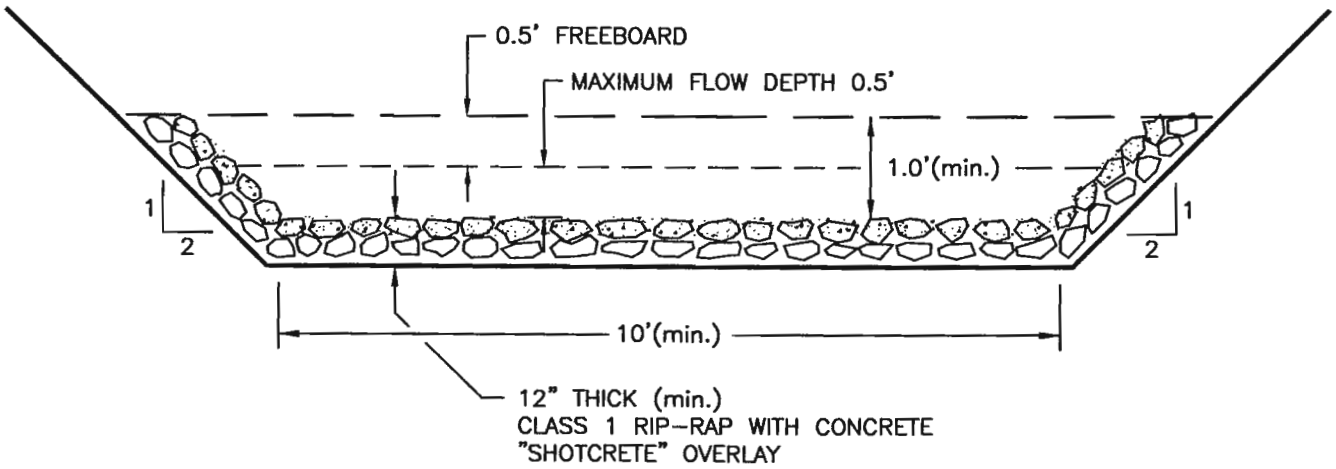

PERC ENGINEERING CO., INC.

Oak Grove Resources, LLC
Concord Prepartion Plant
P-3233
Coarse Refuse Disposal Area Expansion
Typical Down Drain

DRAWN BY: S.A.E. DWG. NAME: OGCPESDA	DATE: 1-22-07
APPROVED BY: S.R.I.	SCALE: NONE

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CONSTRUCTION NARRATIVE

Construction of the Coarse Refuse Disposal Area expansion will follow the previously approved design plans and will occur in three phases. These three phases are listed below:

Phase I - Site Preparation
- Step A - Removal of Vegetation
- Step B - Removal and Segregation of Soil Material

Phase II - Construction
- Step A - Placing and Compacting of Fill Material
- Step B - Construction of Diversions, Slope Benches and Downdrains

Phase III - Revegetation
- Step A - Placement of Cover Material
- Step B - Revegetation

A construction time schedule for this project is for construction to begin in the fall of 2007. Construction oversight and materials testing for the project will be done by a registered professional engineer or other qualified professional specialist under the direct supervision of a qualified registered professional engineer.

PHASE I

Preparation of the site will consist of the removal of all vegetation and the grubbing of the fill area. Topsoil and subsoil from the site will be stockpiled in order to be replaced on the finished slopes of the proposed waste bank.

PHASE II

The material to be placed in the waste bank shall consist of washer reject produced at Concord Preparation Plant. The fill material shall be placed and spread over the entire fill area in horizontal layers not to exceed 24 inches in thickness and compacted to 90% of the standard proctor density. Compaction will be accomplished using rubber tired or track

equipment that is available onsite.

Slope benches and downdrains will be constructed in the locations as shown and in accordance to the specifications described earlier. Slope benches (Terraces or Setbacks), diversions, and down drains will be rough graded as soon as possible and will be finish graded including the addition of 4 feet of non-toxic, non-acid forming, and non-combustible cover material and appropriate channel lining upon the completion of outslope grading and setback construction of the next slope bench. The outslopes below the slope benches and diversions will be finish graded including the addition of 4 feet of non-toxic, non-acid forming, and non-combustible cover material and vegetated upon the completion of the setback construction of the next slope bench and diversion. Temporary diversion around the work area will be constructed as needed. Grading operations will be conducted to allow runoff and prevent ponding on the work area.

Each slope bench and downdrain will be lined with the appropriate channel lining as specified within the design plans. When rip-rap is used, the riprap will consist of a sound durable sandstone or limestone, not subject to disintegration under the action of water and exposure of the elements. Friable, stratified rocks such as shales and rocks which tend to decompose in the water such as claystones will not be acceptable. Rock gradation will be in accordance with that shown in the designs. Smooth round boulders will not be approved. The material will be free of objectionable amounts of earth, quarry dust, and other foreign material; however, washing will not be required. Slabs and slivers will not be acceptable. Slabs and slivers will be defined as pieces for which the smallest dimension is less than 1/3 the largest dimension of the piece. Riprap need not be hand placed but will be dumped and spread in such a manner as to prevent segregation of sizes, to eliminate voids, and to establish uniformity. Riprap will be roughly graded so that the smaller pieces are adjacent to the earth material and the large pieces near the exposed face. Spalls in the amount not in excess of that required to fill the voids will be permissible. The exposed face will present a reasonable uniform and neat appearance. Grass lined channels will be seeded with grass species in quantities as approved in the reclamation

plan and will be fertilized and mulched with the types and rates as specified in the reclamation plan.

PHASE III

The final phase of construction of the Concord Preparation Plant's Coarse Refuse Disposal Area will consist of the placement of the final cover material upon the surface of the waste bank and revegetation. Cover material shall be placed on the surface of the waste bank of Coarse Refuse Disposal Area to a minimum thickness of two feet, unless a lesser amount is approved by the Regulatory Authority. Revegetation shall be performed according to the mixtures and application rates given in the following Permanent Cover-Mixtures and Rates Attachment. Seeding will commence during the first normal planting season to establish a diverse, effective and permanent vegetative cover. Seed bed preparation shall include discing or scarifying the soil to permit seed application and to aid in the mixing of the soil amendments. All areas shall be mulched with hay at a rate of 1 ½ - 3 tons per acre to control erosion, to promote seed germination, and to increase the moisture retention of the soil.

PERMANENT COVER-MIXTURES AND RATES

Spring Planting

Species	Planting Rate	Planting Methods	Planting Dates	Areas to be Planted
Fescue	25#/acre	Broadcast	Spring	All Disturbance
Millet	10#/acre	Broadcast	Spring	All Disturbance
Sericea	35#/acre	Broadcast	Spring	All Disturbance
Bermuda	15#/acre	Broadcast	Spring	All Disturbance

Fall Planting

Species	Planting Rate	Planting Methods	Planting Dates	Areas to be Planted
Sericea	35#/Acre	Broadcast	Spring	All Disturbance
Fescue	40#/Acre	Broadcast	Spring	All Disturbance
Perennial Ryegrass	20#/Acre	Broadcast	Spring	All Disturbance

OPERATIONAL PROCEDURES

Operational procedures for the Concord Preparation Plant's Coarse Refuse Disposal Area will consist of two phases. Phase I will consist of the transporting of the refuse material from the Concord Preparation Plant to Coarse Refuse Disposal Area site. Phase II will consist of the inspection and maintenance of the waste bank which is discussed in other sections of this report.

PHASE I

Refuse material produced at the Concord Preparation Plant will be transported to the waste bank area using conveyors and mobile equipment. The refuse material will be spread in

24 inch (maximum) horizontal lifts and compacted to 90% of the standard proctor density. This filling operation will continue until the design height and configuration is reached.

INSPECTION

The waste bank will be inspected by a registered professional engineer or other qualified professional specialist under the direct supervision of the qualified professional engineer. Inspections will be made at least quarterly and during times of removal of organic material and topsoil, installation of diversion ditches, placement and compaction of refuse material, and revegetation of the fill. Certification inspection reports will be filed with the Regulatory Authority stating that proper construction and maintenance are occurring in accordance with approved design plans. Inspection reports will be retained at the facility office.

ABANDONMENT PLAN

Upon reaching the final waste bank configuration the following steps shall be implemented for abandonment:

1. Reporting to MSHA's district manager of the intention to abandon the waste bank.

2. The waste bank will be covered with 2 feet of the best available non-toxic, non-combustible and non-acid forming soil on site, as approved within the Alternate Soil Cover Plan within Revision R-14, and graded to the final design configuration. (See map 5 of 5).

3. The neutralization potential and pH of the coarse refuse and cover material as taken from the approved Alternate Soil Plan as approved within Revision R-14 are as follows:

SUBJECT TEST	FIZZ	%SULFUR	MAXIMUM POTENTIAL ACIDITY	NEUTRALIZATION POTENTIAL (Tons of CaCo3 eq per tons soil)	A - B ACCOUNT	PASTE pH
*Coarse Refuse	None	0.499	5.21	12.75	7.54	7.57
*Cover Material	None	0.008	0.25	0.75	0.50	4.40
*Cover Material	None	0.018	0.57	15.83	15.26	5.70

*Testing performed by PERC Engineering Co., Inc., and Auburn University and averaged from 3 samples.

Methods according to Field and Laboratory Methods Applicable to Overburdens and Mine Spoils.

Note: A-B Account is an expression to illustrate the potential for acid production in a material. The above test results of the spoil material does not show the potential for acid production. Because it does not show the potential for acid production the pH of the material should be considered the lowest produced by this material. As stated in item No. 2, the cover material will be sampled and analyzed to determine the correct amount of soil amendments, including lime, to be added to the cover material. These soil amendments will ensure a diverse effective vegetative growth upon the material.

4. Revegetation shall be performed according to the mixtures and application rates given in the following Permanent Cover-Mixtures and Rates Attachment. Seeding will commence during the first normal planting season to establish a diverse, effective, and permanent vegetative cover. Topsoil, subsoil, and overburden material will be systematically sampled at a rate of 1 sample per 10 acres and sent to a qualified soil testing laboratory, for analysis to determine type and amount of soil amendments necessary to maintain vegetative growth and applied as recommended. Seed bed preparation shall include discing or scarifying the soil to permit seed application and to aid in the mixing of the soil amendments. All areas shall be mulched with hay at a rate of 1 ½ - 3 ton per acre to control erosion, to promote seed germination, and to increase the moisture retention of the soil.

PERMANENT COVER-MIXTURES AND RATES

Spring Planting

Species	Planting Rate	Planting Methods	Planting Dates	Areas to be Planted
Fescue	25#/acre	Broadcast	Spring	All Disturbance
Millet	10#/acre	Broadcast	Spring	All Disturbance
Sericea	35#/acre	Broadcast	Spring	All Disturbance
Bermuda	15#/acre	Broadcast	Spring	All Disturbance

Fall Planting

Species	Planting Rate	Planting Methods	Planting Dates	Areas to be Planted
Sericea	35#/Acre	Broadcast	Spring	All Disturbance
Fescue	40#/Acre	Broadcast	Spring	All Disturbance
Perennial Ryegrass	20#/Acre	Broadcast	Spring	All Disturbance

DRAWING LIST

Drawing Title	Sheet No.
Vicinity Map	1 of 5
Underground Mine Map	2 of 5
Geotechnical Investigation Map	3 of 5
Grading Plan	4 of 5
Abandonment Grading Plan	5 of 5

OAK GROVE RESOURCES, LLC

CONCORD PREPARATION PLANT

FACILITY ID. NO. 01-00329

REFUSE DISPOSAL AREA EXPANSION

MSHA ID. NO. 1211-AL11-00043-02

FOR

MINE SAFETY AND HEALTH ADMINISTRATION

BY

PERC ENGINEERING CO., INC.

October 4, 2007

P.O. Box 1712
Jasper, AL 35502
Phone: (205) 384-5553

The purpose of this study is to fulfill The Mine Safety and Health Administration's requirements for the design and plan approval of proposed waste banks as outlined in Title 30 - Mineral Resources, Chapter 1, Part 77, dated July 1, 1991.

GENERAL IDENTIFICATION INFORMATION

Oak Grove Resources, LLC, 8800 Oak Grove Mine Road, Adger, Alabama 35006, under the direction of Mr. Larry Bennett, hereby gives notice of their intention to modify their Disposal Area, Facility Id. No. 1211-AL11-00043-02, at the Concord Preparation Plant, MSHA Id. No. 01-00329.

SITE LOCATION

The waste bank site is located in Jefferson County, Alabama approximately one (1) mile West of the Hueytown community. The waste bank area is located in the S ½ of the SW 1/4, the SW 1/4 of the SE 1/4 of Section 23 and the NW 1/4, the S ½ of the NE 1/4, the NW 1/4 of the SW 1/4, the E ½ of the SW 1/4, and the NW 1/4 of the SE 1/4 of Section 26, all within Township 18 South, Range 5 West, Jefferson County, Alabama, as found on the Concord U.S.G.S. Quadrangle Map. (See Map 1 of 5 for site location). The waste bank site will be located on land under control by Oak Grove Resources, LLC. The construction area is located a safe distance away from all air shafts, preparation plants, and tipples. No burning waste banks exist at this facility.

INVESTIGATIVE FINDINGS

A total of twenty (21) borings were made at or near the waste bank site between January and February 1991. Resulting values and analysis of the borings indicate the disposal site is existing coarse refuse produced at the Concord Preparation Plant overlying a sandy clay and sandstone foundation. These resulting investigations show the material to be of a sound and excellent nature. (See Map 3 of 5 for Boring Sites and Results and the attached Cross-Sections).

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

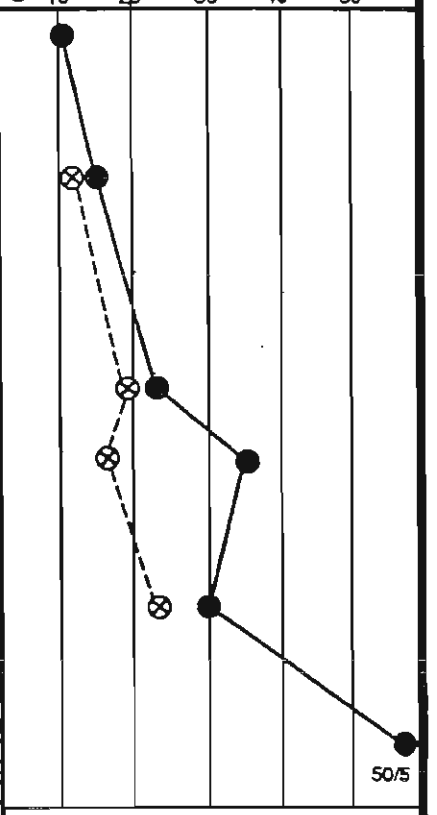
BORING NUMBER	B-1	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-23-91
				DATE COMPLETED:	1-23-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 584.7
0	S-1	1.5	100	-	LOOSE TO MEDIUM DENSE, BLACK COARSE, COAL REFUSE
5	S-2	1.5	100	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, SEVERELY WEATHERED
10	ST-1	2.3	92	-	SANDY CLAY WITH SOME REFUSE
	S-3	0.95	63	-	STIFF, ORANGE AND RED, SANDY CLAY, MOIST, TRACE COARSE, MOIST
15	S-4	1.5	100	-	VERY STIFF, ORANGE AND RED SANDY CLAY, TRACE SANDSTONE FRAGMENTS, MOIST
20	S-5	1.5	100	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED, MOIST
25	S-6	0.9	60	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED, MOIST
	1	0.9	90	0	SANDSTONE - MEDIUM GRAINED, LIGHT GRAY, SOFT, VERY BROKEN, SEVERELY WEATHERED TO RED AND ORANGE, SOME CLAY LENSES
30	2	7.8	82	73	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, MASSIVE, FRESH, TRACE COAL STRINGERS
35					INTERBEDDED GRAY SANDSTONE AND CARBONEOUS SHALE, HARD, BROKEN, FRESH
40					BOTTOM OF BORING AT 37.9 FEET



AUGER REFUSAL AT 28 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

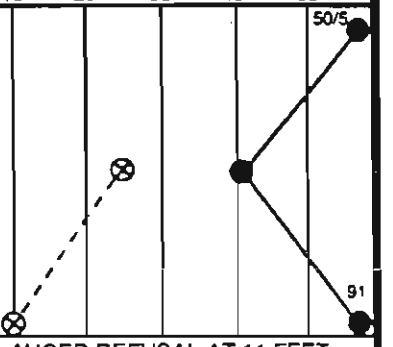
BORING NUMBER	B-2	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, (FT.)	RECOVERY, (%)	ROCK RQD, (%)	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.9	
	S-1	0.9	60	-	VERY DENSE, LIGHT GRAY SLAG	
5	S-2	1.5	100	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO RED AND ORANGE	
10	S-3	1.2	80	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO RED AND ORANGE	
15	1	2.75	55	9	SANDSTONE - CLAYEY, LIGHT GRAY, SOFT TO MEDIUM HARD, VERY BROKEN, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
20	2	5	100	42		
25	3	4.55	82	52	BRECCIA - QUARTZ AND SHALE FRAGMENTS, GRAY AND WHITE, HARD, BROKEN, SLIGHTLY WEATHERED	
					SANDSTONE - FINE GRAINED, GRAY, HARD, BROKEN, FRESH, TRACE COAL STRINGERS	
30					BOTTOM OF BORING AT 26 FEET	
35						
40						



AUGER REFUSAL AT 11 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

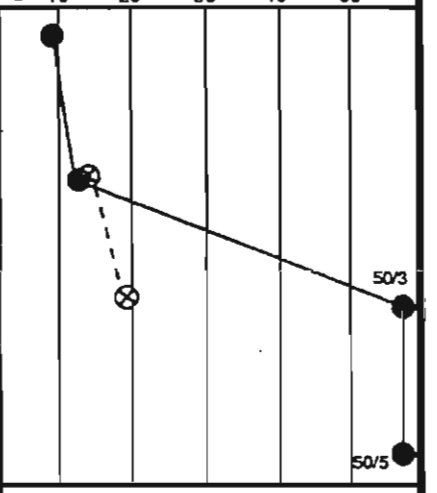
BORING NUMBER	B-3	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.7	
	S-1	0.9	60	-	VERY STIFF, RED AND ORANGE, SANDY CLAY, MOIST	
5	S-2	1.5	100	-	STIFF, RED AND ORANGE, SANDY CLAY, MOIST	
10	S-3	0.6	40	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
15	S-4	0.4	27	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE	
20					BOTTOM OF BORING AT 16.6 FEET	
25						
30						
35						
40						



AUGER REFUSAL AT 16.6 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-3A	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-8-91
				DATE COMPLETED:	2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 570.7	
5	ST-1	2.5	100	-	ORANGE, SANDY CLAY	
					BOTTOM OF BORING AT 5.5 FEET	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

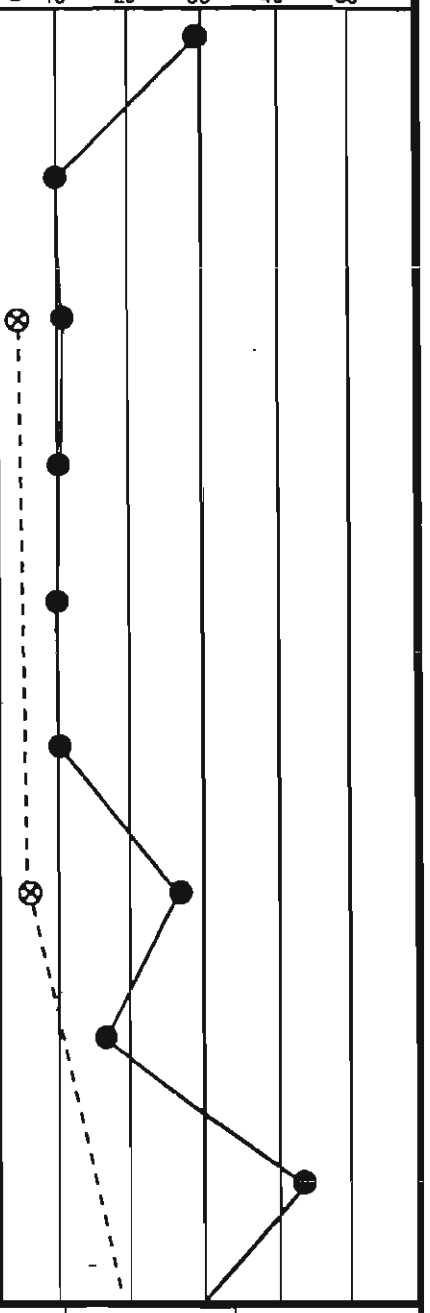
BORING NUMBER	B-4	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-28-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 614.7	
0	S-1	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE	
5	S-2	1.1	73	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
10	S-3	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
15	S-4	1.4	93	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
20	S-5	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
25	S-6	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
30	S-7	1.5	100	-	MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
35	S-8	1.5	100	-	MEDIUM DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	
40	S-9	1.5	100	-	DENSE, GRAY AND BROWN, COARSE, COAL REFUSE	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

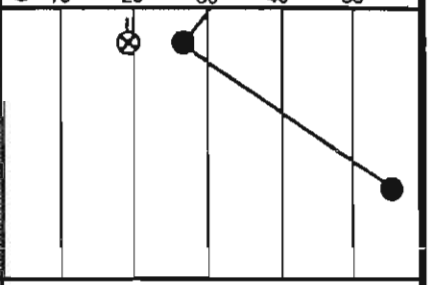
BORING NUMBER	B-4	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-28-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
50	S-10	1.5	100	-	MEDIUM STIFF, BROWN TO ORANGE, SANDY CLAY, MOIST	
	S-11	1.5	100	-	VERY DENSE, RED AND ORANGE, CLAYEY SAND	
55					BOTTOM OF BORING AT 54.5 FEET	
60						
65						
70						
75						
80						
85						



