CERTIFICATION OF CLOSURE

BACKGROUND

The WILLIAM L BONNELL COMPANY, INC., (Bonnell) operates an aluminum extrusion facility in Newnan, Georgia. Prior to November 1989, chromium hydroxide sludge (F019) produced in the Chemical Conversion Coating of Aluminum wastewater treatment system was dewatered in the chromium hydroxide sand drying beds (CrOH sand drying beds). In November 1989, a filter press was installed to handle the CCC clarifier sludge (F019), and use of the CrOH sand drying beds was discontinued.

In March and April, 1990, the CrOH sand drying beds and associated drainage piping were removed. The F019 sludge and chromium contaminated soils in and around the CrOH sand drying beds were excavated and transported to the Chemical Waste Management disposal facility in Emelle, Alabama. Gravel was placed into the excavation to a point above the groundwater. A perforated corrugated metal stand pipe was also installed to allow for possible future groundwater recovery. The area was then backfilled with on-site soil. A summary of those clean-up activities is presented in an appendix to the approved closure plan.

In July 1991, Bonnell submitted to EPD a revised Closure and Post-closure Plan for the CrOH sand drying beds. EPD approved the Closure and Post-Closure Plan on September 30, 1991. Closure activities began on October 15, 1991. Closure of the CrOH sand drying bed was completed on March 9, 1992.

HEALTH AND SAFETY

A site health and safety plan was developed. Site workers reviewed the health and safety plan and signed that they had read it. A copy of the health and safety plan is included as Appendix A.

Air quality monitoring was performed for chromium during early construction activities. The results were below the detection limit. A copy of the results are included as Appendix B.

CONSTRUCTION ACTIVITIES

Field notes were kept during construction activities. A copy of the field notes are included as Appendix C.

The Contractor began construction activities by installing the decontamination station on January 25, 1992. The location of the decontamination station is shown in Exhibit 1. The contamination reduction and exclusion zones were established on January 26.

On January 26, the Contractor cut the corrugated metal standpipe, triple rinsed it on the decontamination pad, visually assured decontamination was successful, and removed it from the site. Next, the Contractor removed the corrugated metal effluent pipe and associated manholes that once served the anodizing wastewater treatment facility. The pipe and manholes were placed into rolloff containers and disposed as hazardous wastes.

The Contractor then placed the six-inch subgrade. The subgrade materials were soil classification. A copy of the geotechnical certification is included as Appendix D. The subgrade was placed in six-inch lifts and compacted. The compaction test results are included in Appendix E. A cover drainage collection system was constructed on the north, east, and south sides of the unit. An anchor trench was constructed on the west side of the unit.

The HDPE was placed over the subgrade. HDPE material certifications are included in Appendix F. Next, a layer of drainage net with geofabric on the bottom side was placed over the HDPE. Six-inch PVC pipe was placed in the drainage collection system ditch on top of the drainage net. The PVC pipe was pre-drilled to allow water to enter it. Crushed stone was placed on top of the PVC pipe. The second layer of geofabric was placed over the drainage net and extended over the crushed stone.

Topsoil was placed over the top layer of geofabric. The first eighteen inches were placed in six-inch lifts and compacted. The compaction test results are included in Appendix E. The final lift of topsoil was not compacted. Finish grading was performed to achieve a final grade of 6.7 percent. A run-on prevention drainage swale was constructed on the north side of the unit. Seed, fertilizer, and straw were placed on the topsoil.

The decontamination station was triple rinsed and inspected, and the decontamination waters were pumped into the chemical conversation coating of aluminum wastewater treatment system for treatment and discharge through the NPDES outfall. The tank was triple rinsed and inspected, and the rinse waters were pumped into the chemical conversation coating of aluminum wastewater treatment system for treatment and discharge through the NPDES outfall.

The six-inch PVC drainage pipe in the cover drainage collection system was connected to the storm sewer to complete construction. Final inspection was performed on March 9, 1992. As-built drawings are included in Appendix G. The approved Closure and Post-closure Care Plan are included in Appendix H.

DEVIATIONS FROM CLOSURE PLAN

There were four minor deviations from the Closure Plan. The changes were as follows:

First, the drainage systems that collects water from the drainage net was expanded to the north side of the unit. This addition improves collection of rain waters draining though the topsoil. EPD was not notified of this change because it was an improvement in the cap.

Second, a drainage swale was constructed on the north side of the unit. However, the drainage ditch shown in the Closure Plan on the north side of the unit running westward from the unit was not constructed because the AlOH wastewater treatment system was constructed over that area. Drainage features of the AlOH wastewater treatment construction prevent run-on from the west toward the unit. Therefore, the drainage ditch shown in the closure plan could not be constructed and was not necessary. EPD was aware of the construction of the AlOH wastewater treatment system. Since run-on protection was achieved, the system as constructed is equivalent to the approved Closure Plan.

Third, the slope of the cover was reduced from eight percent to 6.7 percent due to the final grading achieved. Although soil erosion losses were calculated to be minimal, this flattening of the slope reduces the possibility of soil erosion. EPD was not notified of the change since it was an improvement in the cap system, and it occurred as a result of final grading.

Fourth, Unified Classification System soils CH were used as the subgrade instead of CL soils. CL soils were not available, and the CH soil properties meet or exceed the properties of CL soils. A letter to that effect is included in Appendix D. EPD was not notified of this change since the soils were equivalent and, therefore, the constructed cap is equivalent to the approved Closure Plan.

QA/QC DOCUMENTATION

Appendix D contains the soil classification certifications.
Appendix E contains the soil compaction test certifications.
Appendix F contains the HDPE materials test certifications.

AREAS OF RESPONSIBILITY

The areas of responsibility and lines of authority were defined and explained to all parties involved, except ATEC Associates, in a meeting on January 16, 1992. ATEC Associates received written communication regarding their responsibility. Summarizing, the areas of responsibility were as follows:

The William L. Bonnell Co., Inc.: Owner

Terry Snell & Associates: Closure Design, Closure Certification

ATEC Associates: Compaction Testing, Soil Classification Certification

Payton & Sons Construction Co., Inc.: Contractor

OWNER CERTIFICATION

I, Douglas R. Monk, of The WILLIAM L. BONNELL COMPANY, INC., hereby state and certify that, to the best of my knowledge and belief, the Chromium Hydroxide Sand Drying Beds located at The WILLIAM L. BONNELL COMPANY, INC., 25 Bonnell Street, Newnan, Georgia, 30263, has been closed in accordance with the attached approved closure plan, and that the closure was completed on the 9th day of March, 1992.

D R Monk 3/20/92

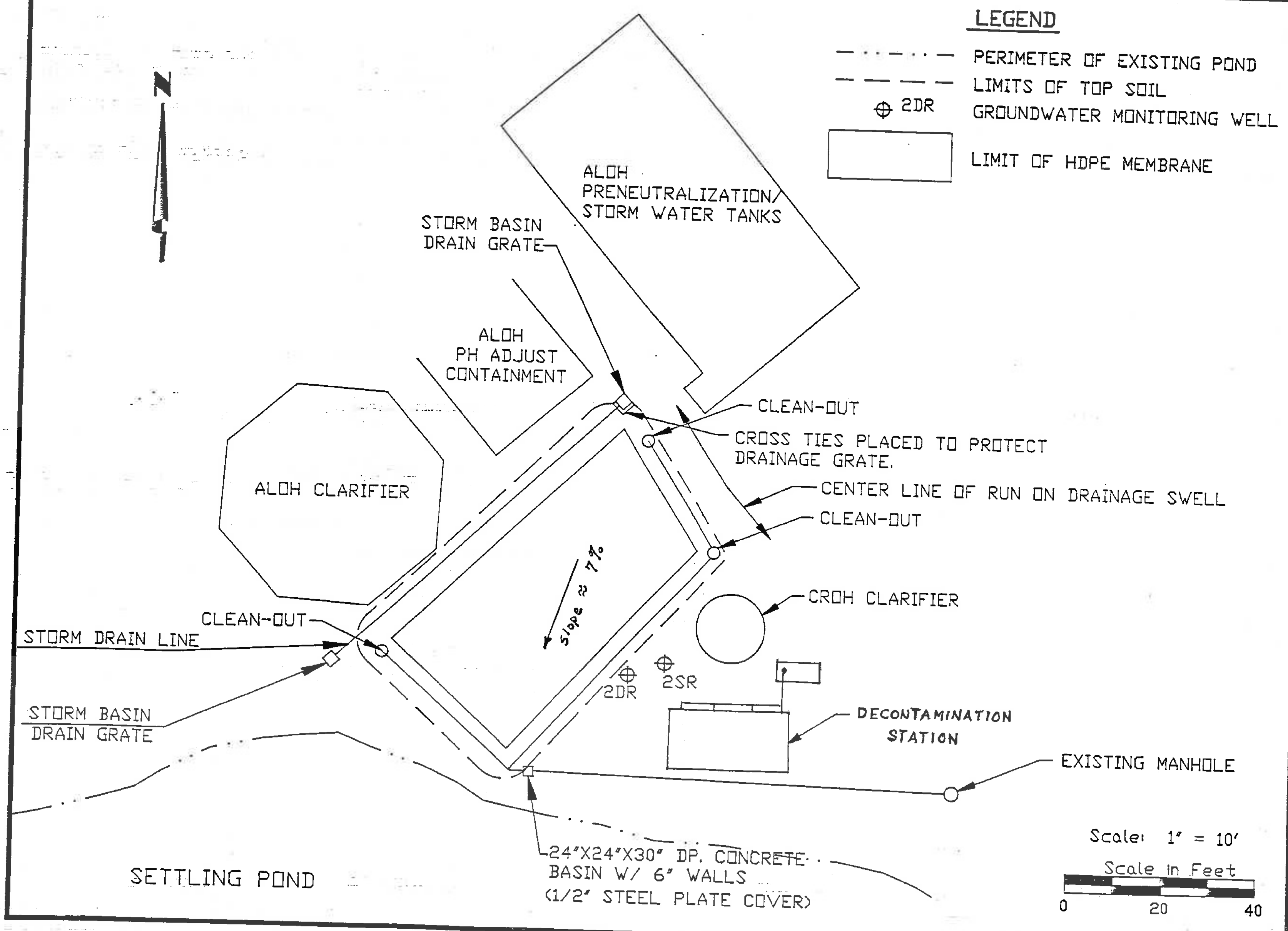
ENGINEER CERTIFICATION

I, Terry D. Snell, a registered professional engineer, hereby certify that I have made visual inspections of the Chromium Hydroxide Sand Drying Beds located at The WILLIAM L. BONNELL COMPANY, INC., 25 Bonnell Street, Newnan, Georgia, 30263; and, to the best of my knowledge and belief, closure of the facility has been performed in accordance with the attached approved closure plan; and that the closure was completed on the 9th day of March, 1992.

Terry D Snell 3/20/92

Georgia Professional Engineer License No. 012711

Terry Snell & Associates
1111 Valerie Woods Drive
Stone Mountain, GA 30083
404/294-8335



TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

EXHIBIT 1
LOCATION OF
DECONTAMINATION
STATION

SCALE: 1" = 10'
DRAWING NO.: EXHIBIT 1
PROJECT NO.: 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED:

APPENDIX A

SITE HEALTH AND SAFETY PLAN

SITE HEALTH AND SAFETY PLAN
FOR THE CLOSURE OF THE CrOH SANDBEDS

THE WILLIAM L. BONNELL COMPANY
NEWNAN, GA

SITE HEALTH AND SAFETY PLAN FOR THE CLOSURE OF THE CrOH SANDBEDS

TABLE OF CONTENTS

SITE SAFETY AND HEALTH PLAN

Project Title: CrOH Sandbed Closure   Project No.: A-013

Site Name: William L. Bonnell Company   Date: January 2, 1991

Newnan, Georgia   EPA I.D. No. GAD003273224

Prepared By: T.B. Schexnayder

Approved By: Terry D. Snell

I. SITE DESCRIPTION AND EVALUATION

Site Location: 25 Bonnell Street, Newnan, GA

County: Coweta

Surrounding Population: 16,000

Plant Site Topography: Slightly Rolling

Size of Closure Site: Approximately 4000 sf

Proposed Start Of Closure Activities: January 13, 1991

A location map is presented as Exhibit A.

II. PROJECT OBJECTIVES

The project objective is to preform the work necessary to close the site of a Chromium Hydroxide (CrOH) Sand Drying Bed as described in Bonnell's Closure and Post-Closure Plan for the Chromium Hydroxide Sludge Drying Bed, Revised August, 1991. In general, the work shall consist of the following items:

1. Excavation, removal and disposal of the existing anodizing piping and catch basins, and a 4-6 foot section of 42 inch CMP standpipe located in the CrOH sludge drying area.

2. Installation of an impermeable HDPE cap over the area.
3. Construction of run-on and runoff control ditches.
4. Removal and appropriate disposal of contaminated materials generated during the cleaning of the site.
5. Decontamination of the equipment utilized.

Project duration is expected to require 5-15 working days depending on weather.

III. SITE/WASTE CHARACTERISTICS

Material/Type:

Aqueous ___ Non-Aqueous ___ Sludge ___

Gas ___ Solid XXX

Material Characteristics:

Toxic ___ Corrosive ___ Ignitable ___

Volatile ___ Reactive ___

Other XXX - Potentially Toxic

Storage Methods: None Required

Site Features:

1. Site adjacent to .75 acre settling pond.
2. Site egress restricted by adjacent waste water equipment, settling pond and topography.

Site Status:

Active ___ Inactive XXX

Site History:

Site had been previously the location of sand drying beds used to dewater chromium hydroxide sludge. All sludge has been removed from the site. Approximately 1225 tons of contaminated soils were also removed and sent to an approved landfill in Emelle, AL. The site was then backfilled with clean soils.

IV. HAZARD EVALUATION

Compounds or substances identified or suspected to be on-site.

Primary Hazard(s)

Compound	Identified	Concentration	Other
Chromium (III)	Lab Analysis	0-150 mg/kg	Toxic by Ingestion

Hazardous Substances Information:

Forms for the known or suspected compounds/substances are attached.

Yes ___ No XXX If no explain: No known NIOSH information available specificly for Cr (III)

Additional Hazards:

Proximity to settling pond and waste water equipment.

V. PROJECT ORGANIZATION AND PERSONNEL

A. Project Organization

The listed personnel are assigned specific site responsibilities. Note that one individual may perform more than one responsibility.

On-Site Personnel

Name	Title	Responsibility
Joe Lewis	Project Team Leader (PTL)	Project Manager
Joe Lewis	Site Health and Safety Officer (SHSO)	SHSO
Rodney Payton		Equipment Operator
Rickie Veal		Worker
Bobbie Beasley		Worker

Support Personnel

Name	Title	Responsibility
O.C. Williams	Safety Supervisor	Provide additional safety supervision and coordinate air monitoring with PTL
T.B. Schexnayder	Civil Engineer	Off-Site Project Management
T.D. Snell	Consulting Engineer	Closure Certification
S.M. Cook	Medical Doctor	Medical Monitoring

B. Training

Bonnell and subcontractors personnel assigned to or regularly entering areas of the site, other than the Support Zone, for the purpose of performing or supervising work, for health, safety, security, or administrative purposes or any other site related function, have received the appropriate safety training in accordance with 29CFR1910.120. Only personnel having completed the required training shall be permitted to enter the contaminated area of the site. Copies of the on site teams training certificates are included in this plan as Exhibit B.

Prior to the initiation of field activities personnel scheduled to perform on-site activities shall attend a health and safety meeting where site specific considerations will be reviewed and to ensure that all personnel are capable of and familiar with use of safety, health, respiratory and protective equipment and with specific procedures required for this site.

Should an operational change which effects on-site activity be made, a meeting prior to implementation of the change shall be convened to explain the change. Daily safety and operations meetings will be held. Operational issues and procedures will be reviewed and addressed as warranted. All personnel will attend the daily meeting.

C. Personnel Medical Surveillance

Personnel engaged in any on-site activities shall have participation in a medical surveillance program in accordance with 29CFR1910.120 (f). All personnel shall have been provided with medical surveillance within one year prior to the project activity. Mr. O.C. Williams, Bonnell Safety Supervisor, will have responsibility for coordination of this program and records maintenance. Medical records shall be made available to the proper authorities upon request.

VI. SITE ENTRY AND CONTROL PROCEDURES

Specific areas of operation will be delineated to coordinate access control and site security. A safe perimeter will be established as per Exhibit C.

The Exclusion Zone is the area where contamination does or could occur. Work to be carried out in this area is described on page 2 of this plan as Section II. Project Objectives.

No unauthorized person will be permitted in this area. All persons arriving or departing the site will be required to log in and out with Project Team Leader or his designate. All activities must be coordinated with and cleared through the Project Team Leader.

A Contaminant Reduction Zone will be designated between the Exclusion and Support Zones and will provide for:

1. The transfer of equipment from the Support Zone to the Exclusion Zone;

2. Decontamination of vehicles, equipment and personnel prior to moving from the Exclusion to the Support Zone; and,

3. For physical separation of the Support and Exclusion Zones.

A Support Zone shall be designated in an area outside the zone of significant contamination. The Support Zone shall be clearly marked and shall be secured from active or passive contamination from the Exclusion Zone. The Support Zone shall be used for:

1. Ingress and egress for all site operations;

2. Location of support activities and facilities and;

3. Staging for required site operation and equipment.

Communications shall be maintained between safety and on-site personnel by visual or audio contact. Emergency numbers including police, fire, ambulance, hospital, poison control center, and state and federal agencies shall be prominently displayed at the Support Zone.

VII. SAFETY PLAN

A. Emergency Response and Contingency Procedures

In the event of any emergency associated with the project activities, the Project Team Leader (PTL) shall without delay take diligent action to remove or otherwise minimize the cause of the emergency and institute measures necessary to prevent recurrence of the conditions or actions leading to or resulting in the emergency. The PTL will promptly notify Bonnell's Plant Safety Supervisor.

Emergency medical services shall be identified and routes to the services verified prior to commencing any on-site activities . The name of this facility, name of the contact person, communications information, and emergency routes shall be posted at the site. All emergency contact names and telephone numbers shall be prominently posted at the site and are presented in Exhibit D.

All site support vehicles shall be equipped with route maps providing directions to off-site medical services. All drivers of site support vehicles shall become familiar with the emergency route and the required travel time. At least one vehicle shall be available for use for emergency transport from the site at all times.

B. Emergency Medical Care

Joe Lewis has been designated as the Site Health and Safety Officer (SHSO).

Hospital: Newnan Humana Hospital
Phone: 253-1912
Contact: Emergency Room
Address: 60 Hospital Road, Newnan, GA
Directions: Exit Bonnell Property on Bonnell St. turn left on Temple Ave. proceed approximately 1/2 mile and turn right onto Hospital Rd. then proceed 3/4 mile to Hospital on left.

Ambulance: Newnan Humana Hospital
Phone: 253-3221

Other Emergency Numbers

Police: 253-1221
Fire Department: 253-1122
Poison Control Center: 253-1912 1-800-282-5846
Bonnell Plant Security: Extension 240
Bonnell Safety Supervisor: Extension 668

C. Site Safety and Health Officer Responsibilities

The Responsibilities of the SHSO are summarized as follows:

1. Selects protective clothing and equipment
2. Periodically inspects protective clothing and equipment.
3. Ensures that protective clothing and equipment are properly stored and maintained.
4. Controls entry and exit at access control points.
5. Coordinates safety and health program with Plant Safety Supervisor and Industrial Hygienist.
6. Monitors the work parties for signs of stress, such as cold exposure, heat stress and fatigue.
7. Monitors on-site hazards and conditions.
8. Participates in the preparation of and implements the Site Safety Plan.
9. Conducts periodic inspections to determine if the site safety plan is being followed.
10. Enforces the Buddy System.
11. Knows emergency procedures, evacuation routes and telephone numbers for emergency services.
12. Coordinates emergency medical care.

D. Personnel Protection Equipment (PPE)

On-site personnel shall be provided with the appropriate personal safety equipment and protective clothing . All safety equipment and protective clothing shall be kept clean and well maintained. The SHSO shall establish upgrade/downgrade action levels From the specified minimum levels. At a minimum the following items shall be provided for each level of protection.

Level D

- Coveralls
- Safety boots or shoes
- Hard hat
- Safety glasses or face shield
- Gloves

Optional

- Neoprene over-boots
- Neoprene gloves

Modified Level C

- Tyvek coveralls
- Latex under gloves
- Neoprene outer gloves
- Hard hat
- Safety boots or shoes
- Neoprene over-boots
- Safety glasses or face shield
- Half face air purifying respirator

Combinations of levels of protection may be employed as directed by the SHSO. The SHSO must document the rationales for any variation in levels of protection.

All prescription eyeglasses in use on site will be safety glasses. Prescription lens inserts will be worn for full face respirators. Contact lenses are prohibited.

All on-site personnel must take a respirator fit test prior to entering the Exclusion or Contamination Reduction Zone. The Bonnel PLant Safety Supervisor shall administer each test. Any person unable to pass the test shall not enter the Exclusion or Contamination Reduction Zone.

Half face respirators shall be dual cartridge and filter air -purifing respirators, as manufactured by North Safety Equipment, Model 7700 Series and fitted with disposable cartridge, N-7500-8, designed for dust, fumes, mist and radionuclides.

All personnel shall wear disposable outerwear, gloves, neoprene over boots, safety glasses, half face respirator and a hard hat during excavation activities. All PPE worn on-site shall be decontaminated or properly disposed of at the end of the work day. The SHSO shall be responsible for ensuring all PPE is decontaminated before reissue.

Each respirator shall be assigned to an individual and not interchanged between workers without cleaning and sanitizing. Cartridges and canisters shall be changed weekly or upon breakthrough whichever occurs first. Documentation for assuring periodic cleaning, maintenance and changeout of cartridges shall be provided by the SHSO.

All protective clothing and over boots which have entered the Contamination Reduction and Exclusion Zone shall be decontaminated or properly disposed of at the completion of the work day.

E. Respirator and Personnel Monitoring

Contaminated soils from the Exclusion Zone were excavated and disposed of in June, 1990. The excavation was then backfilled with clean native soils. Samples tested after the excavation and prior to backfilling indicates that the concentration of total chromium to vary up to approximately 150 ppm. See Exhibit E for actual results.

The potential for exposure to air born contaminates is therefore minimal. During periods of excavation, backfilling there is potential for exposure to air born contaminates (dusting). During these activities Modified Level C PPE will be utilized and air monitoring for chromium contaminants will be conducted. The SHSO will ensure that Modified Level C is being worn by all on-site personnel.

Air monitoring shall be conducted during periods when dust is being generated. The SHSO will coordinate the air monitoring program with the Industrial Hygienist.

All monitoring equipment shall be calibrated as a minimum at the start of each day and end of each day in accordance with the manufactures specifications and directions. Additional calibration will be at the discretion of the SHSO. Date, time, procedure, results and the person preforming the calibration shall be documented in the site logbook.

At each break or cessation of work on-site personnel shall be closely monitored by the SHSO for signs of fatigue or other work related symptoms which may affect their safety, health or work ability. Each individual working on-site shall visually monitor other workers while on-site. Any indication of stress or other impairment shall be reported to the SHSO who will institute actions to remedy the condition as appropriate.

VIII. DECONTAMINATION

A. Personal Hygiene and Decontamination

Disposable outerwear shall not be reused, and when removed, shall be placed inside disposal containers provided for the purpose located in the Contamination Reduction Zone.

Eating, drinking, smoking and chewing shall be prohibited except in a designated break area in the Support Zone.

All outerwear shall be removed prior to entering the break area and prior to cleansing hands.

Personnel shall be required to thoroughly cleanse their hands and other exposed areas before entering the Support Zone.

All personnel working in the Exclusion Zone or Contamination Reduction Zone shall be required to decontaminate and change to fresh clothing after each working period or shift, prior to leaving the site. Decontamination procedures shall be set up in general accordance with the following Modified Level C decontamination program.

The decontamination procedure outlined is for workers wearing Modified Level C protection (with taped joints between gloves, boots, and suit).

B. Procedure for Decontamination

Station 1: Equipment Drop

Deposit equipment used on the site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Each will be contaminated to a different degree. Segregation at the drop rduces the probability of cross contamination.

Station 2: Outer Garment, Over-Boot and Glove Wash and Rinse

Scrub over-boot and outer gloves and splash outer suit with decon solution or detergent/water solution. Rinse off using copious amounts of water.

Station 3: Over-Boot and Glove Removal

Remove over-boot and gloves. Deposit in storage container.

Station 4: Canister or Mask Change

If worker leaves Exclusion Zone to change canister or mask, this is the last step in the decontamination procedure. Workers canister is exchanged, new outer gloves and decontaminated over boots donned, joints taped and worker returns to duty.

Station 5: Gloves and Outer Garment Removal

Splash suit and inner gloves removed and deposited in separate containers lined with plastic.

Station 6: Face Piece Removal

Face piece is removed. Avoid touching face with fingers. Facepiece is deposited on plastic sheet.

Station 7: Field Wash

Hands and face are thoroughly washed. Shower as soon as possible.

C. Equipment Decontamination

All equipment and vehicles used in the Exclusion Zone shall be thoroughly decontaminated in the Contamination Reduction Zone prior to removal from the site. Personnel performing equipment or vehicle decontamination shall be equipped with appropriate PPE and shall go through the personnel decontamination procedure before entering the Support Zone.

D. Review

All site personnel have read and reviewed the above Plan in detail and are familiar with all its provisions.

Name	Title	Signature	Date
Joe Lewis	PTL & SHSO	Joe Lewis	1/16/92
Rodney Payton	Equip. Operator	Rodney Payton	1/16/92
Bobby Beasley	Worker	Bobby Beasley	1/16/92
Ricky Veal	Worker	Ricky Veal	1/16/92

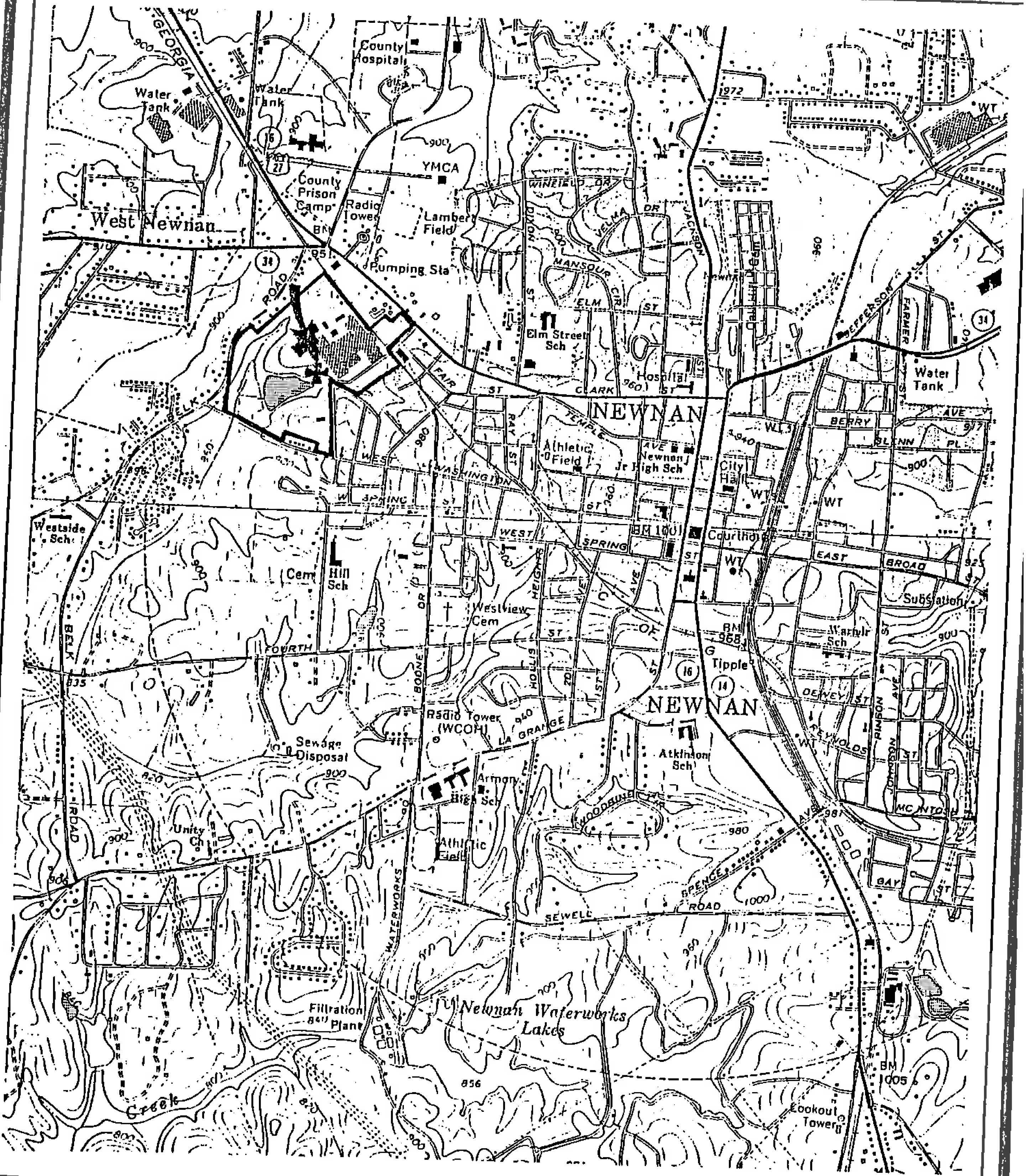


EXHIBIT A

PROJECT LOCATION MAP

EXHIBIT B

TRAINING CERTIFICATES

Special Environmental Services, Inc.

This Certifies that

Ricky Veal

has satisfactorily completed the course study covering

40-HOUR TRAINING FOR HAZARDOUS WASTE SITE HEALTH AND SAFETY

and is therefore entitled to this

CERTIFICATE OF ACHIEVEMENT

12 OCT 1990
Date

James L. Templeton
Course Director

TERRY D. SNELL AND ASSOCIATES
1111 VALERIE WOODS DRIVE
STONE MOUNTAIN, GEORGIA 30083
404/294-8335

December 12, 1991

Leo Harlan
Technical Director
William L Bonnell Company, Inc.
25 Bonnell Street
Newnan, GA 30263

Re: OSHA 8-Hour Refresher Course
Ricky C. Veal

Dear Leo

The purpose of this brief letter is to document that Ricky C. Veal of Jones Sheet Metal, Inc., sucessfully completed the required annual 8-hour refresher training required by 29 CFR 1910.120(e)(8). The refresher course was conducted on December 10, 1991.

If you have any questions, please contact me.

Sincerely

Terry D. Snell

Terry D. Snell, P.E.

cc: Brad Landreau
Ricky C. Veal

Special Environmental Services, Inc.

This Certifies that

Bobby Beasley

has satisfactorily completed the course study covering

40-HOUR TRAINING FOR HAZARDOUS WASTE SITE HEALTH AND SAFETY

and is therefore entitled to this

CERTIFICATE OF ACHIEVEMENT

19 OCT 1990
Date

James L. Templeton
Course Director

TERRY D. SNELL AND ASSOCIATES
1111 VALERIE WOODS DRIVE
STONE MOUNTAIN, GEORGIA 30083
404/294-8335

December 12, 1991

Leo Harlan
Technical Director
William L Bonnell Company, Inc.
25 Bonnell Street
Newnan, GA 30263

Re: OSHA 8-Hour Refresher Course
Bobby Beasley

Dear Leo

The purpose of this brief letter is to document that Bobby Beasley of Payton & Sons Construction Company, Inc., sucessfully completed the required annual 8-hour refresher training required by 29 CFR 1910.120(e)(8). The refresher course was conducted on December 10, 1991.

If you have any questions, please contact me.

Sincerely

Terry D Snell

Terry D. Snell, P.E.

cc: Brad Landreau
Bobby Beasley
Rodney Payton

Special Environmental Services, Inc.

This Certifies that

Rodney Payton

has satisfactorily completed the course study covering

40-HOUR TRAINING FOR HAZARDOUS WASTE SITE HEALTH AND SAFETY

and is therefore entitled to this

CERTIFICATE OF ACHIEVEMENT

12 OCT 1990
Date

James T. Templeton
Course Director

TERRY D. SNELL AND ASSOCIATES
1111 VALERIE WOODS DRIVE
STONE MOUNTAIN, GEORGIA 30083
404/294-8335

December 12, 1991

Leo Harlan
Technical Director
William L Bonnell Company, Inc.
25 Bonnell Street
Newnan, GA 30263

Re: OSHA 8-Hour Refresher Course
Rodney Payton

Dear Leo

The purpose of this brief letter is to document that Rodney Payton of Payton & Sons Construction Company, Inc., sucessfully completed the required annual 8-hour refresher training required by 29 CFR 1910.120(e)(8). The refresher course was conducted on December 10, 1991.

If you have any questions, please contact me.

Sincerely

Terry D Snell

Terry D. Snell, P.E.

cc: Brad Landreau
Rodney Payton

Special Environmental Services, Inc.

This Certifies that

Joe Lewis

has satisfactorily completed the course study covering

40-HOUR TRAINING FOR HAZARDOUS WASTE SITE HEALTH AND SAFETY

and is therefore entitled to this

CERTIFICATE OF ACHIEVEMENT

12 OCT 1990
Date

James L Templeton
Course Director

TERRY D. SNELL AND ASSOCIATES
1111 VALERIE WOODS DRIVE
STONE MOUNTAIN, GEORGIA 30083
404/294-8335

December 12, 1991

Leo Harlan
Technical Director
William L Bonnell Company, Inc.
25 Bonnell Street
Newnan, GA 30263

Re: OSHA 8-Hour Refresher Course
Joseph Z. Lewis

Dear Leo

The purpose of this brief letter is to document that Joseph Z. Lewis of the William L Bonnell Company, Inc., sucessfully completed the required annual 8-hour refresher training required by 29 CFR 1910.120(e)(8). The refresher course was conducted on December 10, 1991.

If you have any questions, please contact me.

Sincerely

Terry D Snell

Terry D. Snell, P.E.

cc: Brad Landreau
Joseph Z. Lewis

EXHIBIT C

ZONE MAP

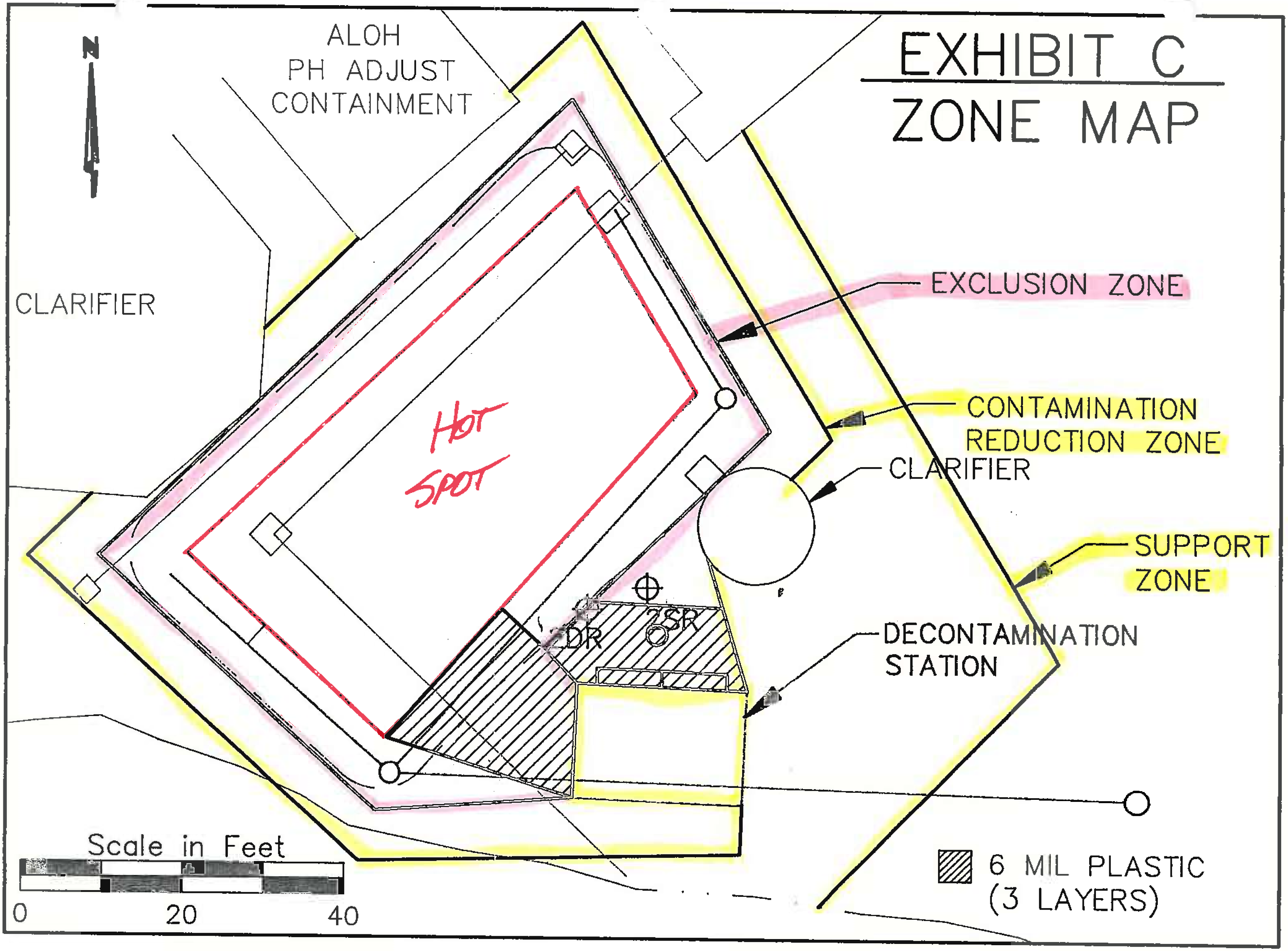


EXHIBIT D

EMERGENCY CONTACTS AND TELEPHONE NUMBERS

Newnan Humana Hospital	Emergency Room	253-1912
Ambulance		253-3221
Police		253-1221
Fire Department		253-1122
Poison Control Center		253-1912
Bonnell Plant Security		Ext. 240
Bonnell Safety Supervisor	O.C. Williams	Ext. 668
Scientific Advisor	T.D. Snell	Ext. 465 294-8335
Project Manager	T.B. Schexnayder	Ext. 611 631-4708

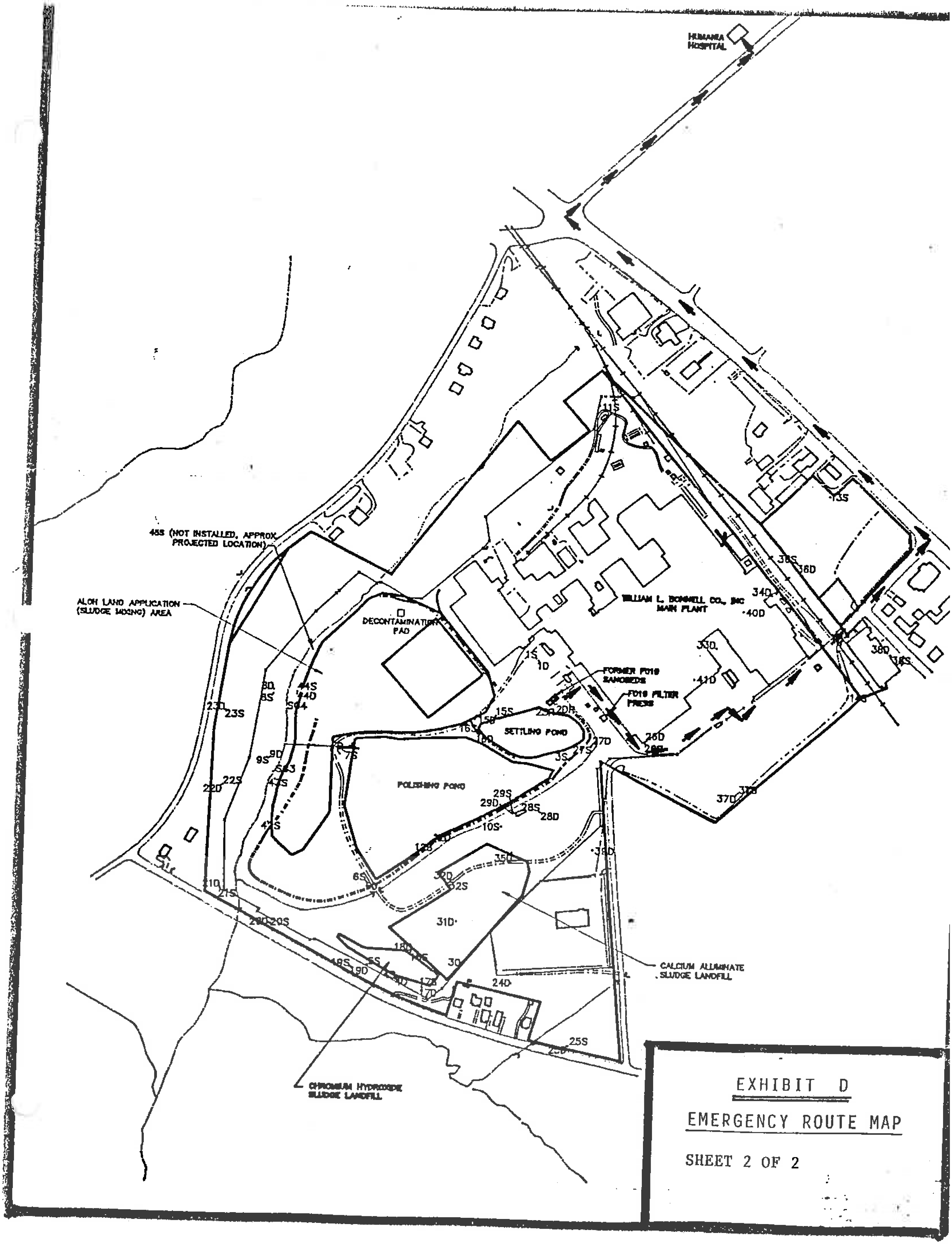


EXHIBIT D

EMERGENCY ROUTE MAP

SHEET 2 OF 2

EXHIBIT E

SAMPLE NUMBER	SAMPLE LOCATION	CONCENTRATION OF TOTAL CHROMIUM
S-60	Bottom	32.7 ppm
S-61	Bottom	35.9 ppm
S-31A	Bottom	63.3 ppm
S-31B	Bottom	91.6 ppm
S-32A	Bottom	152 ppm
S-32B	Bottom	146 ppm

EXHIBIT F

III. IRRITANT FUME PROTOCOL

A. Respirator selection.

Respirators shall be selected as described in section IB above, except that each respirator shall be equipped with high efficiency cartridges.

B. Fit test.

1. The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize him with the characteristic odor of each.
2. The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.
3. The test conductor shall review this protocol with the test subject before testing.
4. The test subject shall perform the conventional positive pressure and negative pressure fit checks. Failure of either check shall be cause to select an alternate respirator.
5. Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.
6. Advise the test subject that the smoke can be irritating to the eyes and instruct him to keep his eyes closed while the test is performed.
7. The test conductor shall direct the stream of irritant smoke from the tube towards the faceseal area of the test subject. He shall begin at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.
8. The following exercises shall be performed while the respirator seal is being challenged by the smoke. Each shall be performed for one minute.
    - i. Normal breathing.
    - ii. Deep breathing. Be certain breaths are deep and regular.
    - iii. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have test subject inhale when his head is at either side.
    - iv. Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his head is in the fully up position.
    - v. Talking--slowly and distinctly, count backwards from 100.
9. If the irritant smoke produces an involuntary reaction (cough) by the test subject, the test

conductor shall stop the test. In this case the tested respirator is rejected and another respirator shall be selected.

10. Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube to determine whether he reacts to the smoke. Failure to evoke a response shall void the fit test.
11. Steps B4, B7, B8 of this protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the irritant smoke.
12. Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL. In other words this protocol may be used to assign protection factors not exceeding ten.

(Approved by the Office of Management and Budget under control number 1218-0092)

(Secs. 4(b)(2), 6(b) and 8(c) of the Occupational Safety and Health Act of 1970 (84 Stat. 1592, 1593, 1599; 29 U.S.C. 653, 655, 657; 5 U.S.C. 553); Secretary of Labor's Order No. 8-76 (41 FR 25059) and 29 CFR Part 1911; secs. 6(b), 8(c) and 8(g) (84 Stat. 1593, 1599, 1600; 29 U.S.C. 655, 657), the Secretary of Labor's Order 8-76 (41 FR 25059) and 29 CFR Part 1911, Ch. XVII of Title 29)

[43 FR 53007, Nov. 14, 1978, as amended at 44 FR 5447, Jan. 26, 1979; 44 FR 14554, Mar. 13, 1979; 45 FR 50338, Aug. 28, 1979; 44 FR 60981, Oct. 23, 1979; 44 FR 68828, Nov. 30, 1979; 45 FR 35283, May 23, 1980; 46 FR 60775, Dec. 11, 1981; 47 FR 51117, Nov. 12, 1982; 48 FR 9641, Mar. 6, 1983; 49 FR 18295, Apr. 30, 1984]

EDITORIAL NOTE: At 49 FR 23175, June 5, 1984, the administrative stay of § 1910.1025(e)(3)(ii)(B) and (E), partially stayed at 47 FR 54433, Dec. 3, 1982, was vacated, effective June 1, 1984. For compliance provisions, see 49 FR 23175, June 5, 1984.

RESPIRATOR FIT TEST CERTIFICATION

Employee Name BEASLEY, ROBERT M.

Social Security Number 257-94-8863

Date 1/16/92

Type of Respirator HALF FACE AIR PURIFYING (NORTH)
7700 SERIES —

Manufacturer NORTH

Model Number 7700 SERIES

Size MEDIUM

Cartridge Type NORTH N-7500-8

Test	Pass	Fail
1. Normal Breathing	✓	
2. Deep Breathing	✓	
3. Turning Head Side to Side	✓	
4. Nodding Head Up and Down	✓	
5. Talking	✓	

Employee Signature Robert M. Beasley

Test Administrator O.C. Williams
O.C. Williams,
Plant Safety Supervisor

Witness

RESPIRATOR FIT TEST CERTIFICATION

Employee Name LEWIS, JOSEPH Z.

Social Security Number 255-72-1934

Date 1-16-92

Type of Respirator HALF FACE AIR PURIFYING-NORTH

Manufacturer NORTH

Model Number 7700 SERIES

Size MEDIUM

Cartridge Type NORTH N-7500-8

Test	Pass	Fail
1. Normal Breathing	✓	
2. Deep Breathing	✓	
3. Turning Head Side to Side	✓	
4. Nodding Head Up and Down	✓	
5. Talking	✓	

Employee Signature Joseph Z. Lewis Jr.

Test Administrator O.C. Williams, Jr.

O.C. Williams,
Plant Safety Supervisor

Witness

RESPIRATOR FIT TEST CERTIFICATION

Employee Name PAYTON, JAMES R.

Social Security Number 253-21-3380

Date 1/16/92

Type of Respirator HALF FACE AIR PURIFYING

Manufacturer NORTH

Model Number 7700 SERIES

Size SMALL

Cartridge Type NORTH N-7500-8

Test	Pass	Fail
1. Normal Breathing	✓	
2. Deep Breathing	✓	
3. Turning Head Side to Side	✓	
4. Nodding Head Up and Down	✓	
5. Talking	✓	

Employee Signature x J. Rodney Payton

Test Administrator O.C. Williams
O.C. Williams,
Plant Safety Supervisor

Witness

APPENDIX B

AIR QUALITY MONITORING RESULTS

CLAYTON ENVIRONMENTAL CONSULTANTS, INC.
22345 Roethel Drive Novi, Michigan 48375

Mr. O. C. Williams, Jr.
Safety Director
THE WILLIAM L. BONNELL COMPANY, INC.
P.O. Box 428
Newnan, GA 30264

Date Reported: 11-FEB-92
Date Received: 5-FEB-92
Clayton Project No. 78273-17
P.O. No. NP 41510
Client Job No. A013

Dear Mr. Williams:

The following is our report on the sample submitted for analysis.

Lab Number	Sample Description	Chromium (mg)
949184	#1 CROH SANDBED CLOSURE	<0.001

Limit of Detection: 0.001 mg
Analytical Method (NIOSH): 7300 (modified)

Please note that samples (where appropriate) will be retained for 30 days after report date.

We appreciate the opportunity to be of assistance to you. Please call our Client Services Department at (313) 344-2650 or me if you have any questions.

Daryl Strandbergh
Manager, Laboratory Services

APPENDIX C

CONSTRUCTION FIELD NOTES

- Air Monitoring Log -

✓ Jan. 26, 1992 - Unit Placed On Bobby Beasley At 11:45 Am Today. Removed At 6:15 pm.

Jan. 27, 1992 - Unit Placed On Bobby Beasley At 8:10 Am Today. Removed At 10:00 Am Due To Industrial Hygienist Needing Unit To Instruct O.C. Williams On Calibration.

Signed - Joe Collins 3/9/92 PR/SHSO

Jan. 25, 1992

On Site At 7:00 am This Morning. First Moved Decon Pad Back A Few Feet To Level Area For Pad And Remove 20' Section Of Uncontaminated Pipe. Rolloff Container Arrived At About 7:45 am. Placed 3 Layers Of 6 Mil Plastic Under Container. Got Decon Pad In Place And Leveled At About 4:00 pm. Had One Tire On Payton Tractor Go Down And Had To Locate Air Source To Pump It Up. Got All Cross Ties In Decon Pad At About 4:30. We Then Excavated Hole For Decon Pad Holding Tank. Got It Set, Hooked Up To Header And Header To Pad And Covered At About 6:00 pm. Called It A Day.

Signed - Joe Lewis PTR/SHSO

JAN. 26, 1992

STARTED WORK AT ABOUT 7:00 AM THIS MORNING. INSTALLED BULLETIN BOARD AND POSTED EMERGENCY ROUTE AND EMERGENCY NUMBERS. SET UP DECON TABLE AND COVERED AREA WITH FOUR LAYERS OF 6 MIL PLASTIC. ALSO COVERED TABLE WITH ABOUT SAME. PUT COPY OF EMERGENCY ROUTE AND EMERGENCY NUMBERS IN DESIGNATED EMERGENCY VEHICLE WHICH DOES HAVE CELLULAR PHONE. ERECTED ZONE DESIGNATION TAPE. RED FOR EXCLUSION ZONE AND YELLOW FOR CONTAMINATION REDUCTION ZONE. GOT PRESSURE WASHER ON SITE AND CUTTING TORCH. HAD TO GET MECHANIC TO START PRESSURE WASHER. HAD SAFETY MEETING WHEN ALL EQUIP. WAS IN PLACE. DRESSED OUT IN CLASS C GEAR PER SITE SAFETY PLAN. BOBBY BEASLEY WAS EQUIPPED WITH AIR MONITOR AT 11:45 AM. IT WAS CALIBRATED PRIOR TO SHIPMENT FROM ATLANTA PER O.C. WILLIAMS. BEGAN ACTUAL WORK AT ABOUT 12:00 NOON. EXCAVATED AROUND STANDPIPE APPROX. 24". CUT WITH TORCH BELOW GRADE. MOVED TRACK LOADER WHICH WILL BE OFF SITE VEHICLE TO EDGE OF EXCLUSION ZONE. LOADED STANDPIPE INTO BUCKET AND MOVED TO DECON PAD WHERE WE TRIPLE RINSED. NOT SURE WHETHER PIPE IS CONSIDERED CONTAMINATED OR NOT SO PUT DOUBLE LAYER OF PLASTIC DOWN AND PLACED STANDPIPE ON IT. BEGAN EXCAVATING CONTAMINATED PIPE BETWEEN BASINS. FIRST MAJOR TASK WAS GETTING DEEP BASIN EXCAVATED. PROVED TO BE A MAJOR TASK TO GET IT OUT OF THE HOLE. MANAGED TO DO THAT IN ONE PIECE BUT IT WAS 48" X 48" X 84" AND PROVED TO BE TOO MUCH WEIGHT FOR THE TRACK LOADER AND PROBABLY TOO BIG OF A CHUNK TO PUT IN ROLLOFF SO WE DECIDED TO WORK AROUND IT AND BUST IT IN PIECES LATER. MOVED ON TO EXCAVATING

JAN. 26, 1992 (CONT'D.)

PIPE BETWEEN BASINS. LEO HARLAN VISITED SITE BUT STAYED IN SUPPORT ZONE. HOPED THE SECOND BASIN WOULD BE SMALLER AND IT WAS BUT NOT MUCH. AS WE WERE TRYING TO GET IT OUT OF THE HOLE WE BLEW A HYDRAULIC LINE ON THE BACKHOE. THIS PUT US COMPLETELY OUT OF BUSINESS. CALLED AROUND TO AUTO PARTS STORES BUT NONE OPEN. THEN I DECIDED TO CHECK WITH OUR MAINT. DEPT. THEY WERE ABLE TO MAKE UP A LINE FOR US. WE GOT THE BACKHOE BACK IN OPERATION AT ABOUT 4:30. WE WILL NOT MAKE THE PROGRESS WE HAD HOPED TO BUT PLAN TO AT LEAST GET THE BASIN OUT OF THE GROUND AND THE REST OF THE PIPE. MANAGED TO ACCOMPLISH THAT. GOT ALL PIPE CUT UP AND IN ROLLOFF. DECONED TORCH HOSE SINCE I HOPE WE ARE THROUGH WITH IT. CALLED IT A DAY AT ABOUT 6:30 PM.

REMOVED AIR MONITOR FROM BOBBY BEASLEY AT ABOUT 6:15 PM.

SIGNED - JOE LEWIS PTR/SHSO

JAN 27, 1992

STARTED WORK AT ABOUT 7:00 AM THIS MORNING. HAD TO GET HOE RAM ON SITE TO BUST UP BASINS. HAD TO MODIFY PLANT AIR HOOKUP FOR AIR SUPPLY. HAD SAFETY MEETING AND THEN WE SUITED UP. PLACED AIR MONITOR UNIT ON BOBBY BEASLEY AT 8:10 AM TODAY. CLASS "C" GEAR UTILIZED FOR PERSONS ON SITE AGAIN TODAY. BASINS BROKE UP EASILY. USED TRACK LOADER TO TRANSPORT CONCRETE TO ROLLOFF. TERRY SNELL VISITED SITE. DISCUSSED STANDPIPE WE REMOVED YESTERDAY. SINCE IT WAS ABOVE GROUND AND TRIPLE RINSED WHEN REMOVED IT WAS DEEMED UNCONTAMINATED MATERIAL. REMOVED HOE RAM FROM BACKHOE AND TRIPLE RINSED IT AND HOSE. ALSO TRIPLE RINSED BUCKET ON TRACK LOADER. 3 YARDS OF 5000# HIGH EARLY CONCRETE ORDERED BY TOM SCHEXNAYDER TO FILL IN STAND PIPE HOLE. INDUSTRIAL HYGIENIST ARRIVED TO INSTRUCT O.C. WILLIAMS AND I ON CALIBRATION OF AIR MONITOR SO I REMOVED UNIT FROM BOBBY BEASLEY AT 10:00 AM TO GO TO O.C. WILLIAMS' OFFICE FOR INSTRUCTION. AS I WAS STARTING IN THAT DIRECTION IT STARTED SPRINKLING AND TOM SCHEXNAYDER SUGGESTED I STAY WITH THE CREW AND START TAMPING AND FILLING TRENCHES. AS FATE WOULD HAVE IT THE TAMP OF PAYTONS WOULD NOT CRANK. I THEN RUSHED TO COWETA EQUIP. RENTAL AND RENTED A COUPLE OF TAMPS TO SPEED UP THE PROCESS. AS WE WERE GETTING THEM MOBILIZED THE CONCRETE TRUCK SHOWED UP AND I HAD TO DIRECT HIM AROUND THE CAKE. WE BACKED HIM UP ON THE DECON PAD AND TRANSPORTED CONCRETE TO STANDPIPE FROM TRUCK VIA PAYTONS FRONT BUCKET. WAS WATER IN HOLE AND WAS FORCED OUT BY CONCRETE WHEN POURED IN HOLE. WHEN WE EMPTIED TRUCK WE PRESSURE

JAN. 27, 1992 (CONT'D)

WASHED TIRES THREE RINSES EVEN THOUGH THE DECON PAD IS CONSIDERED UNCONTAMINATED. GOT BACK TO FILLING IN TRENCHES AND TAMPING. BEGAN SPRINKLING HARDER AND WE FEARED IT MAY BEGIN RAINING. WE USED THE TRACK LOADER TO BRING CLAY TO THE SITE AND THEN USED BOTH TRACTORS TO FILL IN TRENCHES AND COMPACT AS MUCH AS FEASIBLE WITH THE WEIGHT OF THE TRACTORS. WHEN WE FINISHED FILLING UP TRENCHES PULLED THE TRACK LOADER BACK TO DECON AND HAD DECONTAMINATED. PAYTON DRESSED UP THE SITE WITH THE BACKHOE AND THEN PULLED IT TO THE DECON PAD WHERE WE DECONTAMINATED IT. DECONED OURSELVES AND WENT TO CLAY STOCKPILE AND RECOVERED WITH PLASTIC. DECONED ALL TOOLS AND EQUIP. TO BE TURNED IN TO STOCKROOM AND ALL PAYTONS EQUIP. CARRIED EVERYTHING WE ARE NOT PUTTING IN GANG BOX TO IT'S PROPER PLACE, SECURED COVER ON ROLL-OFF CONTAINER TO SEAL AGAINST RAIN. DECONED TWO STEEL PLATES WHICH WERE ON BASINS. THEY WILL BE IDEAL TO USE TO SPAN TRENCHES FOR EQUIPMENT ACCESS ON SITE. ONCE SITE WAS SECURE, PICKED UP RENTED TAMPERS AND RETURNED THEM TO COWETA EQUIP. RENTAL. ACTIVITIES ON SITE WILL CEASE UNTIL WEATHER PERMITS RESUMATION OF ACTIVITIES.

SIGNED- JOE LEWIS PTC/SHSO

Feb. 10, 1992

Mobilized At About 7:00 Am This Morn. Had Rodney Go Over To Coweta Equip. Rental And Pick Vibratory Tamper Up. Our First Assignment For Today Is To Try To Compact Soil On The Site To Allow Proper Compaction Percentages For Clay And Topsoil Layers. Had Safety Meeting And Suited Up In Class "C" Gear With The Exception Of Dust Mask. Results From Air Monitoring Indicate Airborne Chrome Contaminates Virtually NonExistent. Compacted Area For Quite Awhile And Then Had Engineer Tom Schornmyder Inspect. He Felt We Were Not Getting The Compaction We Desired So We Brought The Track Loader On Site And Scarified The Surface And Mixed Lime With Soil. And Scarified The Surface Again And Then Tamped Again. Deconed The Track Loader When We Finished With It. Leo Harlan And Tom Schornmyder Visited The Site Today. Shut Down At About 4:00 pm Today.

Signed - Joe Lewis PTR/SHSO

Feb. 11, 1992

Mobilized At About 7:00 AM This Morning. Had Safety Meeting. Will Suit Up In Class "C" With Exception Of Dust Mask Until Clay Cover Is In Place. Checked Compaction With Soil Probe And Equip. Tires. Still Pumping Some So Decided To Excavate Trench Approx. 30" Dia X 15' Long And Fill With 6" Lifts Tamping With Vibratory Tamper. After This Operation We Checked Compaction Again And It Was No Better. Discussed With Tom Schernayder And He Suggested We Go Ahead And Start Putting Clay In Place. We Deconed Backhoe And Vibratory Tamper And Began Bringing Clay In. Will Work Clay Out From Site Entrance In Front Of Backhoe To Prevent Re-Contamination. Holding Tank For Decon Pad Filled Up. Will Pump Down Into Clarifier As Soon As Clarifier Is Decanted Because It Is Full. Winston Elston With ATEC Visited Site To Check Compaction And Make Moisture Content Tests. Two Tests Were Made On First 6" Lift Of Clay And We Got 94% And 99%. Minimum Required Was 92%. Tom Wanted Safety Margin So We Are Modifying Track Loader To Pull Rosser's Sheepsfoot Drum And We Will Compact With That As Well. We Decided To Go Ahead And Work Late And Get Second 6" Lift Of Clay In Place And Compacted. We Are Running Short On Clay So Tom Schernayder Ordered Another 100 Yards And It Will Be Here At 8:30 Tomorrow Morning. Winston With ATEC Will Be Back Tomorrow At About 10:00 A.M. Terry Snell Visited Site This Afternoon.

Signed - Joe Lewis PTR / SHSO

FEB. 12, 1992

MOBILIZED AT ABOUT 7:00 AM THIS MORN. SINCE WE HAVE NOW COMPLETED HAZARDOUS STAGE OF JOB, I FEEL TYVEKS, RUBBER BOOTS, AND RUBBER GLOVES ARE NO LONGER REQUIRED. COVERED THIS IN OUR SAFETY MEETING. WE BEGAN BRINGING UP GRADE IN 3" TO 5" LIFTS. ADDITIONAL CLAY WAS ON SITE BY 10:00 AM THIS MORNING. TOM SCHERNAYDER SPENT MOST OF THE DAY ON SITE. HE REQUESTED WE USE SHEEPS FOOT COMPACTOR DRUM TO INSURE COMPACTION ON SITE SO WE INITIATED THAT OPERATION. CONTINUED RUNNING TRACK LOADER ON SITE AND VIBRATORY COMPACTING OPERATIONS AS WELL FOR MAXIMUM COMPACTION. WINSTON ELSTON WITH ATEC WAS ON SITE AGAIN FOR COMPACTION AND MOISTURE CONTENT TESTS. FIVE TESTS WERE PERFORMED AND THE RESULTS WERE 99%, 96%, 100%, 97%, & 96% RESP. SHEEPS FOOT DRUM SEEMED TO DO MORE HARM THAN GOOD TO SITE AND COMPACTION TESTS WERE ADEQUATE SO WE DISCONTINUED USE OF SHEEPS FOOT. TERRY SNELL VISITED SITE THIS AFTERNOON. TOM SCHERNAYDER REQUESTED WE WORK TILL DARK THIS AFTERNOON TO TRY AND GET AS FAR ALONG AS POSSIBLE DUE TO FORECAST OF RAIN TOMORROW. WE WORKED TILL ABOUT 8:00 AM AND MANAGED TO GET ENTIRE SITE TO WITHIN +/- 2" OF FINISHED CLAY GRADE. BORDER SLOPES AND FINAL DRESSUP OF SITE REMAINS TO BE DONE.

SIGNED - JOE LEWIS PM/SHSO

Feb. 20, 1992

Mobilized At About 7:00 AM This Morn. Am Going To Have To Break Away And Develop Wells Today, And Leo Harrean Is Going To Stand In For Me Since Tom Schermayder Is Out Of Town And Terry Sheel Is Not Available. Briefed Leo On Our Status And He Took Over. Assisted Him In Setting Stakes For Cover Boundaries. Began Dressing Up Edge 2TO1 Slopes. Had Conweth Equip. Rental Deliver Small Terramite Backhoe And Vibratory Roller For Upcoming Site Work. Was Able To Get Cover Compacted And Edges Finished Up And Began Trenching For Drains, Got North Trench Installed.

Signed - Joe Lewis - PTR/SHSO

FEB. 21, 1992

MOBILIZED AT ABOUT 7:00 AM. BEGAN WORKING ON EAST SIDE TRENCH. HAD TO BREAK AWAY, TO DEVELOP WELLS AGAIN TODAY SO I BASICALLY GOT RODNEY'S CREW MOBILIZED AND BROKE AWAY. TERRY SNELL WAS ON SITE BETWEEN 8:30 & 9:00 AM. BRIEFED HIM ON OUR PROGRESS AND WE DOUBLE CHECKED SOME ELEVATIONS. WE FOUND OUR SLOPE FROM ONE END OF COVER TO OTHER END TO BE 9% AND SPECS. CALL FOR A MAXIMUM OF 8% SO WE SHAVED OFF SOME ELEVATION FROM HIGH POINT AND RECOMPACTED TO ATTAIN 8%. WORKED ON ARMOR TRENCH AND REMAINDER OF TRENCHES. ENCOUNTERED A LOT OF HAND WORK WITH TRENCHES SO HAD PAYTON BRING ONE MORE MAN IN.

SIGNED- JOE LEWIS PTL/SHSO

FEB. 22, 1992

MOBILIZED AT ABOUT 7:00 AM THIS MORN. USED ADDITIONAL MAN ON PALMANS CREW AGAIN. HAND DRESSED ENTIRE SITE TO FILL IN DEPRESSIONS. CLAY WAS PRETTY DRY, SO WE SPRAYED WITH WATER BEFORE COMPACTING AND THIS PROVED TO BE A BAD IDEA BECAUSE CLAY ROLLED UP AND STUCK TO ROLLERS ON COMPACTOR. DISCONTINUED USE OF WATER AND DRY COMPACTED INSTEAD. CHECKED SITE FOR STONES AND STICKS. HAD SOME WATER RUN INTO TRENCHES LAST NIGHT AND WE HAD TO SHOVEL MUCK OUT OF THEM AND INSTALL NEW SOIL AND RECOMPACT. MOVED 40 MIL HDPE MEMBRANE ONTO SITE WHEN WE GOT ALL SOIL WORK COMPLETE. HAD TO USE GALLION CRANE SINCE BUNDLE WAS SO HEAVY. ED HARLAN AND TERRY SNELL SHOWED UP AND ASSISTED US IN UNFOLDING THE BUNDLE. WAS BULKY AND HARD TO HANDLE. SINCE IT WAS IN ONE SHEET. WHEN WE GOT IT SPREAD OUT AND IN PLACE WE THEN BEGAN TO PLACE GEONET. USED NYLON TIES TO TIE TOGETHER. WHEN WE GOT THE GEONET IN PLACE WE THEN INSTALLED DRAIN PIPES IN TRENCHES AND PLACED ENOUGH GRAVEL IN STRATEGIC PLACES TO HOLD EVERYTHING IN PLACE.

SIGNED - JOE LEWIS PTR/SHSO

FEB. 24, 1992

MOBILIZED AT ABOUT 7:00 AM THIS MORN. FINISHED FILLING TRENCHES WITH GRAVEL FIRST THING AND INSTALLING CAPS AND EXTENSIONS ON CLEANOUTS ON DRAIN PIPE. WE THEN PLACED GEO FABRIC OVER ENTIRE SITE. TERRY SNELL, TOM SCHENWALDER, AND LEO HARLAN SHOWED UP AND SAID DUE TO WETNESS OF TOPSOIL FROM RAIN YESTERDAY MORNING, AND A FORECAST OF MORE RAIN FOR TOMORROW THEY FELT WE SHOULD HOLD OFF ON INSTALLING GEOFABRIC SO WE ROLLED IT BACK UP AND BEGAN DISMANTLING OUR DECON PAD AND TRUCKWASHING THE CROSSTIES AND TRANSPORTING THEM TO OUR STORAGE SITE. I HAD TO BREAK AWAY AND ASSIST ASI IN SAMPLING MONITORING WELLS THE REMAINDER OF THE DAY.

SIGNED - JESSE LEWIS PTR/SHSO

FEB. 25, 1992

MOBILIZED AT 7:00 AM THIS MORNING. WAS LIGHT RAIN SO PARTED CONTINUED REMOVING CROSS TIES FROM DECON PAD AND TRIPLE RINSING THEM. WAS GOING TO TRANSPORT MUD FROM PAD TO BRANTLINE ROLLOFF CONTAINER BUT RAIN INCREASED SO WORK WAS DISCONTINUED FOR THE DAY AT ABOUT 9:30 AM. I HAD TO BREAK AWAY ANYWAY AND ASSIST ASI WITH SAMPLING MONITORING WELLS.

SIGNED- JOE CEWIS PTC/SHSO

FEB. 28, 1992

PAYTON CONSTRUCTION MOBILIZED AT ABOUT 7:00 AM THIS MORN. I HAD TO SAMPLE INTERIM STATUS WELLS SO I WAS UNAVAILABLE TO ASSIST THEM TODAY. THEY FINISHED REMOVING CROSS TIES FROM DECON PAN, DECONNING THEM AND PLACING IN STORAGE. THEY THEN DISCONNECTED HEADER FROM STORAGE TANK AND DECON PAN AFTER PUMPING WATER FROM TANK TO PAINTLINE CLARIFIER. PAN WAS SLID TO A LOCATION OFFSITE FOR TEMPORARY STORAGE UNTIL IT CAN BE TRANSPORTED TO PERMANENT STORAGE SITE. ANCHOR BARS ALONG SETTLING POND BANK HAMPERED OUR ABILITY TO MOVE PAN SO THEY WERE EXCAVATED.

SIGNED - JOE COZENS PTC / SHSO

FEB. 29, 1992

MOBILIZED AT 7:00 AM THIS MORNING. I HAVE BEEN TRANSFERRED TO CAD/CAM DEPT. AND AM SUPPOSED TO DISCONTINUE PARTICIPATION IN THIS CLOSURE BUT RALPH UNDERWOOD REQUESTED I HELP OUT TODAY SO I DID. WE HAD FOUR PEOPLE WORKING, TWO DRIVING DUMP TRUCKS, ONE OPERATING FRONT END LOADER AT TOPSOIL STOCKPILE AND ONE OPERATING BACKHOE SPREADING TOPSOIL AT CLOSURE SITE. WE FIRST SPREAD FINAL LAYER OF GEOFABRIC OVER GEONET. RODNEY HAD TO WORK SOME TOPSOIL ON SITE WHERE LEACH PAN WAS SITTING TO PROVIDE SUITABLE ACCESS TO CLOSURE SITE. HE THEN BEGAN PLACING TOPSOIL ON CLOSURE SITE SPREADING A GENEROUS LAYER IN FRONT OF HIM AS HE WORKED HIS WAY ONTO THE SITE. WE ENDED UP WITH APPROX. 4" LAYER AFTER COMPACTION FOR FIRST LAYER. WE COMPACTED WITH VIBRATORY ROLLER. WE THEN WORKED SECOND LAYER AND THEN COMPACTED AGAIN. OBSERVED TRACTOR RUNNING OVER COVER AFTER COMPACTION AND THERE WAS SOME PUMPING WHICH INDICATES WE MAY NOT BE GETTING 92% COMPACTION. WE WILL COMPACT AS WELL AS WE CAN AND HOPE FOR SUITABLE RESULTS. WORKED 8 HOURS.

SIGNED - JOE LEWIS PTL/SHSO

MARCH 2, 1992

PAYTON MOBILIZED AT 7:00 AM THIS MORN. I REPORTED TO CAD/CAM AND REQUESTED A VISIT WITH REIGH UNDERWOOD TO GIVE HIM ELEVATIONS ON THE CLOSURE. HE EXPRESSED THE NEED FOR MY ASSISTANCE ON FINALIZING THIS CLOSURE AND I SUGGESTED HE CALL DENNIS HERRON AND EXPRESS THIS NEED TO HIM. HE DID SO AND MR. HERRON AGREED TO LET ME WORK A LITTLE LONGER TO TRY AND FINISH THIS CLOSURE. GOT PAYTON CONST. ORIENTED ON DESIRED ELEVATIONS AND THEN HAD TO RUN TO ATLANTA TO DELIVER INTERIM STATUS WATER SAMPLES TO ASI. CHECKED IN ON PAYTON WHEN I GOT BACK AND THEY SEEM PRETTY CLOSE TO GRADE. THE EDGES HAVE NOT BEEN DRESSED UP ANY YET. WORKED 8 HOURS TODAY SPREADING SOIL & COMPACTING.

SIGNED - JOE LEWIS PTL/SHSO

MARCH 3, 1992

MOBILIZED AT 7:00 AM THIS MORN. SET UP TRANSIT AND SET GRADE LINES (STRINGS). WORKED ELEVATIONS TO STRINGS AND THEN COMPACTED WITH VIBRATORY ROLLER. DRESSED UP SLOPES AND REMOVED ROCKS FROM SITE. ATEC WAS CALLED TO COME IN AND DO COMPACTION TESTS. WE UNDERSTAND PROCTOR TESTS HAVE ALREADY BEEN PERFORMED ON TOPSOIL. WE PASSED WITH FLYING COLORS WITH 97% COMPACTION. TERRY SWELL WAS ON SITE TODAY TO OBSERVE AND COMMENT ON PROGRESS. WE ARE NOW AT GRADE WITH COMPACTED TOPSOIL. WE DUG TRENCH TO TEMPORARILY BURY ROLLED UP PORTION OF HDPE WHICH WILL LATER TIE INTO SETTLING POND CLOSURE. WE PUT A LAYER OF HDPE OVER ROLL BEFORE COVERING WITH SOIL FOR PROTECTION. TERRY SWELL THOUGHT SITE LOOKED REAL GOOD.

SIGNED - JOE COLLINS PTR/SHSO

March 4, 1992

Mobilized At 7:00am This Morn. Started Bringing In Final 6" Topsoil Uncompacted Layer. Once Again Set Strings At Final Elevation And Worked From Them. Worked 6" Layer Over Entire Site/Including Slopes. Realized We Needed To Go Ahead And Address The Retaining Wall For The Storm Basin. Reagh Had Suggested Going Ahead And Putting Up Outside Form For Wall And Filling In To It But Terry Steele And I Had Talked Earlier About Using Cross Ties And He Seemed To Think It Would Be A Good Idea So We Talked Reagh Into It And Went Ahead And Got Them In Place. Filled In Soil Around Them And Then Finished Dressing Site And Sewed Fertilizer, Grass Seed, And Hay. Put Water Sprinkler On Site To Promote Growth. Mixture Of Bremuda And Rye Grass Was Sewn. Went To Foley Brogdon And Picked Up 24" X 24" X 30" Basin. Plan To Start Installing It Tomorrow. Had Coweta Equip. Rental Pick Vibratory Roller Up Today. Worked 8 Hours At Site.

Signed - Joe Lewis PTR/SHSO

MARCH 5, 1992

MOBILIZED AT 7:00 A.M. TODAY. WORKED ON TYING DRAIN FIELD AROUND SITE INTO STORM DRAIN. EXCAVATED FOR 24" X 24" X 30" BASIN. NOTCHED OUT FOR HDPE & PIPE ENTRANCE INTO BASIN. HAD APPROX. 9" SLOPE TO STORM DRAIN BASIN WHICH WAS ABOUT 1" DROP IN 10' WHICH IS OKAY. PLACED GEONET AND GRAVEL FROM TIE-IN TO DRAINFIELD TO BASIN. PARSONS BACKHOE QUIT ON US AND WE LOST A COUPLE OF HOURS GETTING IT BACK IN OPERATION. BEGAN RAINING LIGHTLY, IN MID AFTERNOON BUT WE CONTINUED TO WORK UNTIL WE GOT ALL DRAINS TIED IN AND COVERED UP. MINOR DRESSING UP AND PLATE FOR BASIN IS ALL THAT IS REQUIRED TO FINISH JOB UP.

SIGNED - JOE LEWIS PTR/SHSO

MARCH 9, 1992

MOBILIZED AT 7:00 AM THIS MORN. INSTALLED PLATE ON 24" X24" X30" BASIN AND FINISHED FILLING IN TOP-SOIL & DRESSING UP SLOPE. MOVED REMAINDER OF EQUIPMENT OUT OF AREA. CUT CLEANOUTS FLUSH WITH GROUND AND INSTALLED CAPS. PULLED STRING FOR CLOSURE CORNERS AND SET STAKES. ALSO RESET MISSING STAKES FOR 10'X10' GRID FOR SURVEYOR CONVENIENCE. TERRY SNELL & SURVEYOR SONNY MARKLAND VISITED SITE TO DISCUSS SURVEY DOCUMENTATION REQUIREMENTS. TERRY SNELL GAVE FINAL APPROVAL ON CLOSURE PROJECT. GAVE HIM TWO ROLLS OF FILM TAKEN DURING PROJECT WORK FOR PROCESSING.

SIGNED- JOE LEWIS PTL/SHSO

APPENDIX D

SOIL CLASSIFICATION CERTIFICATION

ATEC® Associates, Inc.
1300 Williams Drive, Suite A
Marietta, Georgia 30066-6299
[404] 427-9456, FAX # [404] 427-1907

January 27, 1992

Mr. Tom Schexnayder, P.E.
Tredegar
25 Bonnell Street
Newnan, Georgia 30263

RE: Summary of Laboratory Testing
TREDEGAR FACILITY
Newnan, Georgia
ATEC Project Number 32-13332

Gentlemen:

Please find attached a summary of the requested laboratory testing for evaluation of soils for use at the above referenced site. Seven (7) samples were retrieved from various sites around Newnan, Coweta County, Georgia on two separate occasions for use as general site fills and select clay cap fills during the EPD closure program.

ATEC Associates, Inc. has performed Atterberg Limits tests, (ASTM D423 and D424), sieve analysis w/hydrometer tests (ASTM D421 and D422) and Standard Proctor Moisture Density Relationship tests (ASTM D698) to evaluate the various samples. The following table summaries the laboratory tests. Attached with this letter is the laboratory worksheets for the respective test.

SAMPLE NUMBER	SAMPLE LOCATION	ALTERBERG LIMITS			PERCENT PASSING #200 SIEVE	MAXIMUM DRY DENSITY	UNIFIED SOIL CLASSIFICATION
		LL	PL	PI			
1	**Test Pit Combined**	36	38	NP	43	110.0	SM
2	**Lanier On-Site Stockpile**	36	27	9	37	114.4	SM
3	Tredegar Stockpile	42	42	NP	39	100.8	SM
4	Lanier Off-Site Stockpile	43	44	NP	32	102.2	SM
5	McWaters	71	34	37	70	-	MH
6	Universal #1	96	52	46	75	-	MH
7	Universal #2	57	27	30	64	102.0	CH

Haton

ATEC 32-13332.Ltr

Based on the project requirements, sample number 1 through 3 are classified as silty sands (SM) and are suitable for use as general fills. We understand that the select clayey fills are to be classified as (CL). No samples collected to date have been classified as (CL). Sample #7 is classified as (CH), which most nearly satisfies the select clay requirements.

ATEC Associates, Inc. appreciates the opportunity to provide these laboratory testing services. We look forward to our continued relationship during the construction phase of this project. If we can be of further service, or if you have questions concerning this letter, please call us.

Sincerely,

ATEC Associates, Inc.

H. Craig Robinson

H. Craig Robinson, P.E.
Operations Manager, Engineering Services

HCR:rbc

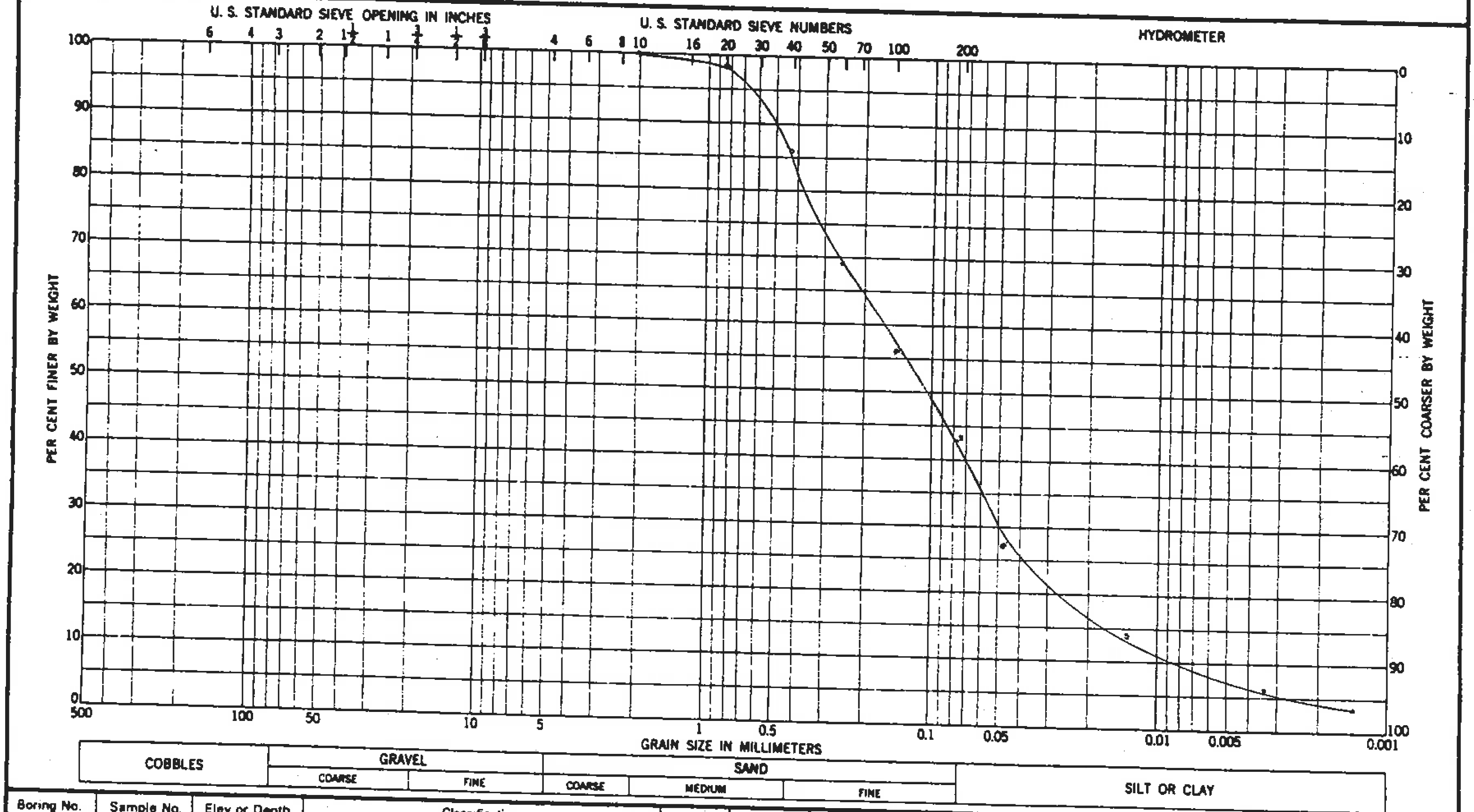
Attachment

Project TREDEGAR

NEWNAN, COWETA COUNTY, GEORGIA

Job No. 32-13332

Date 1/3/92



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	1*	0-8 Ft.	Red brown micaceous silty sand (SM)	12.5	36	38	NP

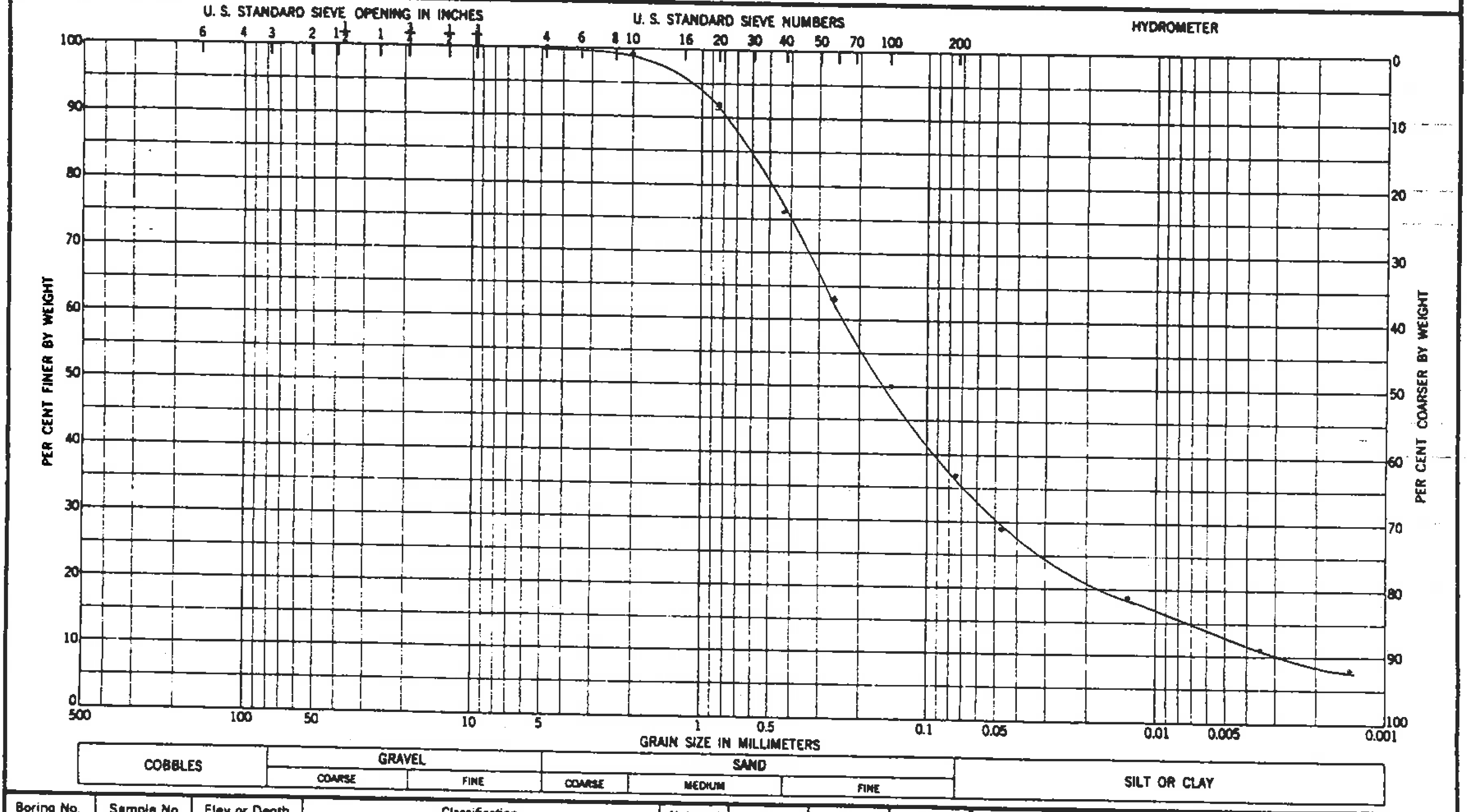
ATEC Associates, Inc.
of Georgia
1190 Hayes Industrial Drive, N.E.
Marietta, Georgia 30062
404-427-9456

GRADATION CURVES

*Test Pit - Lanier Property

Project TREDEGAR Job No. 32-13332

NEWNAN, COWETA COUNTY, GEORGIA Date 1/3/92



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	2*		Orange red-brown micaceous silty sand (SM)		36	27	9

ATEC Associates, Inc.
of Georgia
1190 Hayes Industrial Drive, N.E.
Marietta, Georgia 30062
404-427-9456

GRADATION CURVES

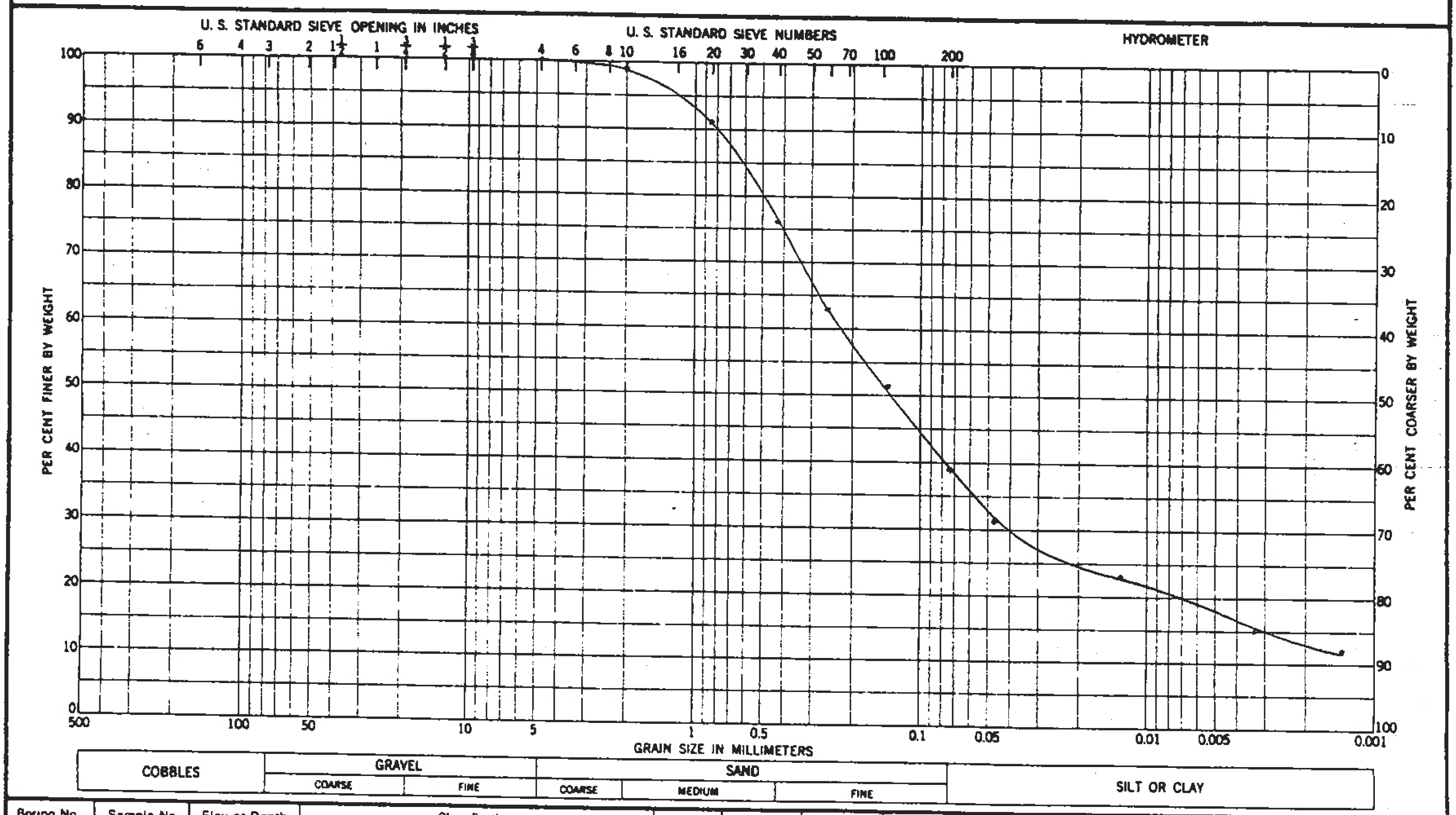
* Horton On-Site Stockpile

Project TREDEGAR

NEWNAN, COWETA COUNTY, GEORGIA

Job No. 32-13332

Date 1/3/92



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	3*		Orange brown silty sand (SM)		42	42	NP