AUGER REFUSAL AT 54.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

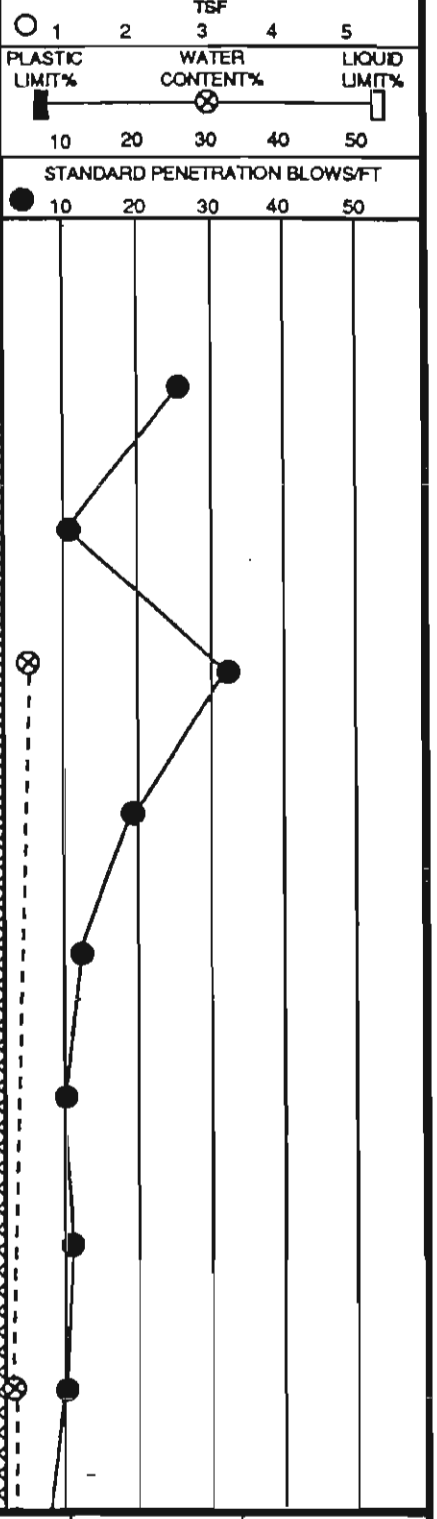
BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91

DRILLING METHOD: HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING

SURFACE ELEVATION: 641.31

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
5	S-1	1.4	93	-	MEDIUM DENSE TO DENSE, GRAY, COARSE , COAL REFUSE, DRY
10	S-2	1.3	87	-	LOOSE TO MEDIUM DENSE, COARSE, COAL REFUSE, DRY
15	S-3	1.2	80	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.3	87	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
35	S-7	0.9	60	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
40	S-8	0.7	47	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

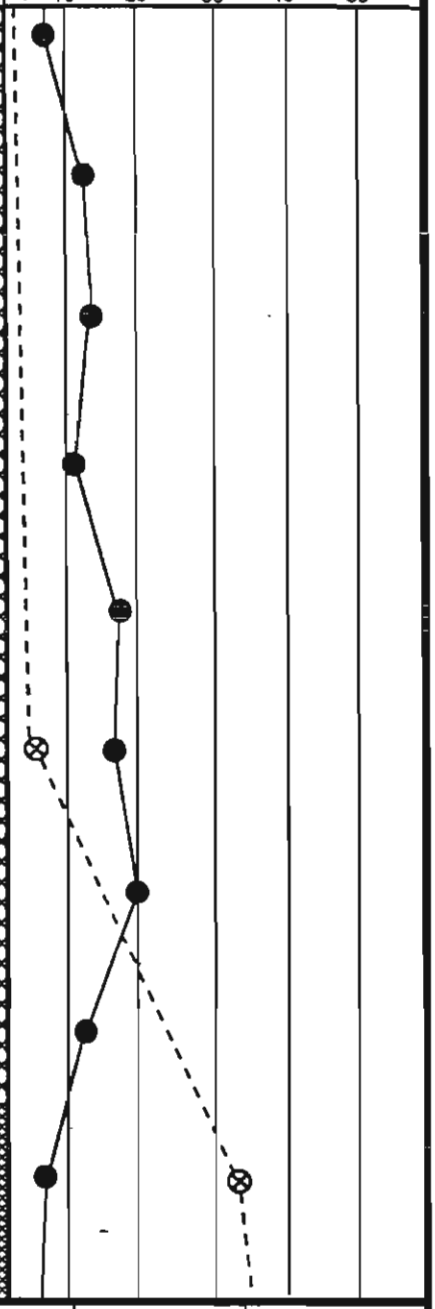
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.1	73	-	LOOSE, GRAY, COARSE COAL REFUSE, DRY
50	S-10	0.9	60	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, DRY
55	S-11	0.6	40	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, DRY
60	S-12	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-13	0.9	60	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
75	S-15	0.9	60	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY
80	S-16	1.3	87	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, WET
85	S-17	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET
	ST-1	1.8	90	-	BLACK, FINE, COAL REFUSE

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-5	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-30-91
				DATE COMPLETED:	2-1-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

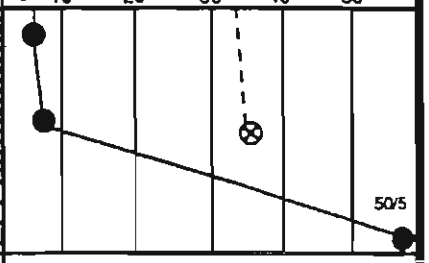
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-18	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET
	ST-2	0	0	-	
	S-19	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET
95					
	S-20	0.4	100	-	SANDSTONE - LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOLTLED TO RED AND ORANGE
100					BOTTOM OF BORING AT 98.4 FEET
105					
110					
115					
120					
125					
130					

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



SPOON REFUSAL AT 98.4 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

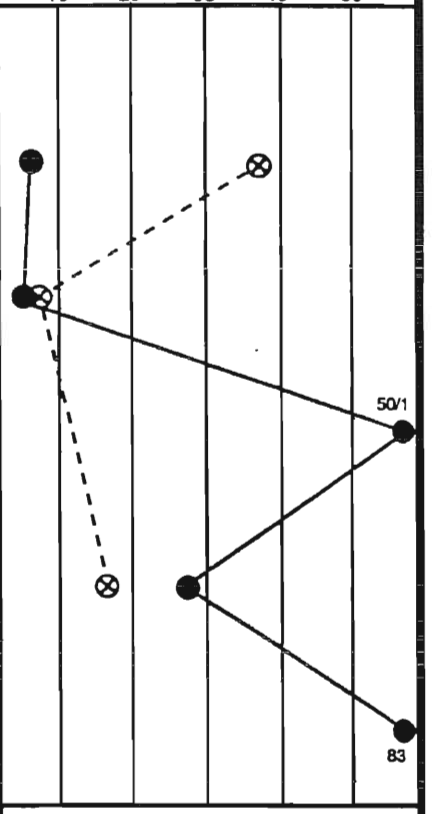
BORING NUMBER	B-6	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-31-91
				DATE COMPLETED:	1-31-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 578.6	
5	S-1	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, WET	
	ST-1	1.5	75	-	BLACK, FINE, COAL REFUSE	
10	S-2	1.5	100	-	VERY SOFT, BLACK, FINE, COAL REFUSE, WET	
15	S-3	0.6	100	-	DENSE, GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST	
20	S-4	1.5	100	-	MEDIUM DENSE, RED AND ORANGE, SANDY CLAY	
25	S-5	1.4	93	-	SANDSTONE - CLAYEY, LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED TO ORANGE AND RED	
30					BOTTOM OF BORING AT 28 FEET	
35						
40						



AUGER REFUSAL AT 28 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

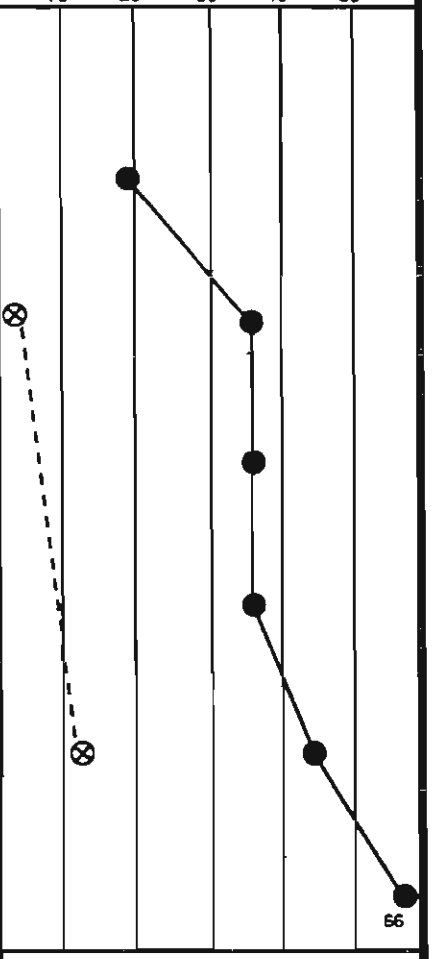
BORING NUMBER	B-7	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-24-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 585.1	
5	S-1	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY	
10	S-2	1.0	67	-	DENSE, BLACK, COARSE, COAL REFUSE, DRY	
15	S-3	1.4	93	-	DENSE, GRAY, COARSE, COAL REFUSE; MEDIUM DENSE, LIGHT BROWN, CLAYEY SAND AT BOTTOM OF SAMPLE	
20	S-4	1.5	100	-	SANDSTONE - ORANGE AND BROWN, VERY SOFT, SEVERELY WEATHERED,	
25	S-5	1.3	87	-	SANDSTONE - ORANGE AND RED, VERY SOFT, SEVERELY WEATHERED,	
30	S-6	1.1	73	-	SANDSTONE - CLAYEY, RED AND ORANGE, VERY SOFT, SEVERELY WEATHERED	
35					BOTTOM OF BORING AT 33.4 FEET	
40						

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



AUGER REFUSAL AT 33.4 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-8	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-24-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91

DRILLING METHOD: HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING

UNCONFINED COMPRESSIVE STRENGTH TSF: 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 551.8
5	S-1	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
10	S-2	0.9	60	-	SANDSTONE - CLAYEY VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE
15	S-3	1.0	67	-	SANDSTONE - CLAYEY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO RED AND ORANGE
20	S-4	0.2	100	-	SANDSTONE - VERY SOFT, SEVERELY WEATHERED TO ORANGE AND BROWN
	1	1.7	74	71	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, BROKEN TO MASSIVE, SLIGHTLY WEATHERED AND STAINED ORANGE, TRACE IRONSTONE LAYERS AND COAL STRINGERS
25	2	4.05	100	47	SANDSTONE - MEDIUM GRAINED, GRAY, HARD, MASSIVE, FRESH
30	3	4.7	100	94	CONGLOMERATE - ROCK FRAGMENT PEBBLES, GRAY HARD, SLIGHTLY BROKEN TO BROKEN, SLIGHTY WEATHERED TO ORANGE, TRACE COAL STRINGERS
35					BOTTOM OF BORING AT 32.8 FEET
40					

PROFILE

50/3

50/2

AUGER REFUSAL AT 27.35 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

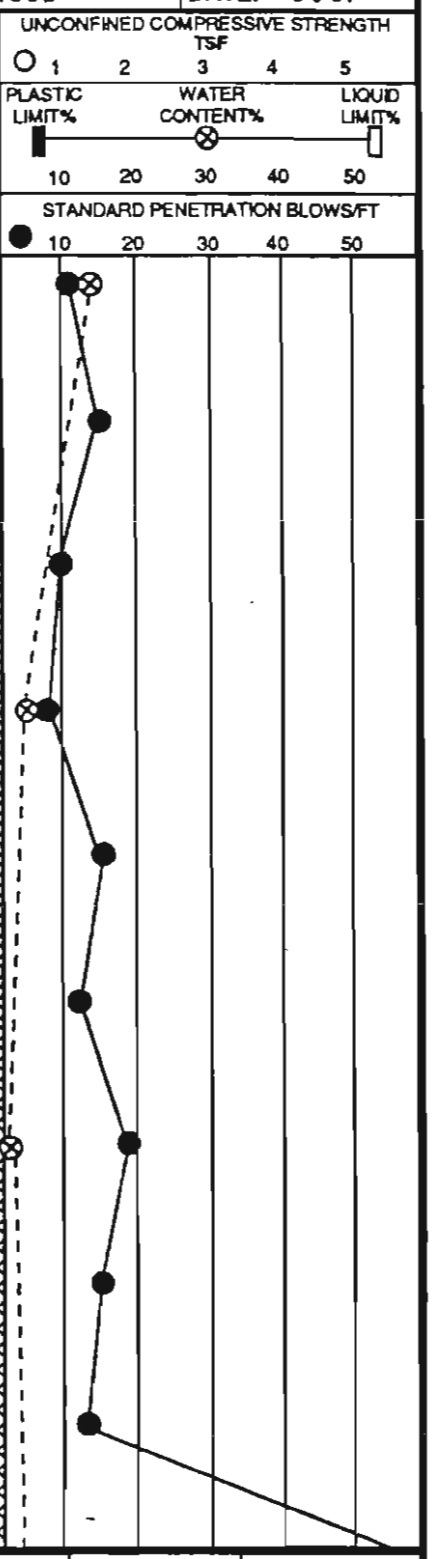
SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-9	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-29-91
				DATE COMPLETED:	1-30-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 536.3
	S-1	1.5	100	-	MEDIUM DENSE, ORANGE AND RED, CLAYEY, SAND, AND SANDSTONE FRAGMENTS, MOIST
5	S-2	0.6	40	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
10	S-3	0.4	27	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE
15	S-4	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN
20	S-5	1.5	100	-	MEDIUM DENSE, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN
25	S-6	1.5	100	-	MEDIUM DENSE, COARSE, COAL REFUSE, MODERATELY WEATHERED TO YELLOWISH BROWN
30	S-7	1.3	87	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE
35	S-8	0.9	60	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN
40	S-9	1.0	67	-	MEDIUM DENSE, GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

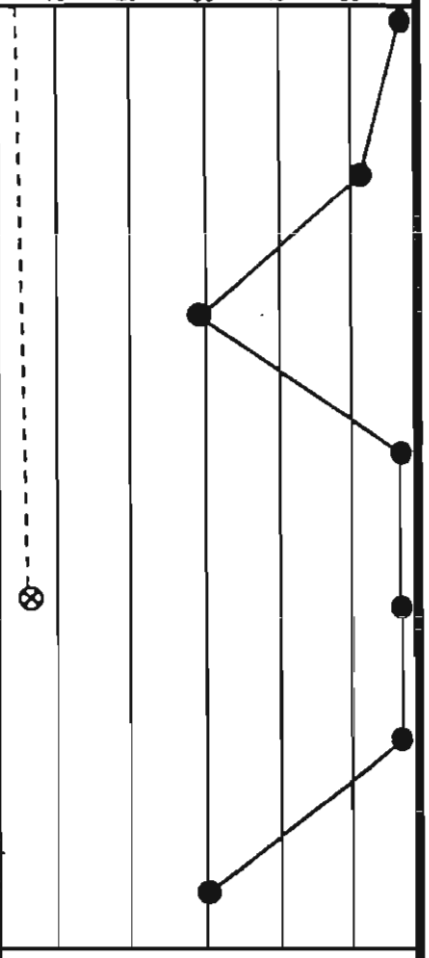
BORING NUMBER	B-9	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-29-91
				DATE COMPLETED:	1-30-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
50	S-10	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
	S-11	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
55	S-12	1.5	100	-	MEDIUM DENSE TO DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
60	S-13	0.5	71	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
65	S-14	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
70	S-15	0.4	80	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO YELLOWISH BROWN	
75	S-16	1.3	87	-	DENSE, SEVERELY WEATHERED, COARSE, REFUSE WITH LIGHT GRAY SANDSTONE AT BOTTOM OF SAMPLE	
80					BOTTOM OF BORING AT 78 FEET	
85						



AUGER REFUSAL AT 78 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-10	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-25-91
				DATE COMPLETED:	1-28-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	CONTINUOUS FLIGHT AUGERS WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

UNCONFINED COMPRESSIVE STRENGTH TSF: O 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, (FT.)	RECOVERY, (%)	ROCK RQD, (%)	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 549.59	
	S-1	-	-	-	NOT SAMPLED	
5	S-2	0.9	100	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE	
10	S-3	1.3	87	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE	
15	S-4	1.5	100	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE	
20	S-5	1.0	67	-	COARSE, COAL REFUSE AND STIFF, ORANGE SANDY CLAY	
	ST-1	1.9	95	-		
25	S-6	0.35	100	-	SANDSTONE - RED, VERY SOFT, SEVERELY WEATHERED	
30	1	0.3	14	0	SANDSTONE - RED AND ORANGE, VERY SOFT, VERY BROKEN, SOME INTERBEDDED CLAY	
	2	4.45	89	35	SANDSTONE - GRAY AND BROWN, MEDIUM HARD, BROKEN TO SLIGHTLY BROKEN WITH ANGULAR CLAY FILLED FRACTURES, SLIGHTLY WEATHERED TO ORANGE	
35					SANDSTONE - GRAY, SEVERELY WEATHERED TO ORANGE, SOFT TO MEDIUM HARD, VERY BROKEN TO BROKEN	
	3	4.5	90	50	SANDSTONE AND CONGLOMERATE - COARSE GRAINED AND PEBBLES, DARK GRAY, HARD, SLIGHTLY BROKEN, SLIGHTLY WEATHERED, TRACE COAL STRINGERS	
40					BOTTOM OF BORING AT 41.6 FEET	

AUGER REFUSAL AT 29.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 658.3
5	S-1	1.2	80	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.7	47	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
15	S-3	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.0	67	-	VERY LOOSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.3	87	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.4	93	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, SOME SAND, MOIST
35	S-7	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
40	S-8	1.3	87	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST

PROFILE

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

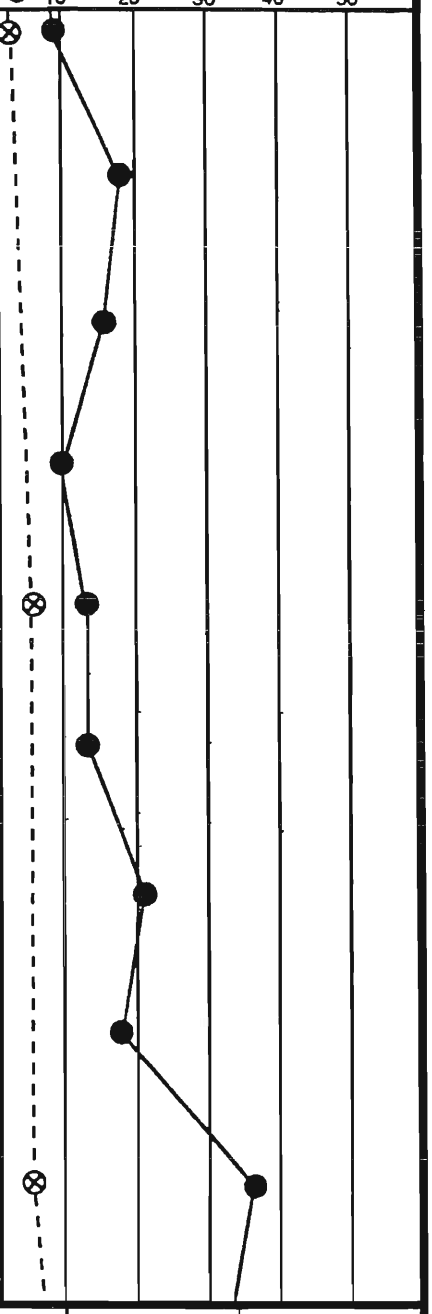
BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: O 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.2	80	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
50	S-10	1.3	87	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
55	S-11	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-13	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
70	S-14	1.5	100	-	LOOSE TO MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
75	S-15	0	0	-	
80	S-16	1.3	87	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
85	S-17	1.1	73	-	DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-11	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-4-91
				DATE COMPLETED:	2-5-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

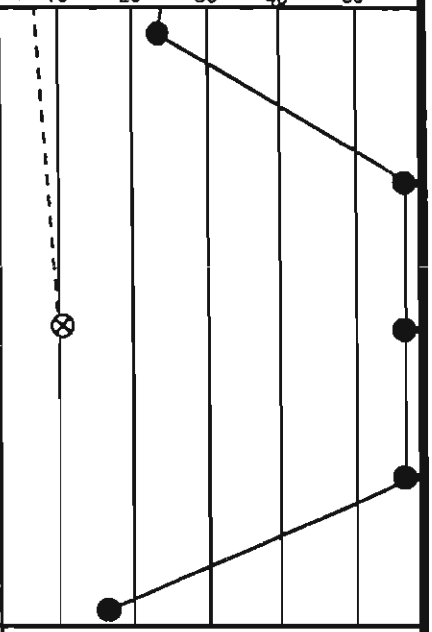
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-18	1.0	67	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN, DRY TO MOIST
95	S-19	1.5	100	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
100	S-20	1.0	67	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
105	S-21	0.4	27	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN
110	S-22	-	-	-	SAMPLE NOT RECOVERED
					BOTTOM OF BORING AT 111.5 FEET
115					
120					
125					
130					

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



AUGER REFUSAL AT 111.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91	
				DATE COMPLETED: 2-8-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

SURFACE ELEVATION: 657.4

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
5	S-1	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-2	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
15	S-3	0.7	47	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
20	S-4	1.2	80	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
25	S-5	1.1	73	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
30	S-6	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
35	S-7	0.9	60	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
40	S-8	0.8	53	-	LOOSE, BLACK AND BROWN, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST

PROFILE

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-8-91
				DATE COMPLETED:	2-8-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