GRADATION CURVES

ATEC Associates, Inc.
of Georgia
1190 Hayes Industrial Drive, N.E.
Marietta, Georgia 30062
404-427-9456

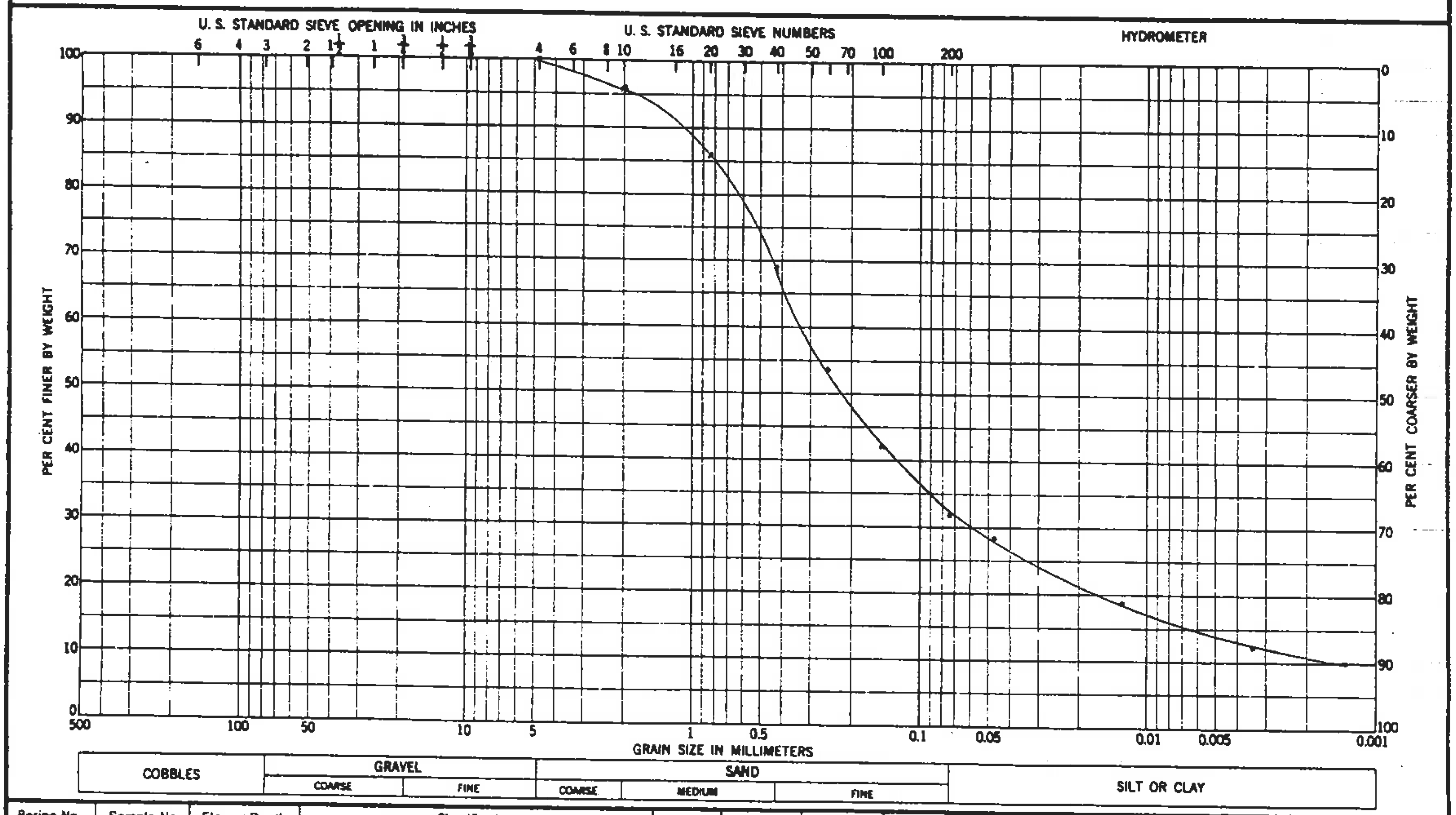
* Horton Off-Site Stockpile

Project TREDEGAR

NEWNAN, COWETA COUNTY, GEORGIA

Job No. 32-13332

Date 1/3/92



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	4*		Grey brown silty sand (SM)		43	44	NP

GRADATION CURVES

ATEC Associates, Inc.
of Georgia
1190 Hayes Industrial Drive, N.E.
Marietta, Georgia 30062
404-427-9456

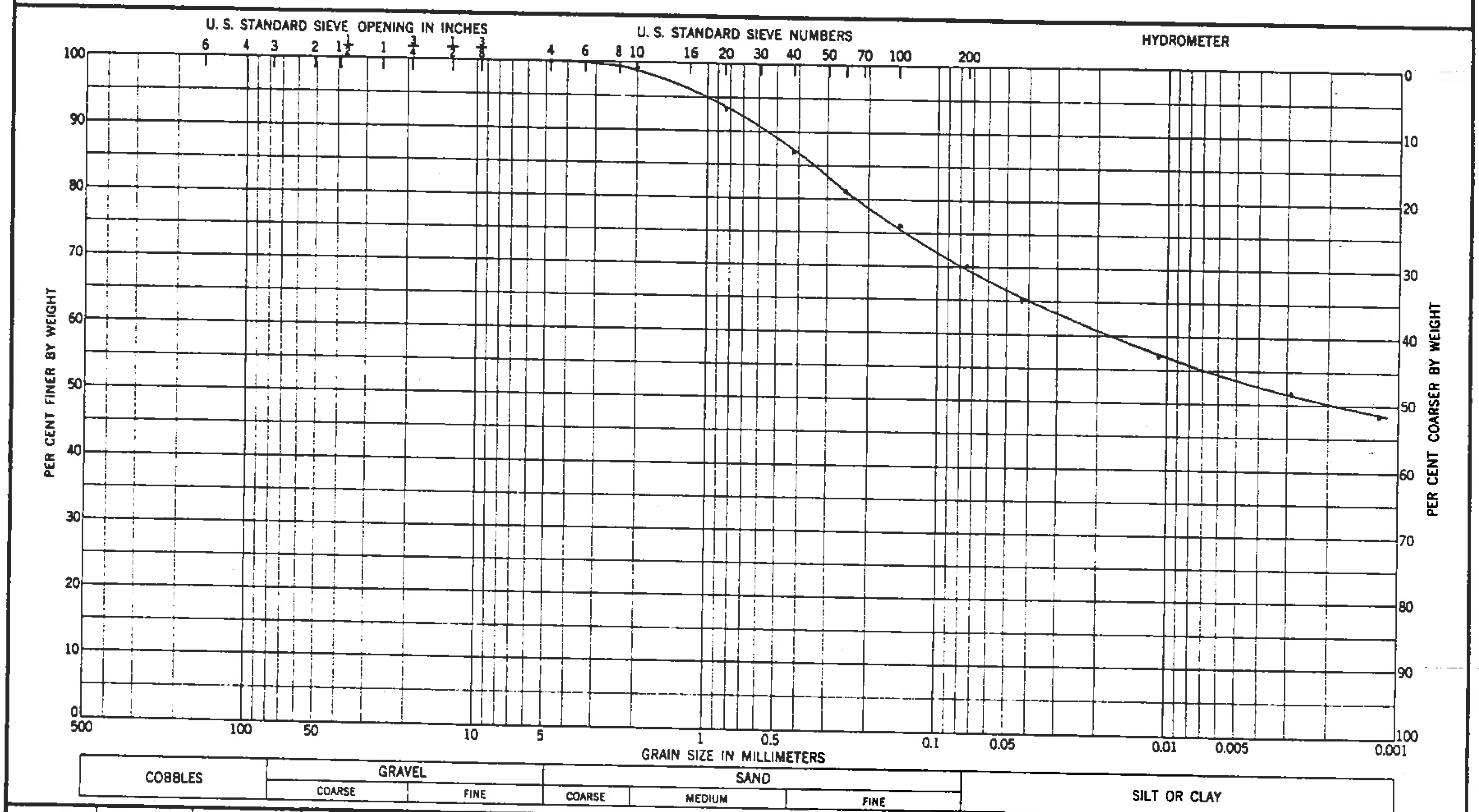
* Lanier Off-Site Stockpile

Project TREDEGAR

NEWNAN, COWETA COUNTY, GEORGIA

Job No. 32-03-91-13332

Date 1/9/92



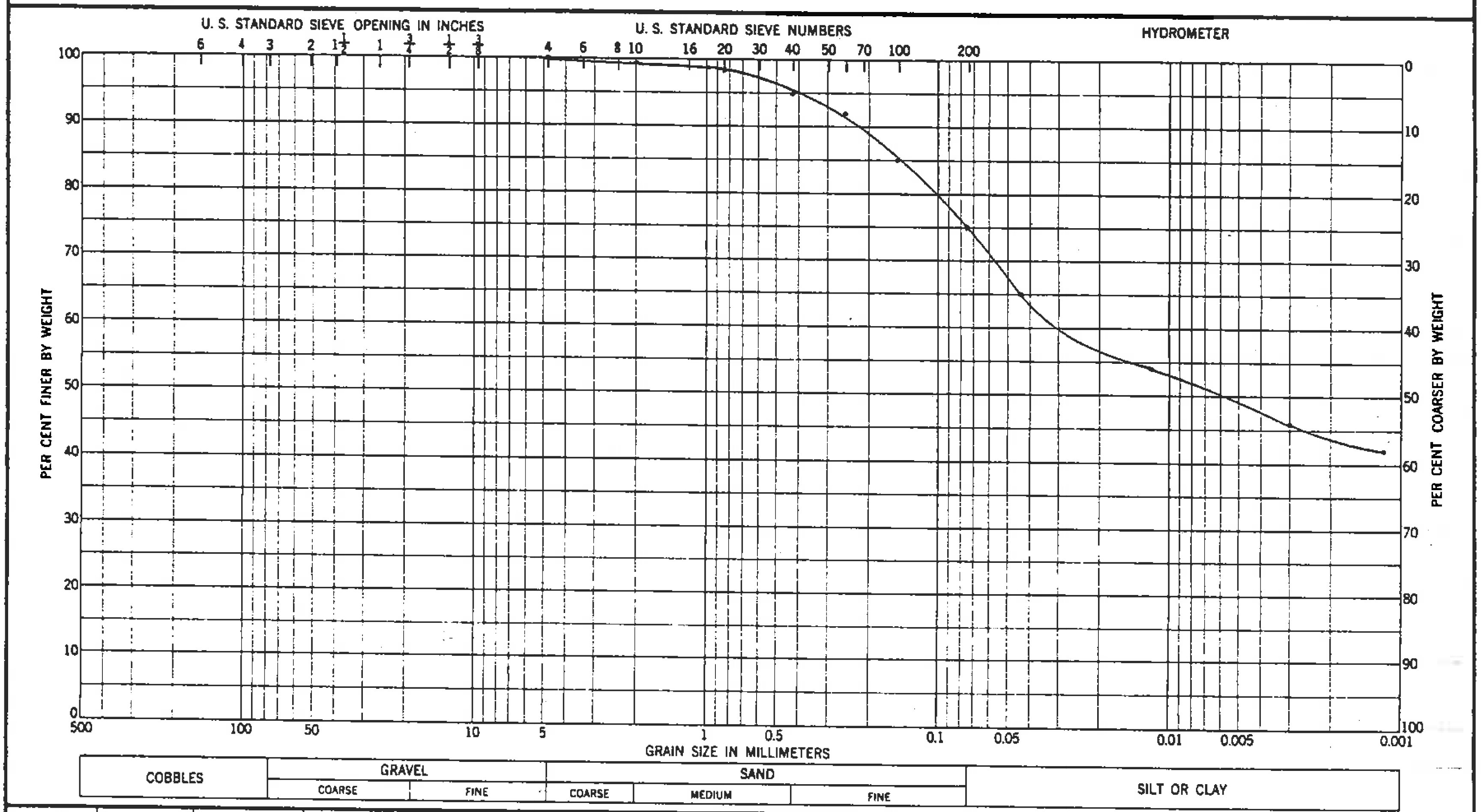
Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	McWaters		Brownish red clayey silt (MH)	18.0	71	34	37

GRADATION CURVES

ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066
404-427-9456

Project TREDEGAR Job No. 32-03-91-13332

NEWNAN, COWETA COUNTY, GEORGIA Date 1/9/92



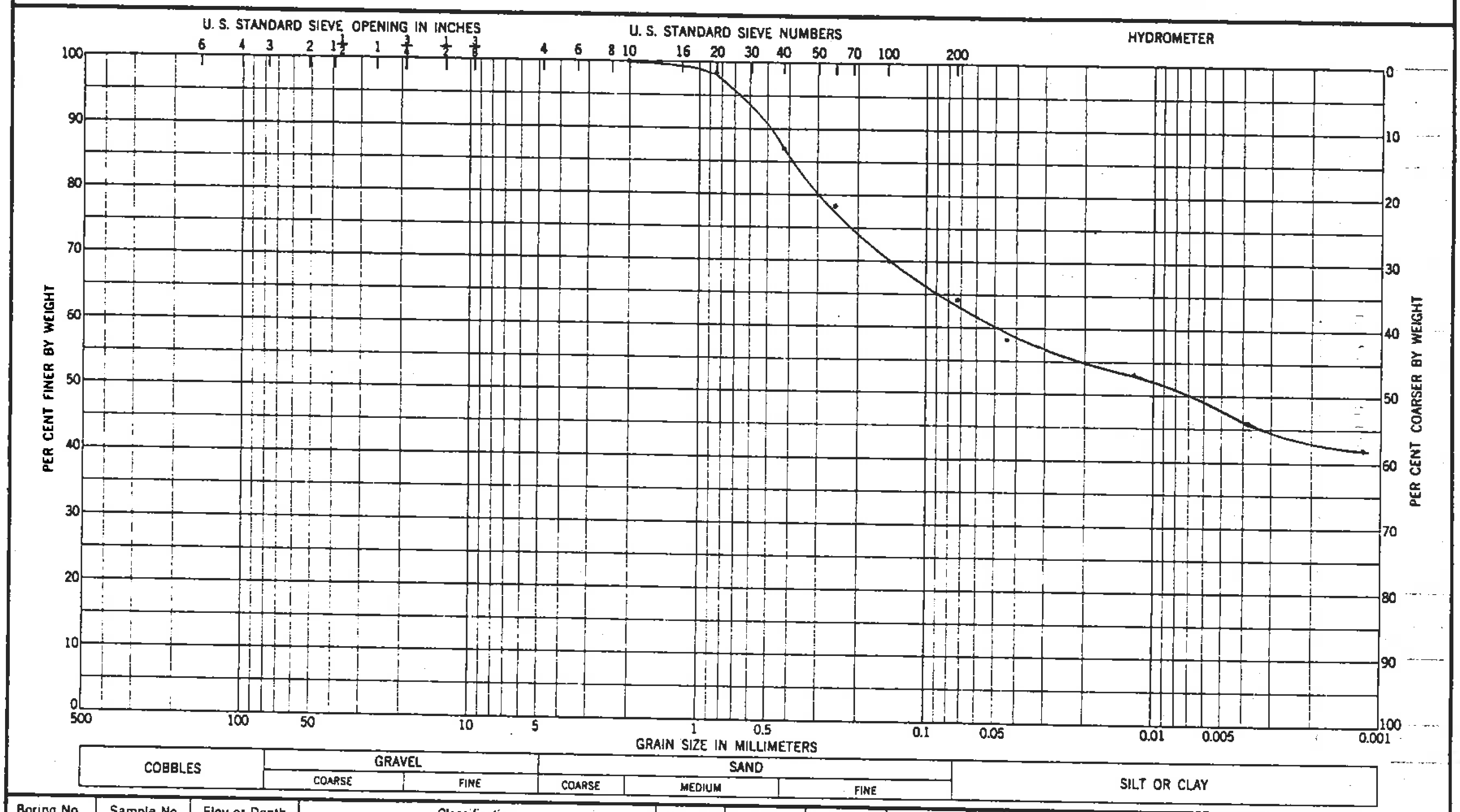
Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	Universal Site 1		Yellow tan & tan clayey silt (MH)	40.3	96	52	46

GRADATION CURVES

ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066
404-427-9456

Project TREDEGAR Job No. 32-03-91-13332

NEWNAN, COWETA COUNTY, GEORGIA Date 1/8/92



Boring No.	Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
	Universal Site 2		Brownish red silty clay (CH)	20.9	57	27	30

GRADATION CURVES

ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066
404-427-9456

ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456

MOISTURE DENSITY RELATIONSHIP
(Proctor Method)

Project Tredegar

Our Project No. 32-13332 Date 01-02-92

Material Pinkish Brown silty sand with weathered rock fragments to 2".

Location Combined Samples 1,2 and 3.

Depth -1.5 to -8 Elev.

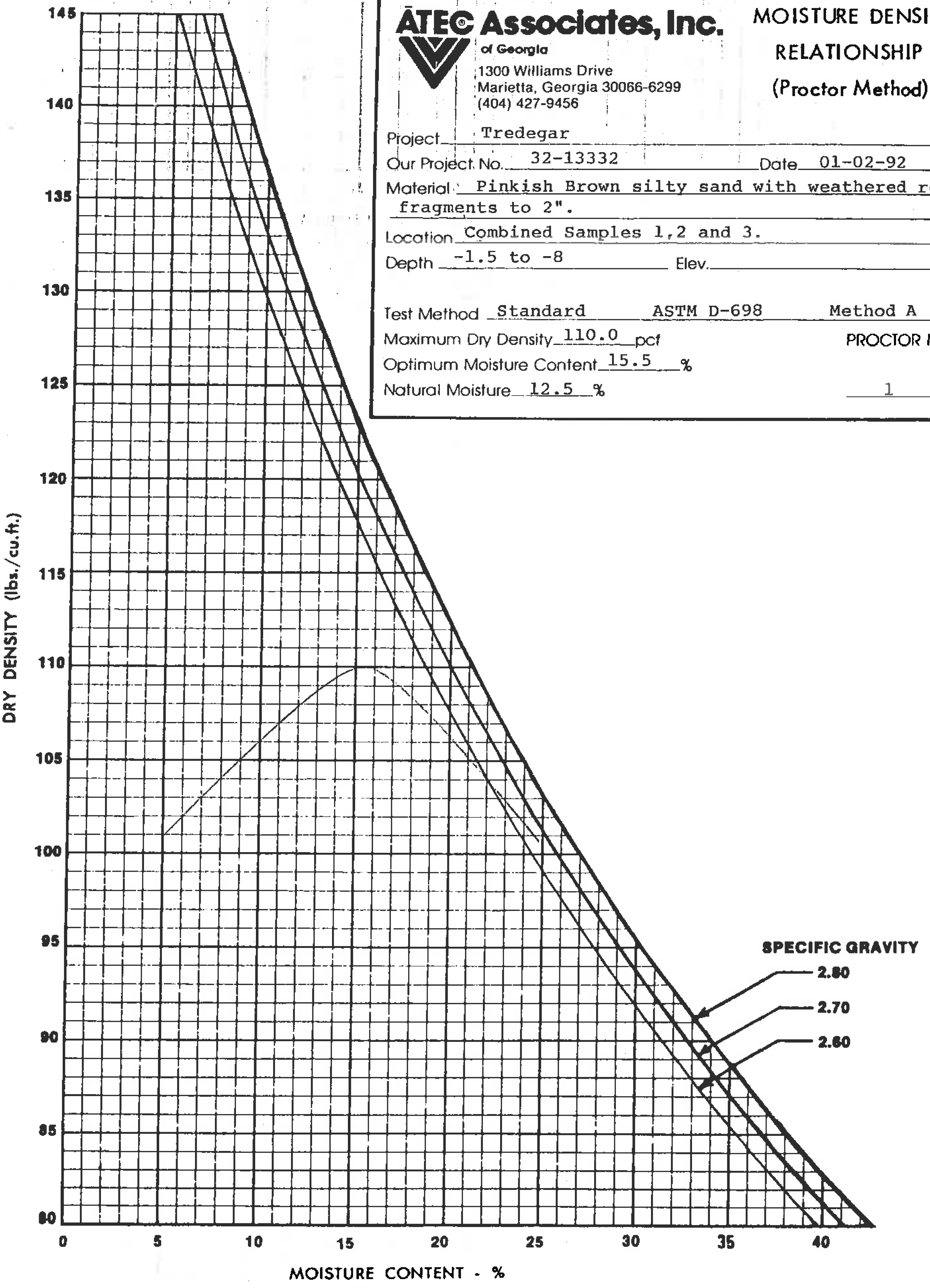
Test Method Standard ASTM D-698 Method A

Maximum Dry Density 110.0 pcf

Optimum Moisture Content 15.5 %

Natural Moisture 12.5 %

PROCTOR No. 1



ĀTEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456

MOISTURE DENSITY RELATIONSHIP
(Proctor Method)

Project Tredegar

Our Project No. 32-13332 Date 01-02-92

Material Red Brown silty clay.

Location (Sample #6)

Depth -6' Elev.

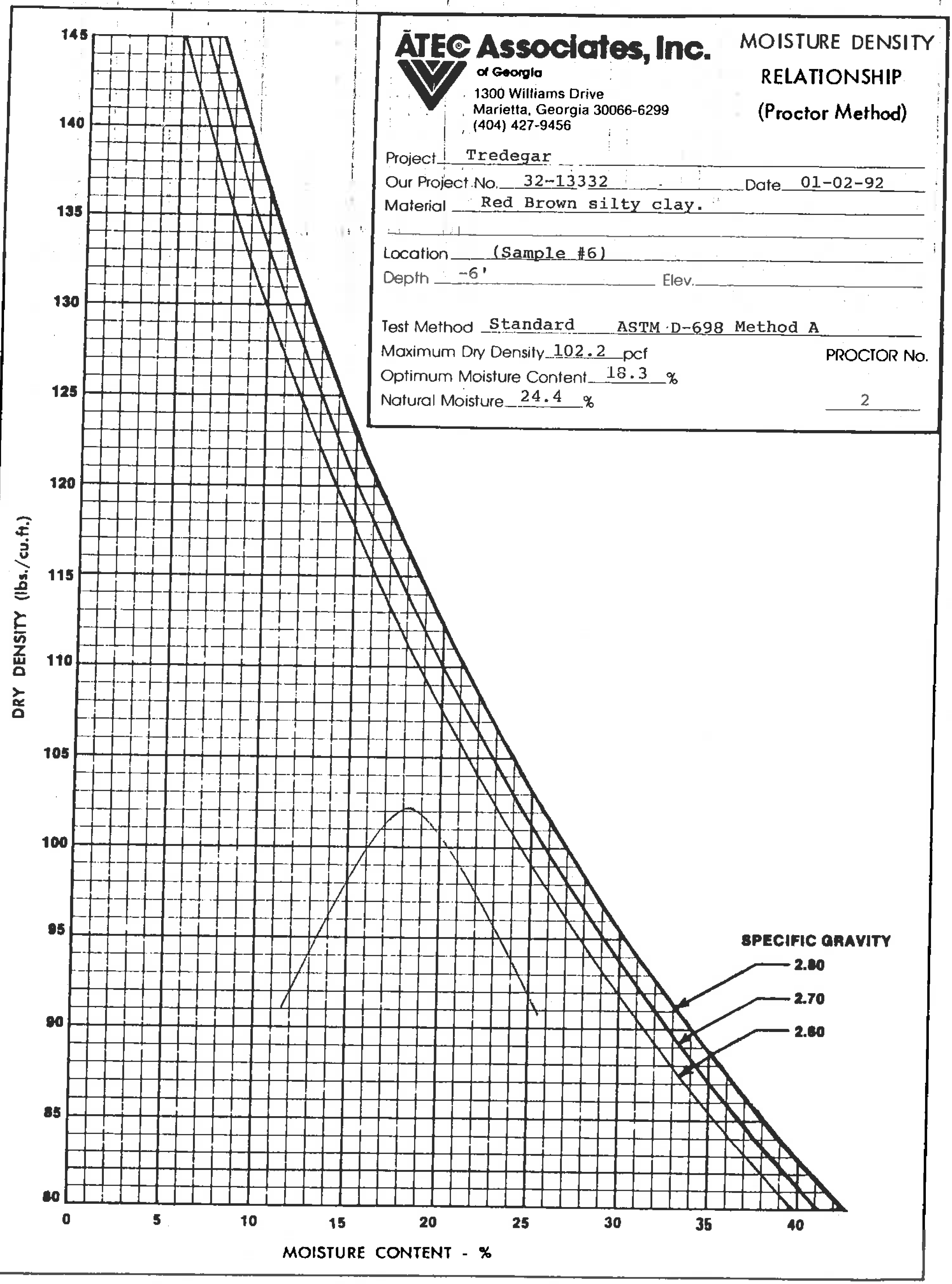
Test Method Standard ASTM D-698 Method A

Maximum Dry Density 102.2 pcf

Optimum Moisture Content 18.3 %

Natural Moisture 24.4 %

PROCTOR No. 2



ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456

MOISTURE DENSITY RELATIONSHIP
(Proctor Method)

Project Tredegar

Our Project No. 32-13332 Date 12-27-91

Material Dark Brown micaceous sandy silt.

Location Tredagar stockpile (Sample #5)

Depth Elev.

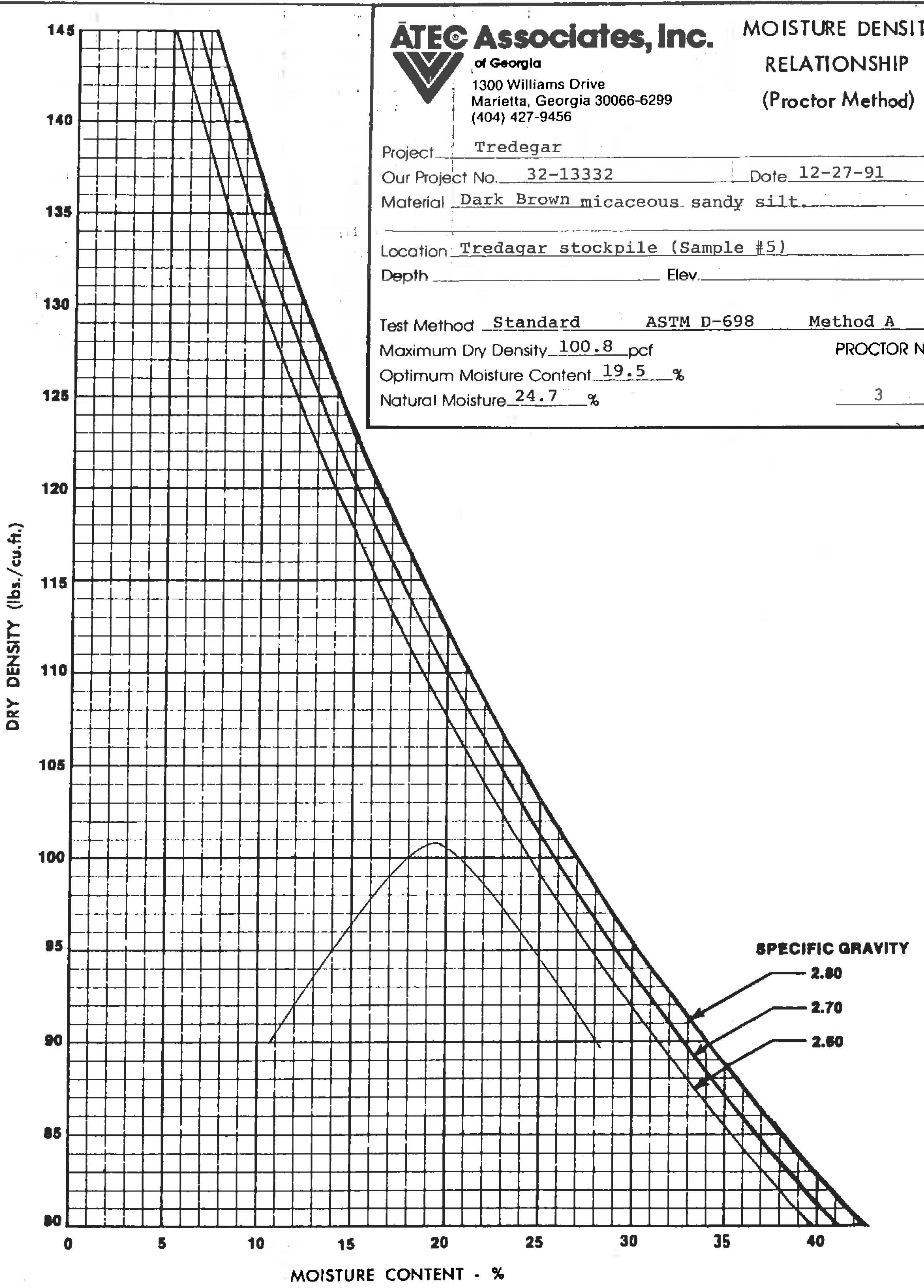
Test Method Standard ASTM D-698 Method A

Maximum Dry Density 100.8 pcf

Optimum Moisture Content 19.5 %

Natural Moisture 24.7 %

PROCTOR No. 3



ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456

MOISTURE DENSITY RELATIONSHIP
(Proctor Method)

Project Tredegar

Our Project No. 32-13332 Date 01-02-92

Material Dark Brown Sandy Silt with mica.

Location Stockpile (Sample #4)

Depth ______ Elev. ______

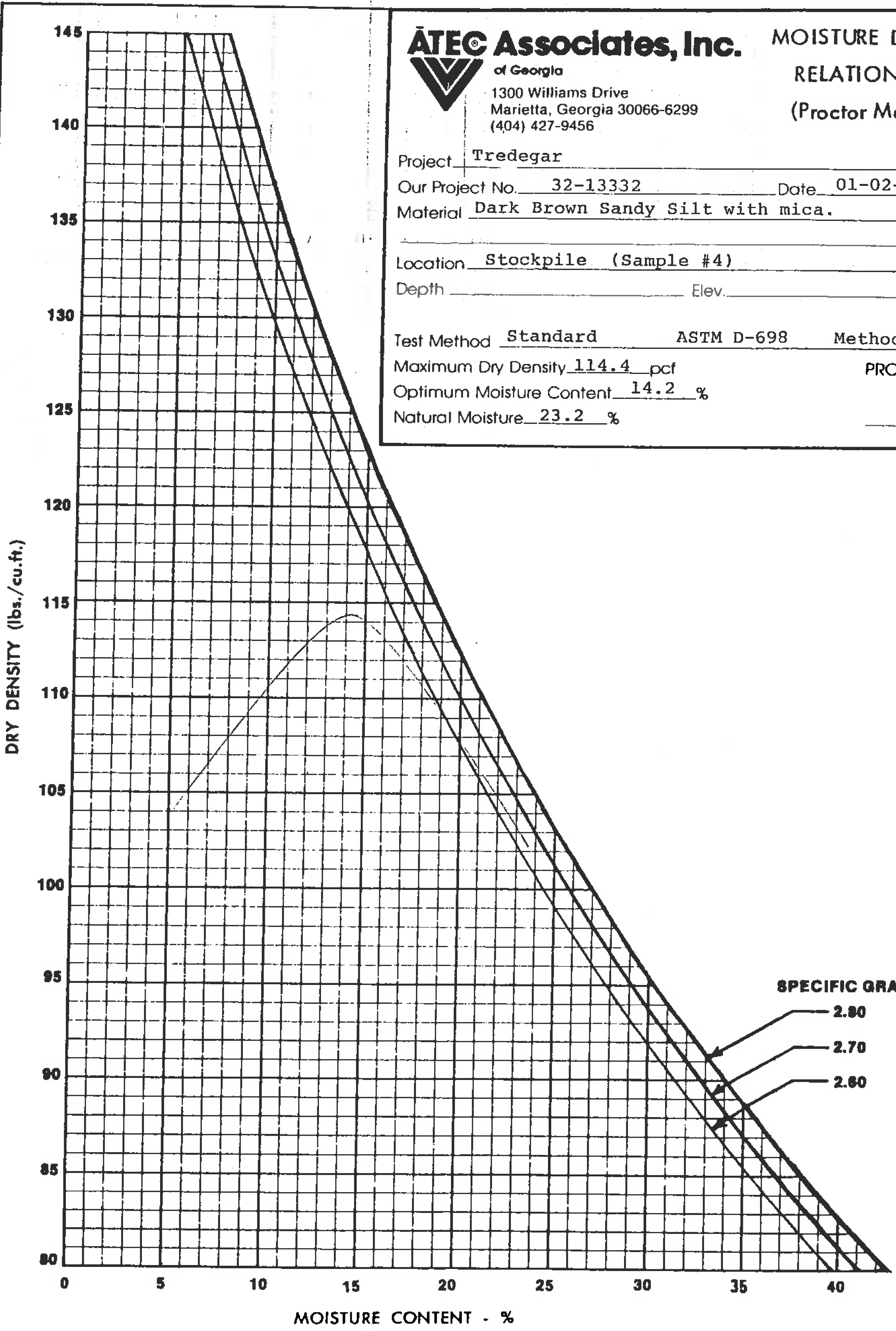
Test Method Standard ASTM D-698 Method A

Maximum Dry Density 114.4 pcf

Optimum Moisture Content 14.2 %

Natural Moisture 23.2 %

PROCTOR No. 4



ATEC Associates, Inc.
of Georgia
1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456

MOISTURE DENSITY RELATIONSHIP (Proctor Method)

Project TREDEGAR

Our Project No. 32-13332 Date 01-16-92

Material Tan and brown silty clay

Location

Depth Elev.

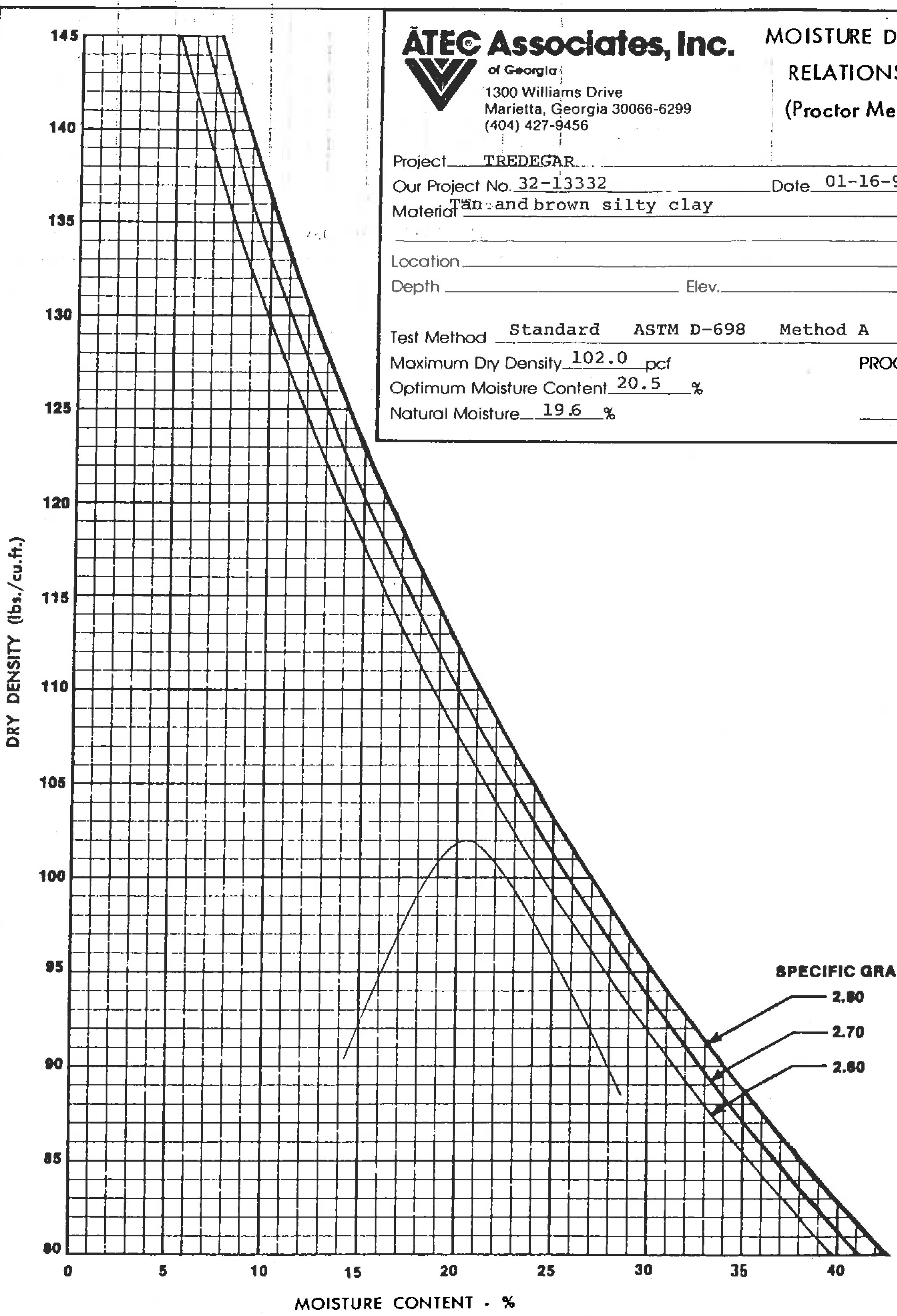
Test Method Standard ASTM D-698 Method A

Maximum Dry Density 102.0 pcf

Optimum Moisture Content 20.5 %

Natural Moisture 19.6 %

PROCTOR No. P-5



ATEC Associates, Inc.
1300 Williams Drive, Suite A
Marietta, Georgia 30066-6299
[404] 427-9456, FAX # [404] 427-1907

March 20, 1992

Mr. Terry Snell
c/o Tredegar
25 Bonnell Street
Newnan, Georgia

RE: Request for Clarification
Tredegar Facility
Newnan, Georgia
ATEC Project Number 32-13332

Gentlemen:

This letter addresses the Summary of Laboratory Testing letter submitted on January 27, 1992 by ATEC Associates, Inc. We understand that clarification regarding Sample #7 being classified as (CH) and the comparison of this soil with the required select fill being classified as (CL) using the Unified Soil Classification system is needed. Based on the select clay soil's intended use as a pond liner, it is ATEC's opinion that soils classified as (CH) should have similar or lower permeabilities than soils classified as (CL), when both soils are compacted under similar conditions. Additionally, based on the laboratory test results, the soil classified as (CH) had a plasticity index of 30 which indicates that the soil's shrink-swell potential is low. It is the soil's liquid limit of 57 which qualifies it as (CH). Had the liquid limit been less than 50, the soil would have been classified as (CL).

ATEC hopes this letter clarifies any misunderstanding. If you need additional information, or if we can be of further service, please call.

Sincerely,
ATEC Associates, Inc.

Steven A. Rowe

Steaven A. Rowe
Staff Engineer

W Michael Ballard

W. Mike Ballard, P.E.
Senior Registered Engineer
Registered Georgia 17513

APPENDIX E

HDPE MATERIALS CERTIFICATION

Gundle Lining Systems Inc

Gundle

19103 Gundle Road
Houston, Texas 77073-3598
U.S.A.

Phone: (713) 443-8564
Toll Free: (800) 435-2008
Telex: 166657 GUNDLE HOU
FAX: (713) 875-6010

LFH DJH KJN GLM LTM
JAN 07 1992
TBS NLM FILE

January 2, 1992

BONNELL COMPANY, INC.
C/O Tredegar Aluminum Group
Accounts Payable Department
P.O. Box 2555
Newnan, GA 30269

RE: Certification of Material and Welds

To Whom It May Concern:

This letter is to certify that the testing of the welds were pressure tested at 30 psi. for a period of fifteen minutes. No visible sign of leaks appeared during this time period. We certify that these welds are leak free for this installation. Attached is the specification sheet for the 40 mil HDPE.

If you have any questions, please do not hesitate to contact me at (800) 435-2008, extension 863.

Sincerely,

Paul Rone

Paul Rone
Fabrication Manager

PR/rmb

Attachment

Gundle Lining Systems Inc

Gundle®

19103 Gundle Road
Houston, Texas 77073-3598
U.S.A.

Phone: (713) 443-8564
Toll Free: (800) 435-2008
Telex: 166657 GUNDLE HOU
FAX: (713) 875-6010

January 2, 1992

Bonnell Co. Inc.
25 Bonnell Street
Newnan, GA 30263

RE: Certification of 40 mil HDPE weld to be shipped for Bonnell Co. Inc., Project # Area 300.

We hereby certify that the 40 mil HDPE weld to be shipped for Bonnell Co. Inc., Project # Area 300 are accepted.

CERTIFIED BY:

Darlene Ho for
R.J. Schaefer
Lab Manager

Gundle®

Quality Control Certificate

RAILCAR : PTLX41720
MATERIAL : HDPE 040 MIL
BATCH # : 111791
ROLL # : 04008892

MANF. DATE : 11/17/1991
PROJECT NAME : AREA 300
MR NUMBER : 7060-21 PROJECT # : 00300
LOCATION : SAN LUIS OBISPO CA

TEST PARAMETER	TESTING FREQUENCY	TYPICAL SPECIFICATIONS	TEST RESULTS	ASTM METHOD
Average Thickness (mils)	EVERY ROLL	36 to 44	40	D 1593
Carbon Black (%)	1/SHIFT	2.0 to 3.0	2.2	D 1603
Carbon Black Dispersion	1/SHIFT	A-1/A-2/B-1	A-1	D 3015
Melt Index (g/10 min)	1/SHIFT	0.30 max	0.14	D 1238 E
Density (g/cm3)	1/SHIFT	0.940 min	0.945	D 1505 A
Tensile Properties:				
T.S. Yield (psi)	2ND ROLL	2300	2513	D 638
T.S. Break (psi)	2ND ROLL	4000	4374	Type IV
Elong. Yield %	2ND ROLL	13	17	2 ipm
Elong. Break %	2ND ROLL	700	763	
Tear Resistance (lbs)	2ND ROLL	30	28	D 1004,Die C
Puncture Resistance (lbs)	2ND ROLL	52	74	FTMS 101,Method 2065

CERTIFIED BY:

R.J. Schaefer
Lab Manager

APPENDIX F

COMPACTION TESTING CERTIFICATION

3/

ATEC Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066
(404) 427-9456

REPORT OF FIELD DENSITY TESTS

PROJECT: TREDEGAR

ATEC PROJECT NO.: 32-02-92-22022

CLIENT: Tredegar

DATE: 03/03/92

Test Number:	8
Wet Density, (PCF):	130.5
Moisture Content, (%):	17.0
Dry Density, (PCF):	111.5
*	P4
Req. % Compaction:	92
Percent Compaction:	97
Type Material:	Soil

TEST NO.	DEPTH	LOCATION
8	FSG	Center of Chromium Hydroxide sand bed closure.

"These test results should be regarded as indicators of the degree of compaction attained at these spot locations and depths only. The degree of compaction at grade depths in the fill and at other locations as well as the condition of the underlying soils has not been determined by this office".