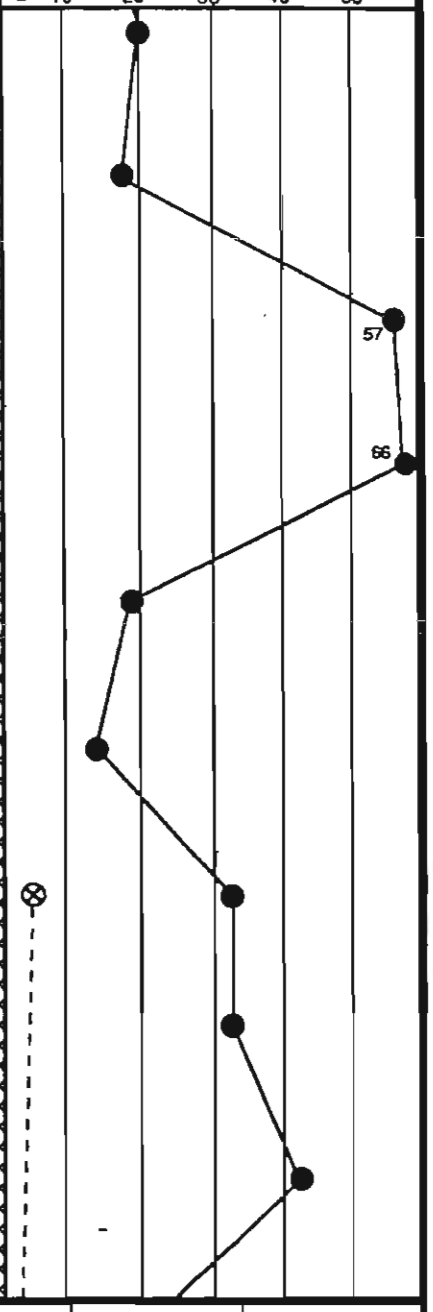
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	0.7	47	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
50	S-10	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
55	S-11	1.5	100	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
60	S-12	1.3	87	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY
70	S-14	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY
75	S-15	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST TO WET
80	S-16	1.3	87	-	DENSE, BLACK AND GRAY, COARSE COAL REFUSE, DRY
85	S-17	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST TO DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

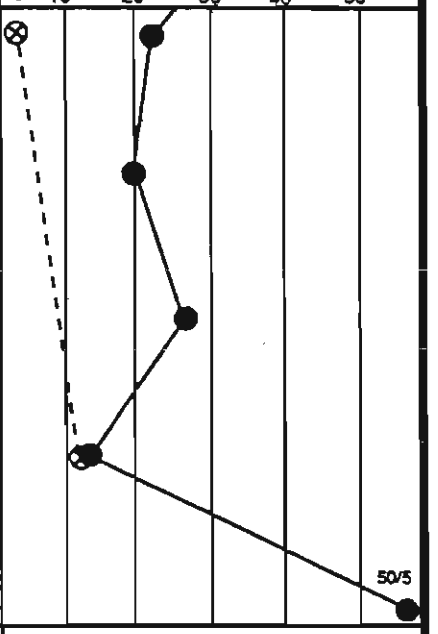
BORING NUMBER	B-12	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-8-91	
				DATE COMPLETED: 2-8-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-18	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
	S-19	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
100	S-20	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, MOIST	
105	S-21	1.1	73	-	STIFF, LIGHT BROWN, SANDY CLAY, MOIST	
110	S-22	0.9	60	-	SANDSTONE- VERY SOFT, SEVERELY WEATHERED TO RED AND YELLOW	
					BOTTOM OF BORING AT 110.9 FEET	
115						
120						
125						
130						



SPOON REFUSAL AT 120.9 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	

DRILLING METHOD: HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING

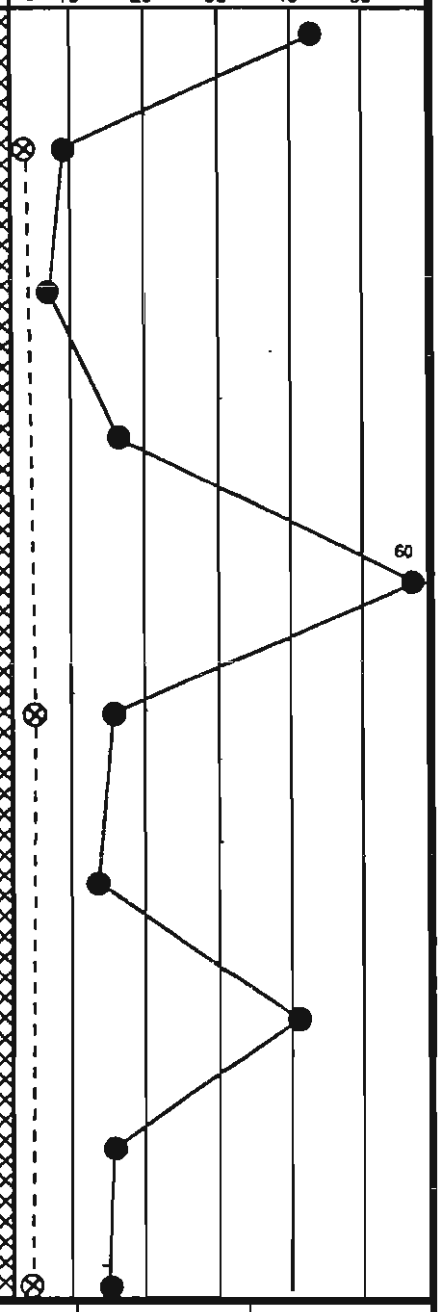
UNCONFINED COMPRESSIVE STRENGTH TSF: O 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 632.82
	S-1	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY
5	S-2	-	-	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-3	-	-	-	LOOSE, GRAY, COARSE, COAL REFUSE, DRY
15	S-4	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
20	S-5	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY
25	S-6	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
30	S-7	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
35	S-8	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
40	S-9	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
	S-10	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

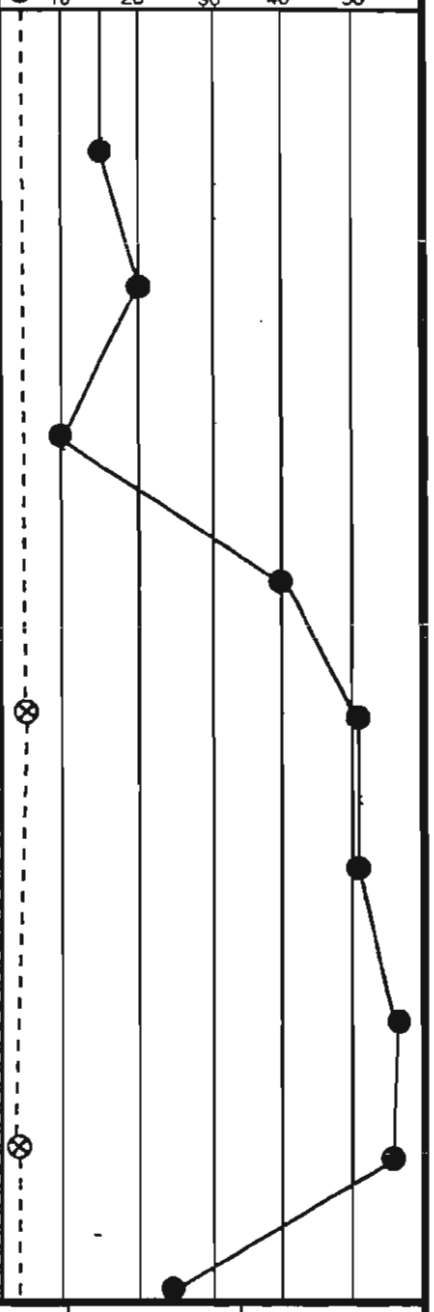
BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-10	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
50	S-11	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
55	S-12	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
60	S-13	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
65	S-14	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
70	S-15	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
75	S-16	-	-	-	DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
80	S-17	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
85	S-18	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
	S-19	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

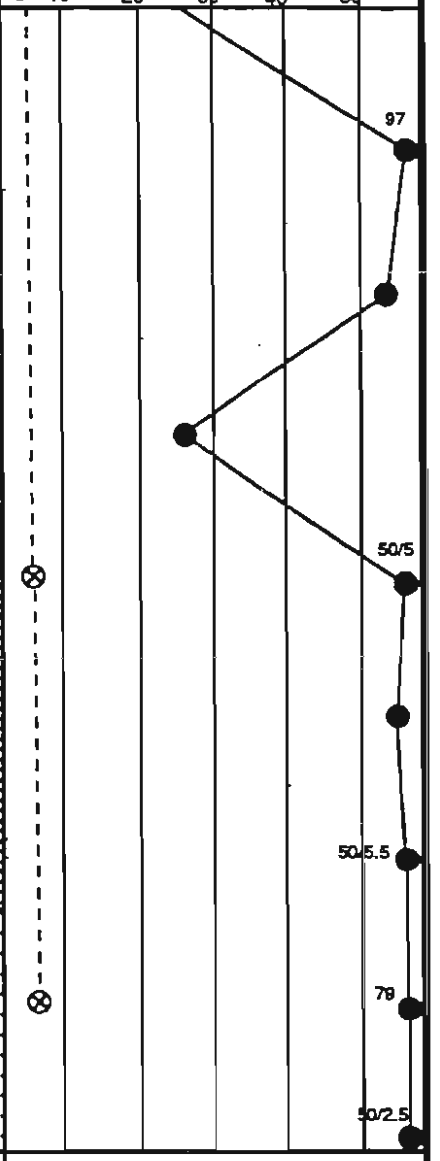
BORING NUMBER	B-13	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-13-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-19	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
95	S-20	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE	
100	S-21	-	-	-	VERY DENSE, GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
105	S-22	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE DRY TO MOIST	
110	S-23	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN	
115	S-24	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN	
120	S-25	-	-	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST, SLIGHTLY WEATHERED TO BROWN	
125	S-26	-	-	-	VERY SOFT, SEVERELY WEATHERED, LIGHT BROWN SANDSTONE	
	S-27	-	-	-	SANDSTONE-LIGHT BROWN, VERY SOFT, SEVERELY WEATHERED	
130					BOTTOM OF BORING AT 129.3 FEET	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: ⊗ 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL APPROXIMATE SURFACE ELEVATION: 658
5	S-1	1.3	87	-	DENSE, GRAY AND BLACK, COARSE , COAL REFUSE
10	S-2	0.8	53	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
15	S-3	1.0	67	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
20	S-4	0.9	60	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
25	S-5	1.3	87	-	LOOSE, GRAY AND BLACK, COARSE , COAL REFUSE, DRY
30	S-6	1.3	87	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
35	S-7	1.2	80	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE , COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, MOIST
40	S-8	1.4	93	-	MEDIUM DENSE, BLACK AND GRAY COARSE COAL REFUSE, MOIST

PROFILE

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

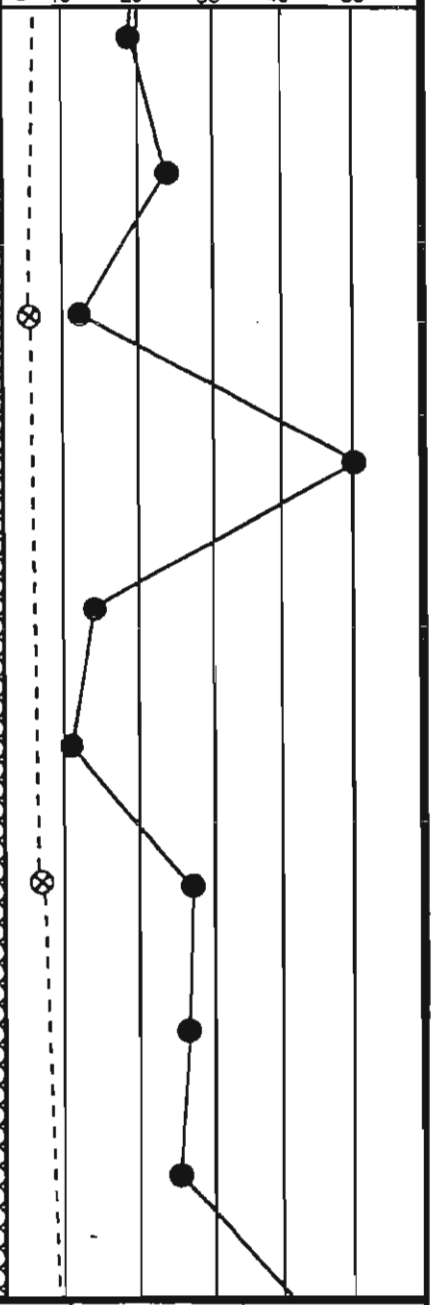
BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
50	S-10	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MODERATELY WEATHERED TO ORANGISH BROWN, MOIST
55	S-11	1.1	73	-	MEDIUM DENSE, GRAY, COARSE COAL, REFUSE, SLIGHTLY WEATHERED TO ORANGISH BROWN, MOIST
60	S-12	1.3	87	-	DENSE TO VERY DENSE, GRAY AND BLACK, COARSE COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
70	S-14	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
75	S-15	1.5	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
80	S-16	1.3	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST
85	S-17	1.5	100	-	MEDIUM DENSE TO DENSE , GRAY AND BLACK, COARSE, COAL REFUSE , MODERATELY WEATHERED TO BROWNISH ORANGE, MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

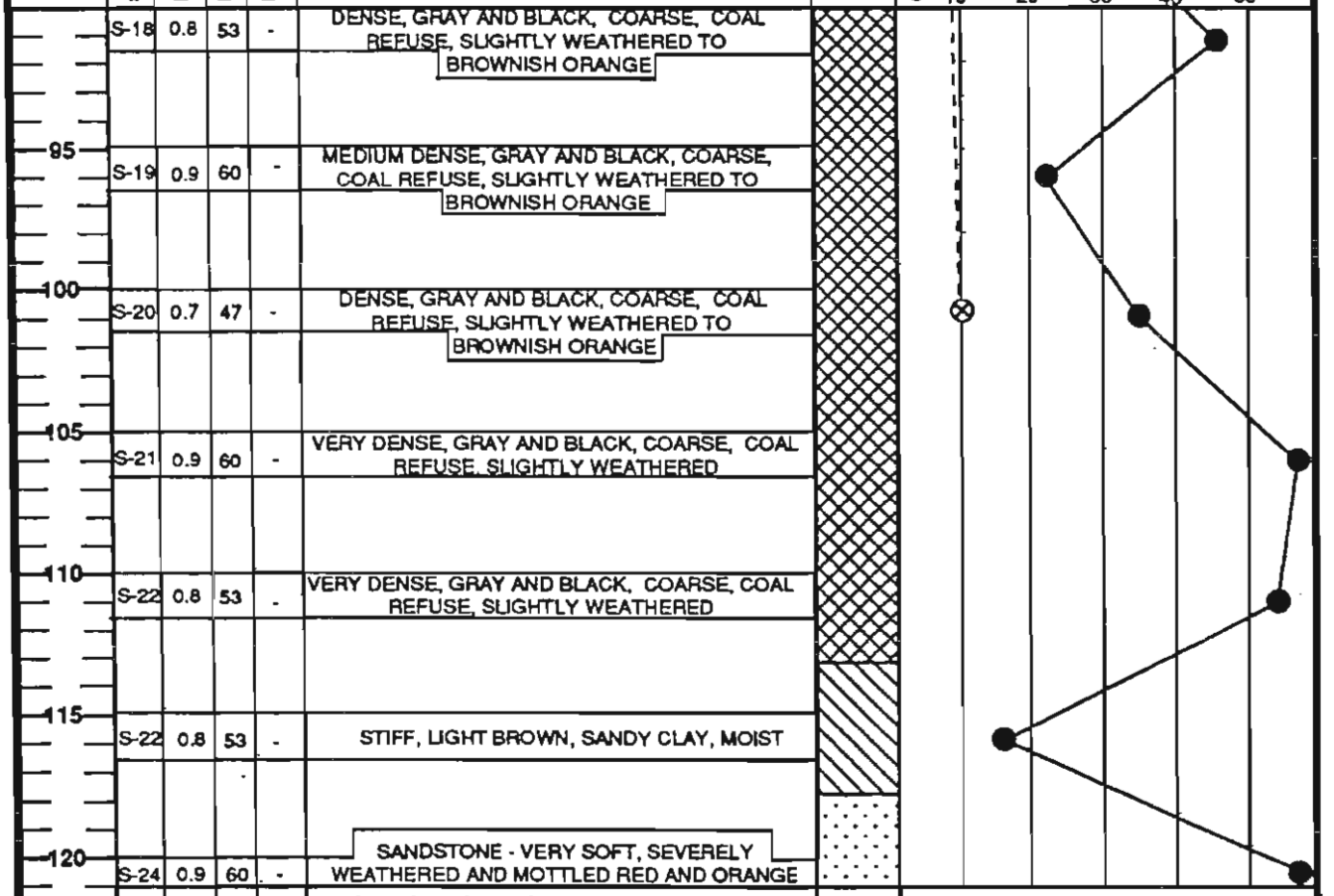
BORING NUMBER	B-14	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-6-91
				DATE COMPLETED:	2-7-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-18	0.8	53	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE
95	S-19	0.9	60	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE
100	S-20	0.7	47	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE
105	S-21	0.9	60	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED
110	S-22	0.8	53	-	VERY DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED
115	S-22	0.8	53	-	STIFF, LIGHT BROWN, SANDY CLAY, MOIST
120	S-24	0.9	60	-	SANDSTONE - VERY SOFT, SEVERELY WEATHERED AND MOTTLED RED AND ORANGE
125					BOTTOM OF BORING AT 120.9 FEET
130					SPOON REFUSAL AT 120.9 FEET



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

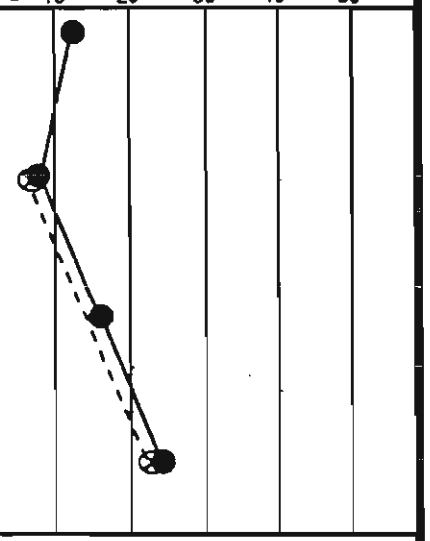
BORING NUMBER	B-15	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-21-91
				DATE COMPLETED:	1-21-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGER WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 568.0	
	S-1	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE COAL REGUSE, DRY	
5	S-2	0.5	33	-	LOOSE, BLACK AND GRAY, COARSE COAL REFUSE	
10	S-3	1.5	100	-	MEDIUM DENSE, ORANGE, CLAYEY SAND, MOIST	
15	S-4	1.5	100	-	SANDSTONE, ORANGE AND BROWN VERY SOFT, SEVERELY WEATHERED,	
20					BOTTOM OF BORING AT 18.5 FEET	
25					AUGER REFUSAL AT 18.5 FEET	
30						
35						
40						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

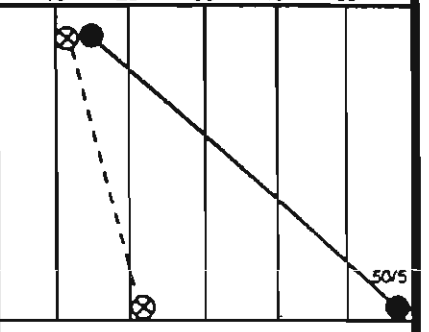
BORING NUMBER	B-16	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	1-22-91
				DATE COMPLETED:	1-22-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGER WITH SPLIT SPOON SAMPLING AND NX ROCK CORING				

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 573.6	
	S-1	1.5	100	-	VERY STIFF, ORANGE, SANDY CLAY WITH SOME REFUSE FRAGMENTS, MOIST	
5	ST-1	1.85	74	-	ORANGE, SANDY CLAY	
10	S-2	0.9	-	-	VERY SOFT, SANDSTONE - LT. GRAY, SEVERLY WEATHERED, TO ORANGE AND RED	
15	1	1.8	36	0	SANDSTONE - LIGHT GRAY, SOFT, VERY BROKEN, SEVERLY WEATHERED TO RED AND ORANGE	
20	2	7.55	100	100	SANDSTONE - GRAY,HARD, MASSIVE, FRESH, TRACE COAL STRINGERS	
25	3	1.85	100	100		
					BOTTOM OF BORING AT 26.25 FEET	
30						
35						
40						

UNCONFINED COMPRESSIVE STRENGTH TSF
O 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
● 10 20 30 40 50



AUGER REFUSAL AT 11.85 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 1
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

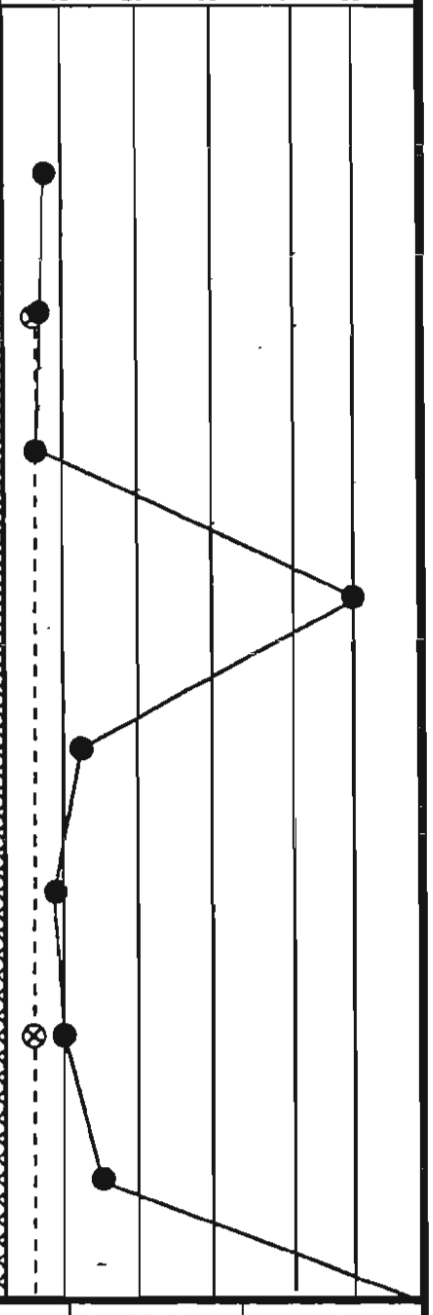
BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 634.7	
5	S-1	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
10	S-2	0.8	53	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
15	S-3	1.0	67	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
20	S-4	1.2	80	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
25	S-5	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
30	S-6	1.1	73	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
35	S-7	1.3	87	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWN, DRY TO MOIST	
40	S-8	1.1	73	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

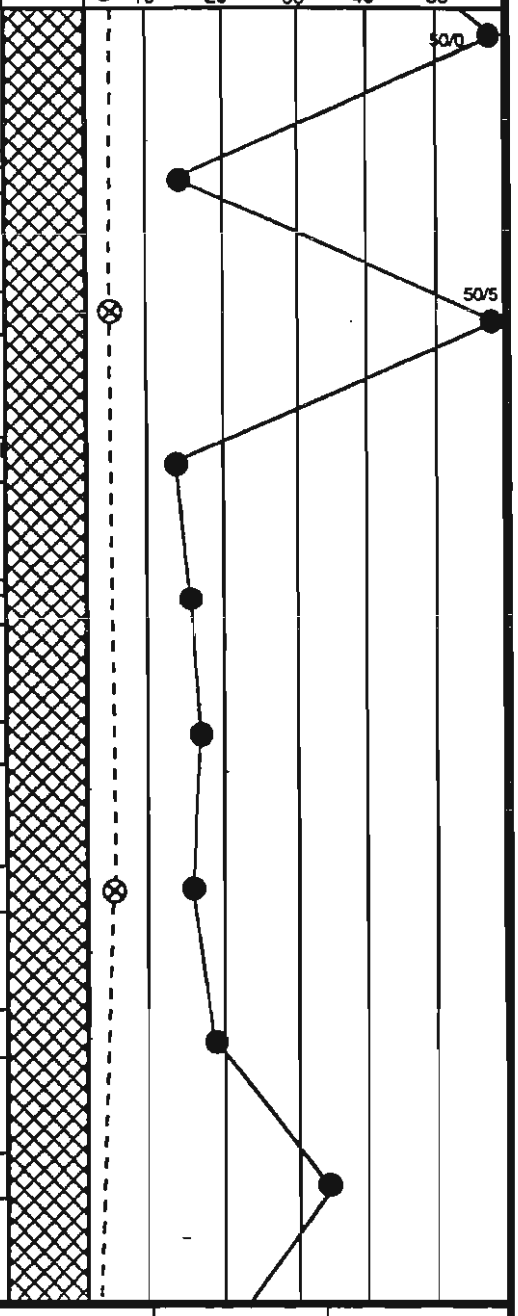
BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-12-91
				DATE COMPLETED:	2-13-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
50	S-10	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
55	S-11	0.8	53	-	VERY DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, MOIST
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.2	80	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
85	S-17	1.5	100	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-17	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-12-91	
				DATE COMPLETED: 2-13-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS AND MUD ROTARY WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-18	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
	S-19	1.3	87	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
100	S-20	1.4	93	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
105	S-21	1.2	80	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
110	S-22	1.2	80	-	DENSE, LIGHT BROWN CLAYEY SAND, MOIST	
	S-23	0.2	100	-	VERY SOFT, SEVERELY WEATHERED RED AND ORANGE SANDSTONE	
115					BOTTOM OF BORING AT 113.7 FEET	
120						
125						
130						

50/2

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

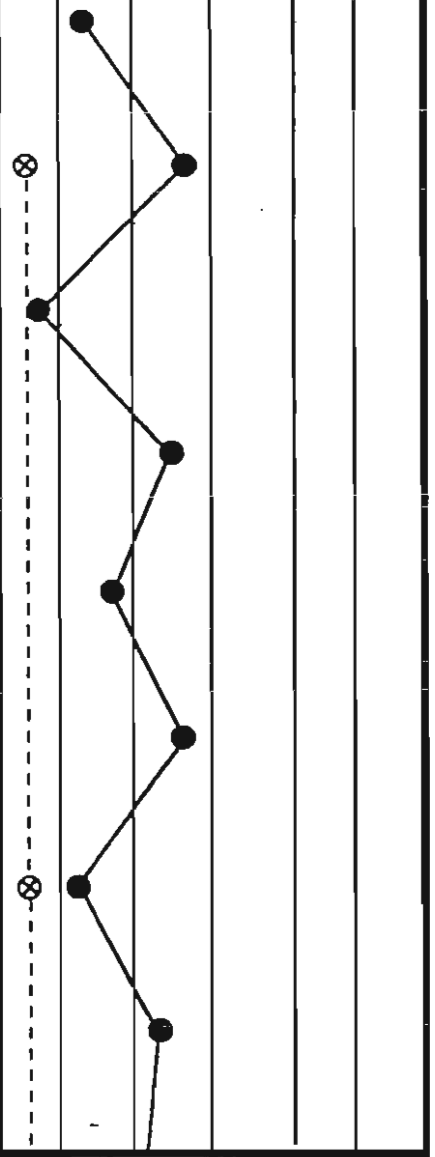
BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 658.8	
5	S-1	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY	
10	S-2	1.3	87	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
15	S-3	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
20	S-4	1.0	67	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
25	S-5	1.2	80	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
30	S-6	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
35	S-7	1.5	100	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
40	S-8	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO. 1 OF 3

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

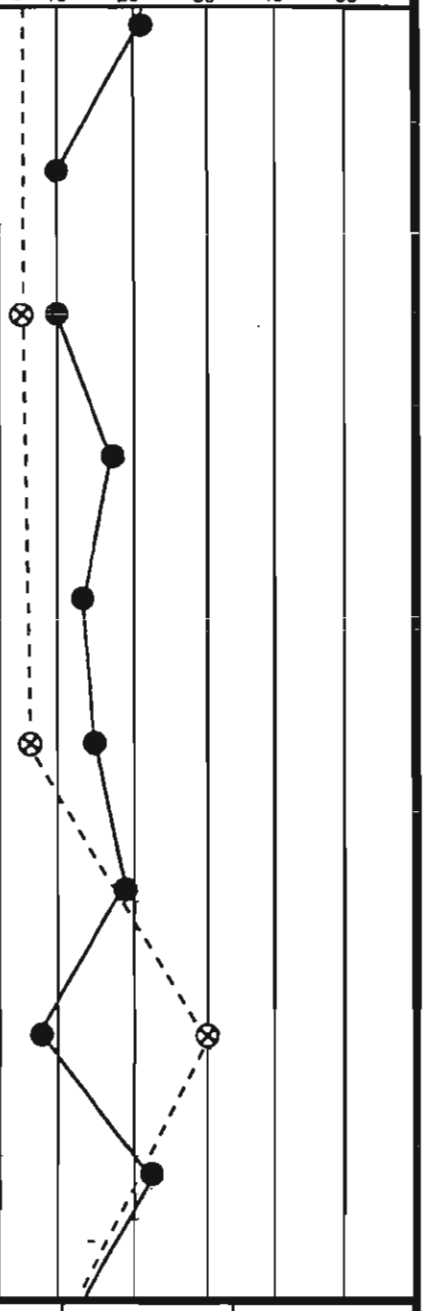
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-9	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
50	S-10	1.0	67	-	LOOSE TO MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
55	S-11	1.2	80	-	LOOSE TO MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
60	S-12	1.0	67	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY TO MOIST
65	S-13	0.8	53	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
70	S-14	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.1	73	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.0	67	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST
85	S-17	0.8	53	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, WET

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

PROJECT NO. 90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-18	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-15-91
				DATE COMPLETED:	2-15-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

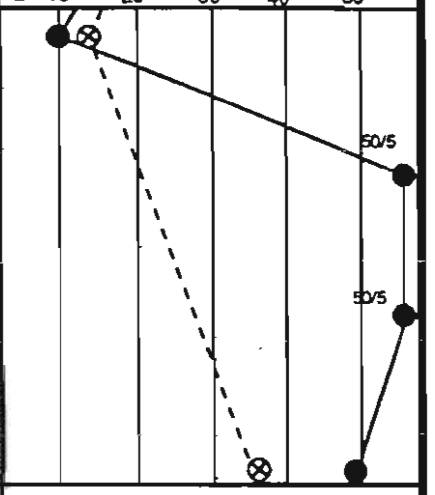
DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-18	-	-	-	LOOSE TO MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, WET
95	S-19	0.7	47	-	DENSE TO VERY DENSE, BLACK, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
100	S-20	0.4	27	-	VERY DENSE, BLACK, COARSE, COAL REFUSE, MOIST
105	S-21	1.1	73	-	DENSE, ORANGE, CLAYEY SAND, MOIST
					BOTTOM OF BORING AT 106.5 FEET
110					
115					
120					
125					
130					

PROFILE

UNCONFINED COMPRESSIVE STRENGTH TSF
1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%
10 20 30 40 50

STANDARD PENETRATION BLOWS/FT
10 20 30 40 50



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

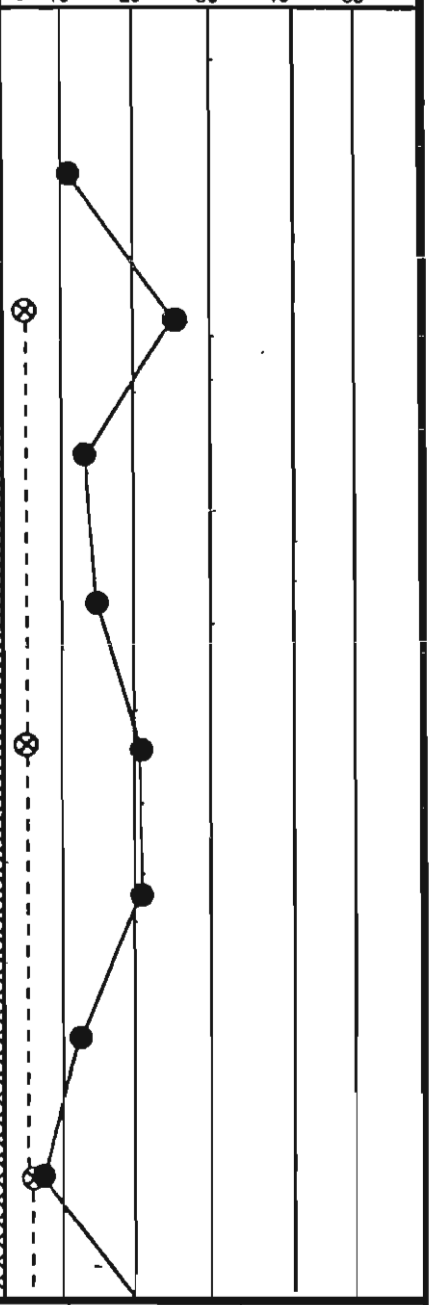
BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
					SURFACE ELEVATION: 658.1	
5	S-1	-	-	-	MEDIUM DENSE, BLACK, COARSE, COAL REFUSE, MOIST	
10	S-2	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST	
15	S-3	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST	
20	S-4	-	-	-	MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY	
25	S-5	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
30	S-6	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
35	S-7	-	-	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	
40	S-8	-	-	-	LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

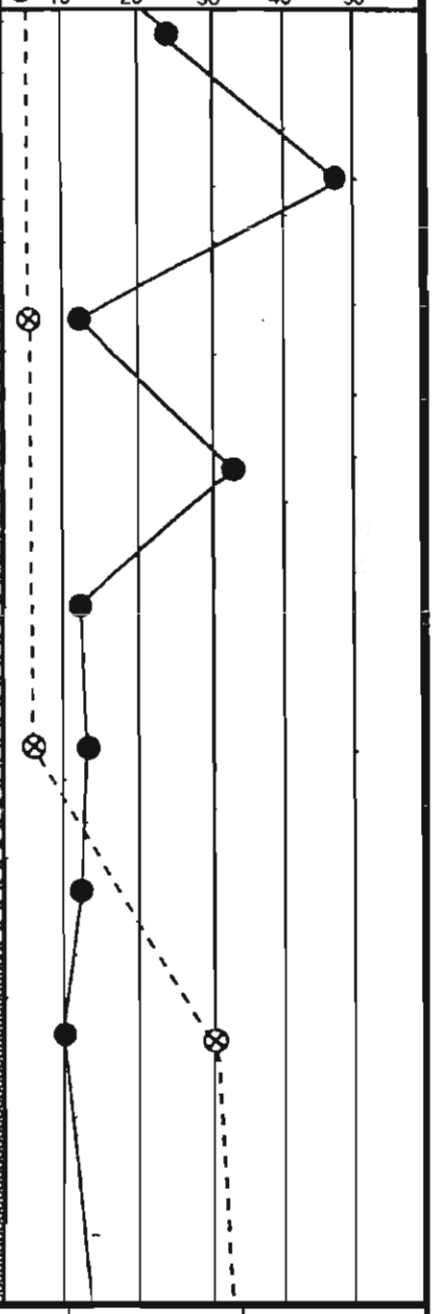
BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: O 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
50	S-9	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
	S-10	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE MOIST
55	S-11	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
60	S-12	-	-	-	DENSE, GRAY AND BLACK, COARSE, COAL REFUSE MOIST
65	S-13	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
70	S-14	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
75	S-15	1.5	100	-	MEDIUM DENSE, GRAY AND BLACK, COARSE, COAL REFUSE, MOIST
80	S-16	1.5	100	-	MEDIUM STIFF TO STIFF, BLACK, FINE, COAL REFUSE, MOIST
85	ST-1	2.5	100	-	BLACK, FINE, COAL REFUSE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

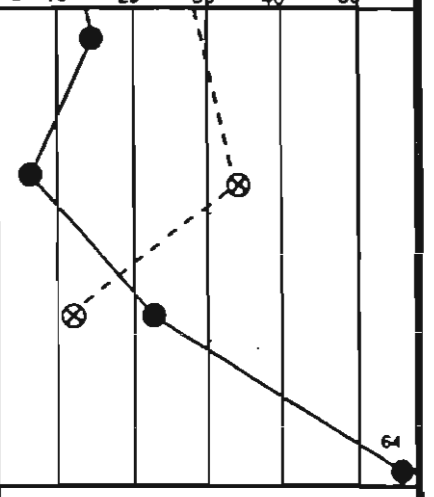
BORING NUMBER	B-19	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-13-91
				DATE COMPLETED:	2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL	PROFILE
95	S-17	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE WITH SOME COARSE, MOIST TO WET	
	S-18	1.5	100	-	STIFF, BLACK, FINE, COAL REFUSE, MOIST TO WET, LIGHT BROWN CLAY IN BOTTOM OF SPOON	
100	S-19	1.3	87	-	STIFF TO VERY STIFF, LIGHT BROWN, SANDY CLAY, MOIST	
105	S-20	1.5	100	-	SANDSTONE-LIGHT GRAY, VERY SOFT, SEVERELY WEATHERED AND MOTTLED RED AND ORANGE	
					BOTTOM OF BORING AT 106.5 FEET	
110						
115						
120						
125						
130						



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-20	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-11-91
				DATE COMPLETED:	2-12-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

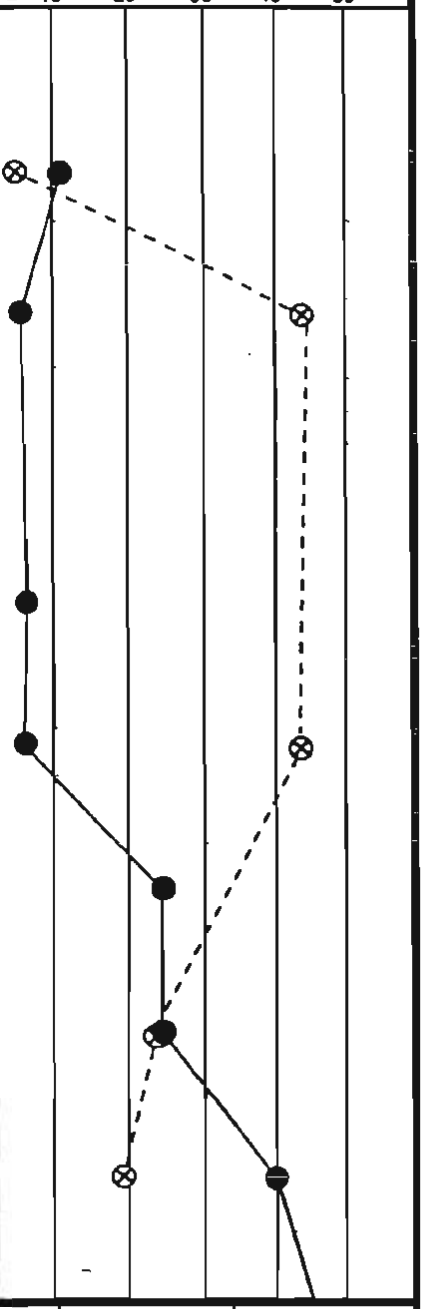
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 592.4
5	S-1	1.5	100		MEDIUM DENSE, GRAY, COARSE, COAL REFUSE, DRY
10	S-2	0.7	100		VERY LOOSE, GRAY AND BLACK, COARSE, COAL REFUSE, DRY
15	ST-1	2.5	100		BLACK, FINE, COAL REFUSE
20	S-3	1.0	67		VERY SOFT, BLACK, FINE, COAL REFUSE, WET
25	S-4	1.5	100		VERY SOFT, BLACK, FINE, COAL REFUSE, WET
	ST-2	2.5	100		BLACK, FINE, COAL REFUSE
30	S-5	1.5	100		MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
35	S-6	1.5	100		MEDIUM DENSE, BROWNISH ORANGE, CLAYEY SAND, MOIST
40	S-7	1.5	100		DENSE, BROWNISH ORANGE, CLAYEY SAND, MOIST

PROFILE



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-20	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED:	2-11-91
				DATE COMPLETED:	2-12-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER:	DOUG CLARK		
		CHECKED BY:	R. WOOD	DATE:	3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL	PROFILE
	S-8	1.1	73		SANDSTONE-LIGHT GRAY VERY SOFT, SEVERELY WEATHERED AND MOTTLED TO ORANGE AND RED	
					BOTTOM OF BORING AT 46.5 FEET	
50						
55						
60						
65						
70						
75						
80						
85						

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 2
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

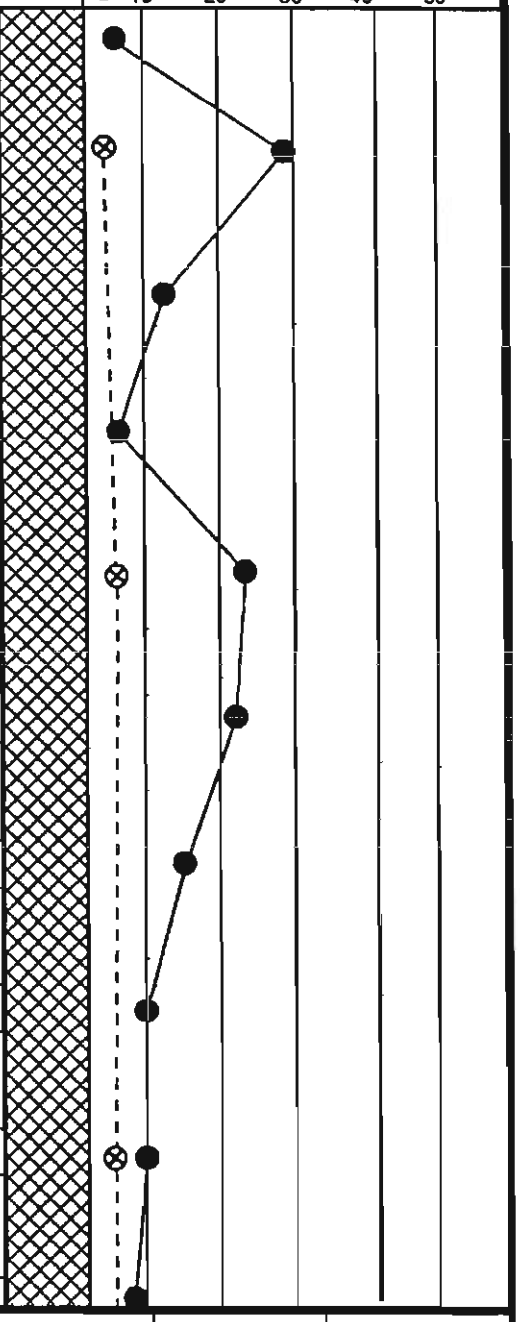
BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK			
		CHECKED BY: R. WOOD		DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% — WATER CONTENT% — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION: 655.8
	S-1	-	-	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
5	S-2	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY
10	S-3	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
15	S-4	-	-	-	LOOSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
20	S-5	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
25	S-6	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
30	S-7	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, DRY TO MOIST
35	S-8	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
40	S-9	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
	S-10	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	1 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