CC: Mr. Tom Schexnayder (1)

*TEST COMPARED TO:

PROCTOR NO. & TYPE	MAXIMUM DRY DENSITY, PCF	OPTIMUM M.C. %
P4	114.4	14.2

Respectfully Submitted,

lpw

ATEC Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066

FIELD DENSITY REPORT

Date 3 Mar 92 Day Tuesday

Project Tredegar

ATEC Job No. 3222022

Client Tredegar

Weather Fine

Temp: AM ______ PM 84

Arrived on site at 2:45 PM to perform requested inplace density testing. I met with Mr. Joe Lewis, of Tredegar who showed me the area/s prepared for testing.

Conditions were found to be generally: CrOH sand bed closure was presented at Final grade

One density tests were performed this day. See attached Density Worksheet(s).

One tests passed.

No TESTS FAILED. Tests: N/A failed apparently ______

______. Tests: ______ failed apparently ______

______. Tests: ______ failed apparently ______

Problems encountered: This result should be regarded as indicative of the degree of compaction achieved in this spot location and elevation only.

ATEC by notes that client's personnel request certification of classification and compaction test results — please send to Loren McCune at Tredegar

This matter was discussed with our office. [✓ Yes]/No

The above conditions were discussed with Mr. Lewis, of Tredegar and a copy of this report and our Field Density Worksheet were left with him.

Any failing tests or problem areas will be retested or tested upon request, when ATEC is notified that the areas in question have been reworked.

Departed Site: 4:30 pm. ATEC by:

Test Results Communicated To:

ATEC Associates, Inc.

1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456, FAX # (404) 427-1907

Date Req. 3 March '92
Time Req. PM
Assigned: W Elkin
ATEC Project No.: 3222012

FIELD DENSITY WORKSHEET

Project: Tredegar S. S. –
Called by: Date Called Time Called
Special Instructions:
Travel Time: Work Time: Standby Miles
Work Performed:

Test No.	W. W. Sample Mold	W. W. Sample	W. W. Cu. Ft.	% Moist	D. W. Cu. Ft.	•	% Comp.	Location	Depth Elev.
8	771.5 179.5	597.4	130.5	17.0	111.5	P4	97		FSG
8a	2147.3 175.0	1967.3	130.1	14.2	113.9	P4	/	Same	/

(1) TEST LOCATION ESTABLISHED BY ☐ GRID LINES ☐ CONTROL POINTS ☒ ESTIMATION ☐ CONTRACTOR
(2) DEPTH OR ELEV. OF TEST ESTABLISHED BY ☐ SURVEY ☐ GRADE STAKES ☒ ESTIMATION ☐ CONTRACTOR
(3) TEST CONDUCTED ON ☐ FULL TIME ☒ INTERMITTENT BASIS

REMARKS:

*Proctor No	% Compaction Required	Maximum pcf	% Moist
P4	92	114.4	14.2

Technician

Test Results Communicated to

ATEC Associates, Inc.

"TRIP TICKET"

Day 3 Mar 92

EMPLOYEE W Elston

Date Tuesday

Project Name Tredegar

Location Newnan

Client Tredegar

Billing to 3221022

Briefing		to		Hours
Time out	1:30	to	2:45	1 1/4 Hours
On Site	2:45	to	4:30	1 3/4 Hours
Time Back	4:30	to	5:45	1 1/4 Hours
Reporting		to		Hours

Subtotal 4 1/4 Hours

Lunch Hours

TOTAL 4 1/4 HOURS

TOTAL 100 MILES

"TYPE WORK"

☐ Concrete Testing
☐ Cylinder Pickup
☒ Soil Density Testing
☐ Footing Inspection
☐ Bolting Inspection
☐ Steel NDT & Inspection
☐ Asphalt
☐ Roofing
☐ Asbestos
☐

Remarks:

Services Approved by:

ATEC Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066
(404) 427-9456

2/2

REPORT OF FIELD DENSITY TESTS

PROJECT: TREDEGAR

ATEC PROJECT NO.: 32-02-92-22022

CLIENT: Tredegar

DATE: 2/11/92

Test Number:	1	2							
Wet Density, (PCF):	118.1	121.5							
Moisture Content, (%):	28.5	25.2							
Dry Density, (PCF):	91.9	97.0							
*	FP1	FP1							
Req. % Compaction:	92	92							
Percent Compaction:	94	99							
Type Material:	Soil	Soil							

TEST NO.	DEPTH	LOCATION
1	-.5'	Station 0+30- south, station 0+40-east.
2	-1'	Station 0+60-south, station 0+10-east.

"These test results should be regarded as indicators of the degree of compaction attained at these spot locations and depths only. The degree of compaction at grade depths in the fill and at other locations as well as the condition of the underlying soils has not been determined by this office".

CC: Mr. Tom Schexnayder (1)

*TEST COMPARED TO:

PROCTOR NO. & TYPE	MAXIMUM DRY DENSITY, PCF	OPTIMUM M.C. %
FP1	97.7	25.9

pw

Respectfully Submitted,

3
vs

ATEC Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066

FIELD DENSITY REPORT

Date 11 Feb '92 Day Tuesday

ATEC Job No. ~~32029113332~~ 3222022

Project Tredegar

Client Tredegar

Weather Fine

Temp: AM 55 PM 65

Arrived on site at 10:15 AM to perform requested inplace density testing. I met with Mr. Schexnyder, of Tredegar who showed me the area/s prepared for testing.

Conditions were found to be generally: Fill placement was commencing in the area of the pipeline among the clarifier, Storm water runoff flume, and the detention pond. Red-brown slightly micaceous sandy clay was placed in fairly thin lifts (4-8 inches) and compacted with a smooth-drum walk-behind roller vibratory roller.

Two density tests were performed this day. See attached Density Worksheet(s).

Two tests passed.

No TESTS FAILED. Tests: N/A failed apparently

. Tests: failed apparently

. Tests: failed apparently

~~Problems~~ Conditions encountered: Mr. Shexnyder indicated that 92 % compaction (ASTM D-698) is required in this area. A field proctor was run for this material; this indicated a maximum dry density of 97.7 pcf at optimum moisture content of 25.8 %.

This matter was discussed with our office. [✓ Yes]/No

The above conditions were discussed with Mr. Lewis, of Burnell and a copy of this report and our Field Density Worksheet were left with him.

Any failing tests or problem areas will be retested or tested upon request, when ATEC is notified that the areas in question have been reworked.

Departed Site: 4:15 Pm

ATEC, by:

Test Results Communicated To:

ATEC Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066
(404) 427-9456

7

REPORT OF FIELD DENSITY TESTS

PROJECT: TREDEGAR

ATEC PROJECT NO.: 32-02-92-22022

CLIENT: Tredegar

DATE: 2/12/92

Test Number:	3	4	5	6	7
Wet Density, (PCF):	121.8	121.6	121.9	121.1	120.6
Moisture Content, (%):	25.9	29.5	23.8	28.2	28.5
Dry Density, (PCF):	96.7	93.9	98.6	94.5	93.9
*	FP1	FP1	FP1	FP1	FP1
Req. % Compaction:	92	92	92	92	92
Percent Compaction:	99	96	100	97	96
Type Material:	Soil	Soil	Soil	Soil	Soil

TEST NO.	DEPTH	LOCATION
3	-1'	Station 0+20-south, station 0+10-east.
4	-1'	Station 0+40-south, station 0+25-east.
5	-3"	Station 0+70-south, station 0+10-east.
6	-3"	Station 0+20-south, station 0+30-east.
7	FSG	Station 0+60-south, station 0+30-east.

"These test results should be regarded as indicators of the degree of compaction attained at these spot locations and depths only. The degree of compaction at grade depths in the fill and at other locations as well as the condition of the underlying soils has not been determined by this office".

*TEST COMPARED TO:

PROCTOR NO. & TYPE	MAXIMUM DRY DENSITY, PCF	OPTIMUM M.C. %
FP1	97.7	25.9

CC: Mr. Tom Schexnayder (1)

pw

Respectfully Submitted,

ATEC® Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066

FIELD DENSITY REPORT

Date 12Feb'92 Day Wed

Project Tredegar

ATEC Job No. 3L22022

Client Tredegar

Weather Fine

Temp: AM 45ish PM 70ish

Arrived on site at 9:45 to perform requested inplace density testing. I met with Mr. Lewis, of Bonnell who showed me the area/s prepared for testing.

Conditions were found to be generally: Elevation of fill generally ½ to ~~2 feet~~ 1½ feet below grade. Work continues using fairly thin lifts (generally less than ~~8~~ 6 inches uncompacted), then "walking it in" with a tracked loader and rolling it with a small walk-behind smooth-drum roller.

Five density tests were performed this day. See attached Density Worksheet(s).

Five tests passed.

No TESTS FAILED. Tests: N/A failed apparently

. Tests: failed apparently

. Tests: failed apparently

Conditions. ~~Problems~~ encountered: These results should be regarded as indicative of the degree of compaction achieved in these spot locations and elevations only. ATEC rep notes that more than six inches of compacted fill ~~were~~ was encountered in all locations at which tests were run today.

This matter was discussed with our office. Yes/No

The above conditions were discussed with Mr. Lewis, of WL Bonnell and a copy of this report and our Field Density Worksheet were left with him.

Any failing tests or problem areas will be retested or tested upon request, when ATEC is notified that the areas in question have been reworked.

Departed Site: 6:15 PM

ATEC, by:

Test Results Communicated To:

ATEC Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066

FIELD DENSITY REPORT

Date 11 Feb '92 Day Tuesday

ATEC Job No. ~~32019113332~~ 3222022

Project Tredegar

Client Tredegar

Weather Fine

Temp: AM 55 PM 65

Arrived on site at 10:15 AM to perform requested inplace density testing. I met with Mr. Schexnayder, of Tredegar who showed me the area/s prepared for testing.

Conditions were found to be generally: Fill placement was commencing in the area of the pipeline among the clarifier, Storm water runoff flume, and the detention pond. Red-brown slightly micaceous sandy clay was placed in fairly thin lifts (4-8 inches) and compacted with a smooth-drum walk-behind ~~roller~~ vibratory roller.

Two density tests were performed this day. See attached Density Worksheet(s).

Two tests passed.

No TESTS FAILED. Tests: N/A failed apparently

Tests: failed apparently

Tests: failed apparently

~~Problems~~ Conditions encountered: Mr. Schexnayder indicated that 92% compaction (ASTM D698) is required in this area. A field proctor was run for this material, this indicated a maximum dry density of 97.7 pcf at optimum moisture content of 25.8%.

This matter was discussed with our office. [✓ Yes]/No

The above conditions were discussed with Mr. Lewis, of Burnell and a copy of this report and our Field Density Worksheet were left with him.

Any failing tests or problem areas will be retested or tested upon request, when ATEC is notified that the areas in question have been reworked.

Departed Site: 4:15 PM

ATEC, by:

Test Results Communicated To: [illegible]

ATEC® Associates, Inc.
1300 Williams Drive
Marietta, Georgia 30066-6299
(404) 427-9456, FAX # (404) 427-1907

Date Req. 11 Feb '92
Time Req. AM
Assigned: Welton
ATEC Project No.: 3221022

FIELD DENSITY WORKSHEET

Project: Tredegar S. S. –
Called by: Date Called Time Called
Special Instructions:
Travel Time: Work Time: Standby Miles
Work Performed:

Test No.	W. W. Sample Mold	W. W. Sample	W. W. Cu. Ft.	% Moist	D. W. Cu. Ft.	•	% Comp.	Location	Depth Elev.
1	718.0 182.1	535.9	118.1	28.5	91.9	FP 1	94	Station 0+30 South, 0+40 east	
CP 1	1893.5 174.7	1718.8	113.7	23.3	92.2	FP 1			– ½ ft
CP 1B	2084.8 238.6	1846.2	122.1	27.7	95.6	FP 1			
CP 1C	2011 174.7	1836.3	121.4	28.5	91.9	FP 1			
2	735.0 183.8	551.2	121.5	25.2	97.0	FP 1	99		– 1ft

(1) TEST LOCATION ESTABLISHED BY ☐ GRID LINES ☐ CONTROL POINTS ☒ ESTIMATION ☐ CONTRACTOR
(2) DEPTH OR ELEV. OF TEST ESTABLISHED BY ☐ SURVEY ☐ GRADE STAKES ☒ ESTIMATION ☐ CONTRACTOR
(3) TEST CONDUCTED ON ☐ FULL TIME ☒ INTERMITTENT BASIS

REMARKS: *Compaction requirement to per Mr. Tim [illegible]

*Proctor No	% Compaction Required	Maximum pcf	% Moist
FP1	*92	97.7	25.9

Technician

Test Results Communicated to

ATEC Associates, Inc.

"TRIP TICKET"

EMPLOYEE [illegible]
Day 11 [illegible]
Date [illegible]

Project Name [illegible]

Location [illegible]

Client [illegible]

Billing to 3601 9711 022

Briefing		to			Hours
Time out	9:00	to	10:15	1¼	Hours
On Site	10:15	to	4:15	6	Hours
Time Back	4:15	to	5:30	1¼	Hours
Reporting		to			Hours

Subtotal 8½ Hours

Lunch - ¾ Hours

TOTAL 7¾ HOURS

TOTAL 100 MILES

"TYPE WORK"

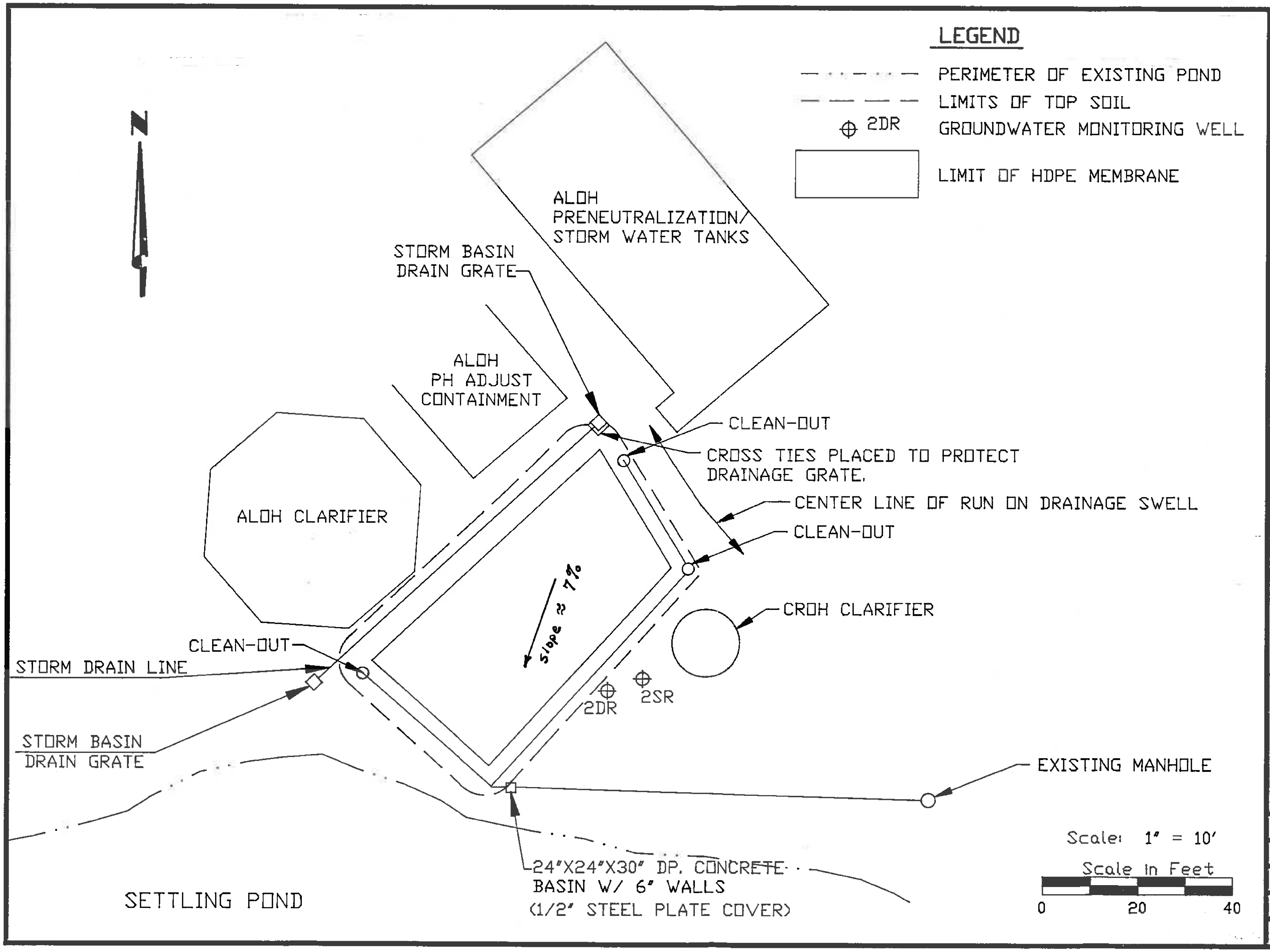
☐ Concrete Testing
☐ Cylinder Pickup
☒ Soil Density Testing
☐ Footing Inspection
☐ Bolting Inspection
☐ Steel NDT & Inspection
☐ Asphalt
☐ Roofing
☐ Asbestos
☐ ______

Remarks:

Services Approved by:

APPENDIX G

AS-BUILT DRAWINGS



TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

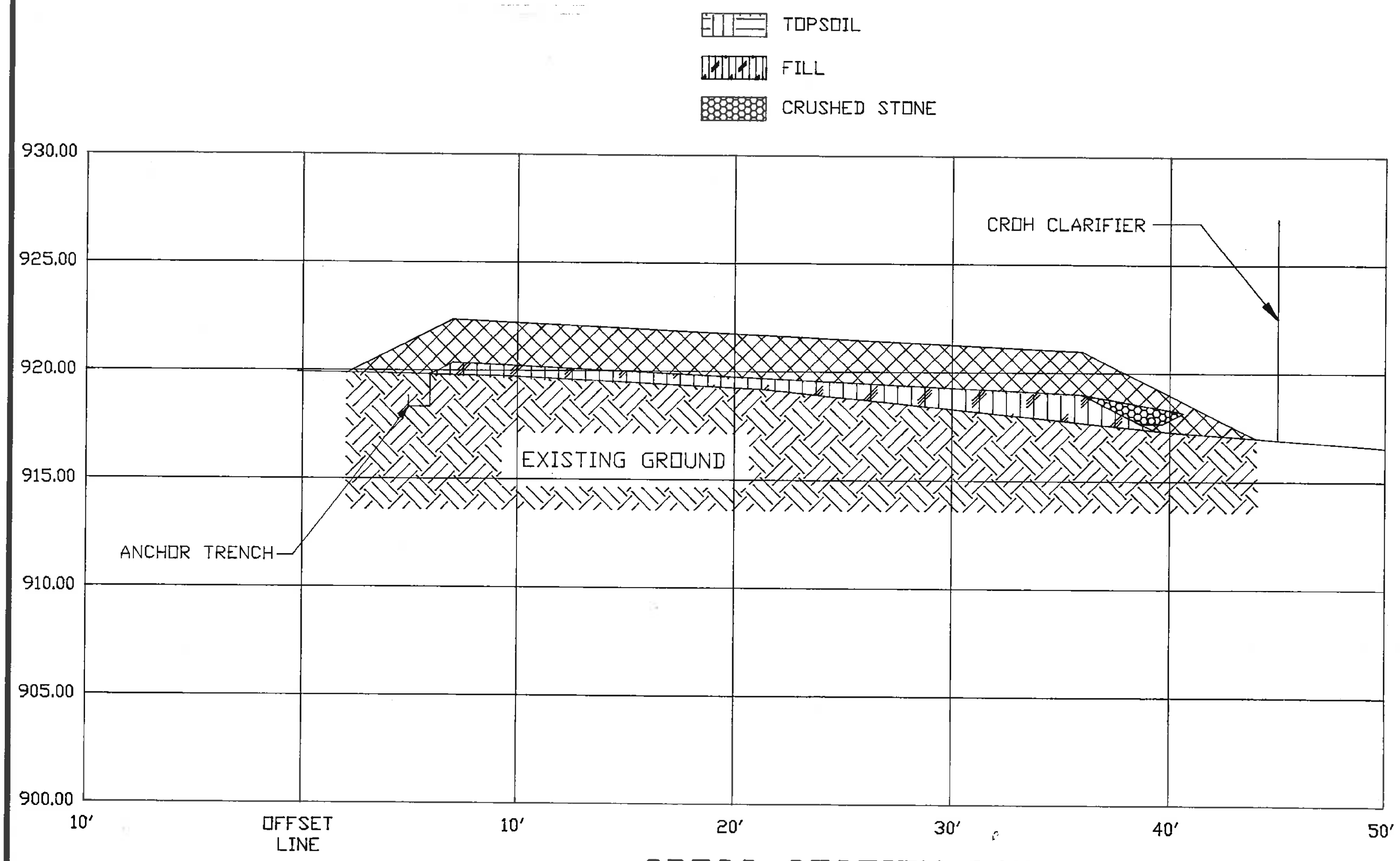
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

PLAN VIEW

SCALE: 1" = 10'	
DRAWING NO: 92SDBCLOCERT01	
PROJECT NO: 92SDBCLOCERT	
DRAWN BY: TDS	CHECK BY: TDS
DATE: 3/19/92	DATE LAST REVISED:



CROSS SECTION 020

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

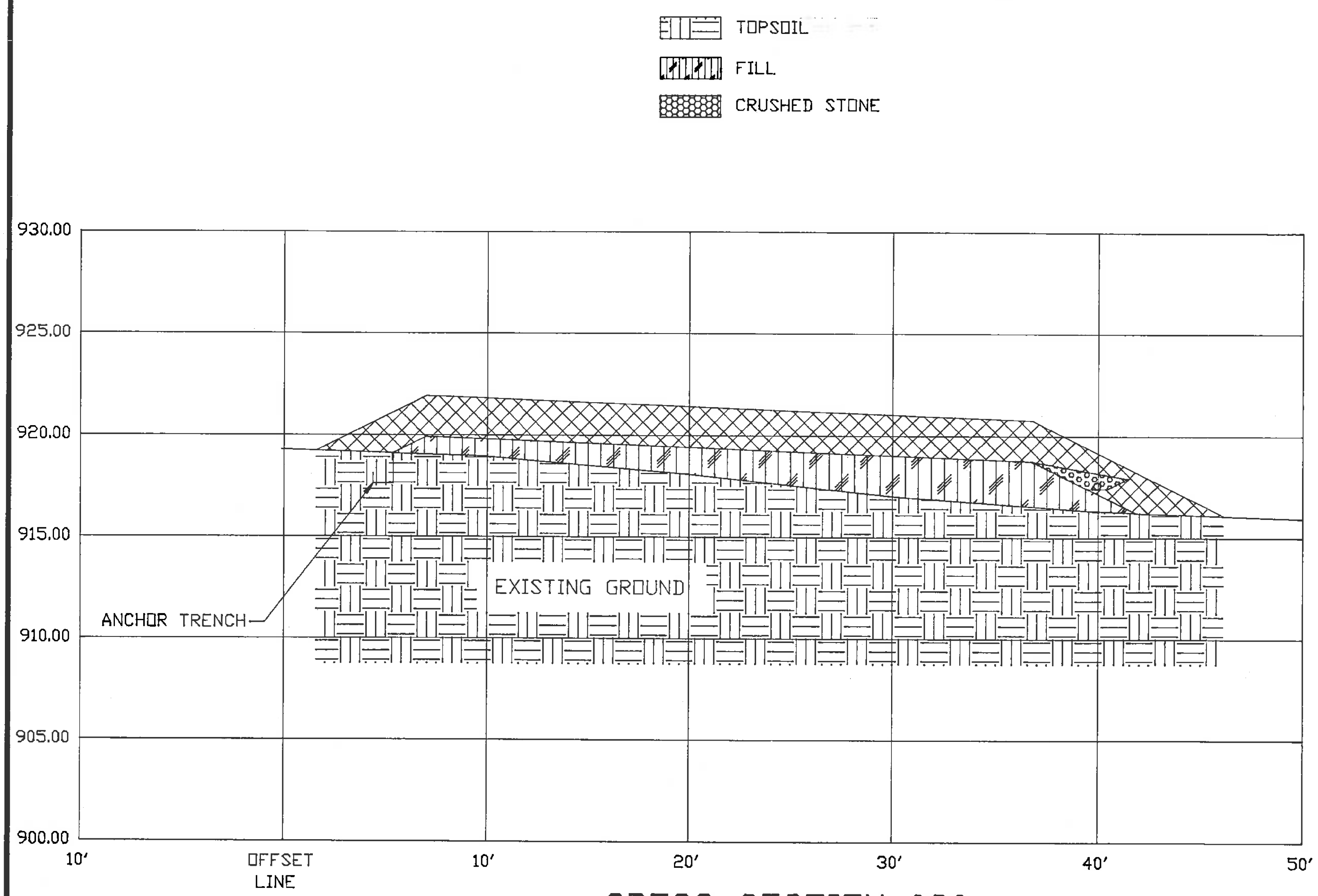
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

CROSS SECTION
AT STATION 020

SCALE: 1″ = 5′
DRAWING NO: 92SDBCLOCERT03
PROJECT NO: 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED:



CROSS SECTION 030

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

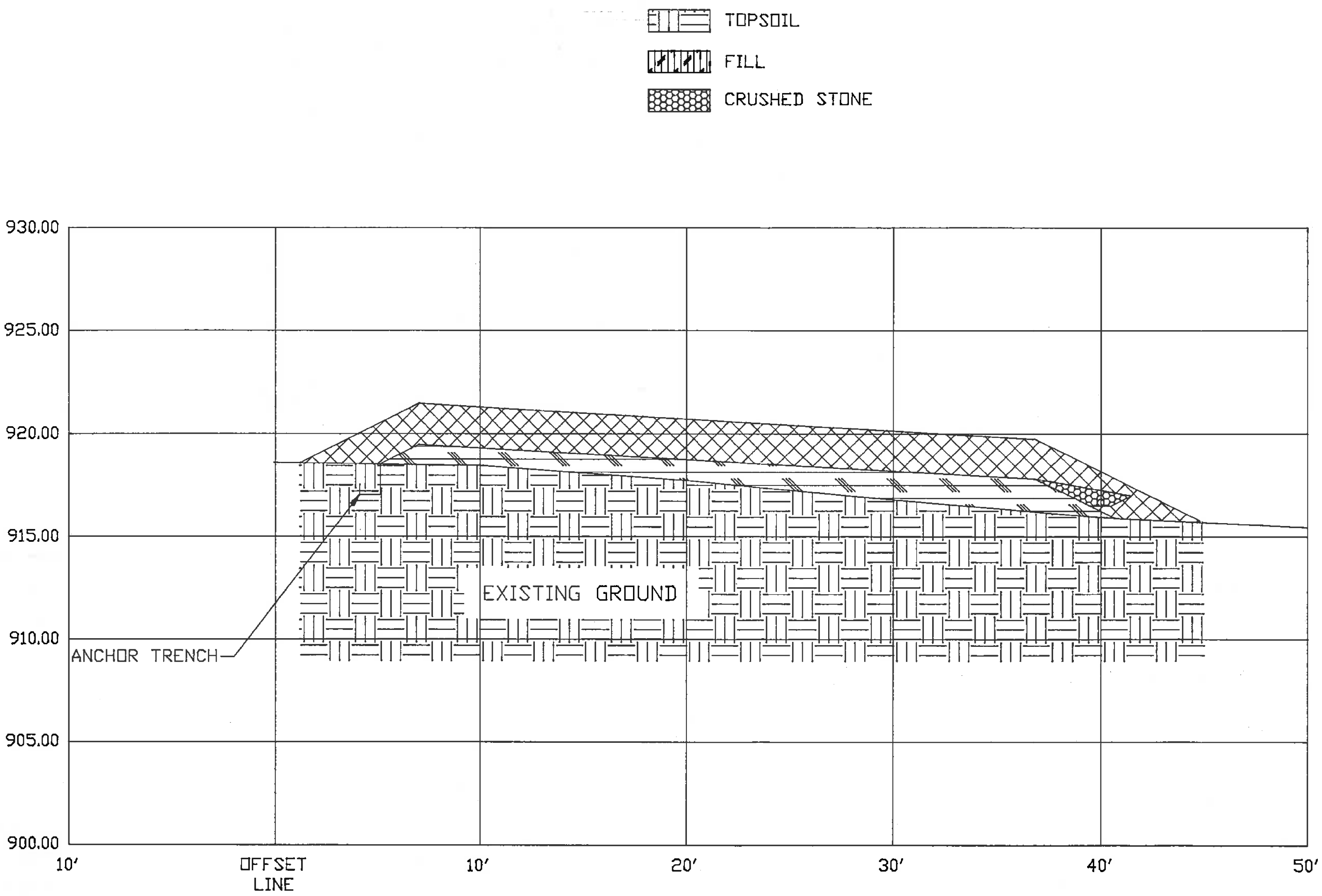
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

CROSS SECTION
AT STATION 030

SCALE: 1' = 5'
DRAWING NO.: 92SDBCLOCERT04
PROJECT NO.: 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED:



CROSS SECTION 040

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

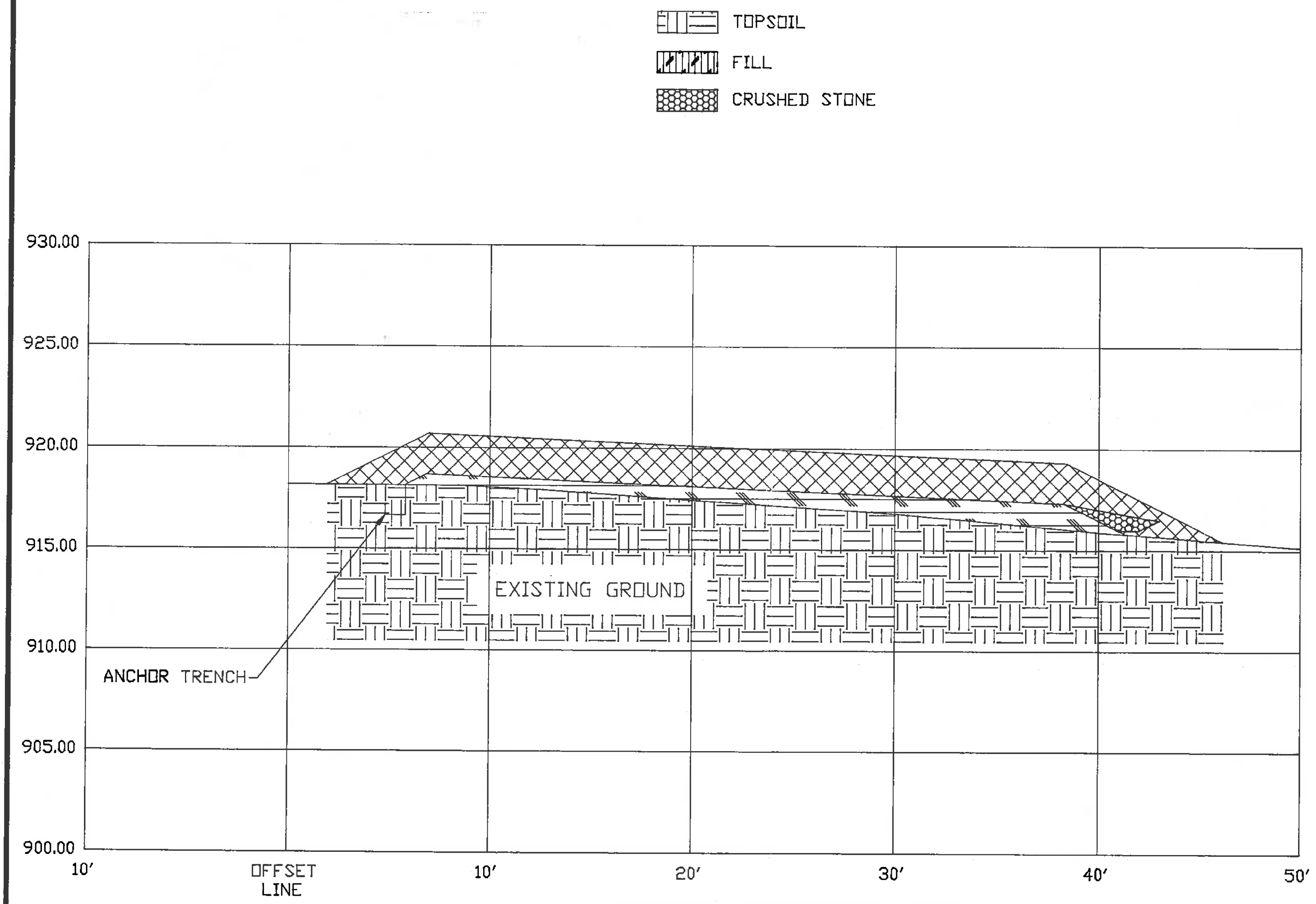
FOR:
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

CROSS SECTION
AT STATION 040

SCALE: 1" = 5'
DRAWING NO.: 92SDBCLOCERT05
PROJECT NO.: 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED:



CROSS SECTION 050

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

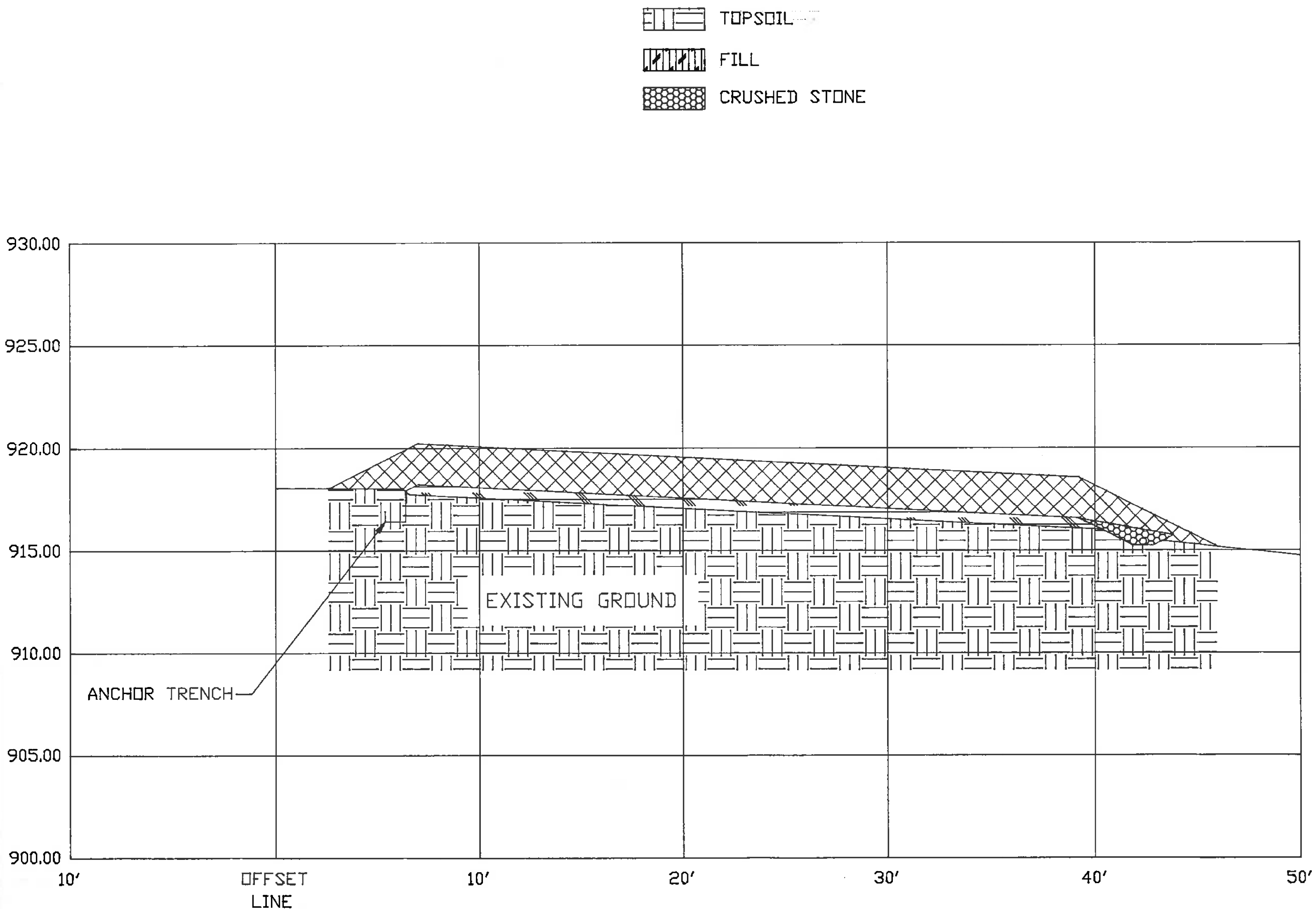
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

CROSS SECTION
AT STATION 050

SCALE: 1″ = 5′
DRAWING NO.: 92SDBCLOCERT06
PROJECT NO.: 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED: -



CROSS SECTION 060

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

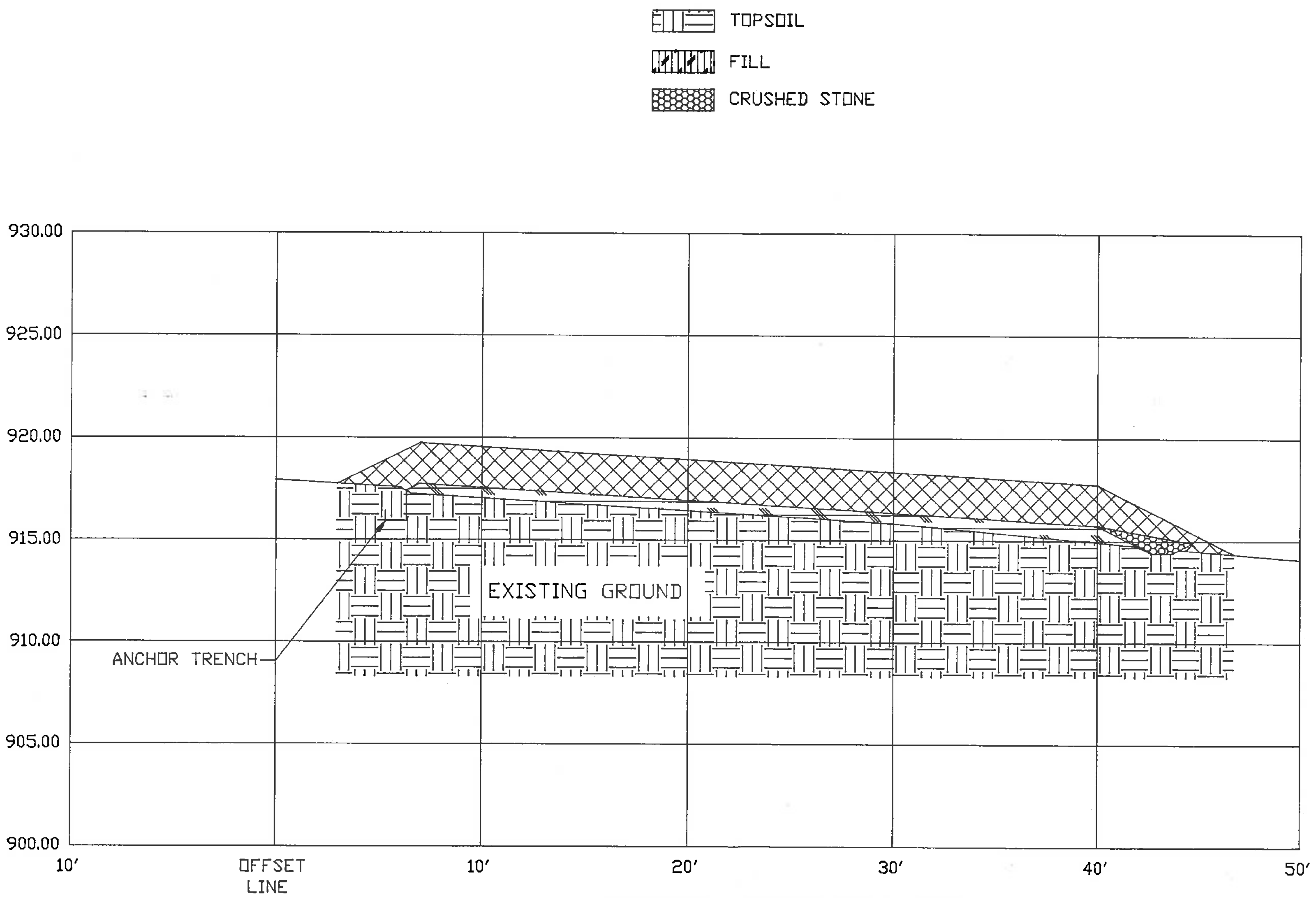
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

CROSS SECTION
AT STATION 060

SCALE: 1″ = 5′
DRAWING NO. 92SDBCLOCERT07
PROJECT NO. 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED:



CROSS SECTION 070

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

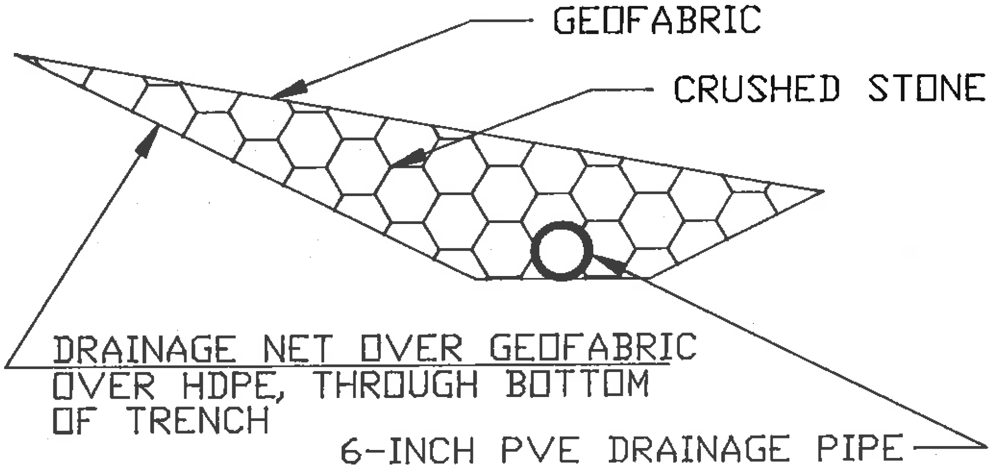
WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

CROSS SECTION
AT STATION 070

SCALE: 1′ = 5′
DRAWING NO.: 92SDBCLOCERT08
PROJECT NO.: 92SDBCLOCERT
DRAWN BY: TDS
CHECK BY: TDS
DATE: 3/19/92
DATE LAST REVISED:



DRAINAGE CONTROL TYPICAL SECTION

2-FT. LAYER OF TOPSOIL

GEOFABRIC

DRAINAGE NET OVER GEOFABRIC

HDPE

6-IN. LAYER OF COMPACTED CLAY

EXISTING GROUND

ARRANGEMENT OF LAYERS

TERRY SNELL
& ASSOC.
STONE MOUNTAIN, GEORGIA

FOR:

WILLIAM L
BONNELL
COMPANY
NEWNAN, GEORGIA

CROH SAND
DRYING BEDS
CLOSURE
CERTIFICATION

AS-BUILT
DRAWING

TYPICAL
SECTIONS

SCALE: NOT TO SCALE

DRAWING NO.: 92SDBCLOCERT09

PROJECT NO.: 92SDBCLOCERT

DRAWN BY: TDS

CHECK BY: TDS

DATE: 3/19/92

LAST REVISION:

APPENDIX H

APPROVED CLOSURE AND POST-CLOSURE PLAN

Georgia Department of Natural Resources
205 Butler Street, S.E., Suite 1252, Atlanta, Georgia 30334
Joe D. Tanner, Commissione
Harold F. Reheis, Directo
Environmental Protection Divisio

LFH
OCT 4 1991

September 30, 1991

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Leo F. Harlan, Sr.
Technical Director
William L. Bonnell Company, Inc.
Post Office Box 428
Newnan, Georgia 30264

Re: Approval of Closure Plan
GAD 003273224

Dear Mr. Harlan:

The Georgia Environmental Protection Division (EPD) revised the closure plan submitted by William L. Bonnell Company, Inc. (Bonnell) for the Chromium Hydroxide (CrOH) sand drying beds. EPD announced its intent to approve the revised closure plan in a public notice issued on August 22, 1991 and on September 24, 1991, a 30-day comment period associated with the public notice expired. In addition, a public hearing was held at the Newnan-Coweta Library on September 17, 1991. The Division did not receive any written comments, nor did anyone attend the public hearing to make a statement regarding the content of the closure plan.

Bonnell is hereby notified that the closure plan is approved. Please begin implementation of closure activities within 30 days after receipt of this letter.