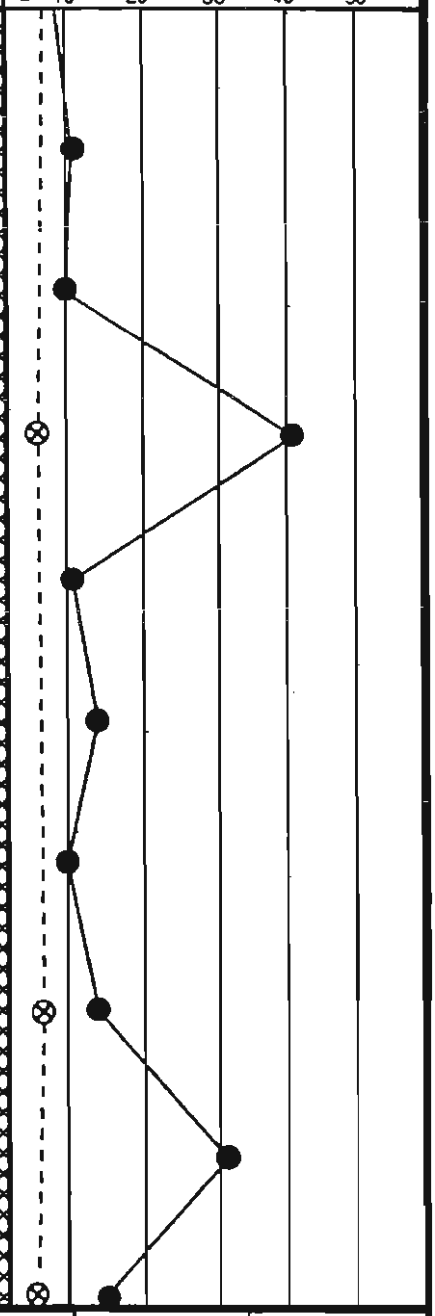
BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	
				DATE COMPLETED: 2-14-91	
BORING LOCATION	REFER TO PLAN			FIELD ENGINEER: DOUG CLARK	
				CHECKED BY: R. WOOD	DATE: 3-8-91
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 3 4 5

PLASTIC LIMIT% — WATER CONTENT% (⊗) — LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK ROD, [%]	DESCRIPTION OF MATERIAL
	S-10	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
50	S-11	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
55	S-12	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, MOIST
60	S-13	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED TO BROWNISH ORANGE, DRY TO MOIST
65	S-14	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
70	S-15	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
75	S-16	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
80	S-17	-	-	-	LOOSE TO MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
85	S-18	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
	S-19	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE COAL REFUSE, SLIGHTLY WEATHERED, MOIST



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	2 OF 3
PROJECT NO.	90-55-27

ALMES & ASSOCIATES, INC. CONSULTING ENGINEERS

BORING NUMBER	B-21	PROJECT NAME	U.S. STEEL MINING COMPANY, INC. CONCORD REFUSE DISPOSAL AREA	DATE STARTED: 2-14-91	DATE COMPLETED: 2-14-91
BORING LOCATION	REFER TO PLAN	FIELD ENGINEER: DOUG CLARK	CHECKED BY: R. WOOD	DATE: 3-8-91	
DRILLING METHOD	HOLLOW STEM AUGERS WITH SPLIT SPOON SAMPLING				

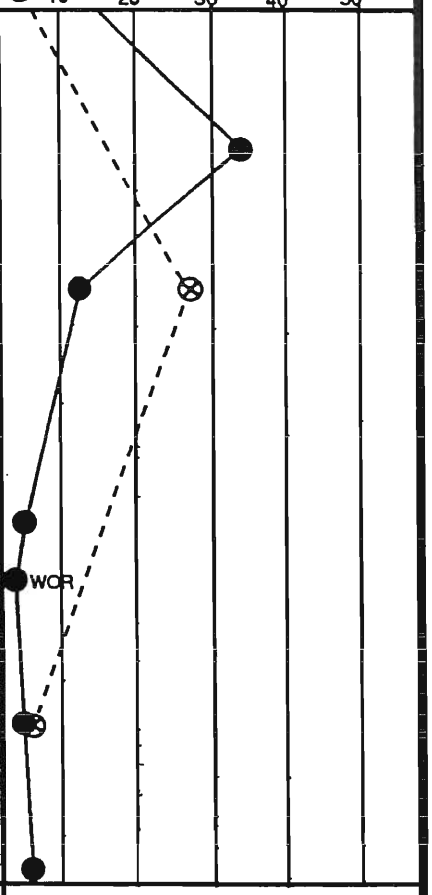
UNCONFINED COMPRESSIVE STRENGTH TSF: ○ 1 2 3 4 5

PLASTIC LIMIT% ⊗ WATER CONTENT% LIQUID LIMIT%: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT: ● 10 20 30 40 50

DEPTH, FT.	SAMPLE NO. OR RUN	RECOVERY, [FT.]	RECOVERY, [%]	ROCK RQD, [%]	DESCRIPTION OF MATERIAL
	S-19	-	-	-	MEDIUM DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, MOIST
95	S-20	-	-	-	DENSE, BLACK AND GRAY, COARSE, COAL REFUSE, SLIGHTLY WEATHERED, WET TO MOIST
100	S-21	-	-	-	VERY STIFF, BLACK, FINE, COARSE, COAL REFUSE, MOIST
	ST-1	0	0	-	
105	ST-2	0	0	-	
	S-22	-	-	-	HARD, BLACK, FINE, COAL REFUSE, MOIST
110	S-23	-	-	-	MEDIUM STIFF, FINE, COAL REFUSE, WET
115	S-24	-	-	-	LOOSE, LIGHT BROWN, CLAYEY SAND, WET
120	S-25	-	-	-	STIFF, ORANGE AND RED, SANDY CLAY, MOIST
					BOTTOM OF BORING AT 120.5 FEET
125					
130					

PROFILE



AUGER REFUSAL AT 120.5 FEET

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN REALITY, THE TRANSITION MAY BE GRADUAL.

SHEET NO.	3 OF 3
PROJECT NO.	90-55-27

SITE GEOLOGY

The disposal site is underlain by rocks of the Pottsville Formation of the Pennsylvania age. These strata consist primarily of alternating sandstones, shaley sandstones, shales, sandy shales, coal seams, and underclays. No exposed coal beds are located within the disposal area. The strike of the Pottsville formations in the area is in the southeasterly direction. The formation dips to the southwest at a very small angle. The area is in the Appalachian Plateau physiographic province, and seismic zone 2. Faults were not found to exist at the proposed disposal site. Faults in the vicinity are not active and pose no imminent hazard to the waste bank.

UNDERGROUND MINE LOCATIONS

The Refuse Disposal Area is underlain by underground workings of the abandoned Concord Mine. These workings are in excess of 600 feet below the rock dump. With this cover and the age of the workings, in excess of 50 years, significant interaction of the rock dump and mine workings is not anticipated. See Map 2 of 5 for underground workings locations.

STABILITY ANALYSIS

MSHA design guidelines recommend a safety factor of 1.5 for the static case. The rock dump was evaluated under static loading conditions. A pore pressure ratio of 0.1 was utilized in the stability analyses. Strength values of the fill and foundation material used within the stability analysis were obtained from laboratory specimens of the proposed fill and foundation material from which triaxial shear testing was performed. The stability analyses were performed using an approximate form of the limiting equilibrium approach as developed by Bishop. The location of the failure surface yielding the minimum safety factor was determined by allowing the computer to use a grid and search routine. The computer program used was the Reame Slope Stability program by Dr. Yang H. Huang, P.E. of the University of Kentucky. All outslopes of the dump will have a minimum slope of 2.5 Horizontal to 1 Vertical. (See attached maps and cross-sections for fill configurations) Results of these stability analyses show that the Concord Preparation Plant's, Refuse Disposal Area can be built safely. Tabular results of the analysis are as follows:

SECTION	STATIC SAFETY FACTOR
A-A' North	1.541
A-A' South	2.101
B-B' West	1.920
B-B' East	1.861

* All calculations performed using simplified Bishop Method of Analysis.

SECTION	STATIC SAFETY FACTOR
A-A' North	1.541
A-A' South	2.101
B-B' West	1.920
B-B' East	1.861

* All calculations performed using simplified Bishop Method of Analysis.

The modifications to the Refuse Disposal Area will consist of an expansion of Concord Preparation Plant's existing coarse refuse area to the northwest and northeast of Concord Preparation Plant's existing coarse refuse area. The expansion areas consist of natural ground and the covering of existing Northwest Slurry Impoundment, Facility Id. No. 1211-AL11-00093-02. As part of the original design plans the original Slurry Impoundment, Facility Id. No. 1211-AL11-00093-01 was included in the design. Sections A-A' and B-B' intersect both impoundments. As shown above the predicted factor of safety for the sections exceed the required 1.5 minimum. With this exceedance in the minimum factor of safety and the fact that the expansion area of the rock dump is not directly adjacent to the impoundment, there will be no adverse effects to Slurry Impoundment, Facility Id. No. 1211-AL11-00093-01 as a result of this expansion. Also, as shown above the predicted factor of safety for the sections exceed the required 1.5 minimum. With this exceedance in the minimum factor of safety and the fact that the expansion area of the rock dump will cover and provide an additional buttress to its embankment, there will be no adverse effects to Northwest Slurry Impoundment, Facility Id. No. 1211-AL11-00093-02 as a result of this expansion.

REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Oak Grove Resources, LLC Concord Preparation Plant Refuse Disposal Area Section A-A' North Static

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4
Number of points on boundary lines are: 2 6 10 14

On boundary line no. 1 Point no. and coordinates are:
1 .000 500.000 2 4570.000 500.000

On boundary line no. 2 Point no. and coordinates are:
1 .000 562.000 2 550.000 570.000 3 1200.000 570.000 4 2150.000 555.000 5 2990.000 542.000
6 4570.000 520.000

On boundary line no. 3 Point no. and coordinates are:
1 .000 562.000 2 550.000 570.000 3 390.000 618.000 4 1300.000 618.000 5 1200.000 570.000
6 2150.000 555.000 7 1980.000 625.000 8 3190.000 625.000 9 2990.000 542.000 10 4570.000 520.000

On boundary line no. 4 Point no. and coordinates are:
1 .000 562.000 2 20.000 565.000 3 135.000 620.000 4 185.000 640.000 5 215.000 640.000
6 340.000 690.000 7 370.000 690.000 8 470.000 730.000 9 2135.000 740.000 10 3800.000 730.000
11 3880.000 700.000 12 4140.000 620.000 13 4190.000 615.000 14 4570.000 520.000

Line no. and slope of each segment are:

1 .000

2 .015 .000 -.016 -.015 -.014

3 .015 -.300 .000 .480 -.016 -.412 .000 .415 -.014

4 .150 .478 .400 .000 .400 .000 .400 .006 -.006 -.375 -.308 -.100 -.250

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1

Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	120.000	33.400	62.020
3	120.000	33.400	128.000

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 2 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

Pore pressure ratio= .100

point1=(.000, 1020.000) point2=(.000, 740.000) point3=(210.000, 740.000) NJ= 4 NI= 3

Automatic search will follow after grid with XINC= 105.000 and YINC= 140.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 1020.000) under seepage 1,the radius and the corresponding factor of safety are:

458.000 2.276 450.706 1.807 443.411 1.856 436.117 1.888 428.823 2.026

455.569 1.781 453.137 1.793 448.274 1.822 445.843 1.838

Lowest factor of safety= 1.781 and occurs at radius = 455.569

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 950.000) under seepage 1,the radius and the corresponding factor of safety are:
388.000 2.294 381.709 1.730 375.418 1.716 369.128 1.737 362.837 1.955
379.612 1.727 377.515 1.720 373.321 1.716 371.225 1.722
Lowest factor of safety= 1.716 and occurs at radius = 375.418

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 880.000) under seepage 1,the radius and the corresponding factor of safety are:
318.000 2.205 312.960 1.588 307.921 1.597 302.881 1.676 297.841 1.978
316.320 1.602 314.640 1.591 311.280 1.587 309.600 1.590
Lowest factor of safety= 1.587 and occurs at radius = 311.280

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
248.000 2.254 244.330 1.549 240.661 1.594 236.991 1.708 233.322 2.120
246.777 1.549 245.554 1.541 243.107 1.560 241.884 1.575
Lowest factor of safety= 1.541 and occurs at radius = 245.554

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
178.000 2.736 175.701 1.642 173.401 1.743 171.102 1.962 168.802 2.651
177.234 1.646 176.467 1.638 174.934 1.669 174.168 1.702
Lowest factor of safety= 1.638 and occurs at radius = 176.467

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 1020.000) under seepage 1,the radius and the corresponding factor of safety are:

463.318 4.508 450.059 1.920 436.799 1.912 423.539 2.021 410.280 2.604

445.639 1.911 441.219 1.908 432.379 1.927 427.959 1.959

Lowest factor of safety= 1.908 and occurs at radius = 441.219

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 950.000) under seepage 1,the radius and the corresponding factor of safety are:

394.264 4.801 381.540 1.882 368.816 1.920 356.092 2.051 343.367 2.421

390.023 3.965 385.781 1.883 377.298 1.886 373.057 1.899

Lowest factor of safety= 1.882 and occurs at radius = 381.540

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 880.000) under seepage 1,the radius and the corresponding factor of safety are:

325.613 5.277 313.599 1.900 301.586 1.927 289.572 2.003 277.558 2.077

321.609 4.627 317.604 3.095 309.595 1.906 305.590 1.914

Lowest factor of safety= 1.900 and occurs at radius = 313.599

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:

257.690 6.016 246.262 1.906 234.834 1.884 223.406 1.834 211.979 1.820

208.169 1.915 204.360 2.382

Lowest factor of safety= 1.820 and occurs at radius = 211.979

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:

191.269 6.840 180.276 5.055 169.282 1.758 158.288 1.670 147.294 1.715

165.617 1.722 161.953 1.693 154.624 1.659 150.959 1.671

Lowest factor of safety= 1.659 and occurs at radius = 154.624

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 1020.000) under seepage 1,the radius and the corresponding factor of safety are:

478.920 5.116 459.271 3.573 439.622 2.073 419.973 2.115 400.324 2.140

452.721 2.082 446.172 2.074 433.072 2.081 426.523 2.093

Lowest factor of safety= 2.073 and occurs at radius = 439.622

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 950.000) under seepage 1,the radius and the corresponding factor of safety are:

412.485 5.385 392.638 4.403 372.791 2.117 352.944 2.114 333.096 2.134

366.175 2.115 359.559 2.111 346.328 2.098 339.712 2.096

Lowest factor of safety= 2.096 and occurs at radius = 339.712

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 880.000) under seepage 1,the radius and the corresponding factor of safety are:

347.454 5.850 326.799 5.295 306.145 2.144 285.491 2.089 264.837 2.311

299.260 2.116 292.376 2.097 278.606 2.105 271.721 2.173
Lowest factor of safety= 2.089 and occurs at radius = 285.491

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
284.788 6.478 263.001 5.686 241.215 2.186 219.428 2.197 197.642 2.507
255.739 5.095 248.477 3.863 233.952 2.170 226.690 2.176
Lowest factor of safety= 2.170 and occurs at radius = 233.952

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
226.460 7.361 203.080 6.775 179.700 4.714 156.320 2.397 132.940 2.529
171.907 2.411 164.113 2.399 148.527 2.411 140.733 2.454
Lowest factor of safety= 2.397 and occurs at radius = 156.320

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (210.000, 1020.000) under seepage 1,the radius and the corresponding factor of safety are:
503.849 6.136 474.016 5.119 444.183 2.338 414.349 2.195 384.516 2.124
374.572 2.192 364.627 2.377
Lowest factor of safety= 2.124 and occurs at radius = 384.516

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (210.000, 950.000) under seepage 1,the radius and the corresponding factor of safety are:
441.185 6.266 410.885 5.426 380.585 2.335 350.285

2.225 319.985 2.198
309.885 2.082 299.785 2.103
Lowest factor of safety= 2.082 and occurs at radius = 309.885

At point (210.000, 880.000) under seepage 1,the radius and the corresponding factor of safety are:
380.000 6.512 348.938 5.820 317.877 3.684 286.815 2.340 255.753 2.244
245.399 2.081 235.045 1.924
Lowest factor of safety= 1.924 and occurs at radius = 235.045

At point (210.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
310.000 6.885 279.940 6.323 249.879 4.981 219.819 2.499 189.758 2.235
179.738 2.127 169.718 1.935
Lowest factor of safety= 1.935 and occurs at radius = 169.718

At point (210.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 7.973 210.941 7.655 181.882 5.557 152.823 2.749 123.764 2.577
114.077 2.555 104.391 2.526
Lowest factor of safety= 2.526 and occurs at radius = 104.391

For pore pressure ratio .100

At point (.000, 810.000) ,RADIUS 245.554
the minimum factor of safety is 1.541

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
248.000 2.254 244.330 1.549 240.661 1.594 236.991 1.708 233.322 2.120
246.777 1.549 245.554 1.541 243.107 1.560 241.884 1.575

Lowest factor of safety= 1.541 and occurs at radius = 245.554

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (105.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
269.312 6.146 252.960 4.964 236.608 2.058 220.256 2.102 203.904 2.235
247.509 3.367 242.059 2.057 231.158 2.063 225.707 2.076
Lowest factor of safety= 2.057 and occurs at radius = 242.059

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

****WARNING AT NEXT CENTER**** When radius is 269.312
center of circle lies below ground line or circle does not intercept ground line properly, or the circle cuts the slope
very slightly, so a large factor of safety is assigned.

At point (-105.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
269.312**********
Lowest factor of safety=********** and occurs at radius = 269.312

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 950.000) under seepage 1,the radius and the corresponding factor of safety are:
388.000 2.294 381.709 1.730 375.418 1.716 369.128 1.737 362.837 1.955
379.612 1.727 377.515 1.720 373.321 1.716 371.225 1.722
Lowest factor of safety= 1.716 and occurs at radius = 375.418

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 670.000) under seepage 1,the radius and the corresponding factor of safety are:

108.000 5.282 107.071 2.348 106.141 2.428 105.212 2.999 104.283 4.734
107.690 2.290 107.380 2.321 106.761 2.224 106.451 2.315
Lowest factor of safety= 2.224 and occurs at radius = 106.761

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (26.250, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
249.385 4.668 243.174 1.596 236.962 1.581 230.750 1.624 224.538 1.838
241.103 1.588 239.032 1.583 234.891 1.586 232.821 1.600
Lowest factor of safety= 1.581 and occurs at radius = 236.962

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (-26.250, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
249.385 1.718 247.704 1.735 246.022 1.887 244.341 2.201 242.659 3.157
Lowest factor of safety= 1.718 and occurs at radius = 249.385

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 845.000) under seepage 1,the radius and the corresponding factor of safety are:
283.000 2.185 278.645 1.550 274.291 1.586 269.936 1.680 265.581 2.002
281.548 1.554 280.097 1.547 277.194 1.558 275.742 1.570
Lowest factor of safety= 1.547 and occurs at radius = 280.097

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 775.000) under seepage 1,the radius and the corresponding factor of safety are:

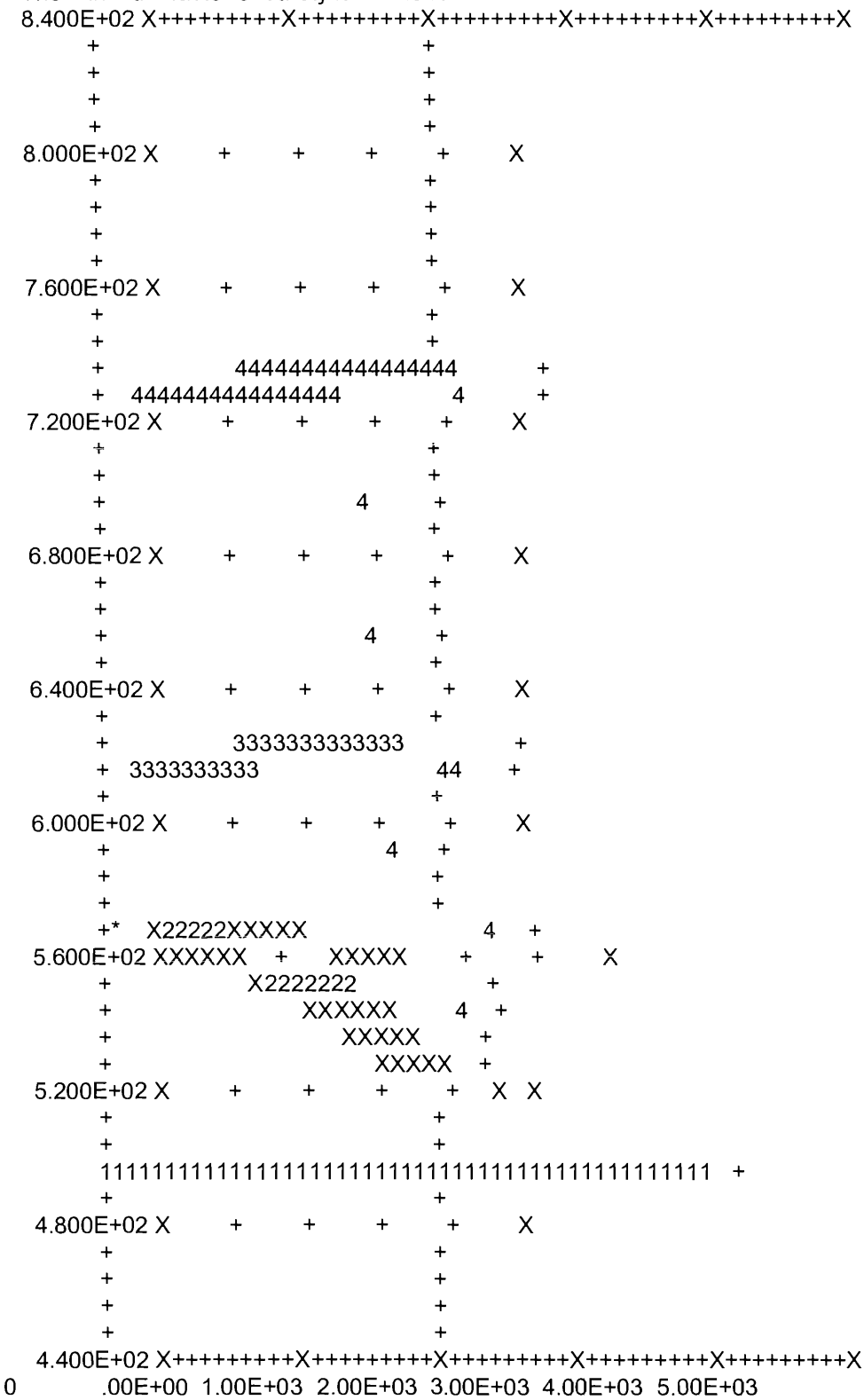
213.000 2.412 210.015 1.569 207.031 1.638 204.046 1.801 201.062 2.326
212.005 1.570 211.010 1.557 209.021 1.586 208.026 1.609
Lowest factor of safety= 1.557 and occurs at radius = 211.010