Sincerely,

Bill Mundy

Bill Mundy
Unit Coordinator
Hazardous Waste Management Program

BM:sec\Bonnell.clo

File: Wm. L. Bonnell (R)

THE WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA FACILITY
EPA I.D. NO. GAD003273224

CLOSURE AND POST-CLOSURE PLAN FOR THE CHROMIUM HYDROXIDE SLUDGE SAND DRYING BED

JULY 31, 1990
REVISED - OCTOBER 24, 1990
REVISED - DECEMBER 20, 1990
August 15
REVISED - J~~ULY 26~~, 1991

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I CLOSURE PLAN

I-1 INTRODUCTION

This plan is submitted in accordance with the requirements of the Georgia Hazardous Waste Management Rule (Georgia Rule) 391-3-11-.10 (40 CFR 265.110 through 265.120 and 265.310). This plan identifies steps necessary to close the chromium hydroxide (CrOH) sludge sand drying bed area located at the William L Bonnell Company, Inc. (Bonnell) plant in Newnan, Georgia (EPA I.D. No. GAD003273224).

I-1a Production Processes

William L Bonnell Company, Inc. operates an aluminum extrusion and finishing facility that uses ingot and recycled scrap aluminum to produce aluminum extrusions for the construction industry and other uses. These extrusions are finished in one of two separate processes: a) a chemical conversion coating operation that uses a solution of chromic and phosphoric acids to prepare the extrusions for painting, or b) an anodizing line that uses a sulfuric acid solution to treat the extrusions. Material Safety Data Sheets for the materials used in these processes are provided in Appendix A. The chemical conversion coating process operations, their wastewater treatment facilities ("WWTFs"), and their sludge handling facilities are discussed below.

I-1a(1) Chemical Conversion Coating Process

The chemical conversion coating process, shown schematically in Figure 1, creates a film of chromium oxide on the aluminum and prepares the metal for painting. Table 1 is a list of materials introduced to the chemical conversion coating process and wastewater treatment facility. Aluminum extrusions are hung on an overhead conveyor which first moves through a spray chamber where the extrusions are sprayed with an alkaline cleaner and rinsed with clear water. Extrusions are then sprayed with a phosphoric acid/chromic acid solution. These then go through two water rinses and a drying oven. Wastewaters for the chemical conversion coating process flow to the chemical conversion process wastewater treatment facility which is discussed below in Section I-1b.

I-1a(2) Anodizing Process

Figure 2 is a schematic flow diagram for the anodizing process. Table 2 is a list of materials introduced to the anodizing process and wastewater treatment facility. The anodizing process creates an exterior layer of clear aluminum oxide over the aluminum extrusion to provide a corrosion resistent, hard surface of various colors. The aluminum extrusion is first dipped in a cleaning bath containing either a mild alkaline cleaner or mild (less than 5 percent) phosphoric acid solution. The extrusion is rinsed with water and placed in an etching bath containing an aqueous solution of sodium hydroxide. Next, the extrusion is rinsed and placed in a dilute sulfuric acid bath containing hydrogen peroxide. It is rinsed again and placed in an electrically charged bath of sulfuric acid, and is rinsed again. The extrusions can then be colored by depositing dyes or tin into the anodic coating pores. The coating is then sealed with hot water or a nickel acetate solution. The extrusion is then rinsed with clear water to complete the anodizing process. Wastewaters for the anodizing process flow to the anodizing process wastewater treatment facility which is discussed below in Section I-1b.

I-1b Wastewater Treatment and Sludge Handling Operations

The Bonnell facility operates two separate wastewater treatment systems. One wastewater treatment facility (WWTF) handles wastewater from the chemical conversion coating (CCC) operation that produces a sludge defined in Georgia Rule 391-3-11.07 (40 CFR 261.31) as F019 (wastewater treatment sludges from chemical conversion coating of aluminum). F019 wastes are listed as hazardous wastes on the basis that they may contain hexavalent chromium and/or cyanide (complexed).

The other WWTF handles wastewater from the sulfuric acid anodizing of aluminum and produces a sludge that is not a listed hazardous waste. Details of the wastewater treatment systems for each of these processes are presented in the following sections.

I-1b(1) Chemical Conversion Coating WWTF and Sludge Handling

Treatment of wastewater generated from the (CCC) process begins with wastewater discharge into one of two lined concrete treatment basins. These basins, along with the discharge location (Point A), are shown on Figure 3. Sulfuric acid and sodium bisulfite are added to the treatment basins and mixed in a batch process to ensure complete mixing and reduction of any hexavalent chromium to trivalent chromium. Samples are then collected and analyzed for hexavalent chromium. If no hexavalent chromium is detected, lime is added to raise the pH to approximately 8.3. A small amount of polymer is added in order to promote flocculation of metals and solids. The wastewater is then discharged to the CCC clarifier (Point B on Figure 3).

Until September 1989, the liquid effluent (F019) from the CCC clarifier was discharged to the settling pond (Point C on Figure 3). Supernatant (F019) from the settling pond then discharged to the polishing pond (Point G on Figure 3). In September 1989, at the suggestion of the Georgia EPD personnel, Bonnell rerouted the CCC clarifier liquid effluent directly to the National Pollutant Discharge Elimination System (NPDES) permitted (Permit No. GA0000507) outfall (Point D on Figure 3).

As discussed previously, chromium hydroxide (CrOH) sludge (F019) is also produced in the CCC clarifier. Prior to November 1989, this sludge (F019) was dewatered in the CrOH sand drying beds (Point E on Figure 3). The dewatered sludge (F019) was periodically removed and placed in an on-site CrOH sludge (F019) disposal area (Point F on Figure 3). Laboratory data for sludge (F019) samples collected from the CrOH sand drying beds are included as Appendix A.

Until September 1989, the filtrate (F019) from the CrOH sand drying beds was discharged into the settling pond. In November 1989, a filter press was installed (Point H on Figure 3) to handle the CCC clarifier sludge (F019) and use of the CrOH sand drying beds was discontinued. Since then, sludge (F019) from the CCC filter press has been collected in roll-off containers for disposal at a permitted hazardous waste landfill in Emelle, Alabama operated by Chemical Waste Management, Inc. The filtrate (F019) from the CCC sludge filter press is routed back to the CCC clarifier tank and from there to the NPDES-permitted outfall. Thus, filtrate (F019) and supernate (F019) from the CCC system is no longer routed to the settling pond. However, the sludge currently in the settling pond is F019. Therefore, any sludge deposited on the AlOH sand drying beds from the settling pond is F019. The filtrate from the AlOH sand drying beds which returns to the settling pond is also F019. In March and April, 1990, the CrOH sludge sand drying beds and associated drainage piping were removed. The F019 sludge and chromium contaminated soils in and around the CrOH sludge sand drying beds were excavated and transported to the Chemical Waste Management disposal facility in Emelle, Alabama. Gravel was placed into the excavation to a point above the ground water. A perforated corrugated metal stand pipe was also installed to allow for possible future ground-water recovery. The area was then backfilled with on-site soil. A summary of the clean-up activities is presented in Appendix B.

I-1b(2) Anodizing Process WWTF and Sludge Handling

Treatment of wastewater generated from the anodizing process flow begins with wastewater discharge into a treatment basin (Point I on Figure 3) where acid, lime, or spent sodium hydroxide is added to treat and neutralize the anodizing solution. Wastewater from this basin flows to the settling pond (Point C on Figure 3), which then discharges to the polishing pond (Point G on Figure 3). The overflow from the polishing pond discharges to the NPDES permitted outfall.

In the settling pond, an aluminum hydroxide (AlOH) sludge is produced from solids that settle out of the solution. Sludge (F019) that collects in the settling pond is dredged and pumped onto the AlOH sand drying beds (Point J on Figure 3) for dewatering. Filtrate (F019) from these sand drying beds is piped back to the settling pond.

The AlOH sludge (F019) from the sand drying beds is moved to the AlOH sludge-soil mixture area (Point K on Figure 3), where it is mixed with soil. The AlOH sludge-soil mixture area is permitted by the state of Georgia as an Industrial Waste Landfill under Permit No. 038-003D(L) which permit does not allow the disposal of hazardous waste including but not limited to F019.

I-2 CLOSURE OBJECTIVES PERFORMANCE STANDARD

This closure plan is designed so that the CrOH sludge sand drying bed area will require only minimal maintenance or controls, potential threats to human health and the environment will be minimized, and escape of hazardous waste to the ground, ground water, surface waters, or the atmosphere will be controlled, minimized, or eliminated in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.111). To accomplish this, the closure plan consists of removal and disposal of the anodizing water discharge piping located in the CrOH sludge sand drying bed area, installation of a cap over the area, construction of run-on control ditches, removal and appropriate disposal of contaminated materials generated during the cleaning of the site, and the decontamination of the equipment. The following sections discuss in detail the approach Bonnell will take to satisfy the closure performance standard in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.112(b)), as discussed on Page 7.

I-3 PARTIAL CLOSURE AND FINAL ACTIVITIES

The partial closure plan describes the activities that will be performed to close the CrOH sludge sand drying bed area. Closure of the other hazardous waste management units will be addressed in separate closure plans.

I-4 MAXIMUM WASTE INVENTORY

As discussed in Section I-1, the F019 sludge (with listing constituents hexavalent chromium and cyanide (complexed)) along with most of the surrounding chromium contaminated soil was removed in March and April, 1990 and later disposed of in June, 1990. A report of these clean-up activities is included as Appendix B. It should be noted that chromium is the only F019 constituent present in the sludge (F019) and surrounding soil. The chemicals used at the Bonnell facility do not contain any, nor does the process generate any, cyanides as verified by previous tests performed on sludge samples. The results of these tests were provided to the U.S. EPA by letter dated December 5, 1980 to Mr. Myles Morse, Hazardous and Industrial Waste Division (WH-565), Waste Characterization Branch. A copy of the letter is included as Appendix C.

From 1970 to December 1989, the CrOH sludge sand drying beds received chromium hydroxide sludge (F019) from the adjacent clarifier. The sludge (F019) production is estimated at 1,680 pounds per day, or 252 tons per year based on a 300 day per year operating schedule. In accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.112(b)(3)), Bonnell estimates that a total of approximately 4,788 tons of sludge (F019) was produced over the 19-year period.

I-5 SCHEDULE OF CLOSURE AND CERTIFICATION

The CrOH sludge sand drying bed area is scheduled to be closed within 2~~8~~6 weeks after closure begins. In accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.112(b)(6)), a schedule for each closure activity has been provided as Figure 4 . As indicated on the schedule, completion of closure is not expected to extend beyond 180 days following Georgia EPD approval of the closure plan. This schedule is in compliance with Georgia Rule 391-3-11-.10 (40 CFR 265.113(b)). The Georgia EPD Director will be notified by Bonnell before beginning final closure of the CrOH sludge sand drying bed area.

The certification of closure will be submitted via registered mail to the Georgia EPD Director within 60 days after completion of closure in accordance with the approved closure plan as per Georgia Rule 391-3-11-.10 (40 CFR 265.115). This certification will be signed by both Bonnell and an independent registered professional engineer. Documentation supporting the engineer's certification will be available to Georgia EPD upon request and will be maintained until Bonnell is released from financial assurance requirements. A survey plat containing the information required by Georgia Rule 391-3-11-.10 (40 CFR 265.116) will also be submitted to the local land use authority and the Georgia EPD as part of the certification of closure. Bonnell will maintain an on-site copy of the approved closure plan and all revisions to the plan until the certification of closure completeness has been submitted and accepted by the Georgia EPD.

I-6 CLOSURE ACTIVITIES

During closure of the CrOH sludge sand drying bed area, access control devices (fences, gates, etc.) will be maintained to prevent unauthorized access by non-Bonnell employees or their subcontractors. Closure of the CrOH sludge sand drying bed area will consist of placing a low permeability cap over the area and providing run-on control. The cover design was modeled using the U.S. EPA Hydrologic Evaluation of Landfill Performance (HELP) program. A copy of the HELP model input and output is included as Appendix D. Details of closure activities are provided in the following sections of this plan.

I-6a Detailed Design and Bidding

Upon final approval of the closure plan by Georgia EPD, preparation of detailed plans and specifications will be initiated. Completion of these documents will allow Bonnell to obtain competitive bids for construction of the CrOH sludge sand drying bed area cover system. The closure activities will be initiated within 30 days of issuance of the construction contract.

I-6b Piping and Associated Equipment Removal

Currently, wastewater from the anodizing line flows into treatment basins where it is neutralized with either lime or sulfuric acid. Wastewater from these basins then flows through 12-inch diameter below-grade corrugated metal piping to the settling pond. This piping, and associated manholes, is located outside the west perimeter of the removed CrOH sand drying beds. As part of these closure activities, the piping will be removed and new piping will be installed routing flow around the cap.

In addition, the corrugated metal stand pipe which exists in the CrOH sludge sand drying bed area will be cut off below ground surface and filled with cement grout prior to placing the cover. After removal, all piping and manhole components will be bulk-loaded and shipped to an Interim Status or approved facility for disposal as hazardous waste (e.g. Chemical Waste Management, Inc. landfill at Emelle, Alabama).

I-6c CrOH Sludge Sand Drying Bed Area Cover

The CrOH sludge sand drying bed area cover will consist of several layers. The cover layers from top to bottom consist of 2 feet of a vegetative soil, a geofabric, geonet drainage layer, a geofabric, a 40-mil high density polyethylene (HDPE) liner, and a clayey soil subgrade. A schematic of the cover is shown on Figure 5. A plan view of the cover system is shown on Figure 6.

Prior to placement of the HDPE membrane the surface of the CrOH sludge sand drying bed area will be prepared. The subgrade preparation will include removal of material (e.g. rocks, and sticks,) that could damage the membrane along with placement of a subgrade soil layer. The soil will be compacted to a density equal to or greater than 92 percent of the material's maximum dry density according the Standard Proctor Compaction Test (ASTM D-698). The approximate 6-inch subgrade soil layer will be composed of soil with a Unified Soil Classification of CL including a compacted hydraulic conductivity on the order of 3.2×10^{-6}.

The barrier portion of the cover will consist of a 40-mil HDPE membrane that will meet or exceed the U.S. EPA recommend design of 1 x 10 $^{-7}$ cm/sec for a barrier system. HDPE has been shown to have a permeability of 4.5 x 10 $^{-10}$ cm/sec. Boring logs for monitoring wells, BN-GW-2S and BN-GW-2D, installed approximately 5 feet east of the removed CrOH sludge sand drying beds show the lithology from 0 to 15 feet to be a sandy clay (Unified Soil Classification - SC). The removed sand beds were approximately 8 feet deep. The typical permeability of SC ranges from 1 x 10 $^{-6}$cm/sec to 1 x 10 $^{-5}$cm/sec (Peck, Hanson and Thornburn, 1973). Hence, the final sand bed cover will have a permeability less than the natural subsoils present as per Georgia Rule 391-3-11-.10 (40 CFR 265.310(a)(5)). Manufacturers' literature summarizing physical properties of HDPE are included in Appendix E and the above well boring logs are included in Appendix F.

The membrane portion of the cover will be overlain by a filter fabric. The filter fabric will increase friction and minimize slippage between the drainage layer and the underlying barrier layer.

The geofabric layer will be overlain by a drainage layer consisting of a geonet having a coefficient of permeability equal to or greater than 1 x 10 $^{-2}$ cm/sec. This layer will be utilized as the lateral drainage medium within the cover. A filter fabric will be placed over the geonet to reduce the potential of silt entering and clogging the drainage layer. The geonet will convey infiltration from the vegetative soil layer to drainage collection pipes, as shown on Figure 5. The collection pipes will be located along the two downgradient sides of the capped area. At the southernmost corner of the cap, the collected drainage will flow by gravity and discharge to an existing ditch.

The upper filter fabric will be overlain by 24 inches of soil with a Unified Soil Classification of SM or an equivalent soil capable of supporting vegetation. The lower 18 inches will be compacted to at least 92 percent of the material's maximum dry density (ASTM D-698). The upper six inches will be disked in preparation for seeding. Following grading, the vegetative layer will be fertilized and seeded to minimize erosion.

In order to confirm that the subgrade and lower 18 inches of vegetative soil meet the compaction requirements, field density tests will be performed using method ASTM D-2937, Density of Soil in Place by the Drive-Cylinder Method. At least one test will be made for each six-inch lift and for each 1000 square feet or 20 cubic yards of vegetative or subgrade soil placed. Soil not meeting density requirements will be scarified, re-compacted and re-tested.

In addition to construction of the cover system, run-on control ditches will be constructed along the northern boundary of the CrOH sludge sand drying bed area. These ditches will be sized to convey run-on to the cover generated by the 24-hour, 25-year storm as determined by U.S. Weather Bureau Technical Paper No. 40. The approximate location of the ditches is shown on Figure 6. Copies of the ditch sizing calculations are included in Appendix G.

I-6d Design Considerations

a. Erosion Potential

Analysis of the final grading of the cover shows that an erosion of 0.32 tons per acre could occur per year. This value is small enough to be considered insignificant. The soil loss calculation considered a maximum cover slope of 8 percent and indicates that significant erosion should not occur. A copy of this calculation is included in Appendix H.

b. Drainage

Storm water run-on will be controlled by the construction of ditches designed to contain the water volume resulting from a 24-hour, 25-year storm.

The run-off will be controlled through maintenance of the grassed condition of the cover surface. The grassed cover sloped approximately 8 percent will minimize the potential for excessive erosion and soil loss due to major storm events that may occur. Run-off from this area will drain to the settling pond as it does currently. Since run-on will be diverted away from the cover, the volume of run-off that drains from the cover to the settling pond will be less after closure than what occurred prior to closure.

c. Geosynthetic Materials

Geosynthetic materials used in the cover construction include a 40-mil HDPE membrane, geonet, and filter fabric. The membrane, as required in a RCRA cover, will be placed over the subgrade soil layer to reduce the potential for infiltration into the closed CrOH sludge sand drying bed area. The filter fabric will separate the geonet from the vegetative layer, prohibiting the finer soil particles in the vegetative layer from clogging the drainage layer. A second filter fabric will separate the membrane from the geonet to reduce the potential for slippage between the layers.

d. Leak Detection and Leachate Collection Systems

Since the CrOH sludge sand drying bed area is part of an interim status facility, leak detection, and leachate collection systems are not required. Thus, there is no clay liner or synthetic liner system to serve as a barrier or to collect and remove leachate from the CrOH sludge sand drying bed area. The cover system has been designed to restrict percolation into the underlying soil in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.310(a)(1)).

e. Prevention of Airborne Contaminant Release

As discussed previously, the main constituent of concern is chromium (see Appendix C). The CrOH sludge sand drying beds, chromium hydroxide sludge (F019), and all connected drainage piping have been removed. On-site soils were used as backfill and therefore, airborne contaminant release is unlikely.

f. Other Considerations

As discussed in Section I-6, the cover system has been modelled using the U.S. EPA HELP computer program. This program is used to predict the movement of surface water (from precipitation) throughout the cover system. The model considers run-off, evapotranspiration and lateral drainage as the mechanism for reducing the amount of percolation that penetrates the cover and moves into the waste. The model also predicts that for all rainfall events including peak rainfall events, no vertical percolation into the waste is expected to occur.

The climatological conditions for the Bonnell facility in Newnan, Georgia were characterized by using synthetically generated rainfall, temperature and solar radiation data for Atlanta, Georgia for a 20-year period. Appendix D presents the HELP model input and output for the cover system to be used for CrOH sludge sand drying bed area.

Input values for the various soil physics parameters were selected from the default data base contained within the HELP model, as shown on Table 3. Fine sandy loam (No. 7, Unified Soil Classification - SM) values were used to describe layer 1, the vegetative soil layer. Although the specific characteristics of the vegetative soil layer have little effect on the amount of percolation through the unit cover, soil actually used in the construction of the cap will meet the parameters used in the HELP model. The purpose of the vegetative soil layer is to support vegetation and to provide a medium for evapotranspiration.

The input parameters that describe layer 2, the lateral drainage layer, were recommended by the author/developer of the HELP model, Dr. Paul Schroeder of the Waterways Experiment Station, U.S. Army Corps of Engineers, Vicksburg, Mississippi. Drainage net meeting the parameters in the HELP model will be used to construct the cap.

Clay loam (No. 11, Unified Soil Classification - CL) values were used to describe layer 3, barrier soil liner with flexible membrane, a compacted layer. When compaction is specified such as in layer 3, the soil characteristics are automatically adjusted as follows: (1) the saturated hydraulic conductivity is reduced by a factor of 20, (2) the porosity is reduced by 25 percent, (3) the field capacity is reduced by 25 percent of the difference between uncompacted field capacity and wilting point and (4) the evaporation coefficient is assigned the minimum value of 3.3. Layer 3 contains a HDPE membrane which the model assumes is impermeable except for possible leaks. Therefore, a leakage fraction of 0.0001, as recommended by Dr. Paul Schroeder assuming installation with good QA/QC procedures, was entered to characterize the potential leaks in the HDPE membrane.

HELP model input values such as the maximum leaf area index (2.00) and evaporative zone depth (22.00 inches) are default values for fair grass in Atlanta, Georgia.

I-6e Extensions for Closure Plan

As previously indicated, the proposed schedule for closure of the CrOH sludge sand drying bed area is based on a 180-day construction period. If, due to encountering unforeseen conditions during closure, additional time is necessary to complete closure, the Georgia EPD will be notified within 30 days prior to expiration of the 180-day period in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.113(c)(2)) and an extension to the schedule to reflect the additional time required will be requested under Georgia Rule 391-3-11-.10 (40 CFR 265.113(b)(1)).

I-6f Ground-Water Monitoring

During closure of the CrOH sludge sand drying bed area, the compliance monitoring program described in the RCRA Part B Permit Application for Post-Closure Care dated October 1990 (which is being revised in accordance with the March 8, 1991 NOD letter) will be maintained. For completeness of this closure plan, a copy of Section E-7 "Description of Compliance Monitoring Program" and E-5 "General Monitoring Program Requirements" from the permit application along with selected tables, figures and appendices referenced in these sections have been included as Appendix I.

I-7 DECONTAMINATION OF EQUIPMENT

Equipment, including earth-moving and transport vehicles, that has been in contact with hazardous wastes during this closure of the CrOH sludge sand drying bed area will be decontaminated, as per Georgia Rule 391-3-11-.10 (40 CFR 265.112(b)(4) and 265.114). The decontamination will be completed by triple rinsing using a low-volume pressure water wash and visual determination that all soil has been removed.

A decontamination station, shown on Figure 7, will be constructed at the location shown on Figure 6. This station will contain the rinse water used in cleaning equipment. At the end of closure activities, the station will be pressure washed. The rinse water will be pumped to the head of the chemical conversion coating process wastewater treatment system for treatment and disposal through the NPDES-permitted outfall. Material that cannot be easily decontaminated (e.g. protective clothing) will be bulk-loaded and shipped to an Interim Status or approved facility for disposal as hazardous waste.

A Safety Plan will be developed prior to initiating closure activities. This plan will be prepared and followed so that individuals participating in the closure are knowledgeable of potential dangers and take specific safety precautions. Only qualified personnel will participate in the closure activities.

II POST-CLOSURE PLAN

II-1 POST-CLOSURE ACTIVITIES

This Post-Closure Plan describes in general, the activities that will be performed to monitor the CrOH sludge sand drying bed area throughout the 30-year post-closure period in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.117-119 and 265.310). Property use during post-closure care will be restricted in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.117(c)). The 30-year post-closure period may be shortened or extended by the Georgia EPD under Georgia Rule 391-3-11-.10 (40 CFR 265.117(a)(2)).

The post-closure certification will be submitted via registered mail to the Georgia EPD Director within 60 days after completion of post-closure care period in accordance with the approved post-closure plan as per Georgia Rule 391-3-11-.10 (40 CFR 265.120). This certification will be signed by both Bonnell and an independent registered professional engineer. Documentation supporting the engineer's certification will be available to Georgia EPD upon request and will be maintained until Bonnell is released from financial assurance requirements.

During plant operation, the Technical Director of Bonnell will be responsible for retaining and updating the on-site copy of the post-closure plan. In accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.118(c)(3)), the following representative can be contacted concerning the post-closure activities of the facilities at the plant:

Mr. Leo F. Harlan, Sr.
Technical Director
William L Bonnell Company, Inc.
25 Bonnell Street
Newnan, Georgia 30263

mailing address: P.O. Box 428
Newnan, Georgia 30264

phone number: (404) 253-2020

II-1a Inspection Plan

The closed CrOH sludge sand drying bed area will be monitored and maintained throughout the post-closure period by regular inspections and ground-water monitoring as per Georgia Rule 391-3-11-.10 (40 CFR 265.118(c)(1) and (2)). Inspection items include:

- cover and surrounding area
- ground-water monitoring wells
- run-on diversion ditches
- permanent benchmarks

Inspections will be made by Bonnell personnel trained for such purposes, on a quarterly basis and after major storm events to ascertain the condition of the cover and surrounding area. This inspection schedule is intended to insure proper monitoring of the closed unit. An inspection checklist has been included as Table 4. The purpose of this checklist is to assist the inspector in noticing particular items during the facility inspections including ground cover maintenance. The following sections describe the general procedures which will be followed during the post-closure care period.

Inspection and monitoring will continue for the 30-year post-closure period or until Bonnell receives approval from the Georgia EPD to discontinue the program. Inspection records will be kept at the Bonnell facility for a period of 5 years after the end of the post-closure care period.

II-1b Ground-Water Monitoring

Ground-water monitoring activities will be performed as described in Section I-6f. The monitoring system, along with the sampling and analysis plan procedures, will be continued for the 30-year post-closure period or until Bonnell receives notification from the Georgia EPD of approval to discontinue monitoring.

II-1c Maintenance Activities

This section addresses maintenance of the closed CrOH sludge sand drying bed area as per Georgia Rule 391-3-11-.10 (40 CFR 265.310(b)) in the following areas:

1. <u>Maintenance and Repair of the Final Cover</u>

   The cover will be inspected quarterly throughout the post-closure care period. Inspections will include checks for consistency of the soil cover, erosion, stability of the lower embankment, settlement, condition of the vegetation, and any other element of the system which may adversely affect the performance of the cover.

2. <u>Run-on/off Control System</u>

   The run-on ditches and diversion structures will be inspected quarterly and after all major storm events to check for proper flow capacity and discharge. Ditches will be repaired and/or seeded as necessary to maintain grass cover.

3. <u>Ground-Water Monitoring System</u>

   Ground-water monitoring wells will be inspected quarterly to verify that accessible parts of the wells including the outer casing and cap, lock, apron, inner casing and cap, measuring point, and well identification number are maintained.

4. <u>Security Control Devices</u>

   All access to the closed CrOH sludge sand drying bed area will be controlled by fences surrounding the Bonnell site. These fences will be repaired or replaced as necessary. The fence will be inspected quarterly. An inspection log for the perimeter fence is included as Figure 8.

5. <u>Vegetative Cover</u>

   The surficial cover and perimeter run-on diversion ditch will be grassed. Fertilizer and seed will be applied as needed to assure continuous grass cover as a deterrent to erosion. Fertilizer will be applied a minimum of once a year.

Post-closure care will include mowing the grass of the CrOH sludge sand drying bed area at least four times per year. Clippings will be left in place to provide nutrients and organic matter and to promote erosion control.

Also during post-closure, supplemental water will be applied as needed during dry weather to maintain the vegetative cover and help control wind erosion. Irrigation will be scheduled based on observations made during field inspections.

During post-closure care, Bonnell will inspect the grass cover quarterly and after major rainfall events. Inspections will be logged, and reports will be retained by Bonnell. The inspections will check for erosion, vegetative distress due to insect infestation or drought, or other factors which may adversely affect the vegetative cover.

6. <u>Additional Considerations</u>

The cover drainage system will be checked during inspections to assure that no ponding of water occurs on the surface of the cover.

II-1d Demonstration of Security at the Site

The plant site is monitored by security guards 24 hours per day, 365 days per year. Signs will be posted that read "DANGER - UNAUTHORIZED PERSONNEL KEEP OUT." The monitoring wells have been provided with locks to maintain the security of the individual wells.

III NOTICE IN DEED AND NOTICE TO LAND AUTHORITY

In conjunction with the closure certification, Bonnell will submit to the local zoning authority and to the Director of Georgia EPD, a survey plat indicating the location and dimensions of the closed CrOH sludge sand drying bed area. This plat will be prepared and certified by a professional land surveyor. The plat will be filed with the local zoning authority and will contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the unit as specified in Georgia Rule 391-3-11-.10 (40 CFR 265.116).

Within 60 days after certification of closure, Bonnell will record a notation on the deed to the property as per Georgia Rule 391-3-11-.10 (40 CFR 265.119(b)(1)). The notation on the deed to the property will include: (1) that the CrOH sludge sand drying bed area has been used to manage hazardous wastes, (2) that its use is restricted under Georgia Rule 391-3-11-.10 (40 CFR 265 Subpart G regulations, 265.117(c)), (3) that a survey plat and record of the type, location and quantity of the wastes which have been stored there as required under Georgia Rule 391-3-11-.10 (40 CFR 265.116 and 265.119(a)), respectively, has been filed with the local zoning authority and with the Georgia EPD. Bonnell will submit a certification of notice that the notation specified in 40 CFR 265.119(b)(1) has been recorded in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.119(b)(2)) to the Director of Georgia EPD.

IV CLOSURE COST ESTIMATE

The closure cost information presented is submitted in accordance with requirements of Georgia Rule 391-3-11-.10 (40 CFR 265.142 and 265.143).

An estimated $83,077 (cost estimate in 1991 dollars) will be needed to close the CrOH sludge sand drying bed area. The closure costs for the area are presented by activity in Table 5. Total costs were calculated by adding 10% for contingencies and 5% for Bonnell's administration of the project.

These closure cost estimates will be kept on file by Bonnell. Until closure is completed, this estimate will be adjusted annually for inflation within 30 days after close of Bonnell's fiscal year in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.142(b)). Whenever a change in the closure plan affects the cost of closure, the cost estimate will be adjusted within 30 days after the revision to the closure plan in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.142(c)).

V POST-CLOSURE COST ESTIMATE

The post-closure cost information presented is submitted in accordance with requirements of Georgia Rule 391-3-11-.10 (40 CFR 265.144). An estimated $8,780 (cost estimate in 1991 dollars) will be needed for post-closure inspections and maintenance procedures over the 30 year post-closure period. The post-closure costs are presented by activity in Table 6.

This post-closure cost estimate will be kept on file by Bonnell. The cost estimate will be adjusted for inflation annually within 30 days after the close of Bonnell's fiscal year in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.144(b). Whenever a change in the post-closure plan affects the cost of post closure, the cost estimate will be adjusted within 30 days after the revision to the post-closure plan in accordance with Georgia Rule 391-3-11-.10 (40 CFR 265.144(c)).

VI FINANCIAL ASSURANCE FOR CLOSURE/POST-CLOSURE AND LIABILITY COVERAGE

Bonnell has selected the "corporate guarantee" as the method for demonstrating financial responsibility for closure, post-closure care, and liability coverage for specified hazardous waste treatment, storage, and disposal units at Bonnell's Newnan, Georgia facility. Bonnell's guarantor is its corporate parent, Tredegar Industries, Inc. ("Tredegar"), a Virginia corporation. Because Tredegar is Bonnell's direct parent, Tredegar can satisfy the requirements of Georgia Rule 391-3-11-.05 (40 CFR 265.143(e)(10), 265.145(e)(11), and 265.147(g)). The documentation required to demonstrate financial assurance for closure and post-closure is included in Appendix J.

VII FINANCIAL ASSURANCE MECHANISM FOR SUDDEN/NON-SUDDEN ACCIDENTAL OCCURRENCES

The documentation required to demonstrate financial assurance under Georgia Rule 391-3-11-.05 (40 CFR 265.147), for sudden and non-sudden accidental occurrences, is included in Appendix J. The documentation reflects liability coverage in the amount of $4 million per occurrence and an $8 million annual aggregate.

REFERENCE

Peck, R.B., W.E. Hanson and T.H. Thornburn. 1973. Foundation Engineering, Second Edition. John Wiley & Sons, Inc., New York.

TABLE 1

LIST OF MATERIALS INTRODUCED IN THE CHEMICAL CONVERSION COATING PROCESS AND WASTEWATER TREATMENT FACILITY
WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

PROCESS:

Aluminum
Chromic acid
Hydrofluoric acid
Isopropyl alcohol
Phosphoric acid
Sodium hydroxide

WWTF:

Lime
Polymer
Sodium bisulfite
Sulfuric acid
Phosphoric acid

TABLE 2

LIST OF MATERIALS INTRODUCED IN THE ANODIZING PROCESS AND WASTEWATER TREATMENT FACILITY
WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

PROCESS:

- Aluminum
- Hydrogen peroxide
- Nickel acetate
- Nitric acid
- Phosphoric acid
- Sodium hydroxide
- Sulfuric acid
- Water

WWTF:

- Lime
- Polymer
- Spent sodium hydroxide
- Spent sulfuric acid
- Sodium hydroxide

TABLE 3
HELP MODEL-DEFAULT UNVEGETATED, UNCOMPACTED SOIL CHARACTERISTICS

HELP	SOIL CLASSIFICATIONS USDA	SOIL CLASSIFICATIONS USCS	POROSITY (VOL/VOL)	FIELD CAPACITY (VOL/VOL)	WILTING POINT (VOL/VOL)	SAT. HYD. CONDUCTIVITY (CM/SEC)
1	CoS	GS	0.417	0.045	0.018	1.0E - 02
2	S	SW	0.437	0.062	0.024	5.8E - 03
3	FS	SM	0.457	0.083	0.033	3.1E - 03
4	LS	SM	0.437	0.105	0.047	1.7E - 03
5	LFS	SM	0.457	0.131	0.058	1.0E - 03
6	SL	SM	0.453	0.190	0.085	7.2E - 04
7	FSL	SM	0.473	0.222	0.104	5.2E - 04
8	L	ML	0.463	0.232	0.116	3.7E - 04
9	SiL	ML	0.501	0.284	0.135	1.9E - 04
10	SCL	SC	0.398	0.244	0.136	1.2E - 04
11	CL	CL	0.464	0.310	0.187	6.4E - 05
12	SiCL	CL	0.471	0.342	0.210	4.2E - 05
13	SC	CH	0.430	0.321	0.221	3.3E - 05
14	SiC	CH	0.479	0.371	0.251	2.5E - 05
15	C	CH	0.475	0.378	0.265	1.7E - 05
16	Liner Soil		0.430	0.366	0.280	1.0E - 07
17	Liner Soil		0.400	0.356	0.290	1.0E - 08
18	Mun. Waste		0.520	0.294	0.140	2.0E - 04
19	USER SPECIFIED SOIL CHARACTERISTICS					
20	USER SPECIFIED SOIL CHARACTERISTICS					

TABLE 4

POST-CLOSURE INSPECTION CHECKLIST FOR CrOH SLUDGE SAND DRYING BED AREA
WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

Date Inspected/Time ____________________

Reasons for Inspection
(routine/rainfall data) ____________________

Erosion (yes/no) ____________________

Ample Vegetative Ground-Cover (yes/no) ____________________

Woody Plant Infiltration (yes/no) ____________________

Security Barrier Intact (yes/no) ____________________

Drainage Ditches checked (yes/no) ____________________

Ground-water Monitoring Wells checked (yes/no)
- Locks
- Structure Integrity
- Identification
- Survey Benchmark ____________________

Comments

____

Date/Type of Corrective Action ____________________

Name of Inspector ____________________
(Signature)

Name of Person responsible for Corrective Action or Further Investigation ____________________
(Signature)

The purpose of this checklist is to assist the inspector in noticing particular item during the facility inspections. These inspections are to occur on a routine basis and also are to be conducted following any heavy rainfall or any natural disaster.

The inspector is encouraged to make general observations in the "Comments" section regarding conditions found during inspections. Comments such as condition of vegetation, weather, repair, etc. should be noted. Any necessary corrective action or further investigation must be noted in the "Comments" section. Finally, the inspector is responsible for obtaining the description of the corrective action or further investigation for entry in the "Date/Type of Corrective Action or Further Investigation" section and for obtaining the signature of the person responsible for the corrective action or further investigation.

TABLE 5
COST ESTIMATE FOR CLOSURE OF CrOH SAND DRY BED AREA

WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

ITEM	QUANTITY	UNIT COSTS	COST **
1. DESIGN			
a. Professional Engineer	40 hours	$100.00 per hour	$4,000
b. Design Engineer	100 hours	$60.00 per hour	$6,000
c. Drafter	50 hours	$40.00 per hour	$2,000
2. SITE PREPARATION			
a. Mobilization/Demobilization	Lump Sum	$1,000.00	$1,000
b. Cover Preparation	200 c.y.	$6.00 per c.y.	$1,200
c. Pipe and Manhole Removal	Lump Sum	$5,000.00	$5,000
3. CONSTRUCTION *			
a. Cap Construction			
1. Fill Material (2 ft. topsoil)	200 c.y.	$6.00 per c.y.	$1,200
2. Geofabric	532 s.y.	$1.62 per s.y.	$862
3. Geonet	266 s.y.	$3.15 per s.y.	$838
4. HDPE Membrane	266 s.y.	$31.05 per s.y.	$8,259
c. Ditch Construction	Lump Sum	$1,000.00	$1,000
4. EQUIPMENT DECONTAMINATION	40 hours	$10.00 per hour	$400
5. FINAL GRADE AND SEED	266 s.y.	$1.70 per s.y.	$452
6. CONTRACTOR SUPERVISION			
a. Labor	300 hours	$50.00 per hour	$15,000
b. Expenses	60 days	$25.00 per day	$1,500
7. ENGINEERING INSPECTION AND CERTIFICATION			
a. Professional Engineer	100 hours	$100.00 per hour	$10,000
b. Technician	300 hours	$40.00 per hour	$12,000
c. Clerical	10 hours	$33.00 per hour	$330
d. Expenses, Travel and Per Diem	40 days	$30.00 per day	$1,200
		SUB-TOTAL	$72,241
		CONTINGENCY (10%)	$7,224
		ADMINISTRATION (5%)	$3,612
		TOTAL COST	$83,077

* Includes labor cost

** 1991 dollars

TABLE 6
COST ESTIMATE FOR POST-CLOSURE CARE OF CrOH SAND DRYING BED AREA

WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

ITEM	QUANTITY	UNIT COSTS	COST **
1. SITE INSPECTION (4 times/year)			
a. Technician	16 hours	$40.00 per hour	$640
2. MOWING AND FERTILIZING *			
a. Mowing (4 times/year)	0.52 acres	$30.00 per acre	$16
b. Fertilizing	0.13 acres	$350.00 per acre	$46
3. ROUTINE EROSION REPAIR *			
a. Soil excavating, hauling, spreading and compaction	0.5 c.y.	$10.00 per c.y.	$5
b. Seeding	40 s.f.	$0.08 per s.f.	$3
4. GROUND-WATER QUALITY MONITORING			
Sampling and Analysis, per year	4 wells	$650.00 per well	***
		SUB-TOTAL	$710
		CONTINGENCY (10%)	$71
		ADMINISTRATION (5%)	$36
		TOTAL COST PER YEAR	$817
		POST-CLOSURE COST (30 years) ****	$8,780

* Includes labor cost

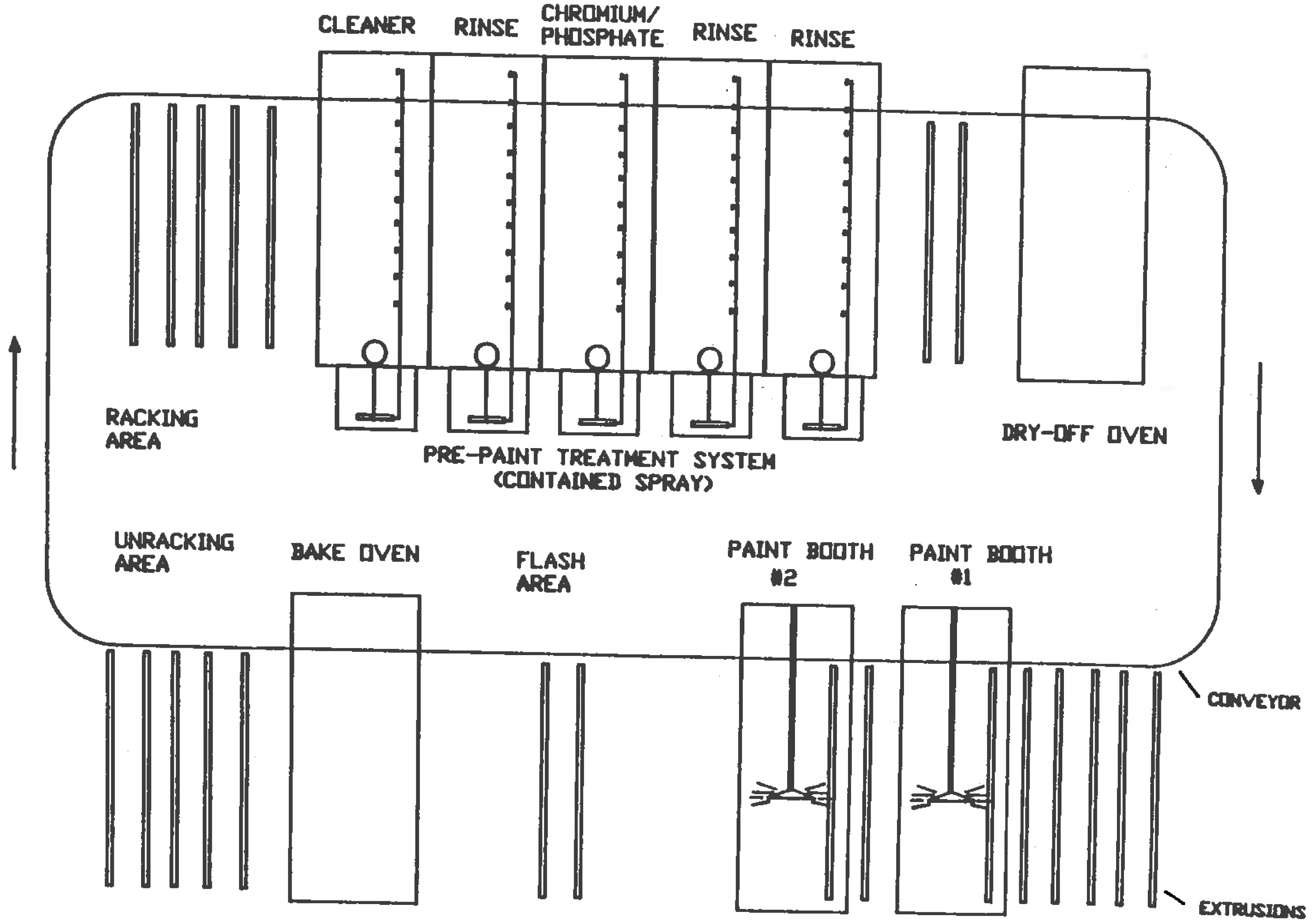
** 1991 dollars

*** Costs for ground-water quality monitoring of the CrOH Sand Drying Bed Area are included in the Polishing Pond Post-Closure Cost Estimate.

**** Calculated as follows:

$$P = A \frac{[(i + 1)^n - 1]}{i(i + 1)^n}$$

where
P - present worth
A - total cost per year
i - Federal Discount Rate of 8.5%
n - number of compounding periods



SOURCE: DELISTING PETITION FOR THE WILLIAM L BONNEL COMPANY

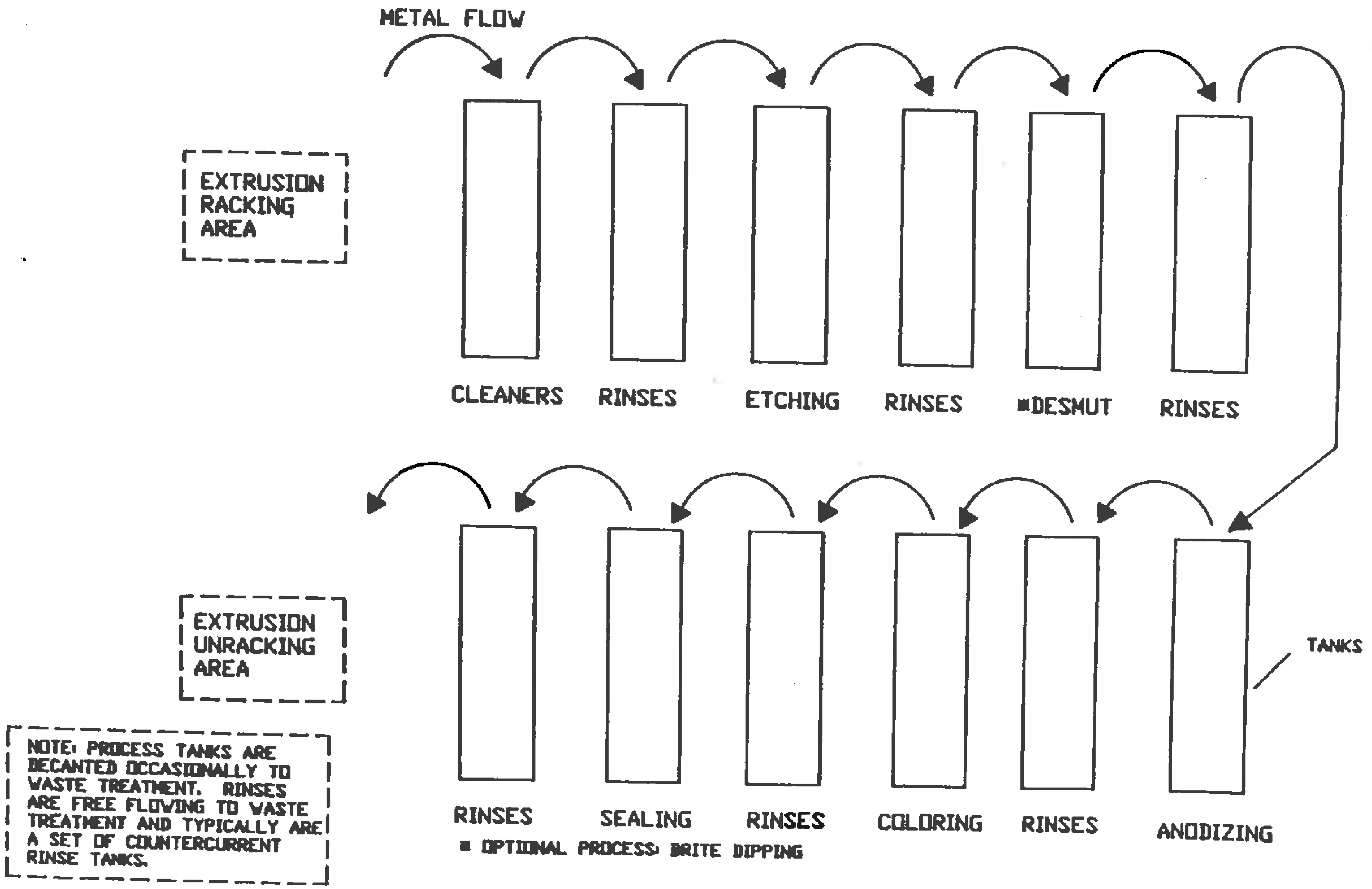
WILLIAM L BONNELL COMPANY
NEWNAN, GEORGIA

LAW ENVIRONMENTAL, INC.

CHEMICAL CONVERSION COATING
PROCESS FLOW DIAGRAM

JOB NO. 55-0649

FIGURE 1



NOTE: PROCESS TANKS ARE DECANTED OCCASIONALLY TO WASTE TREATMENT. RINSES ARE FREE FLOWING TO WASTE TREATMENT AND TYPICALLY ARE A SET OF COUNTERCURRENT RINSE TANKS.

SOURCE: DELISTING PETITION FOR THE WILLIAM L BONNEL COMPANY

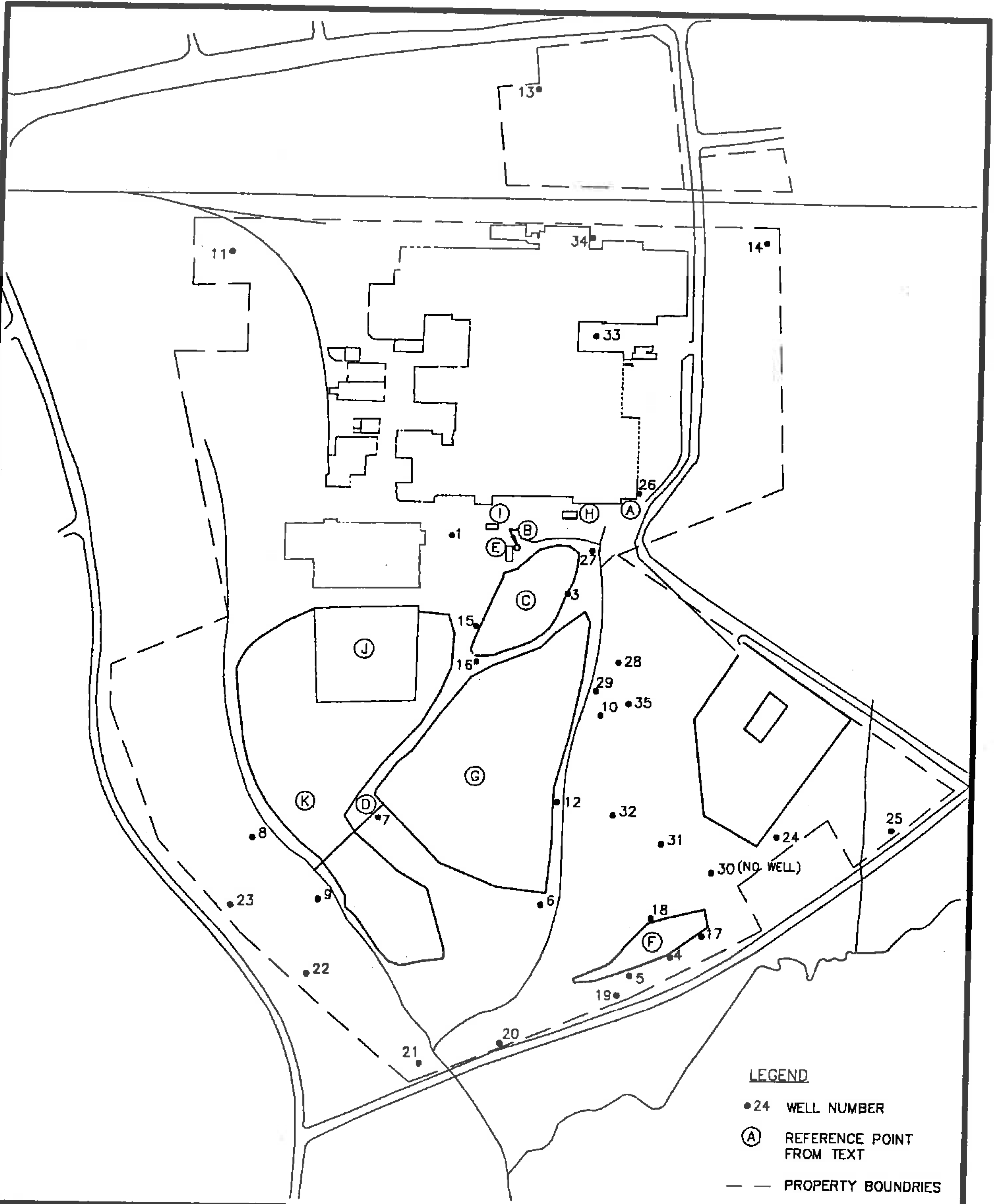
WILLIAM L BONNEL COMPANY
NEWNAN, GEORGIA

LAW ENVIRONMENTAL, INC.

ANODIZING PROCESS
FLOW DIAGRAM

JOB NO. 55-0649

FIGURE 2



WILLIAM L BONNELL COMPANY

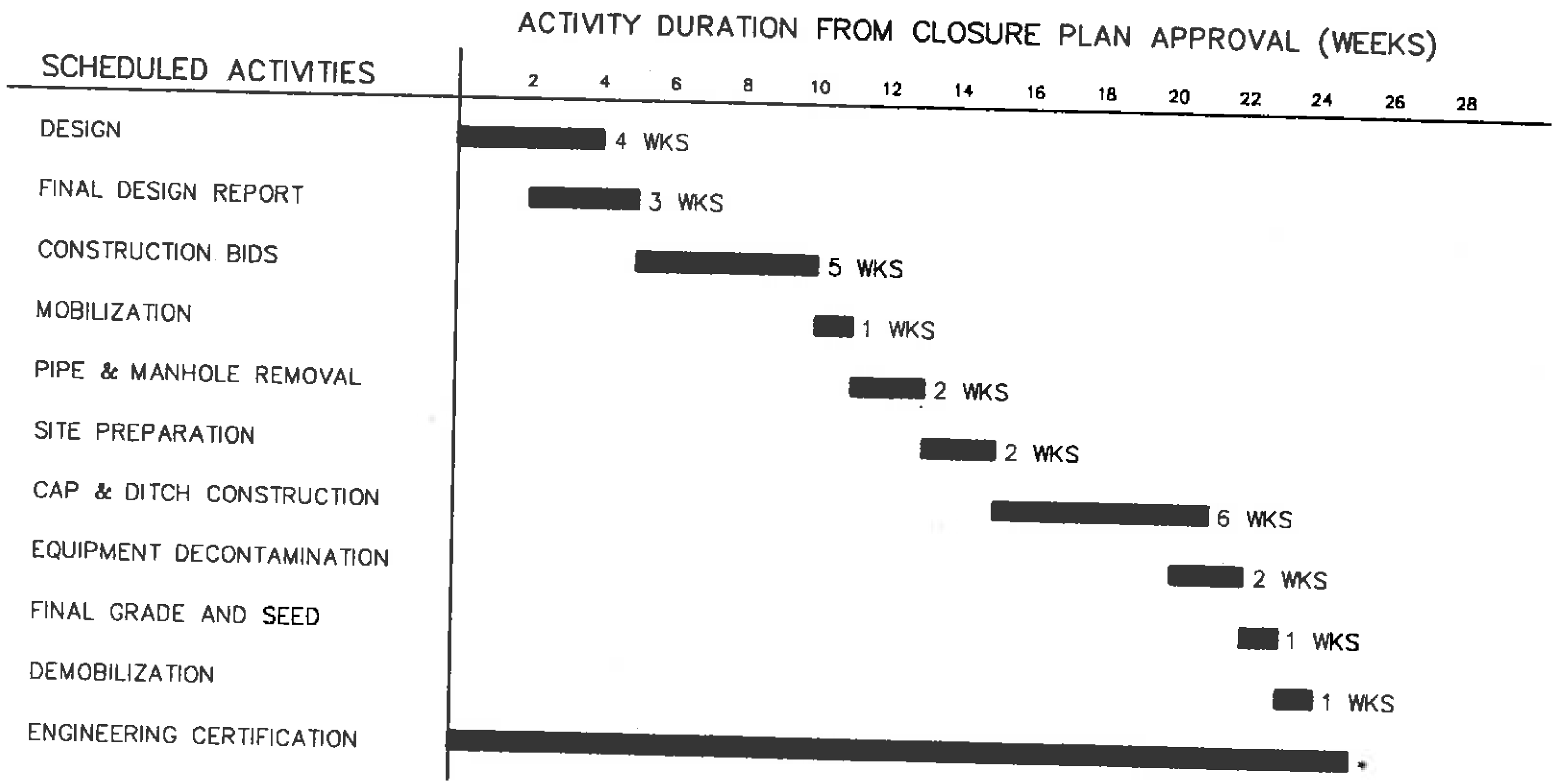
NEWNAN, GEORGIA

LAW ENVIRONMENTAL, INC.

SITE PLAN

JOB NO. 55-0649

FIGURE 3



LEGEND

▬ PROJECTED TIME LINE

* CERTIFICATION TO BE SUBMITTED WITHIN 60 DAYS AFTER CLOSURE COMPLETION

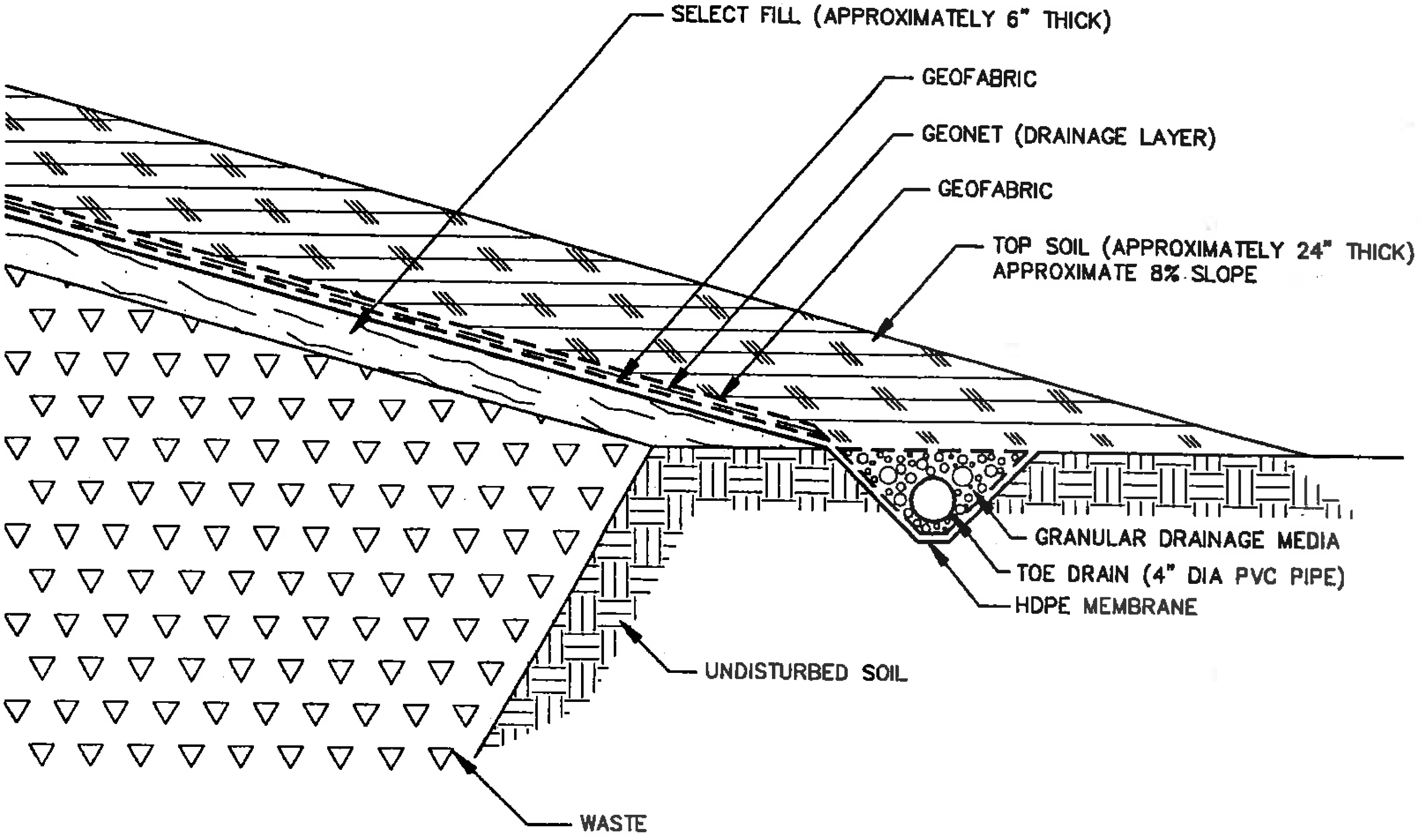
WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

LAW ENVIRONMENTAL, INC.

CrOH SLUDGE
SAND DRYING BED AREA
CLOSURE SCHEDULE

JOB NO. 55-0649

FIGURE 4



WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

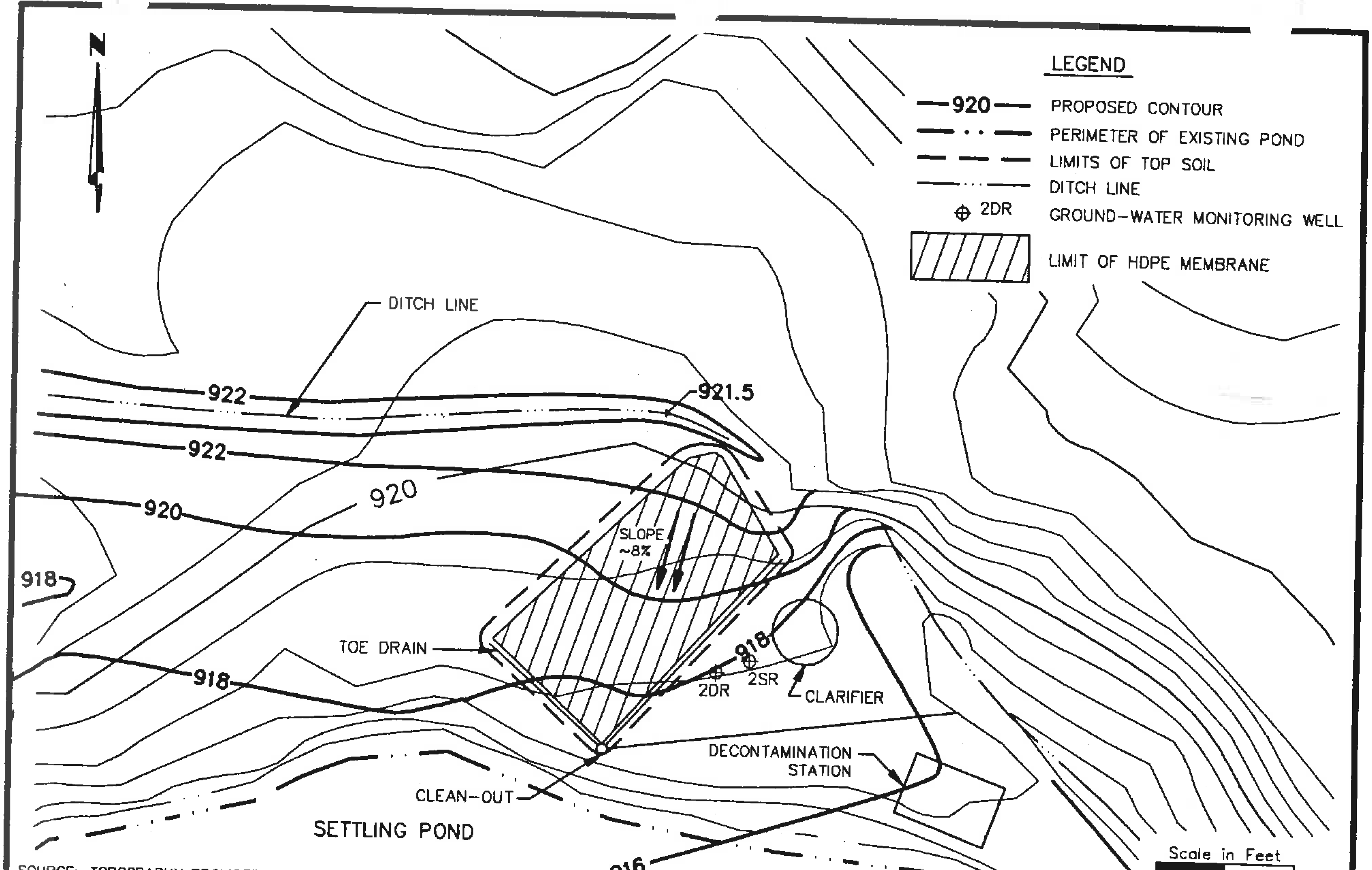
LAW ENVIRONMENTAL, INC.

CrOH SLUDGE
SAND DRYING BED AREA
TYPICAL COVER SCHEMATIC

JOB NO. 55-0649

FIGURE 5

1130sh



SOURCE: TOPOGRAPHY PROVIDED BY WILLIAM L BONNELL COMPANY, INC.

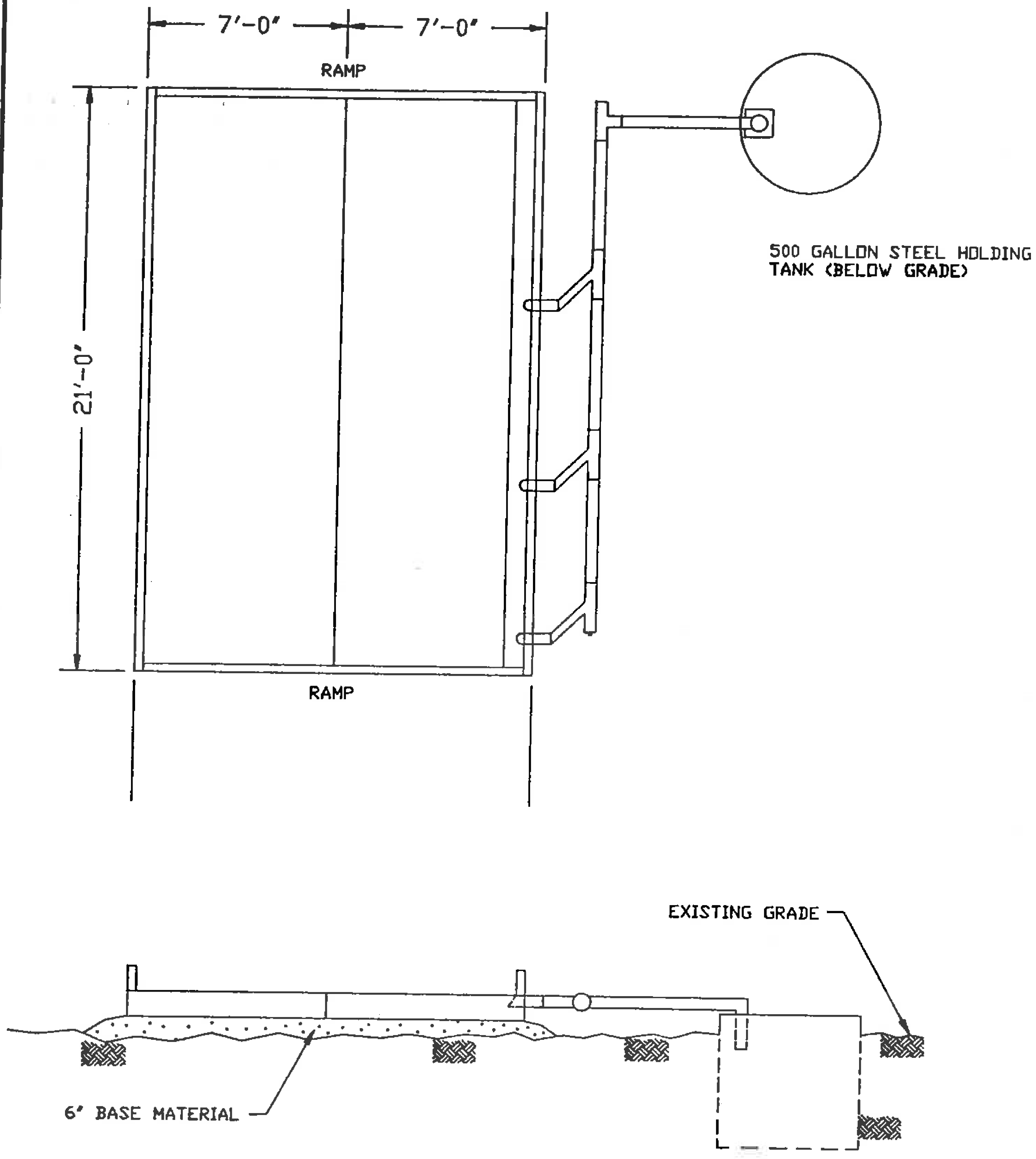
WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA

LAW ENVIRONMENTAL, INC.

CrOH SLUDGE
SAND DRYING BED AREA
CONCEPTUAL COVER

JOB NO. 55-0649

FIGURE 6



SOURCE: REVISED CLOSURE PLAN CHROMIUM HYDROXIDE SLUDGE
SAND DRYING BEDS BY ATEC ENVIRONMENTAL DATED MARCH 7, 1990

SCALE: 1'=5'

WILLIAM L BONNELL COMPANY
NEWNAN, GEORGIA

DECONTAMINATION
WATER COLLECTION SYSYEM
FIGURE 7

EXHIBIT 8

BONNELL PERIMETER FENCE

QUARTERLY INSPECTION LOG

INSPECTION DATE AND TIME: ______________________________

INSPECTOR'S NAME: ______________________________

DESCRIBE LOCATION AND TYPE OF DEFICIENCIES (Breaks, Collapse, Erosion, Excessive Rust):

____

____

____

DESCRIBE REPAIRS MADE TO CORRECT DEFICIENCIES AND INDICATE DATE OF REPAIRS:

____

____

____

APPENDIX A

Laboratory Data and Material Safety Data Sheets

EXHIBIT C-2

RESULTS OF ANALYSES OF BONNELL F019 WASTE
1980-1983

1980

03/06/80	0.50 ppm Extraction Procedure Chromium
08/14/80	0.25 ppm Extraction Procedure Chromium
12/02/80	< 0.1 ppm Total Cyanide

1983

CONCENTRATION (ppm)

Constituent	Sample 1 09/26/83	Sample 2 10/08/83	Sample 3 10/10/83	Sample 4 10/17/83	EP Results
Arsenic	< 6	< 6	< 6	< 6	< 0.5
Barium	34	30	21	14	< 0.1
Cadmium	< 1	< 1	< 1	< 1	< 0.1
Chromium	4,100	4,000	3,000	3,500	0.3
Lead	2	< 3	< 3	< 3	< 0.1
Mercury	2	< 1	< 1	< 1	0.1
Selenium	< 6	< 6	< 6	< 6	< 0.3
Silver	< 1	< 1	< 1	< 1	0.4
Nickel	30	3	2	6	0.1
Oil & Grease	1800	1200	1600	2300	N/A

EXHIBIT C-3

RESULTS OF ANALYESES OF BONNELL F019 WASTE

1986-1988

1986

Total Mercury (Hg) (mg/kg)	< 0.02
Water Soluble Fluoride (F) (mg/kg)	80
Total Solids @ 105°F	11.6%

1988

	Total Solids	Total Cr	Cr^{+6}
05/02/88	10.9%	8350 ppm	< 0.02 ppm
05/10/88	35.1%	7130 ppm	< 0.02 ppm

GM67B

Ethyl Aluminum Group

MATERIAL SAFETY DATA SHE

Emergency Phone 504-344-7147

25.0.2

PRODUCT IDENTIFICATION

TRADE NAME:

ALUMINUM EXTRUSIONS
May be painted or anodized. May contain polyvinyl chloride or polyurethane as cavity fillers.

These products do not in and of themselves constitute a hazardous material under OSHA regulations. The products do contain alloying elements that have been determined by OSHA to be hazardous. However, these elements can only be released by certain manufacturing procedures such as welding, brazing, burning, grinding, etc.

INGREDIENTS

BASE METAL	CAS. NO.	% COMPOSITION BY WEIGHT	EXPOSURE LIMIT
Aluminum	7429-90-5	90 - 99	10 mg/M^3 as metal dust and oxide; 5 mg/M^3 as welding fume (ACGIH).

ALLOYING ELEMENT	CAS. NO.	% COMPOSITION BY WEIGHT	EXPOSURE LIMIT
Magnesium	1309-48-4	0.1 - 1.5	10 mg/M^3 TWA$_8$ as fume (ACGIH). 15 mg/M^3 TWA$_8$ as fume (OSHA).
Silicon	7440-21-3	0.2 - 1.0	10 mg/M^3 TWA$_8$ as total dust (ACGIH).

02/25/86
Continued

ALLOYING ELEMENT	CAS. NO.	% COMPOSITION BY WEIGHT	EXPOSURE LIMIT
Chromium	7440-47-3	0.005 - 0.2	0.5 mg/M^3 TWA_8 (ACGIH). 1.0 mg/M^3 TWA_8 (OSHA).
Zinc	1314-13-2	0.01 - 5.0	5.0 mg/M^3 as fume (OSHA/ACGIH).

PHYSICAL DATA

APPEARANCE: Solids, varying shapes.

MELTING POINT: 593 - 704°C/1100 - 1300°F.

VAPOR PRESSURE: Not applicable.

SOLUBILITY IN WATER: Not applicable.

SPECIFIC GRAVITY: 2.5 - 2.9

FIRE AND EXPLOSION HAZARDS

FLASH POINT: Not applicable.

FLAMMABLE LIMITS: Not applicable.

EXTINGUISHING MEDIA: This product is nonflammable in its massive form. For fires involving fines or chips, use dry sand or Class D extinguishing agents. DO NOT use water or halogenated extinguishing agents.

HAZARDOUS THERMAL DECOMPOSITION PRODUCTS: Extrusions which are painted and/or contain polyvinyl chloride or polyurethane inserts may evolve the following compounds when exposed to high heat or fire: oxides of carbon and nitrogen, traces of hydrogen chloride from polyvinyl chloride inserts and traces of hydrogen cyanide from polyurethane inserts.

Continued

SPECIAL FIRE FIGHTING PROCEDURES:
DO NOT use water or halogenated extinguishing agents.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
None known.

REACTIVITY DATA

STABILITY: Stable.

MATERIALS TO AVOID: May be incompatible with acids, bases and oxidizers.

HAZARDOUS POLYMERIZATION:
Will not occur.

HEALTH HAZARDS

Ozone may be emitted as a by-product during welding or plasma arc cutting. Exposure to ozone may produce irritation to eyes, nose and throat. Prolonged exposure may result in nausea, headache, and pulmonary edema.

Aluminum: Aluminum dust can cause pulmonary fibrosis. Asthma can be caused by aluminum soldering.

Chromium: Can cause skin and eye irritation. Dust may be irritating to the respiratory tract. Hexavalent chromium has been shown to cause nasal perforation and carcinogenicity in laboratory animals. Certain chromium compounds are on the NTP list of carcinogens.

Magnesium: Inhalation of the oxide can cause metal fume fever. Exposure of abraded skin surfaces can cause inflamation. Overexposure to fumes may cause irritation to the eyes and respiratory tract. No chronic effects of overexposure are known.

Silicon: Considered a nuisance dust by ACGIH. No chronic effects of overexposure are known.

Zinc: Inhalation of the oxide can cause metal fume fever. Symptoms from ingestion include stomach cramps, nausea, vomiting, diarrhea and fever. No chronic effects of overexposure are known.

NOTE: If exposures for aluminum fume, dust, and oxides are kept below the permissible exposure limit the alloy components should not present any significant health risk.

EMERGENCY FIRST AID PROCEDURES

INHALATION:	If inhaled, remove to fresh air.
EYE CONTACT:	Immediately flush eyes with water for at least 15 minutes.
SKIN CONTACT:	Wash exposed area with soap and water.
INGESTION:	Not expected to be a route of exposure.

EXPOSURE CONTROL INFORMATION

EXPOSURE LIMITS:	See Ingredients section.
EYE PROTECTION:	Safety glasses with side shields or goggles when cutting extrusions. If extrusions are welded, use standard welding protective eyewear.
PROTECTIVE GLOVES:	Use gloves appropriate for the type of processing activity.
RESPIRATORY PROTECTION:	None needed under normal processing conditions. NIOSH approved dust/fume respirator when grinding, welding, brazing, or burning.
LOCAL EXHAUST VENTILATION:	Not needed under normal processing conditions. Local exhaust ventilation is recommended for grinding, welding, brazing, burning.
MECHANICAL VENTILATION:	Recommended.
OTHER:	Other protective equipment as needed according to the nature of the processing activity.

TRADE NAME: Aluminum Extrusion

ENVIRONMENTAL PROTECTION

SPILLS OR LEAKS: Not applicable.

DISPOSAL METHODS: Used or unused product should be tested as necessary to determine hazard status and disposal requirements under federal, state, or local laws and regulations.

STORAGE REQUIREMENTS: No special storage required.

ADDITIONAL PRECAUTIONS OR COMMENTS

If aluminum extrusions are remelted, make certain no water or moisture is present in cavaties or on external surfaces. Entrapped moisture or the presence of strong oxidizers could cause an explosion.

REVISED: 02/25/86 (Original)
SUPERSEDES: NEW
T&IH File Code: TX 02555-XX-7
MSDS prepared by: Toxicology and Industrial Hygiene Department
Ethyl Corporation

FOR ADDITIONAL NONEMERGENCY MSDS INFORMATION, CONTACT:
TOXICOLOGY AND INDUSTRIAL HYGIENE DEPARTMENT
ETHYL CORPORATION
451 FLORIDA ST.
BATON ROUGE, LA 70801
(504) 388-7717

THIS MATERIAL SAFETY DATA SHEET CONTAINS AT LEAST THE INFORMATION REQUIRED BY THE FEDERAL OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200(g)(2).

MATERIAL SAFETY DATA SHEET

NOVAMAX TECHNOLOGIES (U.S.) INC.
1615 Johnson Road N.W.
Atlanta, Georgia 30318

Phone:
INQUIRY---(404) 799-1292
EMERGENCY-(800) 366-6682

HAZARD RATINGS		
HEALTH	3	0=Least 1=Slight
FLAMMABILITY	0	2=Moderate 3=High
REACTIVITY	2	4=Extreme

IDENTITY: (As used on label and list)

SC-34
SPRAY ALKALINE ALUMINUM CLEANER

SECTION I

MANUFACTURER'S NAME: NOVAMAX TECHNOLOGIES (U.S.) INC.
ADDRESS: 1615 Johnson Road N.W.
Atlanta, Georgia 30318
EMERGENCY PHONE NUMBER: (800) 366-6682
PHONE NUMBER FOR INFORMATION: (404) 799-1292
DATE PREPARED: May 22, 1989
NAME OF PREPARER: Virgil Zipperer

SECTION II HAZARDOUS INGREDIENTS/INFORMATION

HAZARDOUS COMPONENTS

		OSHA PEL	ACGIH TLV	OTHER NIOSH
SODIUM HYDROXIDE	CAS# 1310-73-2	2mg/m3	2mg/m3 Ceil. 15-min.	2mg/m3 Ceil.

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point_____________220 F
Vapor Pressure (mm Hg)____ 16
Vapor Density (Air=1)___ 1.4
Specific Gravity (H2O=1)_________1.514
Melting Point_________________ 50 F
Evaporation Rate
(Butyl Acetate=1)______________20.0
Solubility in Water: Complete.
Appearance and odor: Hazy, off white, viscous liquid with mild amine odor.

SECTION IV- FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used):_NONE Flammable Limits___N/A_ LEL_N/A__ UEL _N/A
Extinguishing Media: N/A
Special Fire Fighting Procedures: This product is corrosive to skin, eyes and mucous membranes. Firefighters should wear full protective clothing and face shield to prevent contact with solutions.
Unusual Fire and Explosion Hazards: Solutions of this product react with aluminum and magnesium to produce hydrogen gas which is explosive.

NOVAMAX TECHNOLOGIES (U.S.) INC.
1618 Johnson Road N.W.
Atlanta, Georgia 30318

****

SECTION V- REACTIVITY DATA

****

Stability: Stable

Incompatibility (Materials to Avoid): Do not mix with acids, reducing agents, aluminum, zinc or tin.

Hazardous Decomposition or Byproducts: Heat and/or hydrogen.

Hazardous Polymerization: Will Not Occur.

****

SECTION VI- HEALTH HAZARD DATA

****

Route(s) of Entry:

Inhalation? Mists are corrosive.

Skin? Solutions and mists are corrosive.

Ingestion? Solutions are corrosive.

Health Hazards (Acute and Chronic): Corrosive to skin, eyes and mucous membranes.

Carcinogenicity:

NTP? Not on list.

IARC Monographs? Not on list.

OSHA Regulated? Refer to SECTION II for PEL and TLV values.

Signs and Symptoms of Exposure:

INHALATION- Irritation of respiratory system with possible difficulty in breathing.

INGESTION- Small amounts may cause gastric pain, diarrhea and vomiting.

SKIN CONTACT-Irritation, inflammation, pain.

Medical Conditions Generally Aggravated by Exposure: Unknown

Emergency and First Aid Procedures:

INGESTION-Administer citrus juices or dilute vinegar; [illegible]
available [illegible]

ata Sheet

IV FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD) None

AUTOIGNITION TEMPERATURE None

FLAMMABLE LIMITS IN AIR, % BY VOL. None **LOWER** **UPPER**

EXTINGUISHING MEDIA Water, dry chemical, foam

SPECIAL FIRE FIGHTING PROCEDURES
Strong oxidizer self contained breathing apparatus and full protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARD
Strong oxidizer do not mix with organic materials.

V HEALTH HAZARD INFORMATION

HEALTH HAZARD DATA

ROUTES OF EXPOSURE

INHALATION Redness, irritaiton, may cause perforation of nasal septum

SKIN CONTACT Redness, irritation, chrome sores

SKIN ABSORPTION Redness, irritation, chrome sores

EYE CONTACT Causes severe damage and blindness very rapidly

INGESTION Results in severe damage to mucous membranes and deep tissues can result in death

EFFECTS OF OVEREXPOSURE
ACUTE OVEREXPOSURE redness, blistering, blindness, stopped breathing death

CHRONIC OVEREXPOSURE Liver damage, lung damage

EMERGENCY AND FIRST AID PROCEDURES
EYES Immediately flush with large amounts of water for 15 minutes, lifting upper and lower lids. get medical attention

SKIN Immediately flush exposed area with water for 15 minutes. get medical attention. Remove contaminated clothing. Launder clothing before reuse.

INHALATION If affected remove to fresh air. If breathing impaired give oxygen. If breathing stopped give artifical respiration. Keep person warm. get medical attention.

INGESTION Do not induce vomiting. Vomiting will further damage the throat. Dilute by giving water. Give milk of magnesia. Keep warm and quiet.Get medical attention.

NOTES TO PHYSICIAN

Data Sheet

VI REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
Stable

INCOMPATIBILITY
Organic material, bases

HAZARDOUS DECOMPOSITION PRODUCTS
Chromic gas, hydrofluoric gas

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
none

VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Collect in absorbent material haul to hazardous landfill.

NEUTRALIZING CHEMICALS
Alkalies, soda ash, caustic

WASTE DISPOSAL METHOD
Treat chrome and remove from solution.
Collect sludge and haul to landfill - dispose of water.

VIII INDUSTRIAL HYGIENE CONTROL MEASURES

VENTILATION REQUIREMENTS
Provide sufficient air movement to take care of fumes.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY (SPECIFY IN DETAIL)
If adequate ventilation none necessary

EYE
Splash goggles, face shield, safety glasses.

GLOVES
Rubber gloves

OTHER CLOTHING AND EQUIPMENT
Rubber gloves, apron, boots

Data Sheet

IX SPECIAL PRECAUTIONS

PRECAUTIONARY STATEMENTS

Corrosive, oxidizer poisionous

For Industrial Use Only

OTHER HANDLING AND STORAGE REQUIREMENTS

Do not store with alkalies

Do not allow to contact organics

DEPARTMENT OF TRANSPORTATION INFORMATION
PROPER SHIPPING NAME:
HAZARD CLASS:
I.D. NO.:
HAZARD SUBSTANCE:

PREPARED BY

DATE

Paint.
✓

SPECIALTY CHEMICALS & SERVICES, INC.

MATERIAL SAFETY DATA SHEET

(APPROVED BY THE U. S. DEPARTMENT OF LABOR AS FORM APPROVED OMB NO. 44-R1387)
Information on this form is furnished solely for the purpose of compliance with the Occupational Safety and Health Act of 1970 and shall not be used for any other purpose. Use or dissemination of all or any part of this information for any other purpose may result in a violation of law or constitute grounds for legal action.

SECTION I

MANUFACTURER'S NAME SPECIALTY CHEMICALS & SERVICES, INC.

EMERGENCY TELEPHONE NO. 525-1518

ADDRESS (Number, Street, City, State, and ZIP Code) 89 Mangum St. S.W., Atlanta, Ga. 30313

CHEMICAL NAME AND SYNONYMS SC-27B, chromate acidulated rinse

TRADE NAME AND SYNONYMS

CHEMICAL FAMILY acid solution

FORMULA

SECTION II HAZARDOUS INGREDIENTS

PAINTS, PRESERVATIVES, & SOLVENTS	%	TLV (Units)	ALLOYS AND METALLIC COATINGS	%	TLV (Unit
PIGMENTS			BASE METAL		
CATALYST			ALLOYS		
VEHICLE			METALLIC COATINGS		
SOLVENTS			FILLER METAL PLUS COATING OR CORE FLUX		
ADDITIVES			OTHERS		
OTHERS					

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES	%	TLV (Units)
Chromic Acid		
Phosphoric Acid	30	0.1 mg
	22	1.0 mg

SECTION III PHYSICAL DATA

BOILING POINT (°F.)	no data	SPECIFIC GRAVITY (H_2O=1)	1.445
VAPOR PRESSURE (mm Hg.)	no data	PERCENT VOLATILE BY VOLUME (%)	48
VAPOR DENSITY (AIR=1)	no data	EVAPORATION RATE (________=1)	no data
SOLUBILITY IN WATER	complete		

APPEARANCE AND ODOR Slight acidic odor. Reddish brown liquid

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used) N.A.

FLAMMABLE LIMITS N.A. Lel Uel

EXTINGUISHING MEDIA N.A.

SPECIAL FIRE FIGHTING PROCEDURES N.A.

UNUSUAL FIRE AND EXPLOSION HAZARDS N.A.

SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE XXXX.5 Mil/Cu Centimeter=Chromic Acid
1.0 " " " =Phosphoric acid

EFFECTS OF OVEREXPOSURE Will cause skin and eye damage.

EMERGENCY AND FIRST AID PROCEDURES
Eye & skin contact: flush 15 minutes with water. If irritation per
seek medical aid. Ingestion: do not induce vomiting. Take large
amounts of aluminum hydroxide or milk of magnesia. Follow with
milk or white of eggs. Consult physician.

SECTION VI REACTIVITY DATA

STABILITY	**UNSTABLE**		**CONDITIONS TO AVOID** N.A.
	STABLE	X	

INCOMPATABILITY (Materials to avoid) Organic materials

HAZARDOUS DECOMPOSITION PRODUCTS N.A.

HAZARDOUS POLYMERIZATION	**MAY OCCUR**		**CONDITIONS TO AVOID** N.A.
	WILL NOT OCCUR	X	

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Small amounts, flush to drain. Large amounts should be absorbed
in light soda ash and placed in adequate landfilliarea.

WASTE DISPOSAL METHOD Consult local authorities.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specific type) N.A.

VENTILATION	**LOCAL EXHAUST** N.A.	**SPECIAL**	N.A.
	MECHANICAL (General) N.A.	**OTHER**	NA.

PROTECTIVE GLOVES rubber

EYE PROTECTION glasses with side shields

OTHER PROTECTIVE EQUIPMENT face shield & rubber apron.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Avoid skin and eye contact.

OTHER PRECAUTIONS

AMCHEM PRODUCTS, INC.
DIVISION OF HENKEL CORPORATION
300 BROOKSIDE AVENUE
AMBLER, PA 19002

AMCHEM

2
1 0

MATERIAL SAFETY DATA SHEET

WILLIAM L BONNELL COMPANY, INC
25 BONNELL STREET
NEWNAN, GA 30263

CUSTOMER # 32560001

PRODUCT TRADE NAME	RINSE AID
DOT PROPER SHIPPING NAME	Not Regulated
DOT HAZARD CLASSIFICATION	None
TECHNICAL CONTACT (NAME)	Charles Gruszka
TELEPHONE NUMBER	(215) 628-1364
EMERGENCY NUMBER	(215) 628-1000

1 HAZARDOUS INGREDIENTS

MATERIAL	CAS NO.	CONTENTS (% WT/WT)	HAZARD	TLV
Isopropanol	67-63-0	5-10	Flammable	980mg/M³

2 PHYSICAL DATA

APPEARANCE	Clear colorless liquid
SOLUBILITY IN WATER	Complete
ODOR, @ 60 °F.	Solvent
SPECIFIC GRAVITY @ 60 °F.	0.97-0.99
OTHER:	N/A
pH of CONCENTRATE	N/A
BOILING POINT, °F.	>212

3 FIRE & EXPLOSION DATA

FLASH POINT >120°F

TEST METHOD TCC

EXTINGUISHING MEDIA Carbon dioxide, foam, or vaporizing liquid

UNUSUAL FIRE OR EXPLOSION HAZARDS

None

SPECIAL FIRE FIGHTING PROCEDURES

None

PERSONAL PROTECTION

VENTILATION REQUIREMENTS

GENERAL AREA EXHAUST ☒
LOCAL EXHAUST ☐
NO EXHAUST NECESSARY ☐

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION Safety goggles
SKIN PROTECTION Rubber gloves
RESPIRATORY PROTECTION Fume mask - NIOSH approved
OTHER REQUIRED EQUIPMENT None

9 SPECIAL PRECAUTIONS & STORAGE

Store in a cool place.