For pore pressure ratio .100

At point (.000, 810.000) ,RADIUS 245.554
the minimum factor of safety is 1.541

1

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 1.541



REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Oak Grove Resources, LLC Concord Preparation Plant Refuse Disposal Area Section A-A' South Static

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4
Number of points on boundary lines are: 2 2 4 6

On boundary line no. 1 Point no. and coordinates are:
1 2990.000 500.000 2 4570.000 500.000

On boundary line no. 2 Point no. and coordinates are:
1 2990.000 542.000 2 4570.000 520.000

On boundary line no. 3 Point no. and coordinates are:
1 2990.000 625.000 2 3190.000 625.000 3 2990.000 542.000 4 4570.000 520.000

On boundary line no. 4 Point no. and coordinates are:
1 2990.000 734.865 2 3800.000 730.000 3 3880.000 700.000 4 4140.000 620.000 5 4190.000 615.000
6 4570.000 520.000

Line no. and slope of each segment are:
1 .000
2 -.014
3 .000 .415 -.014
4 -.006 -.375 -.308 -.100 -.250

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	120.000	33.400	62.020
3	120.000	33.400	128.000

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 2 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

Pore pressure ratio= .100

point1=(4270.000, 740.000) point2=(4570.000, 740.000) point3=(4570.000, 1140.000) NJ= 3 NI= 4
Automatic search will follow after grid with XINC= 150.000 and YINC= 200.000

At point (4270.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 8.764 220.134 6.074 200.268 3.554 180.402 3.382 160.536 3.085
153.915 3.054 147.293 3.354
Lowest factor of safety= 3.054 and occurs at radius = 153.915

At point (4370.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 8.802 224.985 7.255 209.970 3.006 194.955 2.917 179.939 2.945
204.965 2.973 199.960 2.942 189.949 2.902 184.944 2.905
Lowest factor of safety= 2.902 and occurs at radius = 189.949

At point (4470.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:

240.000 11.716 229.836 10.999 219.671 6.556 209.507 2.872 199.342 3.055
216.283 2.866 212.895 2.864 206.119 2.895 202.730 2.947
Lowest factor of safety= 2.864 and occurs at radius = 212.895

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4570.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
220.000 7.736 218.686 3.526 217.373 3.879 216.059 4.600 214.745 6.785
219.562 3.377 219.124 3.445 218.248 3.621 217.810 3.737
Lowest factor of safety= 3.377 and occurs at radius = 219.562

At point (4270.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 7.515 319.537 5.231 299.074 3.153 278.611 3.175 258.148 3.310
312.716 3.175 305.895 3.160 292.253 3.152 285.432 3.159
Lowest factor of safety= 3.152 and occurs at radius = 292.253

At point (4370.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 8.465 324.388 6.899 308.775 2.899 293.163 2.800 277.551 2.861
303.571 2.857 298.367 2.826 287.959 2.788 282.755 2.807
Lowest factor of safety= 2.788 and occurs at radius = 287.959

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4470.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
335.261 10.390 325.447 9.022 315.633 2.768 305.820 2.801 296.006 3.029
322.176 7.937 318.905 4.542 312.362 2.771 309.091 2.781

Lowest factor of safety= 2.768 and occurs at radius = 315.633

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4570.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:

320.000 5.979 318.089 3.176 316.178 3.415 314.267 3.906 312.356 5.403

319.363 3.076 318.726 3.122 317.452 3.240 316.815 3.319

Lowest factor of safety= 3.076 and occurs at radius = 319.363

At point (4270.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:

440.000 6.736 418.940 4.621 397.881 2.902 376.821 2.948 355.761 3.272

411.920 2.913 404.900 2.905 390.861 2.906 383.841 2.920

Lowest factor of safety= 2.902 and occurs at radius = 397.881

At point (4370.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:

440.000 7.939 423.791 6.461 407.581 2.919 391.372 2.843 375.162 2.826

369.759 2.964 364.356 3.468

Lowest factor of safety= 2.826 and occurs at radius = 375.162

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4470.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:

431.741 9.328 422.034 7.013 412.327 2.716 402.620 2.766 392.913 3.014

418.798 3.896 415.563 2.712 409.091 2.724 405.856 2.740

Lowest factor of safety= 2.712 and occurs at radius = 415.563

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4570.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
420.000 5.189 417.492 2.993 414.984 3.172 412.476 3.543 409.968 4.682
419.164 2.919 418.328 2.952 416.656 3.041 415.820 3.100
Lowest factor of safety= 2.919 and occurs at radius = 419.164

At point (4270.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
540.000 5.911 518.493 4.196 496.986 2.733 475.478 2.766 453.971 3.043
511.324 2.744 504.155 2.737 489.816 2.735 482.647 2.744
Lowest factor of safety= 2.733 and occurs at radius = 496.986

At point (4370.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
540.000 7.405 523.193 5.935 506.387 2.856 489.580 2.899 472.774 2.905
517.591 3.747 511.989 2.851 500.785 2.865 495.182 2.881
Lowest factor of safety= 2.851 and occurs at radius = 511.989

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4470.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
529.528 8.634 519.667 5.139 509.805 2.684 499.944 2.741 490.082 2.993
516.379 2.687 513.092 2.683 506.518 2.694 503.231 2.712
Lowest factor of safety= 2.683 and occurs at radius = 513.092

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4570.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
520.000 4.661 516.895 2.880 513.790 3.023 510.685

3.320 507.579 4.237
518.965 2.822 517.930 2.848 515.860 2.918 514.825 2.965
Lowest factor of safety= 2.822 and occurs at radius = 518.965

At point (4270.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.549 618.212 3.856 596.424 2.615 574.636 2.625 552.848 2.808
610.949 2.614 603.687 2.615 589.161 2.610 581.899 2.612
Lowest factor of safety= 2.610 and occurs at radius = 589.161

At point (4370.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 6.920 622.596 5.427 605.193 2.762 587.789 2.852 570.385 3.052
616.795 2.744 610.994 2.751 599.391 2.782 593.590 2.812
Lowest factor of safety= 2.744 and occurs at radius = 616.795

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4470.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
628.013 8.136 617.857 2.739 607.702 2.700 597.546 2.722 587.390 2.968
614.472 2.721 611.087 2.707 604.316 2.698 600.931 2.704
Lowest factor of safety= 2.698 and occurs at radius = 604.316

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4570.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
620.000 4.293 616.298 2.804 612.595 2.921 608.893 3.169 605.191 3.936
618.766 2.756 617.532 2.778 615.064 2.835 613.829 2.873
Lowest factor of safety= 2.756 and occurs at radius = 618.766

For pore pressure ratio .100

At point (4270.000, 1140.000) ,RADIUS 589.161
the minimum factor of safety is 2.610

At point (4270.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.549 618.212 3.856 596.424 2.615 574.636 2.625 552.848 2.808
610.949 2.614 603.687 2.615 589.161 2.610 581.899 2.612
Lowest factor of safety= 2.610 and occurs at radius = 589.161

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (4420.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
637.887 7.786 623.331 6.092 608.775 2.803 594.220 2.825 579.664 2.849
618.479 3.997 613.627 2.791 603.924 2.814 599.072 2.819
Lowest factor of safety= 2.791 and occurs at radius = 613.627

At point (4120.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.539 610.225 2.764 580.449 2.552 550.674 2.323 520.899 2.119
510.974 2.196 501.048 2.429
Lowest factor of safety= 2.119 and occurs at radius = 520.899

At point (3970.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 6.660 600.717 3.502 561.434 3.160 522.151 2.861 482.869 2.526
469.774 2.408 456.680 2.336
Lowest factor of safety= 2.336 and occurs at radius = 456.680

At point (4120.000, 1340.000) under seepage 1,the radius and the corresponding factor of safety are:
840.000 5.799 808.456 2.915 776.912 2.696 745.367 2.442 713.823 2.169
703.309 2.133 692.794 2.229
Lowest factor of safety= 2.133 and occurs at radius = 703.309

At point (4120.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
440.000 5.516 411.994 2.791 383.987 2.635 355.981 2.507 327.974 2.299
318.639 2.278 309.303 2.482
Lowest factor of safety= 2.278 and occurs at radius = 318.639

At point (4157.500, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.460 612.430 2.669 584.861 2.493 557.291 2.341 529.721 2.269
520.531 2.238 511.341 2.464
Lowest factor of safety= 2.238 and occurs at radius = 520.531

At point (4082.500, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.692 608.019 2.901 576.038 2.644 544.057 2.358 512.076 2.113
501.416 2.118 490.755 2.350
Lowest factor of safety= 2.113 and occurs at radius = 512.076

At point (4045.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.887 605.813 3.062 571.627 2.779 537.440 2.445 503.254 2.189
491.858 2.125 480.462 2.190
Lowest factor of safety= 2.125 and occurs at radius = 491.858

At point (4082.500, 1190.000) under seepage 1,the radius and the corresponding factor of safety are:
690.000 5.764 657.577 2.940 625.154 2.688 592.731 2.397 560.307 2.137
549.500 2.110 538.692 2.277

Lowest factor of safety= 2.110 and occurs at radius = 549.500

At point (4082.500, 1240.000) under seepage 1,the radius and the corresponding factor of safety are:
740.000 5.840 707.135 2.981 674.269 2.735 641.404 2.442 608.538 2.178
597.583 2.128 586.628 2.208
Lowest factor of safety= 2.128 and occurs at radius = 597.583

At point (4120.000, 1190.000) under seepage 1,the radius and the corresponding factor of safety are:
690.000 5.598 659.782 2.796 629.565 2.579 599.347 2.343 569.130 2.101
559.057 2.152 548.985 2.415
Lowest factor of safety= 2.101 and occurs at radius = 569.130

At point (4157.500, 1190.000) under seepage 1,the radius and the corresponding factor of safety are:
690.000 5.479 661.988 2.686 633.976 2.507 605.964 2.326 577.952 2.209
568.615 2.219 559.278 2.453
Lowest factor of safety= 2.209 and occurs at radius = 577.952

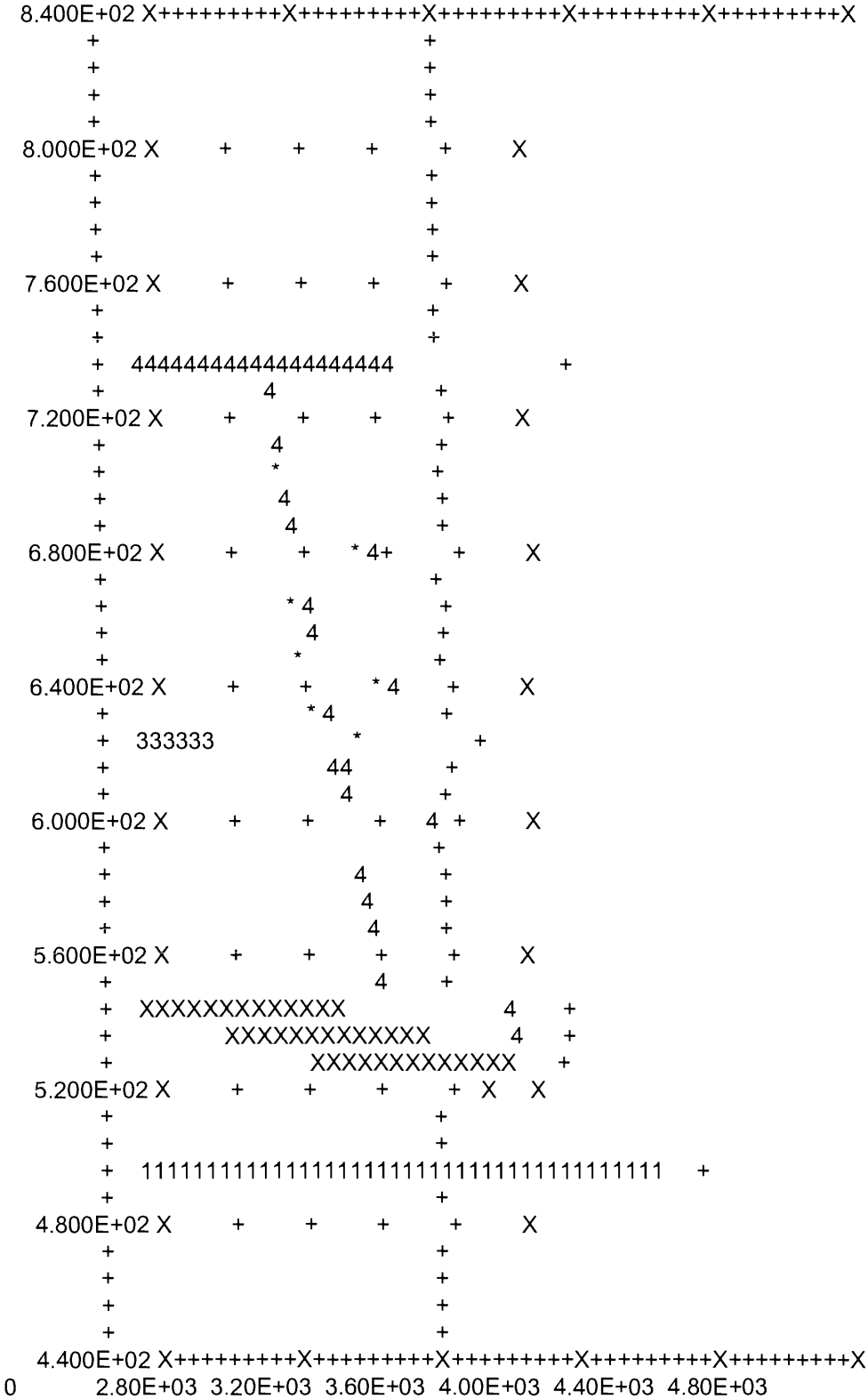
At point (4120.000, 1240.000) under seepage 1,the radius and the corresponding factor of safety are:
740.000 5.662 709.340 2.834 678.681 2.612 648.021 2.371 617.361 2.107
607.141 2.116 596.921 2.363
Lowest factor of safety= 2.107 and occurs at radius = 617.361

At point (4120.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.539 610.225 2.764 580.449 2.552 550.674 2.323 520.899 2.119
510.974 2.196 501.048 2.429
Lowest factor of safety= 2.119 and occurs at radius = 520.899

For pore pressure ratio .100

At point (4120.000, 1190.000) ,RADIUS 569.130
the minimum factor of safety is 2.101

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 2.101



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2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Oak Grove Resources, LLC Concord Preparation Plant Refuse Disposal Area Section B-B' West Static

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4
Number of points on boundary lines are: 2 6 8 20

On boundary line no. 1 Point no. and coordinates are:
1 .000 500.000 2 3270.000 500.000

On boundary line no. 2 Point no. and coordinates are:
1 .000 590.000 2 970.000 573.000 3 1600.000 560.000 4 3160.000 534.000 5 3200.000 535.000
6 3270.000 540.000

On boundary line no. 3 Point no. and coordinates are:
1 .000 590.000 2 970.000 573.000 3 800.000 625.000 4 1720.000 625.000 5 1600.000 560.000
6 3160.000 550.000 7 3200.000 535.000 8 3270.000 540.000

On boundary line no. 4 Point no. and coordinates are:
1 .000 590.000 2 30.000 600.000 3 150.000 620.000 4 200.000 625.000 5 310.000 670.000
6 360.000 670.000 7 390.000 680.000 8 440.000 700.000 9 515.000 730.000 10 1568.000 740.000
11 2620.000 730.000 12 2757.500 675.000 13 2787.500 675.000 14 2912.500 625.000 15 2942.500 625.000

16 3076.500 575.000 17 3097.500 575.000 18 3160.000 550.000 19 3200.000 535.000 20 3270.000 540.000

Line no. and slope of each segment are:

1 .000

2 -.018 -.021 -.017 .025 .071

3 -.018 -.306 .000 .542 -.006 -.375 .071

4 .333 .167 .100 .409 .000 .333 .400 .400 .009 -.010 -.400 .000

-.400 .000 -.373 .000 -.400 -.375 .071

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1

Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	120.000	33.400	62.020
3	120.000	33.400	128.000

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 2 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

Pore pressure ratio= .100

point1=(.000, 740.000) point2=(.000, 1090.000) point3=(280.000, 740.000) NJ= 5 NI= 4

Automatic search will follow after grid with XINC= 140.000 and YINC= 175.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:

150.000 3.569 148.636 3.825 147.271 4.267 145.907 5.183 144.543 8.050

Lowest factor of safety= 3.569 and occurs at radius = 150.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 810.000) under seepage 1,the radius and the corresponding factor of safety are:
220.000 3.752 218.415 4.011 216.830 4.441 215.245 5.296 213.660 7.812
Lowest factor of safety= 3.752 and occurs at radius = 220.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 880.000) under seepage 1,the radius and the corresponding factor of safety are:
290.000 3.853 288.224 4.107 286.449 4.523 284.673 5.329 282.898 7.683
Lowest factor of safety= 3.853 and occurs at radius = 290.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 950.000) under seepage 1,the radius and the corresponding factor of safety are:
360.000 3.910 358.034 4.155 356.068 4.551 354.102 5.320 352.136 7.571
Lowest factor of safety= 3.910 and occurs at radius = 360.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 1020.000) under seepage 1,the radius and the corresponding factor of safety are:
430.000 3.948 427.843 4.172 425.687 4.552 423.530 5.279 421.374 7.435
Lowest factor of safety= 3.948 and occurs at radius = 430.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (.000, 1090.000) under seepage 1,the radius and the corresponding factor of safety are:

500.000 4.027 497.653 4.215 495.306 4.542 492.959 5.220 490.612 7.204
Lowest factor of safety= 4.027 and occurs at radius = 500.000

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 652.500) under seepage 1,the radius and the corresponding factor of safety are:
93.842 27.025 84.115 32.504 74.389 30.013 64.662 18.109 54.936 5.145
51.694 5.403 48.452 6.527
Lowest factor of safety= 5.145 and occurs at radius = 54.936

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 722.500) under seepage 1,the radius and the corresponding factor of safety are:
149.854 23.036 142.735 22.967 135.615 18.611 128.496 4.552 121.377 4.982
133.242 4.470 130.869 4.501 126.123 4.616 123.750 4.740
Lowest factor of safety= 4.470 and occurs at radius = 133.242

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 792.500) under seepage 1,the radius and the corresponding factor of safety are:
214.257 21.955 208.067 20.142 201.876 4.406 195.686 4.533 189.495 5.059
206.003 16.691 203.940 9.047 199.813 4.443 197.749 4.488
Lowest factor of safety= 4.406 and occurs at radius = 201.876

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 862.500) under seepage 1,the radius and the corresponding factor of safety are:
281.347 18.430 275.548 15.626 269.749 4.519 263.950

4.666 258.151 5.169
273.615 4.395 271.682 4.484 267.816 4.565 265.883 4.618
Lowest factor of safety= 4.395 and occurs at radius = 273.615

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 932.500) under seepage 1,the radius and the corresponding factor of safety are:
349.580 13.976 343.944 7.223 338.308 4.272 332.672 4.837 327.036 5.392
342.065 3.861 340.187 4.048 336.429 4.544 334.551 4.796
Lowest factor of safety= 3.861 and occurs at radius = 342.065

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 1002.500) under seepage 1,the radius and the corresponding factor of safety are:
418.397 10.750 412.807 3.110 407.217 3.456 401.627 4.342 396.038 5.660
416.534 10.170 414.671 7.592 410.944 3.191 409.081 3.305
Lowest factor of safety= 3.110 and occurs at radius = 412.807

****WARNING AT NEXT CENTER**** When radius is 65.000
the center of circle is located below the intersection of circle with ground line, so a large factor of safety is assigned

At point (140.000, 565.000) under seepage 1,the radius and the corresponding factor of safety are:
65.000**********
Lowest factor of safety********** and occurs at radius = 65.000

At point (140.000, 635.000) under seepage 1,the radius and the corresponding factor of safety are:
135.000 32.022 111.288 43.216 87.576 77.222 63.864 56.794 40.152 7.799
32.248 7.208 24.344 6.658
Lowest factor of safety= 6.658 and occurs at radius = 24.344

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 705.000) under seepage 1,the radius and the corresponding factor of safety are:
181.177 15.090 162.059 18.641 142.941 16.999 123.822 17.970 104.704 5.564
155.686 20.343 149.313 16.059 136.568 18.805 130.195 16.377 98.332 5.920
91.959 6.596
Lowest factor of safety= 5.564 and occurs at radius = 104.704

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 775.000) under seepage 1,the radius and the corresponding factor of safety are:
232.002 12.055 216.647 13.292 201.292 12.302 185.936 3.380 170.581 3.986
196.173 10.632 191.055 8.891 180.818 3.465 175.699 3.632
Lowest factor of safety= 3.380 and occurs at radius = 185.936

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 845.000) under seepage 1,the radius and the corresponding factor of safety are:
290.904 11.059 277.699 10.697 264.494 8.482 251.289 2.798 238.083 2.935
260.092 7.050 255.690 2.833 246.887 2.786 242.485 2.825
Lowest factor of safety= 2.786 and occurs at radius = 246.887

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (140.000, 915.000) under seepage 1,the radius and the corresponding factor of safety are:
353.871 10.139 341.322 9.412 328.773 5.489 316.225 2.609 303.676 2.449

299.493 2.491 295.310 2.336
Lowest factor of safety= 2.336 and occurs at radius = 295.310

At point (210.000, 477.500) under seepage 1the circle does not intercept the slope

At point (210.000, 547.500) under seepage 1the circle does not intercept the slope

****WARNING AT NEXT CENTER**** When radius is 74.791
the center of circle is located below the intersection of circle with ground line, so a large factor of safety is assigned

At point (210.000, 617.500) under seepage 1,the radius and the corresponding factor of safety are:
117.500 27.329 96.146 31.447 74.791**********
Lowest factor of safety= 27.329 and occurs at radius = 117.500

At point (210.000, 687.500) under seepage 1,the radius and the corresponding factor of safety are:
187.500 19.663 160.812 14.504 134.124 13.522 107.436 9.576 80.748 2.570
71.852 2.275 62.956 2.096
Lowest factor of safety= 2.096 and occurs at radius = 62.956

At point (210.000, 757.500) under seepage 1,the radius and the corresponding factor of safety are:
257.500 12.541 229.770 13.150 202.039 11.082 174.309 6.461 146.579 2.163
137.335 1.920 128.092 1.948
Lowest factor of safety= 1.920 and occurs at radius = 137.335

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (210.000, 827.500) under seepage 1,the radius and the corresponding factor of safety are:
317.027 9.599 290.349 9.896 263.671 8.870 236.993 2.816 210.315 2.184
201.422 1.993 192.530 2.001
Lowest factor of safety= 1.993 and occurs at radius = 201.422

At point (280.000, 390.000) under seepage 1the circle does not intercept the slope

At point (280.000, 460.000) under seepage 1the circle does not intercept the slope

At point (280.000, 530.000) under seepage 1the circle does not intercept the slope

****WARNING AT NEXT CENTER**** When radius is 100.000
the center of circle is located below the intersection of circle with ground line, so a large factor of safety is assigned

At point (280.000, 600.000) under seepage 1,the radius and the corresponding factor of safety are:
100.000**********
Lowest factor of safety=********** and occurs at radius = 100.000

At point (280.000, 670.000) under seepage 1,the radius and the corresponding factor of safety are:
170.000 19.266 138.272 14.866 106.544 12.889 74.815 4.494 43.087 3.515
32.511 3.158 21.935 2.837
Lowest factor of safety= 2.837 and occurs at radius = 21.935

At point (280.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 11.497 207.229 11.860 174.459 8.463 141.688 3.259 108.918 3.147
97.994 2.930 87.071 2.785
Lowest factor of safety= 2.785 and occurs at radius = 87.071

For pore pressure ratio .100

At point (210.000, 757.500) ,RADIUS 137.335
the minimum factor of safety is 1.920

At point (210.000, 757.500) under seepage 1,the radius and the corresponding factor of safety are:

257.500 12.541 229.770 13.150 202.039 11.082 174.309 6.461 146.579 2.163
137.335 1.920 128.092 1.948
Lowest factor of safety= 1.920 and occurs at radius = 137.335

At point (350.000, 757.500) under seepage 1,the radius and the corresponding factor of safety are:
257.500 11.075 223.234 8.855 188.969 7.674 154.703 3.416 120.438 3.486
177.547 5.499 166.125 3.429 143.281 3.411 131.859 3.443
Lowest factor of safety= 3.411 and occurs at radius = 143.281

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (70.000, 757.500) under seepage 1,the radius and the corresponding factor of safety are:
181.539 22.396 174.987 23.622 168.436 4.391 161.884 4.517 155.333 5.021
172.803 20.011 170.619 16.063 166.252 4.414 164.068 4.459
Lowest factor of safety= 4.391 and occurs at radius = 168.436

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (210.000, 932.500) under seepage 1,the radius and the corresponding factor of safety are:
401.754 8.130 377.584 7.591 353.413 5.855 329.243 2.559 305.073 2.420
297.016 2.401 288.959 2.541
Lowest factor of safety= 2.401 and occurs at radius = 297.016

****WARNING AT NEXT CENTER**** When radius is 82.500
the center of circle is located below the intersection of circle with ground line, so a large factor of safety is assigned

At point (210.000, 582.500) under seepage 1,the radius and the corresponding factor of safety are:
82.500**********
Lowest factor of safety=********** and occurs at radius = 82.500

At point (245.000, 757.500) under seepage 1,the radius and the corresponding factor of safety are:
257.500 10.847 227.119 13.249 196.739 10.091 166.358 2.980 135.977 2.319
125.850 2.150 115.723 2.051
Lowest factor of safety= 2.051 and occurs at radius = 115.723

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (175.000, 757.500) under seepage 1,the radius and the corresponding factor of safety are:
242.242 12.439 220.214 14.382 198.186 11.649 176.157 7.861 154.129 2.694
146.786 2.671 139.444 2.775
Lowest factor of safety= 2.671 and occurs at radius = 146.786

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

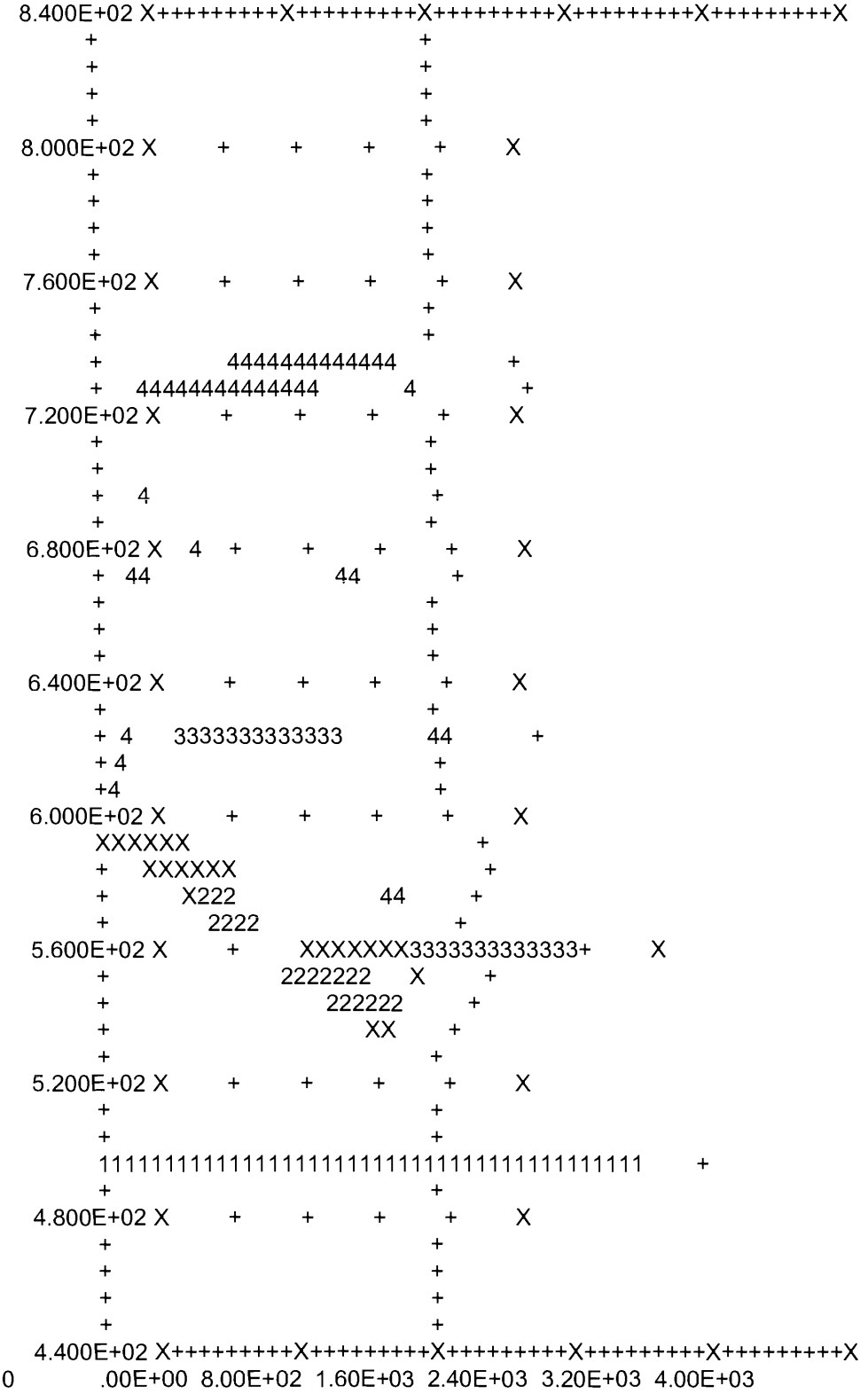
At point (210.000, 801.250) under seepage 1,the radius and the corresponding factor of safety are:
297.870 10.236 270.164 10.245 242.459 9.218 214.753 2.884 187.047 2.179
177.812 1.934 168.577 1.935
Lowest factor of safety= 1.934 and occurs at radius = 177.812

At point (210.000, 713.750) under seepage 1,the radius and the corresponding factor of safety are:
213.750 13.655 186.671 14.090 159.592 11.253 132.514 6.847 105.435 2.316
96.408 2.086 87.382 2.016
Lowest factor of safety= 2.016 and occurs at radius = 87.382

For pore pressure ratio .100

At point (210.000, 757.500) ,RADIUS 137.335
the minimum factor of safety is 1.920

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 1.920



REAME (Rotational Equilibrium Analysis of Multilayered Embankments)
Implemented on the 16-bit Microcomputers C. F. Hains, Jr. and D. M. Hains
2301 22nd Ave.
Northport, AL 35476
(205)-339-6536

Oak Grove Resources, LLC Concord Preparation Plant Refuse Disposal Area Section B-B' East Static

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4
Number of points on boundary lines are: 2 4 6 11

On boundary line no. 1 Point no. and coordinates are:
1 1600.000 500.000 2 3270.000 500.000

On boundary line no. 2 Point no. and coordinates are:
1 1600.000 560.000 2 3160.000 534.000 3 3200.000 535.000 4 3270.000 540.000

On boundary line no. 3 Point no. and coordinates are:
1 1600.000 625.000 2 1720.000 625.000 3 1600.000 560.000 4 3160.000 534.000 5 3200.000 535.000
6 3270.000 540.000

On boundary line no. 4 Point no. and coordinates are:
1 1600.000 739.696 2 2620.000 730.000 3 2757.500 675.000 4 2787.500 675.000 5 2912.500 625.000
6 2942.500 625.000 7 3076.500 575.000 8 3097.500 575.000 9 3160.000 550.000 10 3200.000 535.000
11 3270.000 540.000

Line no. and slope of each segment are:
1 .000

2 -.017 .025 .071
3 .000 .542 -.017 .025 .071
4 -.010 -.400 .000 -.400 .000 -.373 .000 -.400 -.375 .071

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	10000.000	45.000	170.000
2	120.000	33.400	62.020
3	120.000	33.400	128.000

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 2 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

Pore pressure ratio= .100

point1=(2900.000, 740.000) point2=(3200.000, 740.000) point3=(3200.000, 1140.000) NJ= 3 NI= 4
Automatic search will follow after grid with XINC= 150.000 and YINC= 200.000

At point (2900.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 7.121 212.426 5.589 184.853 3.016 157.279 2.724 129.706 2.259
120.515 2.046 111.324 2.014
Lowest factor of safety= 2.014 and occurs at radius = 111.324

At point (3000.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 7.037 217.569 6.158 195.138 2.620 172.707 2.515 150.276 2.559
187.661 2.553 180.184 2.523 165.230 2.516 157.753 2.530
Lowest factor of safety= 2.515 and occurs at radius = 172.707

At point (3100.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
240.000 8.512 224.561 7.792 209.122 5.486 193.683 2.247 178.243 2.341
203.975 2.279 198.829 2.257 188.536 2.255 183.390 2.282
Lowest factor of safety= 2.247 and occurs at radius = 193.683

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3200.000, 740.000) under seepage 1,the radius and the corresponding factor of safety are:
211.896 18.439 207.770 15.591 203.644 2.036 199.518 2.075 195.392 2.406
206.395 13.369 205.020 8.062 202.269 2.039 200.894 2.050
Lowest factor of safety= 2.036 and occurs at radius = 203.644

At point (2900.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 5.922 310.996 4.494 281.992 2.524 252.988 2.421 223.984 2.199
214.316 1.963 204.648 1.966
Lowest factor of safety= 1.963 and occurs at radius = 214.316

At point (3000.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 6.303 316.511 5.312 293.022 2.349 269.534 2.218 246.045 2.430
285.193 2.288 277.363 2.230 261.704 2.240 253.875 2.297
Lowest factor of safety= 2.218 and occurs at radius = 269.534

At point (3100.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 7.594 323.299 6.918 306.598 4.120 289.897 2.228 273.196 2.118
267.629 2.130 262.062 2.328
Lowest factor of safety= 2.118 and occurs at radius = 273.196

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3200.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
308.058 12.258 303.273 2.180 298.488 2.307 293.703 2.509 288.918 2.825
306.463 10.683 304.868 1930.920 301.678 2.213 300.083 2.254
Lowest factor of safety= 2.180 and occurs at radius = 303.273

At point (2900.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
440.000 5.649 409.566 4.076 379.131 2.330 348.697 2.209 318.262 2.137
308.117 2.202 297.973 2.311
Lowest factor of safety= 2.137 and occurs at radius = 318.262

At point (3000.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
440.000 5.644 416.041 4.773 392.082 2.272 368.123 2.185 344.164 2.160
336.178 2.338 328.191 3.353
Lowest factor of safety= 2.160 and occurs at radius = 344.164

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3100.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
434.626 6.890 417.738 5.836 400.850 2.163 383.961 2.206 367.073 2.194
412.109 5.116 406.479 3.693 395.220 2.176 389.591 2.190 361.444 2.135
355.814 2.342
Lowest factor of safety= 2.135 and occurs at radius = 361.444

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3200.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
406.079 7.705 400.687 2.099 395.295 2.240 389.903 2.619 384.511 3.537
404.281 3985.167 402.484 2.071 398.890 2.135 397.092 2.180
Lowest factor of safety= 2.071 and occurs at radius = 402.484

At point (2900.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
540.000 5.650 508.389 3.963 476.778 2.332 445.166 2.149 413.555 2.026
403.018 2.207 392.481 2.913
Lowest factor of safety= 2.026 and occurs at radius = 413.555

At point (3000.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
540.000 5.375 515.563 4.223 491.126 2.166 466.689 2.134 442.252 2.177
482.980 2.151 474.834 2.134 458.543 2.147 450.397 2.164
Lowest factor of safety= 2.134 and occurs at radius = 466.689

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3100.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
528.110 6.265 511.263 4.713 494.416 2.102 477.569 2.128 460.722 2.315
505.647 3.060 500.032 2.111 488.800 2.098 483.185 2.104
Lowest factor of safety= 2.098 and occurs at radius = 488.800

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3200.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
504.876 1077.084
Lowest factor of safety= 1077.084 and occurs at radius = 504.876

At point (2900.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.620 607.683 3.994 575.366 2.404 543.049 2.212 510.732 1.995
499.960 2.063 489.188 2.685
Lowest factor of safety= 1.995 and occurs at radius = 510.732

At point (3000.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
640.000 5.364 614.132 4.076 588.265 2.131 562.397 2.062 536.530 2.175
579.642 2.098 571.020 2.066 553.775 2.080 545.152 2.119
Lowest factor of safety= 2.062 and occurs at radius = 562.397

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3100.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
623.618 5.632 606.604 3.387 589.589 2.107 572.575 2.075 555.560 2.309
583.918 2.105 578.246 2.088 566.903 2.072 561.232 2.120
Lowest factor of safety= 2.072 and occurs at radius = 566.903

****WARNING AT NEXT CENTER**** at radius control zone no. 1,maximum radius is limited by the end point of ground line

At point (3200.000, 1140.000) under seepage 1,the radius and the corresponding factor of safety are:
604.070 2044.478
Lowest factor of safety= 2044.478 and occurs at radius = 604.070

For pore pressure ratio .100

At point (2900.000, 840.000) ,RADIUS 214.316
the minimum factor of safety is 1.963

At point (2900.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 5.922 310.996 4.494 281.992 2.524 252.988 2.421 223.984 2.199
214.316 1.963 204.648 1.966
Lowest factor of safety= 1.963 and occurs at radius = 214.316

At point (3050.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 6.684 319.803 5.774 299.606 2.314 279.409 2.283 259.212 2.257
252.480 2.237 245.747 2.350
Lowest factor of safety= 2.237 and occurs at radius = 252.480

At point (2750.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 7.430 302.083 4.574 264.165 3.111 226.248 2.721 188.331 2.254
175.691 2.072 163.052 1.886
Lowest factor of safety= 1.886 and occurs at radius = 163.052

At point (2600.000, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 12.062 293.961 6.858 247.922 6.436 201.883 6.389 155.844 7.127
232.576 6.301 217.229 6.340 186.537 6.494 171.190 6.700
Lowest factor of safety= 6.301 and occurs at radius = 232.576

At point (2750.000, 1040.000) under seepage 1,the radius and the corresponding factor of safety are:
540.000 7.206 499.222 3.740 458.443 3.197 417.665 2.915 376.887 2.515
363.294 2.273 349.701 2.243
Lowest factor of safety= 2.243 and occurs at radius = 349.701

****WARNING AT NEXT CENTER**** When radius is 119.159
the center of circle is located below the intersection of circle with ground line, so a large factor of safety is assigned

At point (2750.000, 640.000) under seepage 1,the radius and the corresponding factor of safety are:
140.000 12.582 119.159**********
Lowest factor of safety= 12.582 and occurs at radius = 140.000

At point (2787.500, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 6.662 304.868 4.526 269.736 2.817 234.604 2.478 199.472 2.277
187.762 2.312 176.051 2.515
Lowest factor of safety= 2.277 and occurs at radius = 199.472

At point (2712.500, 840.000) under seepage 1,the radius and the corresponding factor of safety are:
340.000 7.654 299.297 4.355 258.594 3.584 217.892 3.073 177.189 2.283
163.621 2.057 150.054 1.931
Lowest factor of safety= 1.931 and occurs at radius = 150.054

At point (2750.000, 890.000) under seepage 1,the radius and the corresponding factor of safety are:
390.000 7.187 351.367 4.400 312.735 3.077 274.102 2.727 235.470 2.269
222.592 2.044 209.715 1.861
Lowest factor of safety= 1.861 and occurs at radius = 209.715

At point (2750.000, 940.000) under seepage 1,the radius and the corresponding factor of safety are:
440.000 7.214 400.652 4.233 361.304 3.094 321.957 2.772 282.609 2.336
269.493 2.094 256.377 1.939
Lowest factor of safety= 1.939 and occurs at radius = 256.377

At point (2787.500, 890.000) under seepage 1,the radius and the corresponding factor of safety are:
390.000 6.606 354.153 4.387 318.306 2.807 282.458 2.454 246.611 2.180
234.662 2.143 222.713 2.256
Lowest factor of safety= 2.143 and occurs at radius = 234.662

At point (2712.500, 890.000) under seepage 1,the radius and the corresponding factor of safety are:

390.000 7.773 348.582 4.192 307.164 3.536 265.746 3.101 224.328 2.392

210.522 2.203 196.716 2.082

Lowest factor of safety= 2.082 and occurs at radius = 196.716

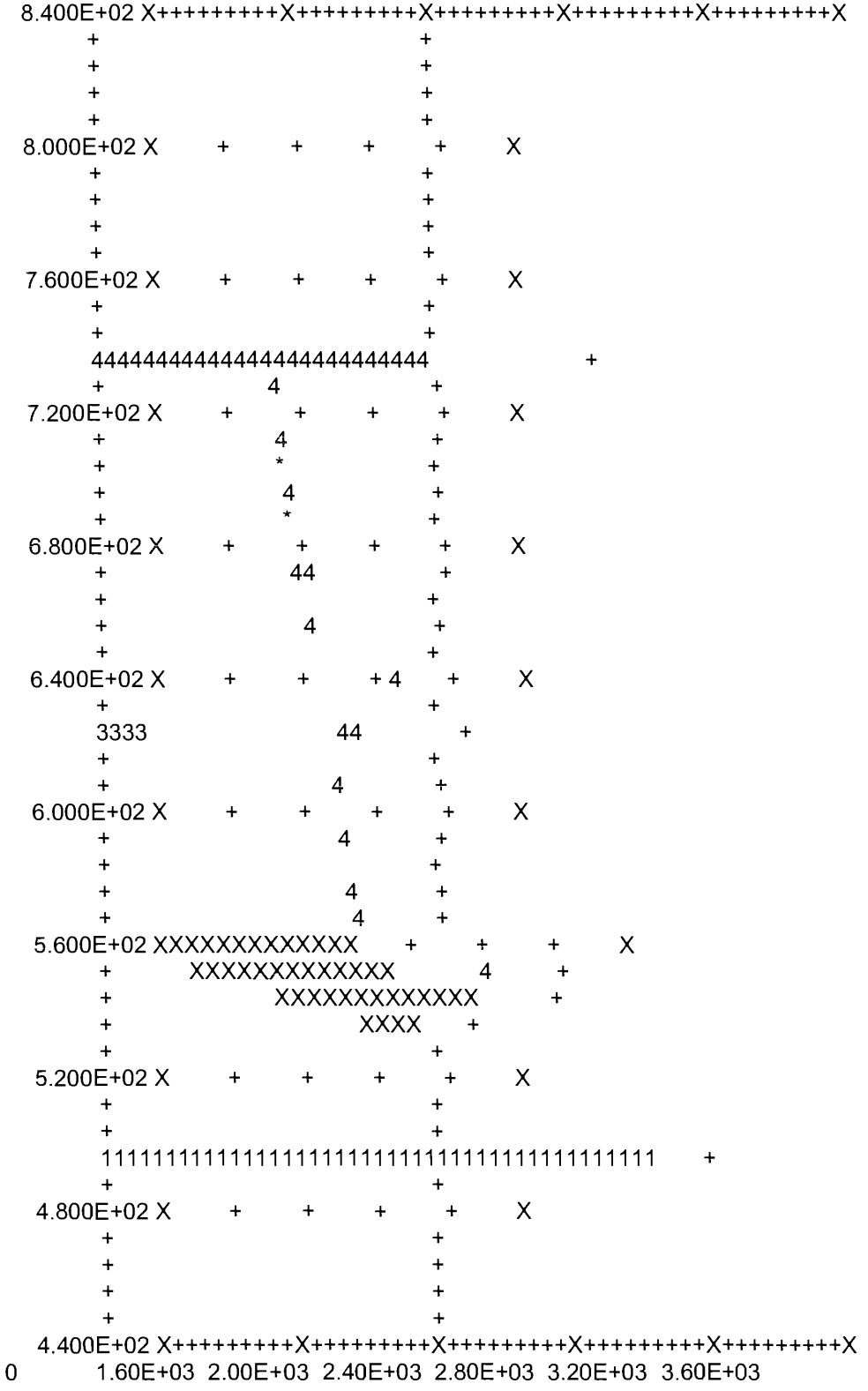
For pore pressure ratio .100

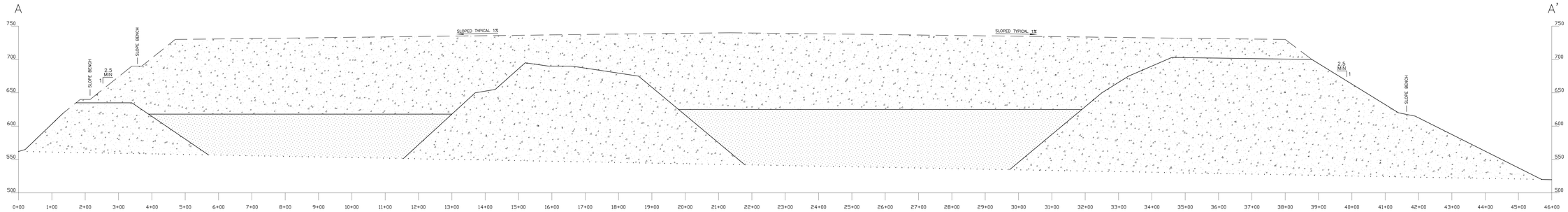
At point (2750.000, 890.000) ,RADIUS 209.715

the minimum factor of safety is 1.861

1

Cross section in distorted scale. Numerals indicate boundary line no.
If there area more than 10 bound. lines, alphabets will then be used. P indicates
Piezometric line. If a portion of Piezometric line coincides with
the ground or another boundary line, only the ground or boundary
line will be shown. X indicates intersection of two boundary
lines. * indicates failure surface.
The minimum factor of safety is 1.861





SCALE: 1" = 100' HORIZONTAL
1" = 50' VERTICAL

LEGEND

- FILL CONDITION LEVEL
- EXISTING GROUND LINE
- APPROXIMATE GROUND LEVEL
- FINE COAL WASTE (SLURRY)
- COARSE COAL WASTE (COAL REFUSE)

PERC ENGINEERING CO., INC.