PREPARED BY Charles Gruszka
DATE 10/23/86
TITLE Senior Chemist

4 REACTIVITY DATA

STABLE ☒ UNSTABLE ☐

CONDITIONS TO AVOID

INCOMPATIBLE MATERIALS

Strong oxidants

HAZARDOUS POLYMERIZATION

WILL OCCUR ☐

WILL NOT OCCUR ☒

CONDITIONS TO AVOID

HAZARDOUS DECOMPOSITION PRODUCTS

Oxides of carbon

5 HEALTH HAZARD DATA

Skin: May irritate.
Eyes: May irritate.
Ingestion: May irritate mucous membranes.
Inhalation: May irritate mucous membranes if prolonged.

6 FIRST AID RECOMMENDATIONS

Skin: Wash with soap and water and rinse thoroughly.
Eyes: Flush immediately with copious amounts of water for at least 15 minutes. Call a doctor.
Ingestion: Dilute by drinking several glasses of water or milk. Call a doctor. Do not induce vomiting unless directed by a doctor.
Inhalation: Remove from contaminated area to fresh air.

7 SPILL PROCEDURES & WASTE DISPOSAL

SPILL PROCEDURES

Transfer any excess to a clean mild steel container. Soak up remaining residue with absorbent material.

WASTE TREATMENT

Either incinerate or put in a landfill with approval of regulatory agency.

APPENDIX B

Report of Clean-up Activities
Conducted March and April, 1990

TERRY D. SNELL AND ASSOCIATES
1111 VALERIE WOODS DRIVE
STONE MOUNTAIN, GEORGIA 30083
404/294-8335

December 20, 1990
Revised January 5, 1991
Revised July 26, 1991

Leo Harlan
Technical Director
William L Bonnell Company, Inc.
25 Bonnell Street
Newnan, GA 30263

Re: Closure Activities
Chromium Hydroxide Sand Drying Beds

Dear Leo

The purpose of this brief report is to document the closure activities for the chromium hydroxide sand drying beds (CrOH sand drying beds) during March, April, and June, 1990 performed by Bonnell and Four Seasons Industrial Services, Inc. (Four Seasons), and directed by Terry Snell. The closure activities were an attempt to achieve clean closure of the CrOH sand drying beds unit (CrOH SDB Unit) in accordance with the Partial Closure Plan dated March 7, 1990, (submitted to EPD on March 7, 1990). This report will also respond to the comment in Bill Mundy's letters to you dated November 5, 1990, and June 26, 1991, in reference to the Notices of Deficiencies for the Revised [Partial] Closure Plan for the CrOH Sand Drying Beds dated July 31, 1990, (submitted to EPD on July 31, 1990) and the revision dated December 1990 (submitted to EPD on December 20, 1990). The referenced NODs requested a more detailed description of the closure activities.

The location of the CrOH SDB Unit is shown on Figure 1. Under the Partial Closure Plan, Bonnell was to "remove and decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with wastes and leachate, and manage them as hazardous wastes" from the CrOH SDB Unit in accordance with 40 CFR 265.228.

Under the March 7, 1990, Partial Closure Plan, materials removed from the CrOH SDB Unit were to be stockpiled on-site prior to disposal at Chemical Waste Management's permitted landfill at Emelle, Alabama. The location of the stockpile is also shown on Figure 1. The stockpile area was prepared by Bonnell prior to the arrival of Four Seasons. The area was bermed and three layers of polyethylene sheeting were placed on the ground and over the berms.

In addition, Bonnell constructed and placed the decontamination station shown on Figure 1 near the CrOH SDB Unit. The decontamination station was used during closure activities to decontaminate equipment necessary for the closure operations prior to removing it from the site. Personnel decontamination was also performed at the decontamination station.

Four Seasons mobilized to the site on March 18. On March 19, a project meeting was held at the site to discuss the project's site health and safety plan and to ensure that all parties understood their role in the closure activities.

Four Seasons began the operation by placing three layers of polyethylene sheeting on the ground in a working area large enough for a dump truck to operate. The polyethylene sheeting also covered the area between the CrOH SDB Unit, the decontamination station, and the stockpile area. Four Seasons then began removing the sand from the CrOH SDB Unit and placing it and other materials from the CrOH SDB Unit (i.e., concrete and piping) into the bed of a dump truck. The bed of the dump truck and the side of the dump truck were protected with polyethylene sheeting to prevent their contamination. Polyethylene sheeting was also wrapped around the tires of the dump trucks during loading to prevent soils from the CrOH SDB Unit from contacting them.

The dump truck was used to transport the contaminated materials from the CrOH SDB Unit to the stockpile area across the three layers of polyethylene sheeting to prevent contamination of the ground between the CrOH SDB Unit and the stockpile area. Four Seasons continued the operation by demolishing the concrete structure and moving the concrete debris and piping associated with the CrOH SDB Unit to the stockpile area. All soil was removed from under the CrOH SDB Unit to below groundwater. The excavation ranged from approximately 6 feet to 15 feet in depth due to surface topography, with a relatively flat bottom. The areal extent of the excavation is shown on Figure 2.

Soil samples were then collected from the areas shown on Figure 3 for analysis. The result of the analyses are summarized in Table 1. The certified laboratory reports are included as Attachment A.

Soil samples were collected using a spatula. The following decontamination procedures were specified for the spatula:

1. scrubbing between samples with tap water and laboratory grade detergent,

2. rinsing once with deionized water,

3. rinsing once with reagent grade isopropanol, and
4. rinsing three times with deionized water.

The samples were placed in clean glass jars supplied by Analytical Services, Inc. (ASI). All samples were labeled, numbered, and placed on ice for preservation and transportation to ASI. The soil samples were then tested for total chromium using EPA method 6010.

After the results of these laboratory analyses were received, additional soil was removed from the area which expanded the excavation to the area shown on Figure 4 and a second set of soil samples was collected as shown on Figure 5 and summarized in Table 2. The certified laboratory reports are included as Attachment B. Only total chromium values were used to determine whether or not additional soil removal was performed.

In addition, a visible lens of soil that had a turquoise green color was observed at the southeastern end of the excavation. The areal extent of the turquoise green material is shown on Figure 6. All of the turquoise green colored lens was excavated and placed in the stockpile area with the other hazardous materials. Analyses of samples taken from the lens material are summarized in Table 3. The certified laboratory reports are included as Attachment C along with a description of the test for hexavalent chromium (method 7196).

When the contaminated soils, concrete, and piping were taken to the stockpile area, they were dumped onto the polyethylene sheeting and spread by a small backhoe. The operation was conducted such that the backhoe worked on a layer of soil and did not contact the polyethylene sheeting directly. This prevented any direct contact between the CrOH SDB Unit materials and the soils under the stockpile. Concrete and other debris were placed on top of several layers of CrOH SDB Unit soil so that they had no contact with the polyethylene sheeting.

The material removed from the CrOH SDB Unit consisted of contaminated soils, concrete, and piping, from the unit itself. In addition, uncontaminated surface soils from areas outside the CrOH SDB Unit were removed to allow excavation of piping as shown on Figure 2. These soils from outside the unit were stockpiled separately from the contaminated soils.

The stockpiled contaminated soil, sand, concrete, and piping were covered with layers of polyethylene sheeting which was secured in place. Four Seasons then demobilized until June 17, 1990.

On June 19, Four Seasons began loading the stockpiled contaminated material into trucks. The trucks beds were lined with polyethylene sheeting, and the sides of the truck beds were protected with polyethylene sheeting in the same manner as the dump truck. The trucks were owned and operated by Chemical Waste Management, Inc., a permitted hazardous wastes transporter. Each truck was washed at the decontamination station prior to leaving the immediate project control area. The trucks were weighed at Bonnell's security gate prior to leaving the facility. All the contaminated material from the CrOH SDB Unit, which included sand, soil, concrete debris, and pipe debris, was transported to Emelle, Alabama and disposed of in the Chemical Waste Management permitted landfill.

In discussions with Mark Smith of EPD, it was determined that it would be wise to remove a layer of soil below the liner and dispose of that soil with the CrOH SDB Unit materials. Therefore, one foot of soil below the polyethylene liner for the stockpile was removed and shipped to Emelle. A total of 1,231.35 tons of soils and debris were transported to Emelle, Alabama and disposed of in the Chemical Waste Management permitted landfill.

Four Seasons then began backfilling the excavation pit. The backfilling operations were as follows:

1. A 24-inch corrugated metal stand pipe was first placed in the excavation to facilitate installation of groundwater recovery equipment in anticipation of groundwater remediation, if required. The standpipe's location is shown on Figure 7. Gravel was then placed in the excavation pit around the standpipe up to approximately 2 feet above the groundwater and compacted with the backhoe. The total volume of gravel was approximately 150 cubic yards.

2. Backfill soils obtained from an area on Bonnell property remote from the CrOH SDB Unit was then placed in the excavation pit. Approximately 400 cubic yards of these soils were placed in the excavation in six-inch lifts and compacted with the backhoe.

3. Approximately 50 cubic yards of soils previously removed from areas outside of the CrOH SDB Unit were placed into the excavation pit in six-inch lifts and compacted with the backhoe. Summary results of laboratory analyses of samples of these soils are included in Table 4. The certified laboratory reports are included as Attachment D. The samples collected from these soils are designated

"Soil Pile #3" on laboratory report No. 21769[1]. The total chromium in the 50 cubic yards averaged 133 mg/kg, which was less than the 152 mg/kg level in soils left in the ground (i.e., never removed from the ground) at sample point 32A shown on Figure 5. Backfilling of the excavation pit with the soils from outside the CrOH SDB Unit was discussed in a June 5, 1990, meeting between Bonnell representatives and Mark Smith and Kathy Methier of EPD. In the meeting, EPD requested that Bonnell proceed with transportation and disposal of the stockpiled materials. Bonnell agreed to dispose of the contaminated material, and EPD agreed that the soils from outside the CrOH SDB Unit could be placed into the excavation pit providing these soils had total chromium levels less than the total chromium levels of soils that were left in (i.e., never removed from) the excavation pit. From a technical point of view, since these soils did not come from the CrOH SDB Unit and were not F019 material, placing these soils into the pit could not be a violation of the Georgia Hazardous Waste Management Act, including the Land Ban Restrictions (which did not come into effect for F019 materials until August 8, 1990). In addition, sample S-41 had a total chromium content of 1970 mg/kg, and an EP toxicity level of 0.51 mg/l. Since the soils from outside the CrOH SDB Unit which were placed in the excavation pit had total chromium levels that averaged only 133 mg/kg (which were less than the S-41 level), an EP toxicity level less than 5.2 mg/l would be expected. Therefore, treatment standards would have been met.

4. Approximately 200 cubic yards of additional backfill soils were placed over the area in six-inch lifts and compacted with the backhoe.

The area was then staked to mark the extent of the excavation and backfill. Additional area was included within the staked area in order to be conservative. This area is shown on Figure 7, and is larger than the final excavation limits shown on Figure 4. Therefore, the HDPE cap will cover even more area than the final excavation limits.

---

[1] It should be noted that the laboratory report designates both samples as "Soil grab from covered waste pile, samples 6/14/90". Soil pile #2 was soil removed from areas designated as the unit. Soil pile #3, however, was from areas outside the unit and should not have been designated as a waste pile.

In conclusion, the activities under the March 7, 1990 Partial Closure Plan described in this report conformed to 40 CFR 265.112(b)(4). Soils that remain on-site (i.e., in the unit) will be capped according to the closure performance standards included in Section 1.2 of the Revised Closure Plan dated July 26, 1991. Therefore, waste residues were not decontaminated during the activities under the March 7, 1990 Partial Closure Plan. No equipment or structures were left in the CrOH SDE Unit.

The decontamination station referred to in this report was constructed for decontamination of mobile construction equipment used during the partial closure activities. There was no other equipment to be decontaminated. The decontamination procedure used for construction equipment was a triple rinse to remove all visible contamination. This procedure is described in the NIOSH/OSHA/USCG/EPA document entitled "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities" (October 1985). The mobile construction equipment was visually inspected to ensure that all soil had been removed. All rinsewaters were collected and pumped to the head of the chemical conversion coating wastewater treatment system for treatment and disposal in the NPDES permitted outfall.

Personnel wore protective clothing during closure activities. All protective clothing was collected at the decontamination station. Clothing that could be decontaminated (i.e., boots) were decontaminated using the same triple rinse method described in the referenced manual. Clothing that could not be decontaminated (i.e., tyvek suits) were disposed of with the materials shipped to Emelle, Alabama.

There was no decontamination of "...waste residues and contaminated containment systems components, equipment structures, [or] soil..." as discussed in <u>40 CFR265.112(b)(4)</u> during the partial closure activities. Initial efforts were directed toward removing all contaminated soils with a goal of clean closure. All "contaminated containment systems components" and "equipment structures" (i.e., concrete and piping) were taken to Chemical Waste Management's permitted landfill at Emelle, Alabama, for disposal. Since no decontamination was attempted or performed for closure purposes, no decontamination closure performance standard was applicable.

If you have any questions, please contact me.

Sincerely

Terry D Snell

Terry D. Snell, P.E.

cc: Kevin Finto
    Loren McCune

FIGURES

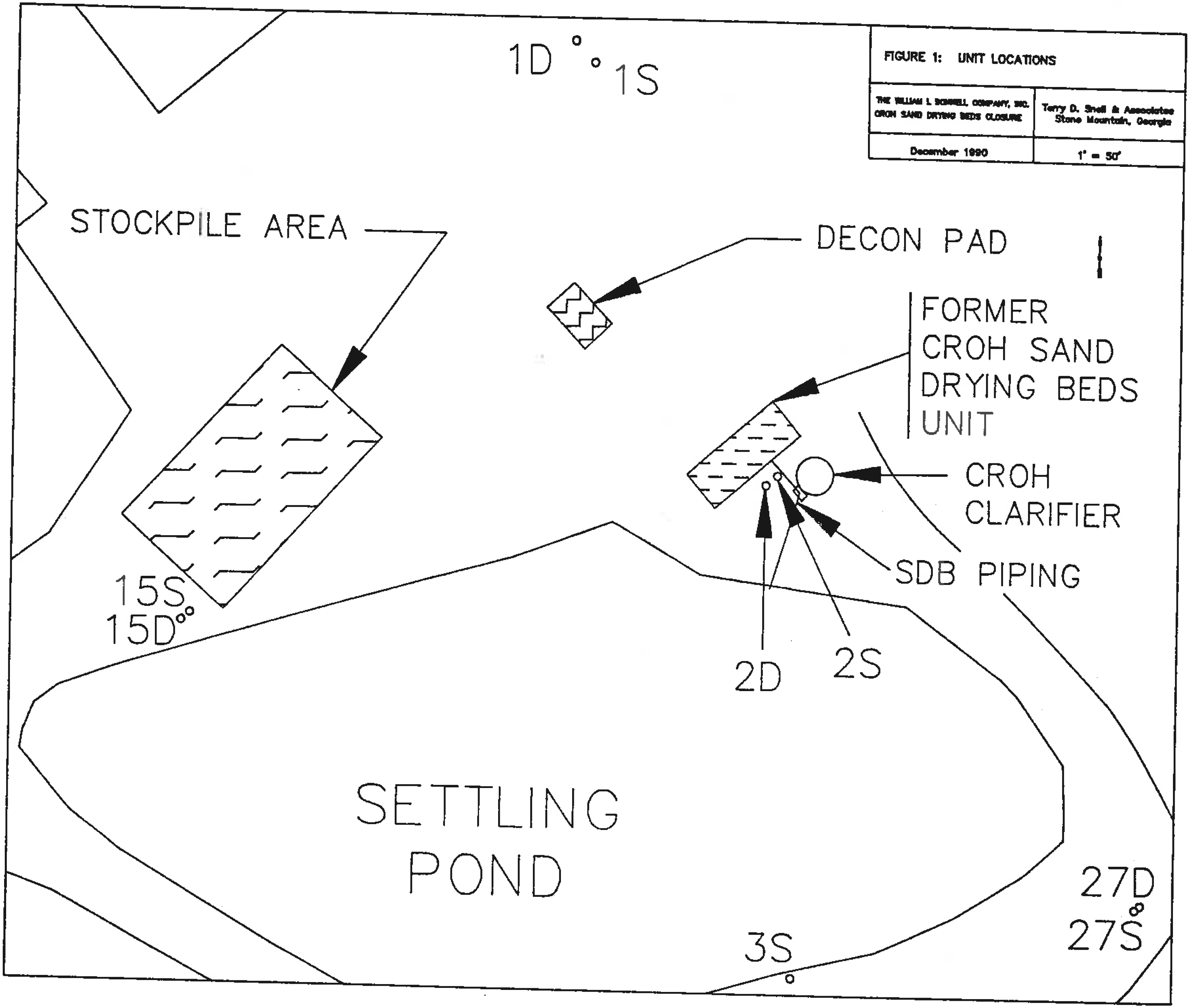


FIGURE 1: UNIT LOCATIONS

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1" = 50'

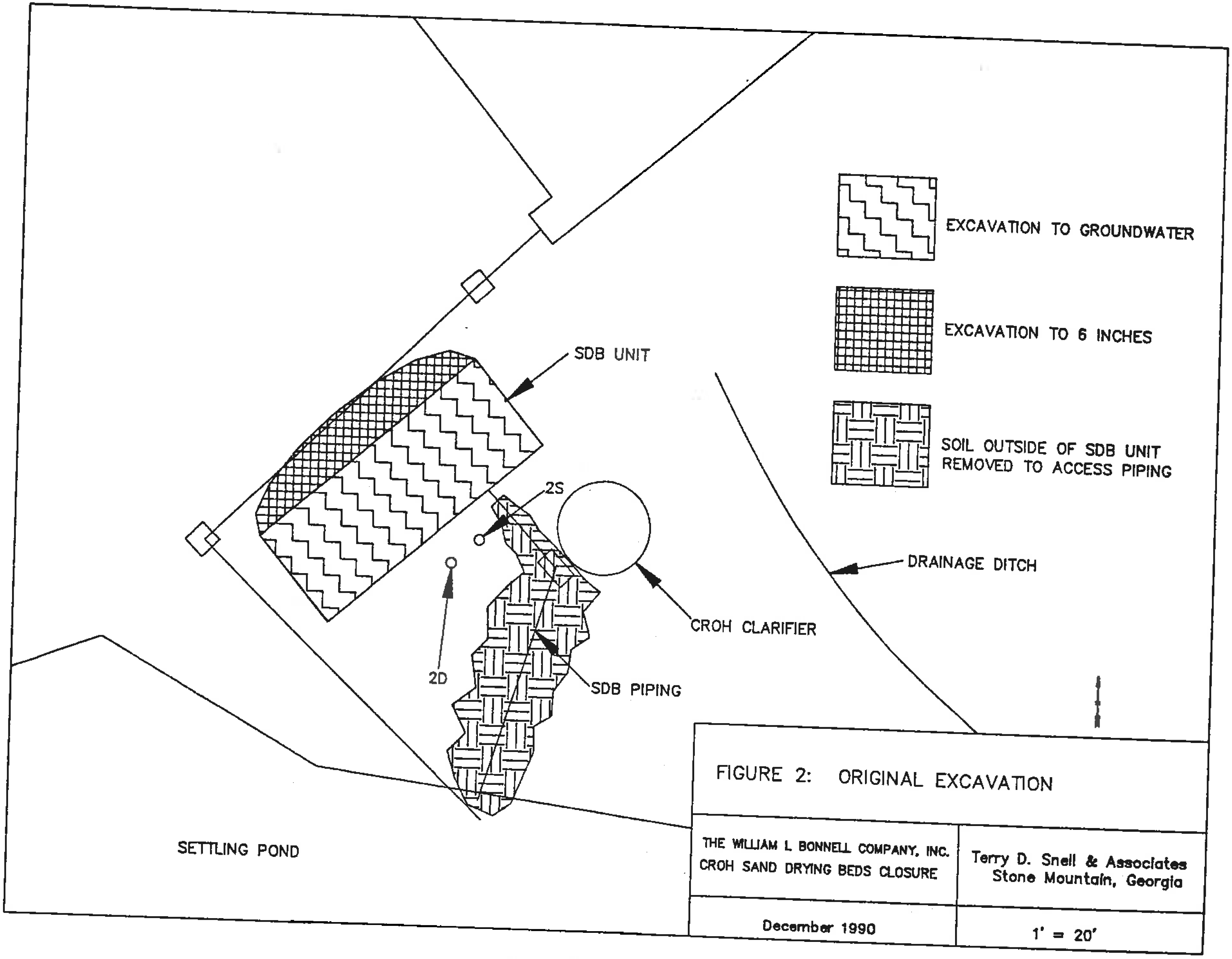


FIGURE 2: ORIGINAL EXCAVATION

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1' = 20'

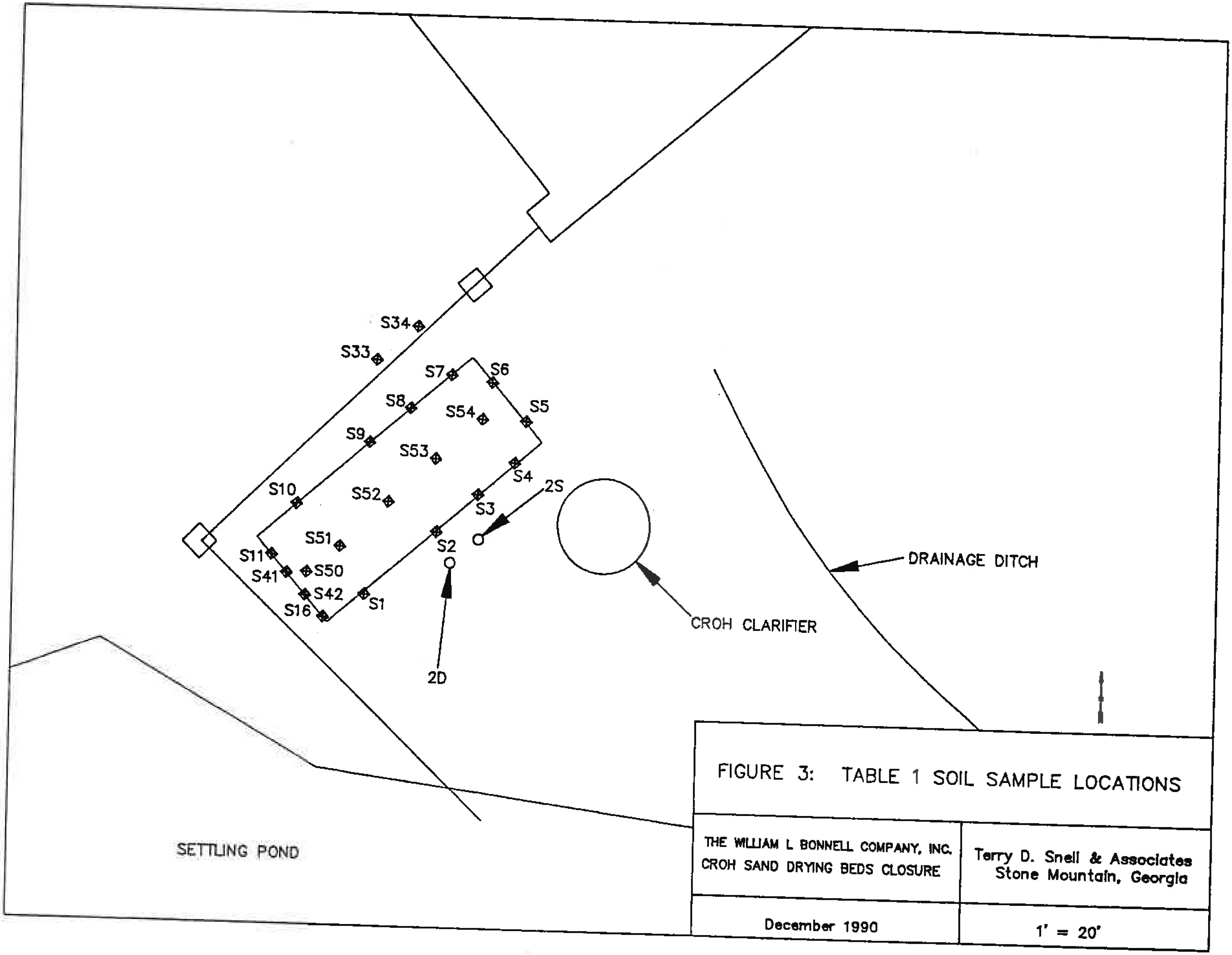


FIGURE 3: TABLE 1 SOIL SAMPLE LOCATIONS

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1' = 20'

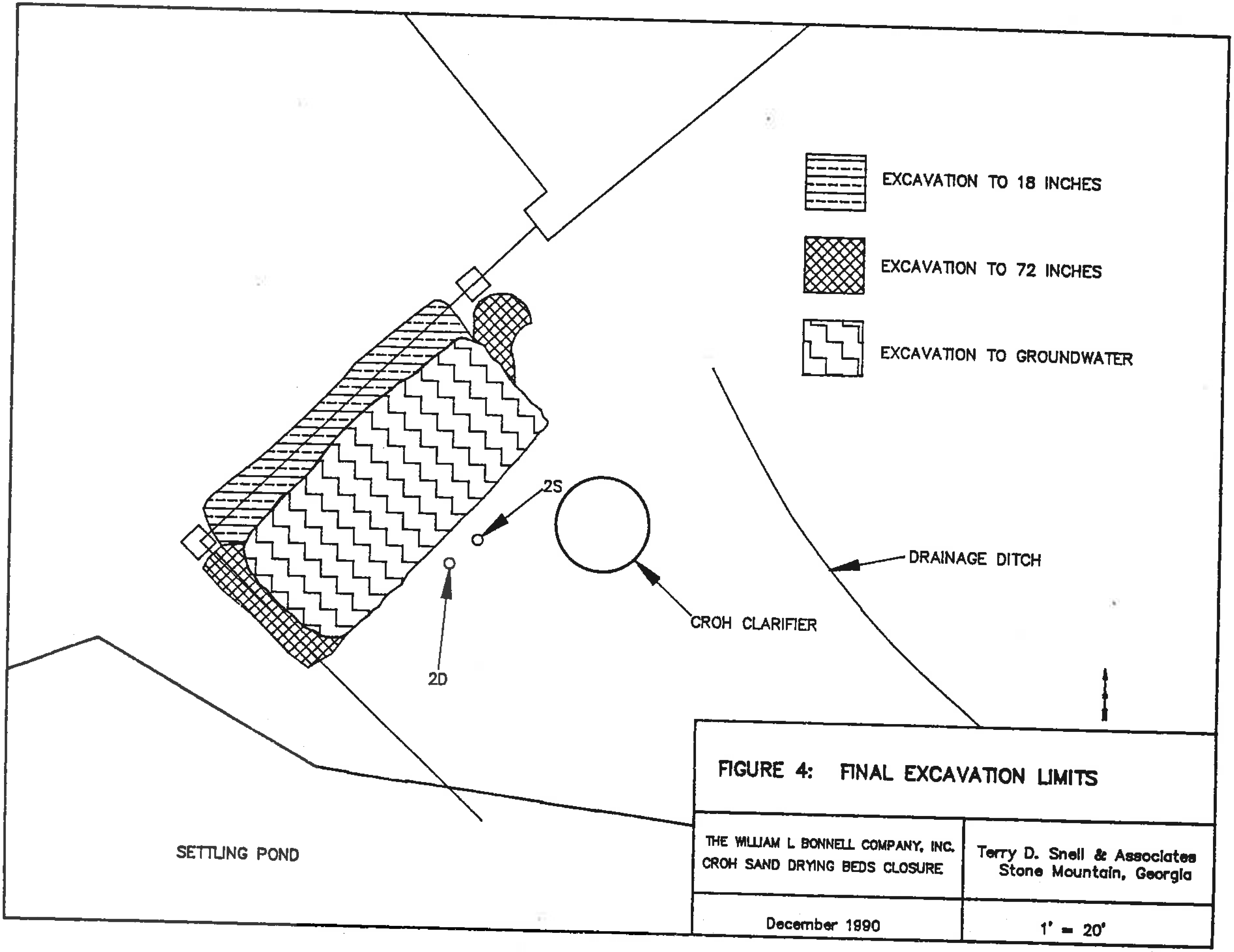


FIGURE 4: FINAL EXCAVATION LIMITS

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1' = 20'

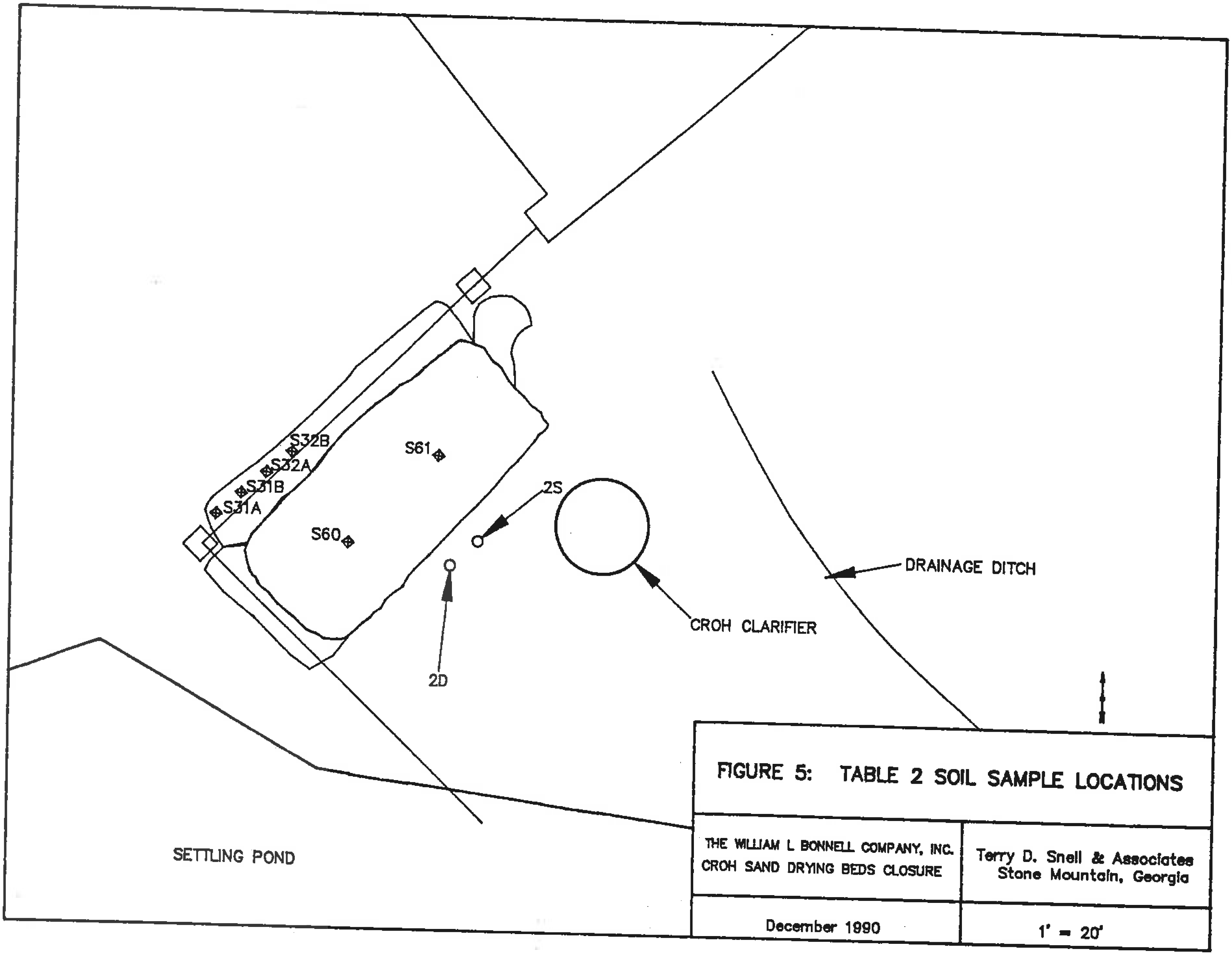


FIGURE 5: TABLE 2 SOIL SAMPLE LOCATIONS

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1' = 20'

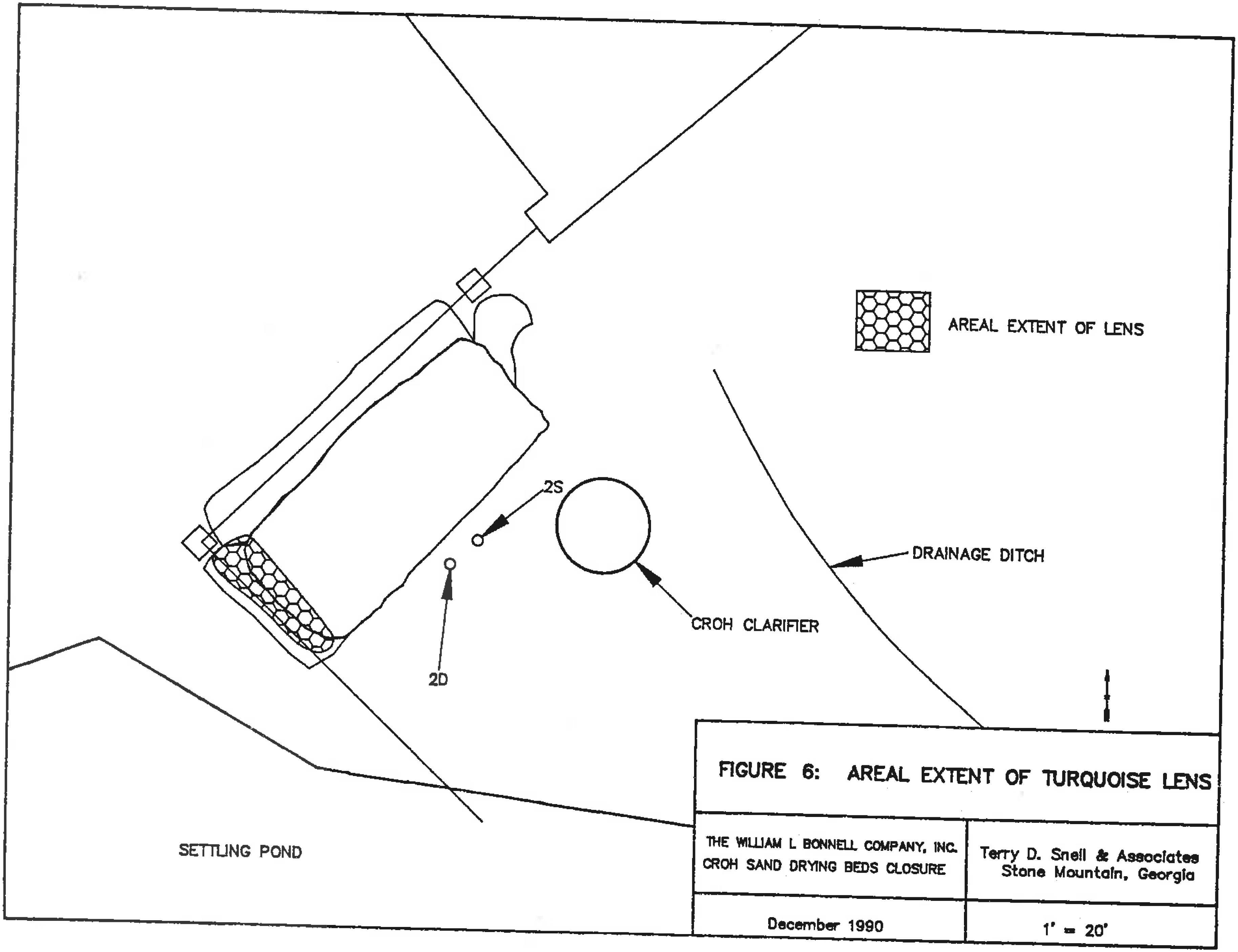


FIGURE 6: AREAL EXTENT OF TURQUOISE LENS

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1' = 20'

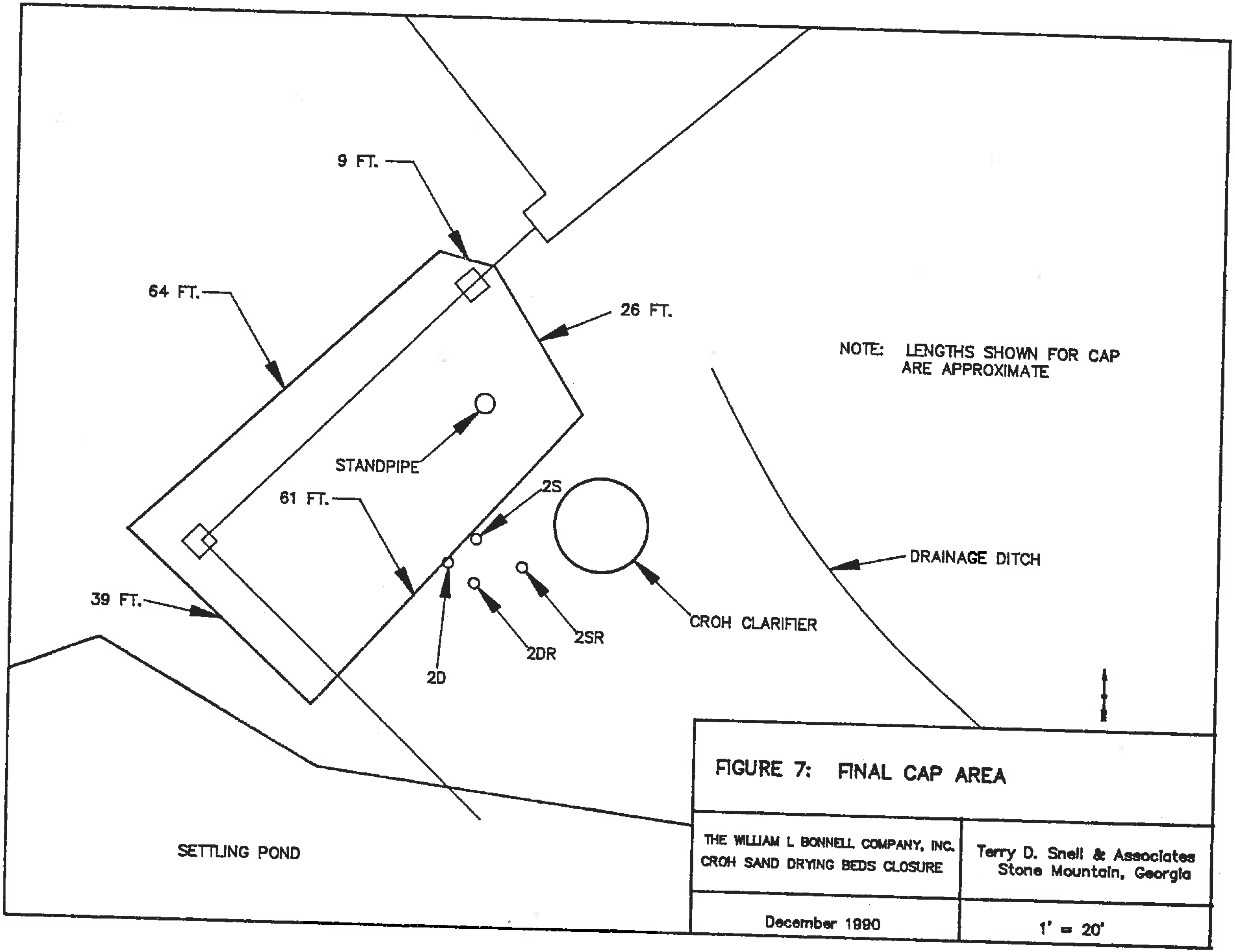


FIGURE 7: FINAL CAP AREA

THE WILLIAM L BONNELL COMPANY, INC.
CROH SAND DRYING BEDS CLOSURE

Terry D. Snell & Associates
Stone Mountain, Georgia

December 1990

1' = 20'

TABLES

TABLE 1: SUMMARY OF SOIL SAMPLE RESULTS ORIGINAL EXCAVATION PIT[1].

SAMPLE NUMBER	SAMPLE LOCATION	CONCENTRATION OF TOTAL CHROMIUM
S-1	Sidewall	41 ppb
S-2	Sidewall	46 ppb
S-3	Sidewall	43 ppb
S-4	Sidewall	22 ppb
S-5	Sidewall	18 ppb
S-6	Sidewall	27 ppb
S-7	Sidewall	77 ppb
S-8	Sidewall	34 ppb
S-9	Sidewall	56 ppb
S-10	Sidewall	43 ppb
S-11	Sidewall	27 ppb
S-16	Sidewall	31 ppb
S-31	Bottom	191 ppb
S-32	Bottom	73 ppb
S-33	Bottom	28 ppb
S-34	Bottom	28 ppb
S-50	Bottom	31 ppb
S-51	Bottom	68 ppb
S-52	Bottom	36 ppb
S-53	Bottom	50 ppb
S-54	Bottom	44 ppb

---

1. From Analytical Services Laboratory Reports # 20398, dated March 30, 1990, and 20421, dated March 30, 1990 (See Attachment A).

TABLE 2: SUMMARY OF SOIL SAMPLE RESULTS AFTER ADDITIONAL SOIL REMOVAL[1]

SAMPLE NUMBER	SAMPLE LOCATION	CONCENTRATION OF TOTAL CHROMIUM
S-60	Bottom	32.7 ppb
S-61	Bottom	35.9 ppb
S-31A	Bottom	63.3 ppb
S-31B	Bottom	91.6 ppb
S-32A	Bottom	152 ppb
S-32B	Bottom	146 ppb

---

[1] From Analytical Services Laboratory Report # 20441, dated April 4, 1990 (See Attachment B).

TABLE 3: SUMMARY OF SOIL SAMPLE RESULTS LENS MATERIAL

SAMPLE NUMBER	TOTAL CHROMIUM	TRIVALENT CHROMIUM	HEXAVALENT CHROMIUM	EP TOXICITY
ZB-1[1]	6430 ppb	6430 ppb	BDL	N/A
ZB-2[1]	3000 ppb	3000 ppb	BDL	N/A
ZB-3[1]	5470 ppb	5470 ppb	BDL	N/A
ZB-4[1]	8210 ppb	8210 ppb	BDL	N/A
S-41[2]	1970 ppb	N/A	N/A	0.51 mg/l

---

1. From Analytical Services Laboratory Report # 20647, dated April 12, 1990 (See Attachment C).

2. From Analytical Services Laboratory Report # 20398, dated March 30, 1990 (See Attachment A).

TABLE 4: SUMMARY OF SOIL SAMPLE RESULTS BACKFILL SOILS[1.]

SAMPLE NUMBER	CONCENTRATION OF TOTAL CHROMIUM
A	129 ppb
B	137 ppb

---

1. From Analytical Services Laboratory Report # 20398, dated March 30, 1990 (See Attachment D).

ATTACHMENT A

SOIL REMOVAL FROM UNIT

CERTIFIED LABORATORY REPORTS

ASI ANALYTICAL SERVICES, INC.
ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE • ATLANTA, GEORGIA 30309 • (404) 892-8144
FAX (404) 892-2740 • Federal I.D. # 58-1625655

LABORATORY REPORT

William L. Bonnell, Co. Inc.
P.O. Box 428
Newnan, GA 30264

March 30, 1990

Attention: Mr. Leo Harland, Sr.

Report No. 20398

Sample: Soil, Grab, William L. Bonnell, sampled by Terry Snell/ Mark Potts, 3/26/90

RECEIVE
4-4-90

RESULTS

Sample	Total Chromium (Cr)(mg/kg)(EPA 6010)
S-41	
S-1	1970
S-2	41
S-3	46
S-4	43
S-5	22
S-6	18
S-7	27
S-8	77
S-9	34
S-10	56
S-11	43
S-16	27
S-42	31
S-17	35
S-18	34
S-19	13
S-20	45
S-22	179
S-23	67
S-24	106
S-25	88
S-26	28
S-27	85
S-28	41
S-29	74
S-30	62
S-31	39
S-32	191
S-33	73
S-34	28
	28
Detection Limit	2

Respectfully submitted,
By: F. Denise

cc: Janet Hart/Terry Snell
3-93000

A Unit of American Analytical Services, Inc.