Oak Grove Resources, LLC
Concord Preparation Plant
01-00329
Coarse Refusel Disposal Area
MSHA ID. 1211-AL11-00043-02
Profile A-A'

DRAWN BY: P.T.O.	DATE: 11-21-07
DWG. NAME: OGCPESAA	
APPROVED BY: S.R.I.	SCALE: AS SHOWN

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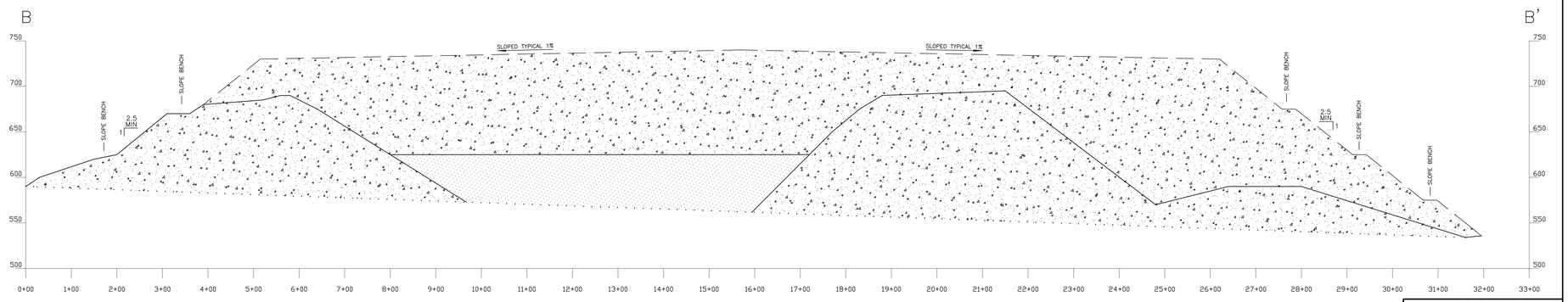

SCALE: 1" = 100' HORIZONTAL
1" = 50' VERTICAL

LEGEND

- FILL CONDITION LEVEL
- EXISTING GROUND LINE
- APPROXIMATE GROUND LEVEL
- FINE COAL WASTE (SLURRY)
- COARSE COAL WASTE (COAL REFUSE)

PERC ENGINEERING CO., INC.

Oak Grove Resources, LLC
Concord Preparation Plant
01-00329
Coarse Refusel Disposal Area
MSHA ID. 1211-AL11-00043-02
Profile B-B'

DRAWN BY: P.T.O. DWG. NAME: OGCPES8B	DATE: 11-21-07
APPROVED BY: S.R.I.	SCALE: AS SHOWN

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CONSTRUCTION

Construction of Concord Preparation Plant's Refuse Disposal Area will occur in three phases. These three phases are listed below:

Phase I - Site Preparation

Step A - Removal of Vegetation and Undesirable Material

Step B - Removal and Segregation of Soil Material

Step C - Placement of Identification Signs

Phase II - Construction

Step A - Placing and Compacting of Fill Material

Phase III - Revegetation

Step A - Placement of Cover Material

Step B - Revegetation

A construction time schedule for this project is for construction to begin in the Fall of 2007. Construction oversight and materials testing for the project will be done by a qualified specialist. At all times, access to the waste bank area will be limited to personnel authorized by Oak Grove Resources, LLC. Access will be restricted through the use of fences, road gates, signs and guards.

PHASE I

Preparation of the site will consist of the removal of all vegetation and undesirable material and the grubbing of the fill area. Topsoil and subsoil from the site will either be stockpiled in order to be replaced on the finished slopes of the proposed waste bank.

Permanent identification signs identifying the waste bank as Oak Grove Resources, LLC, Concord Preparation Plant's, Refuse Disposal Area, and with a waste bank identification number as assigned by MSHA, will be placed adjacent to the waste bank area at least six feet high.

PHASE II

Due to the expansion area being a continuation of an existing operating coarse refuse disposal area, no clay barrier will be required between the existing fill and the expansion area. The material to be placed in the waste bank will consist of washer reject produced at Concord Preparation Plant. No extraneous construction combustible material will be placed within the fill area. The fill material will be transported to the waste bank area using conveyors and mobile equipment. The fill material will be placed and spread over the entire fill area in layers not to exceed 24 inches in thickness and compacted to 90% of the standard proctor density to ensure stability and to minimize the flow of air through the fill. Compaction will be accomplished using rubber tired or track equipment that is available onsite. The placement of the fill material will be performed in such a manner as not to impound water or impede drainage. The placement of the fill material will be performed in such a manner as not to impound water or impede drainage. All outslopes of the dump will have a minimum slope of 2.5 Horizontal to 1 Vertical.

PHASE III

The final phase of construction of the Concord Preparation Plant's, Refuse Disposal Area will consist of grading the fill area to the design configuration and the placement of the final cover material upon the surface of the waste bank and revegetation.

GENERAL OPERATION

Refuse will not be deposited on a burning waste pile except for the purpose of controlling or extinguishing the fire. Clay or other sealants will be used to seal the surface of any waste pile in which a spontaneous ignition has occurred. Surface seals will be kept intact and protected from erosion by drainage facilities. No extraneous combustible material will be deposited in a waste pile. Any fire in the waste pile will be extinguished, and the method used will be in accordance with a plan approved by the District Manager of MSHA. The plan will contain as a minimum, provisions to ensure that only those persons authorized by the operator, and who have an understanding of the procedure to be used, will be involved in the extinguishing operation. The proposed waste pile will be constructed in such a manner to prevent accidental sliding or shifting of materials.

ABANDONMENT

Upon reaching the final waste bank configuration the Mine Safety and Health Administration's district manager will be notified of the intention to abandon the waste bank. An abandonment plan will be submitted at the time of this notification.

CONCLUSIONS

The exploratory activities, testing procedures, and evaluative approaches used in this project have been consistent with those employed in geotechnical engineering for waste banks. In conclusion, the Concord Preparation Plant's Refuse Disposal Area was designed, investigated and analyzed using current prudent engineering practices resulting in the design of a safe and sound refuse embankment.

If any questions arise, please contact the design engineer.

_____

Steven R. Ingle, P.E.
AL Reg. No. 18213
Design Engineer

DRAWING LIST

Drawing Title	Sheet No.
Vicinity Map	1 of 5
Underground Mine Map	2 of 5
Geotechnical Investigation Map	3 of 5
Grading Plan	4 of 5
Abandonment Grading and Drainage Control Plan	5 of 5

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BASIN 018

SEDIMENT POND 3A

SEDIMENT POND 3B

BASIN 017

COLLECTION POND No. 3

COLLECTION POND No. 2

BASIN 014

COLLECTION POND No. 1

STOCK PILE

TAILINGS

STORAGE AREA

Scale: 1" = 400'

LEGEND

730	EXISTING CONTOURS
----730----	PROPOSED EXPANSION CONTOUR
→	DOWNDRAIN
	SLOPE BENCH

PERC

drawn by: S.A.E.
checked by: R.E.P.
scale: 1"=400'
job number: 04-03901-002

Oak Grove Resources, LLC
Concord Preparation Plant
01-00329
Coarse Refuse Disposal Area Expansion
MSHA ID. No. 1211-AL11-00043-02
Grading Plan
Map 5 of 5

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LEGEND

730	EXISTING CONTOURS
----730----	PROPOSED EXPANSION CONTOUR
→	DOWNDRAIN
	SLOPE BENCH

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ENGINEERING CO., INC.
1606 Highway 78 West Jasper, Alabama 35501
P.O. Box 1712 Jasper, Alabama 35502
(205) 384-5553 Office (205) 384-9491 Fax

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page:	4 of 5
dwg name:	OGCPCRD1

Oak Grove Resources, LLC
Concord Preparation Plant
01-00329
Coarse Refuse Disposal Area Expansion
MSHA ID. No. 1211-AL11-00043-02
Grading Plan
Map 4 of 5

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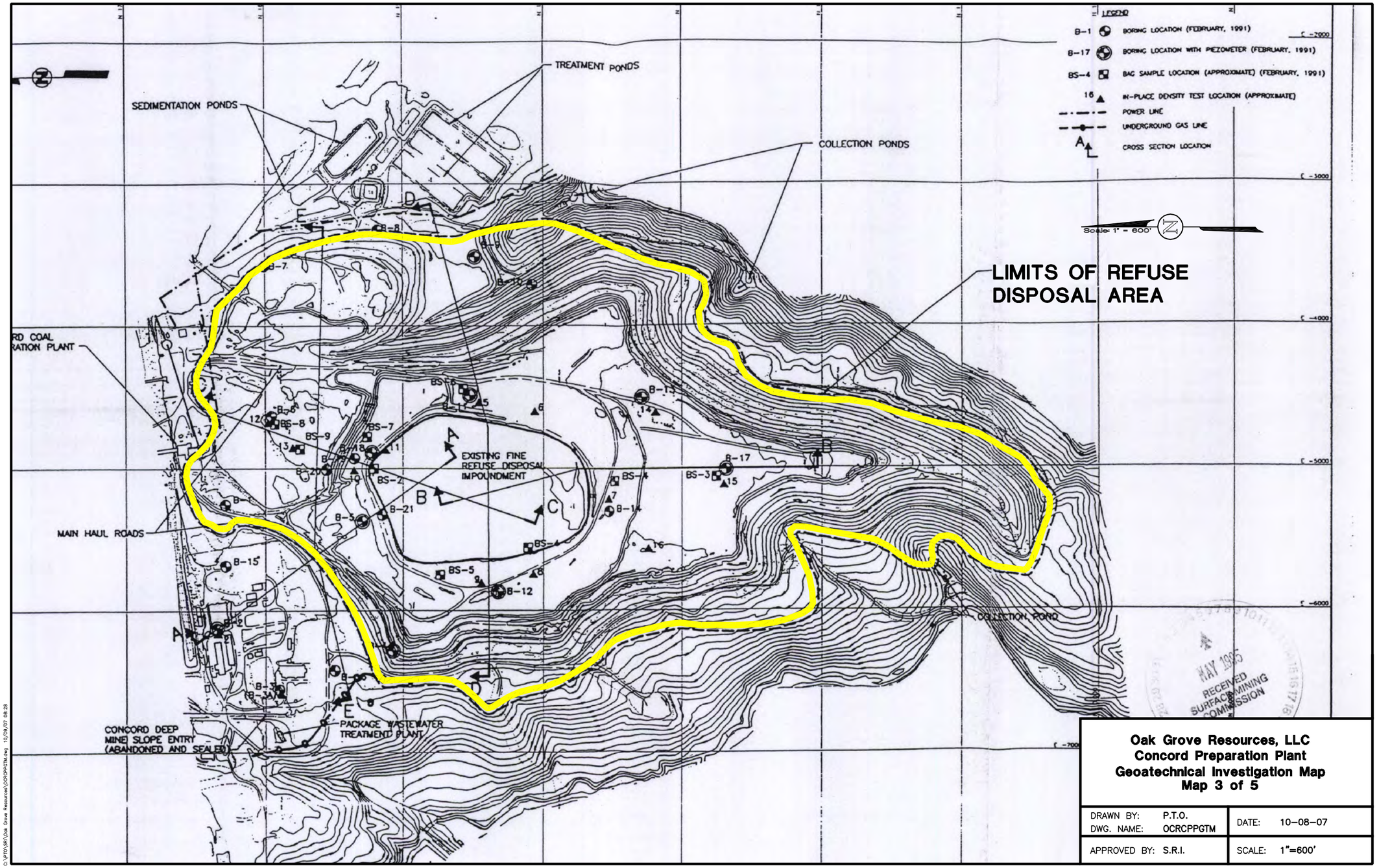

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Geoatechnical Investigation Map
Map 3 of 5

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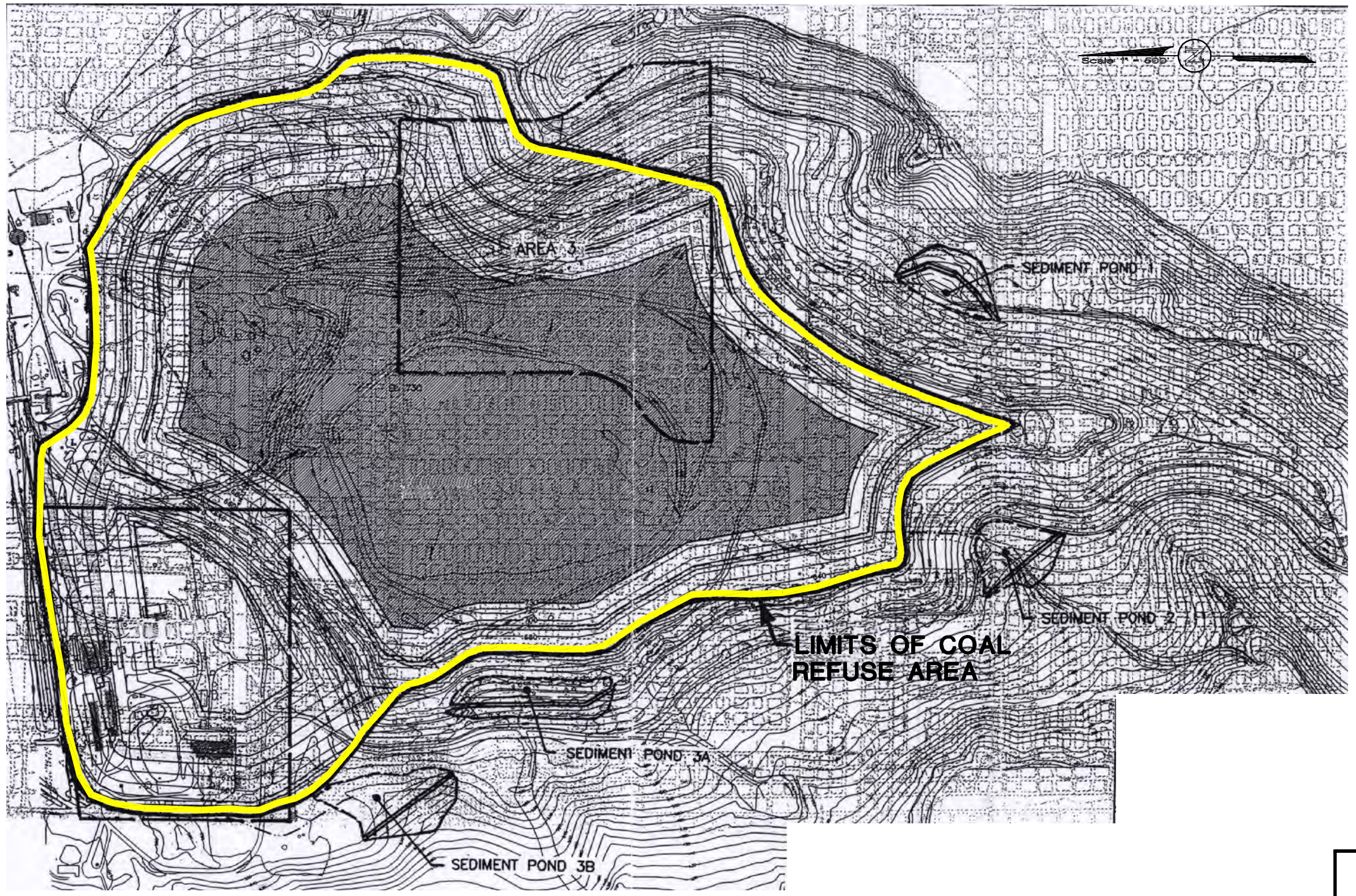

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Oak Grove Resources, LLC
Concord Preparation Plant
Underground Mine Map
Map 2 of 5

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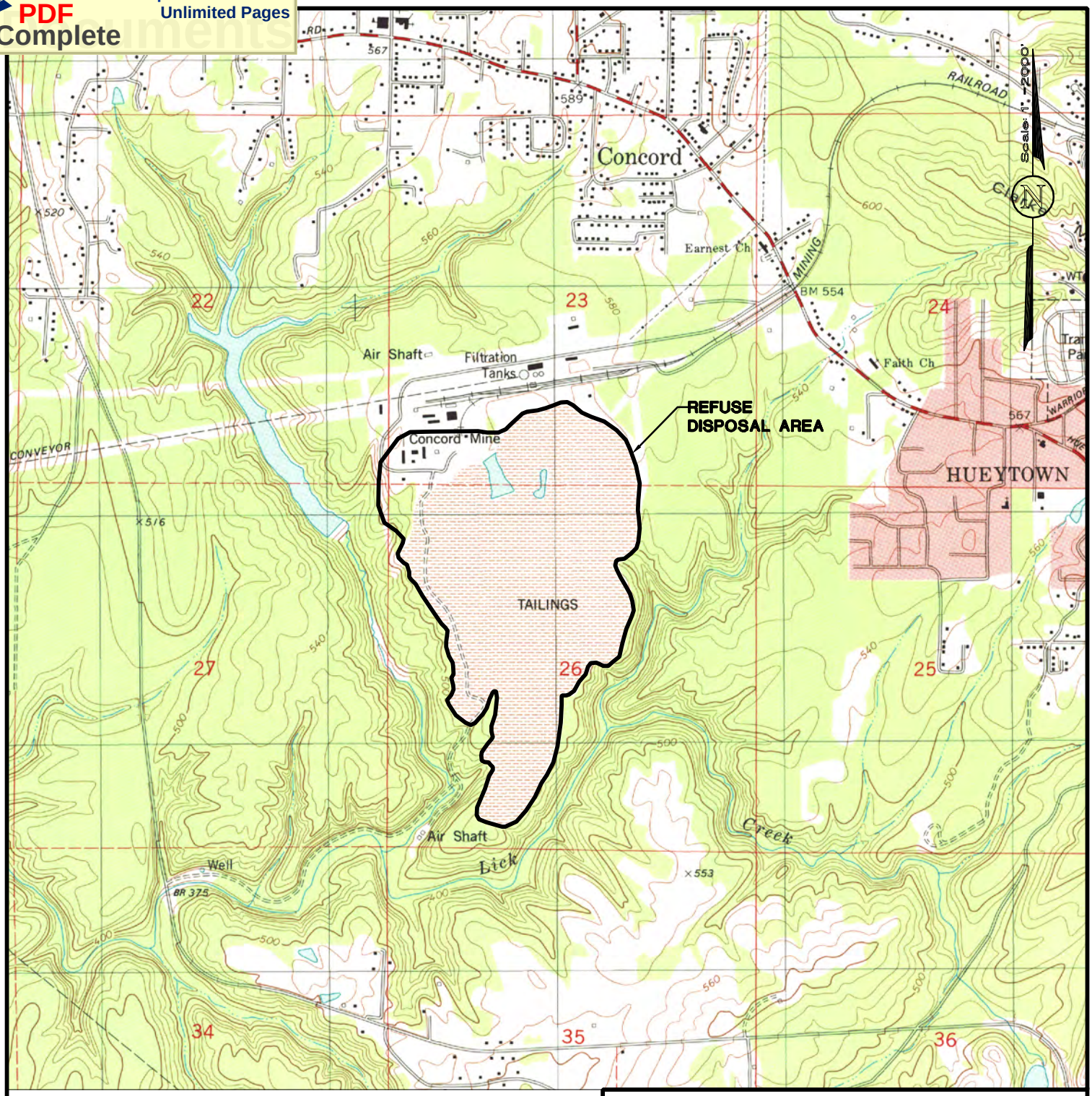

Oak Grove Resources, LLC
Concord Preparation Plant
Jefferson County, Alabama
Vicinity Map
Concord, Alabama Quadrangle
Map 1 of 5

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