ASI
ANALYTICAL SERVICES, INC.
ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE • ATLANTA, GEORGIA 30309 • (404) 892-8144
FAX (404) 892-2740 • Federal I.D. # 58-1625655

LABORATORY REPORT

William L. Bonnell Co., Inc.
P.O. Box 428
Newnan, GA 30264

March 30, 1990

Attention: Mr. Gary L. Mitchell

Report No. 20421

Sample: Soil, Grab, William L. Bonnell, 3/27/90

RESULTS

Sample	Total Chromium (Cr) (mg/kg) (EPA 6010)
S-50	31
S-51	68
S-52	36
S-53	50
S-54	44
Detection Limit	2

Respectfully submitted,

By:

cc: Mr. Terry Snell

3-15000

ASI ANALYTICAL SERVICES, INC
ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE ● ATLANTA, GEORGIA 30309 ● (404) 892-8144
FAX (404) 892-2740 ● Federal I.D. # 58-1625655

LABORATORY REPORT

William L. Bonnell Co., Inc.
P.O. Box 428
Newnan, GA 30264

April 4, 1990

Attention: Mr. Gary L. Mitchell

Report No. 20398-1AT

Sample: Soil S-41, Grab, William L. Bonnell, sampled by Terry Snell/
Mark Potts AEM, 3/26/90

RESULTS

The material was extracted and analyzed according to the procedures contained in the Code of Federal Regulations, Title 40, part 261 (40 CFR 261). The analysis of the extract is as follows:

	Result	Detecti Limit
Chromium (Cr)(mg/l)..........................	0.51	0.04

Respectfully submitted,

By: T. Denise Lund

cc: Mr. Terry Snell
AEM

3-13000

ATTACHMENT B

SECOND ROUND SOIL REMOVAL

CERTIFIED LABORATORY REPORTS

ASI ANALYTICAL SERVICES, INC.
ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE • ATLANTA, GEORGIA 30309 • (404) 892-8144
FAX (404) 892-2740 • Federal I.D. # 58-1625655

LABORATORY REPORT

William L. Bonnell Co., Inc.
P.O. Box 428
Newnan, GA 30264

April 4, 1990

P. O. No. NP21740

Report No. 20441

Attention: Mr. Gary L. Mitchell

Sample: Soil samples, sampled by AEM, 3/28/90

RESULTS

	Total Chromium (Cr) (mg/kg) (EPA 6010)
S-60	32.7
S-61	35.9
S-31A	63.3
S-31B	91.6
S-32A	152
S-32B	146
Detection Limit	1

Respectfully submitted,

By:

cc: Mr. Terry Snell
AEM

RECEIVED 4-10-90

3-15000

A Unit of American Analytical Services, Inc.

ATTACHMENT C

TURQUOISE LENS MATERIAL

CERTIFIED LABORATORY REPORTS AND

HEXAVALENT CHROMIUM METHODOLOGY

Bonnell 90-74
DATA

ASI ANALYTICAL SERVICES, INC.
ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE ● ATLANTA, GEORGIA 30309 ● (404) 892-8144
FAX (404) 892-2740 ● Federal I.D. # 58-1625655

LABORATORY REPORT

William L. Bonnell Co., Inc.
P.O. Box 428
Newnan, GA 30264

April 12, 1990

Attention: Mr. Gary L. Mitchell

Report No. 20647

Sample: Soil sample, SDB Closure Project #90-74-05, 4/10/90, sampled by AEM

RESULTS

	Total Chromium (Cr) (mg/kg) (EPA 6010)	Trivalent Chromium (Cr^{+3}) (mg/kg) (difference)	Hexavalent Chromium (Cr^{+6}) (mg/kg) (EPA 7196)
ZB-1 4:00..........	6430	6430	BDL
ZB-2 4:30..........	3000	3000	BDL
ZB-3 4:30..........	5470	5470	BDL
ZB-4 4:30..........	8210	8210	BDL
Detection Limit	0.2	0.2	0.2

BDL = Below Detection Limit

Respectfully submitted,

By:

cc: Terry Snell/AEM
Janet Hart/AEM

3-24000

ASI

ANALYTICAL SERVICES, INC.

ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE ● ATLANTA, GEORGIA 30309 ● (404) 892-8144
FAX (404)892-2740 ● Federal I.D. #58-1625655

July 18, 1991

Terry Snell & Associates
1111 Valerie Woods Dr.
Stone Mountain, GA 30083

Dear Mr. Snell:

SOLUBLE HEXAVALENT CHROME IN SOILS

Hexavalent Chromium (Cr^{+6}) was analyzed by EPA Method 7196 (SW-846, 1986) after leaching the soil with a 5% HNO_3 solution. A weighed amount of soil was placed in an acid-rinsed plastic container. A known volume of ~5% HNO_3 was added to the container and the sample extracted by rotating end-over-end for approximately one hour. The sample was then filtered and the leachate analyzed by the stated colorimetric method. The results represent the soluble hexavalent chromium in the sample.

Please note that there is no method for hexavalent chromium in soil in the current edition of SW-846 (1986).

Respectfully submitted,

By: Victor E. Bendeck, Jr.

ATTACHMENT D

STOCKPILE SOILS FROM OUTSIDE THE CrOH SAND DRYING BEDS UNIT

CERTIFIED LABORATORY REPORTS

ASI ANALYTICAL SERVICES, INC.
ENVIRONMENTAL MONITORING & LABORATORY ANALYSIS
390 TRABERT AVENUE • ATLANTA, GEORGIA 30309 • (404) 892-8144
FAX (404) 892-2740 • Federal I.D. # 58-1625655

LABORATORY REPORT

William L. Bonnell Co., Inc.
P.O. Box 428
Newnan, GA 30264

June 18, 1990

Attention: Mr. Gary L. Mitchell

Report No. 21769

Sample: Soil grab from covered waste pile, sampled 6/14/90, received 6/15/90

RESULTS

	Total Chromium (Cr) (mg/kg) (EPA 6010)
Soil Pile #2	
A.	269
B.	135
Soil Pile #3	
C.	129
D.	137
Detection Limit	0.1

Respectfully submitted,

By:

3-12000

APPENDIX C

Letter to Myles Morse

ATTACHMENT C

ETHYL CORPORATION

December 5, 1980

PLEASE ADDRESS REPLY
TO: P. O. BOX 341
BATON ROUGE, LA. 70821

CERTIFIED MAIL

Mr. Myles Morse
Environmental Protection Agency
Hazardous and Industrial Waste Division (WH-565)
Waste Characterization Branch
401 M Street SW
Washington, D. C. 20460

Dear Mr. Morse:

Re: Petition for Temporary Exclusion and
Proposed Rulemaking

This letter is written in response to your questions and comments concerning Ethyl Corporation's November 10, 1980, Petition. We appreciate your quick response and consideration of the Petition. Answers to your questions are itemized below.

Principal Products

The principal products produced at all four Ethyl Aluminum Division plants are aluminum extrusions of various forms, sizes, and finishes. Depending on customer requirements, the extrusions may be anodized, conversion coated, or painted, or a combination of these processes can be utilized to produce a desired surface finish. These extrusions have end uses primarily in the building materials trade. Capitol Products Corporation also uses some of its own extrusions for use in patio door and window assemblies.

Description of Operation

All four facilities paint some of the extrusions prior to use or sale. The aluminum extrusion is first cleaned and conversion coated to prepare the metal surface for painting. This process is shown as Figure 1 (attached). Table 1 lists overflow rates, sizes, pH and hexavalent chromium contents of the various tanks used at the Carthage, Tennessee, Bonnell facility for conversion coating. The Newnan, Georgia, Bonnell and the two Capitol Products facilities utilize a similar 5-stage pre-treatment process although tank sizes and overflow rates vary.

Chromium bearing wastewater originates from Stages 4 and 5 as shown in Figure 1. Stage 4, a cold water rinse, has a continuous overflow containing a maximum of about 125 ppm Cr^{+6}. Stage 5, an acidic rinse, does not overflow but must be drained and recharged on a weekly basis. This solution contains a maximum of about 75 ppm Cr^{+6}. Although overflow quantities and tank sizes vary, this same process is used at each of the four Aluminum Division Plants. All facilities have waste water treatment using SO_2 to reduce to chrome to trivalent and lime to precipitate it. The Bonnell Plants have batch processes while the Capitol plants employ a continuous process.

At the Bonnell facilities, two reaction tanks, each having a minimum capacity equal to eight hours of waste flow, are provided and are used alternately. When a reaction tank has been filled, sulfuric acid is added to lower the pH to about 2.0. Sulfur dioxide is then added to reduce the hexavalent chromium to the trivalent state. The contents of the reaction tanks are agitated to insure thorough mixing. After the reduction is complete, lime is added to raise the pH to about 8.0 and precipitate the trivalent chromium. Chemical dosages are controlled by pH measurements and by analytical techniques. Also, a distinct color change is evident upon complete reduction. The precipitates are removed by sedimentation and the accumulated sludge is dewatered via a vacuum filter and hauled away for land disposal. A process flow diagram is attached as Figure 2.

At the Capitol Products facilities, a proprietary continuous reduction-neutralization process is utilized. This process uses a four-stage tank for reduction, reaction, recycle, and neutralization. The reduction is controlled automatically by pH and oxidation-reduction potential (ORP) instruments. Sulfuric acid is added to the hexavalent chromium continuing wastewater to lower the pH to 2.5 to 3.0. Sulfur dioxide is then added, controlled by the ORP instrument. Water overflows the first stage and enters the second stage which is sized so as to ensure ample residence time for completion of the reduction reaction. Water then enters the third or recycle stage where filtrate from the vacuum filter is re-introduced to the system. Finally water overflows to the fourth, or neutralization stage, where lime is added to bring the pH to 8.0-8.5. Water exits the fourth stage and goes to a thickener where flocculants are added to enhance settling of the chromium hydroxide sludge. The sludge is pumped from the thickener to a rotary vacuum filter for dewatering and hauled away for disposal. A process flow diagram is attached as Figure 3.

Hazardous Constituents

Chemical conversion coating sludges are listed as hazardous wastes on the basis that they contain significant amounts of hexavalent chromium and cyanide complexes. Ethyl Corporation has completed tests on sludges from all four Aluminum Division facilities, and the results are discussed below.

calcium fluorophosphate, aluminum hydroxide and chromium hydroxide. The chromium content of the sludge is about 3 wt % dry basis and 1% wet basis.

Estimated sludge volumes generated at each plant are as follows:

	Wet Basis	
	Estimated lbs/month	Approximate cu yd/mo
Bonnell, Newnan, GA	90,000	45
Bonnell, Carthage, TN	36,000	18
Capitol, Harrisburg, PA	43,000	22
Capitol, Kentland, IN	20,000	10

Disposal Sites

Proposed disposal sites are as follows:

Hexavalent Chromium

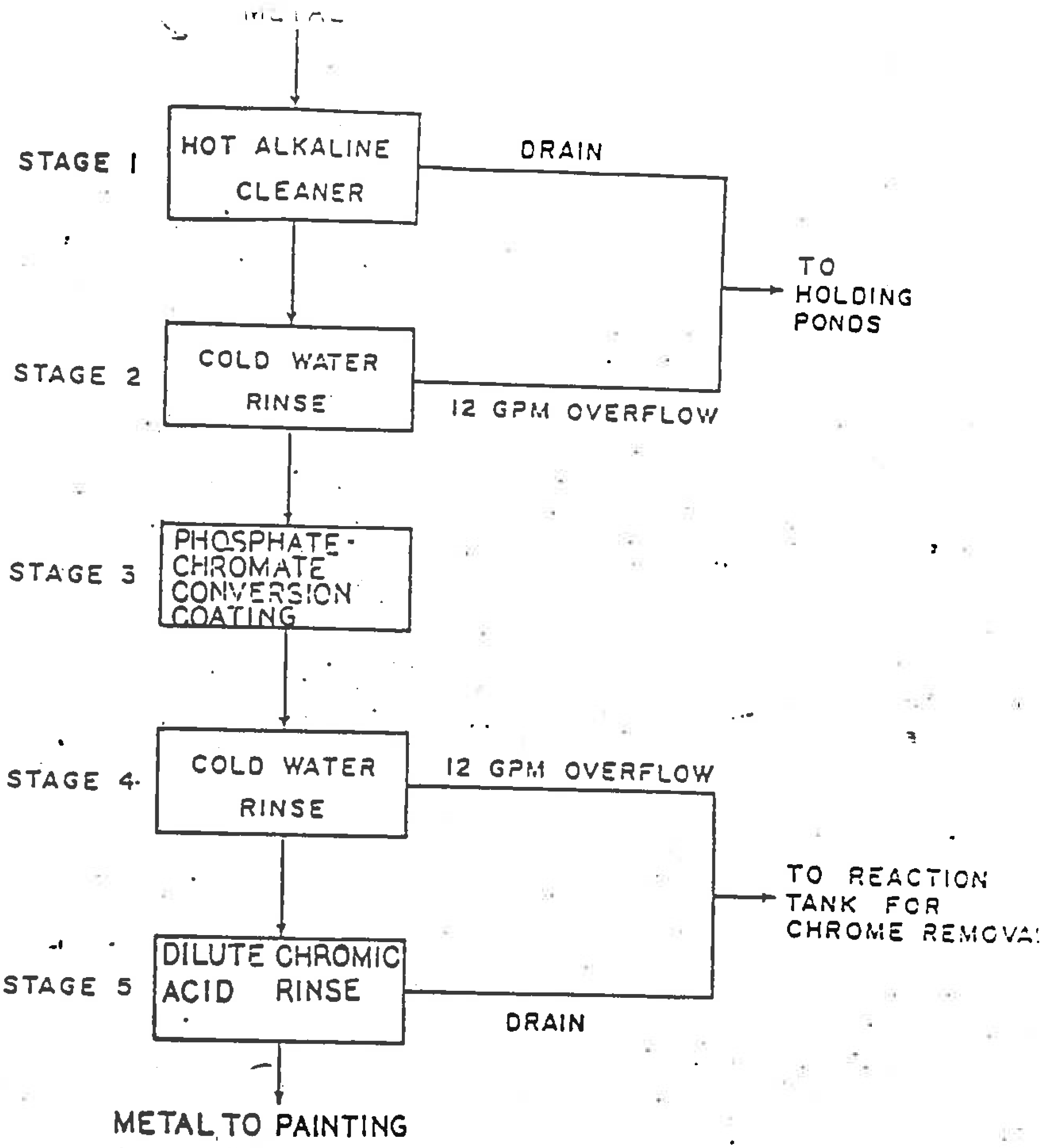
We have performed the EPA EP Toxicity test for chromium on samples from each plant. Test results were as follows:

Facility	Date of Test	Total Chromium in Extract
William L. Bonnell, Newnan,. GA	3/6/80	0.50 ppm
William L. Bonnell, Newnan, GA	8/14/80	0.25 ppm
William L Bonnell, Carthage, TN	8/28/80	0.70 ppm
Capitol Products Corp., Kentland, IN	10/2/80	0.26 ppm
Capitol Products Corp., Harrisburg, PA	8/20/80	0.20 ppm

Since the total chromium in the extract is very low, this demonstrates that there is little or no hexavalent chromium present in the sludges.

Cyanide Content

The chemicals employed in the conversion coating contain no cyanides.



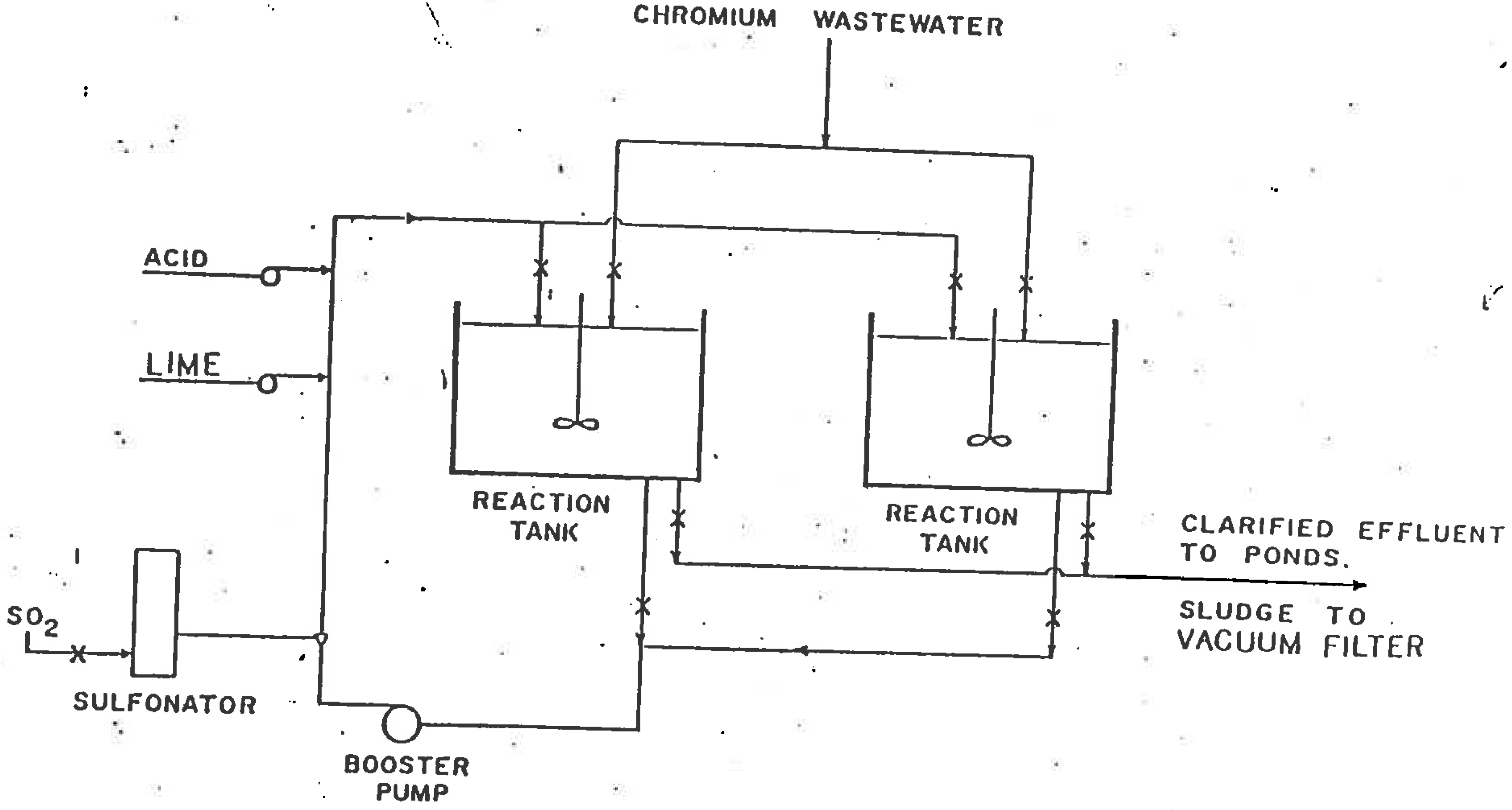
CONFIDENTIAL TREATMENT FOR OTHER THAN EMISSION DATA IN ACCORDANCE WITH THE PURPOSES OF SECTION 1905 OF TITLE 18 OF THE UNITED STATES CODE IS REQUESTED.

FIG, I – FIVE-STAGE PRE-PAINT TREATMENT PROCESS

TABLE 1

FIVE-STAGE PRE-PAINT TREATMENT PROCESS

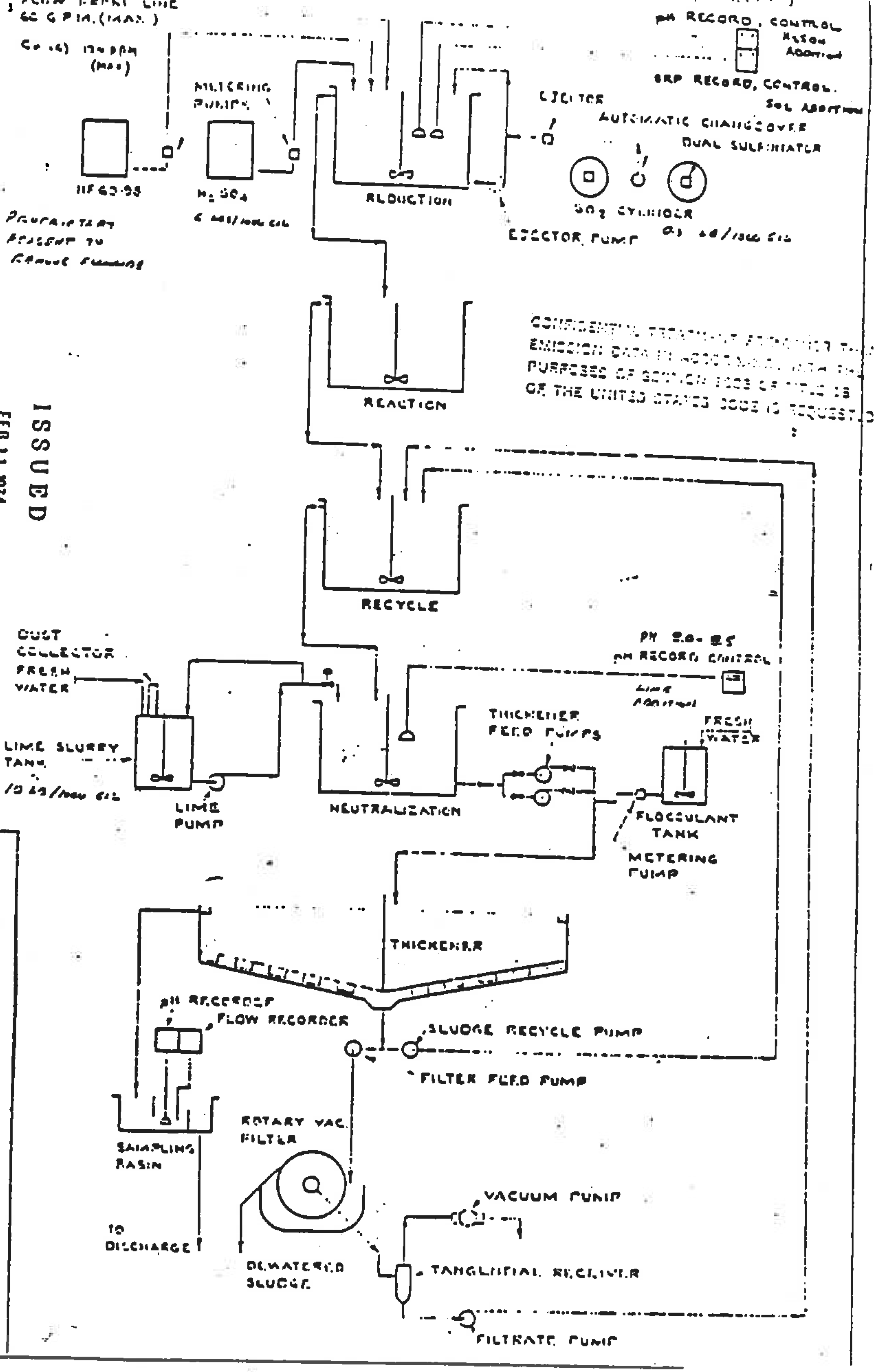
Stage	Overflow gpm	Capacity of tank gal	Dumping Interval	pH	Chromium mg/l
1	0	2100	2 weeks	9.5-10.5	0
2	12	1000		8.0- 9.0	0
3	0	2100	Never	1.5- 2.5	2500
4	12	1000		3.5- 4.0	100±25
5	0	1000	Weekly	3.5	50±25



CONFIDENTIAL TREATMENT FOR OTHER THAN
EMISSION DATA IN ACCORDANCE WITH THE
PURPOSES OF SECTION 1905 OF TITLE 18
OF THE UNITED STATES CODE IS REQUESTED.

FIG. 2 BONNELL CHROMIUM WASTEWATER TREATMENT SYSTEM

[illegible] WASTEWATER TREATMENT SYSTEM



CONFIDENTIAL TREATMENT [illegible] OTHER THAN EMISSION DATA IN ACCORDANCE WITH THE PURPOSES OF SECTION 1905 OF TITLE 18 OF THE UNITED STATES CODE IS REQUESTED

ISSUED
FEB 11 1974

PRELIMINARY FLOW DIAGRAM
CAPITOL PRODUCTS
MECHANICSBURG, PA

DATE 2-8-74
DRAWN R.G.
SCALE NONE
CHECKED
APPROVED

CF-100

Attachment 1

Raw Materials Used in the Manufacturing Process

0041 Capitol Products Corporation, Harrisburg, PA

Multi-Stage Pre-Paint Treatment Process

Chemical Trade Name

Buzz Kleen No. 734
Buzz Bond No. 1047
Buzz Bond No. 1407

Four-Stage Wastewater Treatment Process

Chemical Trade Name

Sulfur Dioxide
Hydro-fax Reagent 98
Sulfuric Acid
Calcium Hydrated Lime
Hydro-fax Flocculent 190

Data sheets for each chemical are included in this section.

CONFIDENTIAL TREATMENT FOR OTHER THAN
EMISSION DATA IN ACCORDANCE WITH THE
PURPOSES OF SECTION 1905 OF TITLE 18
OF THE UNITED STATES CODE IS REQUESTED.

APPENDIX D

HELP Model Input and Output

EXHIBIT 1

HELP MODEL INPUT DATA FOR CLOSURE OF CROH SANDBEDS

STEP	INFORMATION REQUESTED AND RESPONSE
1.1	SELECT INPUT OPERATION 1 TO ENTER, EDIT OR REVIEW CLIMATOLOGICAL DATA. 1
1.2	SELECT TYPE OF RAINFALL DATA INPUT: 3 TO SYNTHETICALLY GENERATE RAINFALL DATA.
4.2	ENTER NAME OF STATE OF INTEREST. GEORGIA
4.3	ENTER NAME OF CITY OF INTEREST. ATLANTA
4.4	ENTER NUMBER OF YEARS OF DATA TO BE GENERATED. 20
7.3	DO YOU WANT TO ENTER THE NORMAL MEAN MONTHLY TEMPERATURE DATA FOR YOUR LOCATION? NO
	THE LATITUDE BEING USED FOR SOLAR RADIATION DATA GENERATION IS 33.65. (ATLANTA GEORGIA)
7.7	DO YOU WANT TO CORRECT THIS VALUE FOR YOUR SITE? NO
4.5	DO YOU WISH TO IMPROVE THE GENERATED RAINFALL DATA BY ENTERING THE NORMAL MEAN MONTHLY RAINFALL FOR YOUR EXACT LOCATION? NO

4.9 ENTER THE MAXIMUM LEAF AREA INDEX.

2.0 FOR FAIR GRASS.

4.11 ENTER THE EVAPORATIVE ZONE DEPTH IN INCHES.

22 IN. FOR FAIR GRASS.

GROWING SEASON SELECTED FOR ATLANTA GEORGIA STARTS ON DAY 92 AND ENDS ON DAY 312.

4.12 DO YOU WANT TO ENTER A NEW GROWING SEASON?

NO

1.3 SELECT TYPE OF SOIL AND DESIGN DATA INPUT:

1 TO USE DEFAULT SOIL CHARACTERISTICS.

5.1 ENTER A 3-LINE TITLE. FOR EXAMPLE: ENTER PROJECT TITLE ON LINE 1, ENTER LOCATION OF DISPOSAL SITE ON LINE 2, AND ENTER TODAY'S DATE ON LINE 3.

SANDBED DEFAULT SOILS 12/90
BONNELL
07/25/91

5.2 DO YOU WANT THE PROGRAM TO INITIALIZE THE SOIL WATER CONTENT FOR EACH LAYER? IF YOU ANSWER NO, YOU WILL BE ASKED TO ENTER THE SOIL WATER CONTENT FOR EACH LAYER.

YES

5.3 ENTER THE NUMBER OF LAYERS IN YOUR DESIGN. YOU MAY USE UP TO 12 LAYERS AND UP TO 4 BARRIER SOIL LINERS.

3

THE LAYERS ARE NUMBERED SUCH THAT
SOIL LAYER 1 IS THE TOP LAYER AND
SOIL LAYER 3 IS THE BOTTOM LAYER.

5.5 ENTER THICKNESS OF SOIL LAYER 1 IN INCHES.

24

5.6 ENTER THE LAYER TYPE FOR LAYER 1.

1 FOR A VERTICAL PERCOLATION LAYER.

5.8 DO YOU WANT A LIST OF DEFAULT SOIL TYPES AND CHARACTERISTICS? ENTER YES OR NO.

NO

5.9 ENTER SOIL TEXTURE OF SOIL LAYER 1.

7

5.14 IS SOIL LAYER 1 COMPACTED?

NO

5.5 ENTER THICKNESS OF SOIL LAYER 2 IN INCHES.

0.22

5.6 ENTER THE LAYER TYPE FOR LAYER 2.

2

5.9 ENTER SOIL TEXTURE OF SOIL LAYER 2.

19

5.10 ENTER THE WILTING POINT OF THE LAYER IN VOL/VOL.

0.02

5.11 ENTER THE FIELD CAPACITY OF THE LAYER IN VOL/VOL.

0.05

5.12 ENTER THE POROSITY OF THE LAYER IN VOL/VOL.

0.82

5.13 ENTER THE HYDRAULIC CONDUCTIVITY OF THE LAYER IN CM/SEC.

18

5.5 ENTER THE THICKNESS OF SOIL LAYER 3 IN INCHES.

6

5.6 ENTER THE LAYER TYPE FOR LAYER 3.

4

5.7 WHAT FRACTION OF THE AREA OF THE SOIL LINER DRAINS FROM LEAKS IN THE FLEXIBLE MEMBRANE OR WHAT FRACTION OF THE DAILY POTENTIAL PERCOLATION THROUGH THE BARRIER SOIL LINER IS ABLE TO OCCUR ON ANY DAY?

0.0001

5.9 ENTER SOIL TEXTURE OF SOIL LAYER 3.

11

5.14 IS SOIL LAYER 3 COMPACTED?

YES

5.17 SELECT THE TYPE OF VEGETATIVE COVER.

3 FOR FAIR GRASS

5.18 DO YOU WANT TO ENTER A RUNOFF CURVE NUMBER TO OVERRIDE THE DEFAULT VALUE?

NO

5.20 IS THE LANDFILL OPEN OR ACTIVE (UNCOVERED)?

NO

10.1 ENTER THE TOTAL AREA OF THE SURFACE, IN SQUARE FEET.

2395

10.2 ENTER THE SLOPE AT THE BASE OF SOIL LAYER 2, IN PERCENT.

8

```
10.3     ENTER THE MAXIMUM DRAINAGE DISTANCE HORIZONTALLY TO THE
         COLLECTOR, IN FEET.

                 70

1.1      SELECT INPUT OPERATION:

                 5 TO STOP THE PROGRAM


help
```

```
***************************************************************************
***************************************************************************

 WILLIAM L BONNELL
 SAND BED COVER
 DECEMBER 13, 1990

***************************************************************************
***************************************************************************


                                FAIR GRASS

                                 LAYER  1
                                 --------

                       VERTICAL PERCOLATION LAYER
  THICKNESS                                    =       24.00 INCHES
  POROSITY                                     =        0.4730 VOL/VOL
  FIELD CAPACITY                               =        0.2217 VOL/VOL
  WILTING POINT                                =        0.1043 VOL/VOL
  INITIAL SOIL WATER CONTENT                   =        0.2217 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY             =        0.001560000004 CM/SEC


                                 LAYER  2
                                 --------

                        LATERAL DRAINAGE LAYER
  THICKNESS                                    =        0.22 INCHES
  POROSITY                                     =        0.8200 VOL/VOL
  FIELD CAPACITY                               =        0.0500 VOL/VOL
  WILTING POINT                                =        0.0200 VOL/VOL
  INITIAL SOIL WATER CONTENT                   =        0.0500 VOL/VOL
  SATURATED HYDRAULIC CONDUCTIVITY             =      18.000000000000 CM/SEC
  SLOPE                                        =        8.00 PERCENT
  DRAINAGE LENGTH                              =       70.0 FEET


                                 LAYER  3
                                 --------

            BARRIER SOIL LINER WITH FLEXIBLE MEMBRANE LINER
  THICKNESS                                    =        6.00 INCHES
```

```
       POROSITY                                        =        0.3949 VOL/VOL
       FIELD CAPACITY                                  =        0.2797 VOL/VOL
       WILTING POINT                                   =        0.1875 VOL/VOL
       INITIAL SOIL WATER CONTENT                      =        0.3949 VOL/VOL
       SATURATED HYDRAULIC CONDUCTIVITY                =        0.000003200000 CM/SEC
       LINER LEAKAGE FRACTION                          =        0.00010000


                              GENERAL SIMULATION DATA
                              -----------------------

      SCS RUNOFF CURVE NUMBER                        =        74.26
      TOTAL AREA OF COVER                            =      2395. SQ FT
      EVAPORATIVE ZONE DEPTH                         =        22.00 INCHES
      UPPER LIMIT VEG. STORAGE                       =        10.4060 INCHES
      INITIAL VEG. STORAGE                           =         5.6194 INCHES
      INITIAL SNOW WATER CONTENT                     =         0.0000 INCHES
      INITIAL TOTAL WATER STORAGE IN
        SOIL AND WASTE LAYERS                        =         7.7012 INCHES

                 SOIL WATER CONTENT INITIALIZED BY PROGRAM.


                               CLIMATOLOGICAL DATA
                               -------------------

     SYNTHETIC RAINFALL WITH SYNTHETIC DAILY TEMPERATURES AND
     SOLAR RADIATION FOR       ATLANTA                 GEORGIA

     MAXIMUM LEAF AREA INDEX                       = 2.00
     START OF GROWING SEASON (JULIAN DATE)         =   92
     END OF GROWING SEASON (JULIAN DATE)           =  312

             NORMAL MEAN MONTHLY TEMPERATURES, DEGREES FAHRENHEIT

  JAN/JUL      FEB/AUG      MAR/SEP      APR/OCT      MAY/NOV      JUN/DEC
  -------      -------      -------      -------      -------      -------

   41.90        44.90        52.50        61.80        69.30        75.80
   78.60        78.20        73.00        62.20        52.00        44.50

*************************************************************************

                     MONTHLY TOTALS FOR YEAR    1
-------------------------------------------------------------------------

                          JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                          ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)      1.58    4.92    4.01    2.58    2.91    4.87
                            6.40    3.70    4.77    1.41    5.27    6.41
```

```
 RUNOFF (INCHES)             0.000    0.000    0.000    0.000    0.000    0.000
                             0.015    0.000    0.013    0.000    0.000    0.057

 EVAPOTRANSPIRATION          1.898    2.380    4.011    2.832    3.394    4.965
    (INCHES)                 5.450    5.299    2.942    2.993    2.111    1.790

 LATERAL DRAINAGE FROM      0.8688   0.1524   2.8159   0.2689   0.0941   0.0287
   LAYER  2 (INCHES)        0.0151   0.0099   0.0071   0.0059   0.0047   4.4123

 PERCOLATION FROM           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
   LAYER  3 (INCHES)        0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

-------------------------------------------------------------------------------
                    MONTHLY SUMMARIES FOR DAILY HEADS
-------------------------------------------------------------------------------

 AVG. DAILY HEAD ON           0.00     0.00     0.02     0.00     0.00     0.00
   LAYER  3 (INCHES)          0.00     0.00     0.00     0.00     0.00     0.07

 STD. DEV. OF DAILY HEAD      0.00     0.00     0.01     0.00     0.00     0.00
   ON LAYER  3 (INCHES)       0.00     0.00     0.00     0.00     0.00     0.21
*******************************************************************************

*******************************************************************************
                      ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         (INCHES)      (CU. FT.)     PERCENT
                                        ----------    ----------    -------
 PRECIPITATION                            48.83           9746.     100.00

 RUNOFF                                    0.085            17.       0.17

 EVAPOTRANSPIRATION                       40.064          7996.      82.05

 LATERAL DRAINAGE FROM LAYER  2            8.6837         1733.      17.78

 PERCOLATION FROM LAYER  3                 0.0002            0.       0.00

 CHANGE IN WATER STORAGE                  -0.003            -1.      -0.01

 SOIL WATER AT START OF YEAR               8.58           1712.

 SOIL WATER AT END OF YEAR                 8.57           1711.

 SNOW WATER AT START OF YEAR               0.00              0.

 SNOW WATER AT END OF YEAR                 0.00              0.

 ANNUAL WATER BUDGET BALANCE               0.00              0.       0.00
*******************************************************************************
```

```
*******************************************************************************

                      MONTHLY TOTALS FOR YEAR     2
-------------------------------------------------------------------------------

                          JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                          ------- ------- ------- ------- ------- -------

 PRECIPITATION (INCHES)     0.95    2.49    5.11    8.72    5.90    4.13
                            5.25    0.88    3.39    2.03    4.87    5.11

 RUNOFF (INCHES)           0.000   0.000   0.129   0.123   0.081   0.000
                           0.000   0.000   0.000   0.000   0.002   0.011

 EVAPOTRANSPIRATION        1.984   2.318   3.261   5.479   6.560   3.113
      (INCHES)             6.320   1.300   2.936   2.060   1.363   1.467

 LATERAL DRAINAGE FROM    0.8799  0.1616  0.6077  1.5820  2.9462  0.0693
   LAYER  2 (INCHES)      0.0214  0.0124  0.0084  0.0067  0.3909  3.1408

 PERCOLATION FROM         0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
   LAYER  3 (INCHES)      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-------------------------------------------------------------------------------
                   MONTHLY SUMMARIES FOR DAILY HEADS
-------------------------------------------------------------------------------

 AVG. DAILY HEAD ON          0.00    0.00    0.00    0.01    0.02    0.00
   LAYER  3 (INCHES)         0.00    0.00    0.00    0.00    0.00    0.02

 STD. DEV. OF DAILY HEAD     0.00    0.00    0.00    0.02    0.03    0.00
   ON LAYER  3 (INCHES)      0.00    0.00    0.00    0.00    0.00    0.03

*******************************************************************************

*******************************************************************************

                      ANNUAL TOTALS FOR YEAR     2
-------------------------------------------------------------------------------
                                       (INCHES)    (CU. FT.)    PERCENT
                                       --------    ---------    -------
  PRECIPITATION                         48.83         9746.     100.00

  RUNOFF                                 0.345          69.       0.71

  EVAPOTRANSPIRATION                    38.161        7616.      78.15

  LATERAL DRAINAGE FROM LAYER  2         9.8274       1961.      20.13

  PERCOLATION FROM LAYER  3              0.0002          0.       0.00

  CHANGE IN WATER STORAGE                0.497          99.       1.02
```

```
    SOIL WATER AT START OF YEAR              8.57         1711.
    SOIL WATER AT END OF YEAR                9.07         1810.
    SNOW WATER AT START OF YEAR              0.00            0.
    SNOW WATER AT END OF YEAR                0.00            0.
    ANNUAL WATER BUDGET BALANCE              0.00            0.        0.00
  ***********************************************************************




 ***********************************************************************

                      MONTHLY TOTALS FOR YEAR     3
 -----------------------------------------------------------------------

                            JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                            ------- ------- ------- ------- ------- -------

 PRECIPITATION (INCHES)       4.23    3.00    6.22    2.17    5.49    3.06
                              4.29    3.29    1.53    3.71    5.64    4.38

 RUNOFF (INCHES)             0.025   0.000   0.000   0.000   0.000   0.000
                             0.000   0.000   0.000   0.016   0.000   0.000

 EVAPOTRANSPIRATION          2.129   2.352   3.805   3.281   3.909   5.329
       (INCHES)              4.364   3.217   1.959   2.110   1.940   1.995

 LATERAL DRAINAGE FROM      2.5438  0.7062  2.3250  1.0981  0.1613  0.0542
   LAYER  2 (INCHES)        0.0224  0.0128  0.0086  0.0068  0.9463  3.1687

 PERCOLATION FROM           0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
   LAYER  3 (INCHES)        0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

 -----------------------------------------------------------------------
                    MONTHLY SUMMARIES FOR DAILY HEADS
 -----------------------------------------------------------------------


 AVG. DAILY HEAD ON           0.04    0.00    0.01    0.01    0.00    0.00
   LAYER  3 (INCHES)          0.00    0.00    0.00    0.00    0.01    0.02

 STD. DEV. OF DAILY HEAD      0.18    0.00    0.02    0.00    0.00    0.00
   ON LAYER  3 (INCHES)       0.00    0.00    0.00    0.00    0.02    0.01
 ***********************************************************************


 ***********************************************************************

                      ANNUAL TOTALS FOR YEAR     3
 -----------------------------------------------------------------------
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```
                                   (INCHES)     (CU. FT.)    PERCENT
                                   --------     ---------    -------
  PRECIPITATION                     47.01          9382.     100.00

  RUNOFF                             0.041            8.       0.09

  EVAPOTRANSPIRATION                36.391         7263.      77.41

  LATERAL DRAINAGE FROM LAYER  2    11.0542        2206.      23.51

  PERCOLATION FROM LAYER  3          0.0002           0.       0.00

  CHANGE IN WATER STORAGE           -0.476          -95.      -1.01

  SOIL WATER AT START OF YEAR        9.07          1810.

  SOIL WATER AT END OF YEAR          8.59          1715.

  SNOW WATER AT START OF YEAR        0.00             0.

  SNOW WATER AT END OF YEAR          0.00             0.

  ANNUAL WATER BUDGET BALANCE        0.00             0.       0.00
***********************************************************************


***********************************************************************
                  MONTHLY TOTALS FOR YEAR    4
-----------------------------------------------------------------------

                         JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                         ------- ------- ------- ------- ------- -------
PRECIPITATION (INCHES)     4.11    2.17    3.72    2.74    4.06    5.38
                           2.34    0.62    0.95    2.87    0.40    7.09

RUNOFF (INCHES)           0.000   0.000   0.000   0.000   0.000   0.000
                          0.000   0.000   0.000   0.069   0.000   0.020

EVAPOTRANSPIRATION        2.147   2.758   3.350   2.908   4.696   5.762
    (INCHES)              2.654   0.620   0.279   2.872   0.473   1.628

LATERAL DRAINAGE FROM    1.9818  1.0563  0.4057  0.2116  0.0858  0.0254
  LAYER  2 (INCHES)      0.0141  0.0095  0.0069  0.0087  0.0248  1.8383

PERCOLATION FROM         0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
  LAYER  3 (INCHES)      0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-----------------------------------------------------------------------
              MONTHLY SUMMARIES FOR DAILY HEADS
-----------------------------------------------------------------------
```

```
  AVG. DAILY HEAD ON              0.01    0.01    0.00    0.00    0.00    0.00
    LAYER  3 (INCHES)             0.00    0.00    0.00    0.00    0.00    0.01

  STD. DEV. OF DAILY HEAD         0.00    0.00    0.00    0.00    0.00    0.00
    ON LAYER  3 (INCHES)          0.00    0.00    0.00    0.00    0.00    0.03
  ***************************************************************************


  ***************************************************************************

                       ANNUAL TOTALS FOR YEAR    4
  ---------------------------------------------------------------------------
                                        (INCHES)      (CU. FT.)     PERCENT
                                        --------      ---------     -------
   PRECIPITATION                         36.45           7275.      100.00

   RUNOFF                                 0.088            18.        0.24

   EVAPOTRANSPIRATION                    30.147          6017.       82.71

   LATERAL DRAINAGE FROM LAYER  2         5.6690         1131.       15.55

   PERCOLATION FROM LAYER  3              0.0002            0.        0.00

   CHANGE IN WATER STORAGE                0.546           109.        1.50

   SOIL WATER AT START OF YEAR            8.59           1715.

   SOIL WATER AT END OF YEAR              9.14           1824.

   SNOW WATER AT START OF YEAR            0.00              0.

   SNOW WATER AT END OF YEAR              0.00              0.

   ANNUAL WATER BUDGET BALANCE            0.00              0.        0.00
  ***************************************************************************



  ***************************************************************************

                       MONTHLY TOTALS FOR YEAR    5
  ---------------------------------------------------------------------------

                             JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                             ------- ------- ------- ------- ------- -------

PRECIPITATION (INCHES)        1.62    1.70    5.75    1.92    2.05    2.83
                              4.60    1.86    4.39    3.24    1.39    8.04

 NOFF (INCHES)                0.000   0.000   0.000   0.000   0.000   0.000
                              0.000   0.000   0.000   0.000   0.000   0.020

EVAPOTRANSPIRATION            2.216   1.888   3.890   2.892   1.952   3.627
```

```
        (INCHES)                 4.232    2.228    4.390    1.851    1.528    1.521

   LATERAL DRAINAGE FROM         1.2691   0.2496   0.1767   1.6394   0.1129   0.0249
     LAYER  2 (INCHES)           0.0140   0.0094   0.0069   0.0057   0.0045   3.4843

   PERCOLATION FROM              0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
     LAYER  3 (INCHES)           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

-------------------------------------------------------------------------------
                    MONTHLY SUMMARIES FOR DAILY HEADS
-------------------------------------------------------------------------------

 AVG. DAILY HEAD ON               0.01     0.00     0.00     0.01     0.00     0.00
   LAYER  3 (INCHES)              0.00     0.00     0.00     0.00     0.00     0.02

 STD. DEV. OF DAILY HEAD          0.01     0.00     0.00     0.02     0.00     0.00
   ON LAYER  3 (INCHES)           0.00     0.00     0.00     0.00     0.00     0.04
*******************************************************************************


*******************************************************************************

                      ANNUAL TOTALS FOR YEAR     5
-------------------------------------------------------------------------------
                                        (INCHES)      (CU. FT.)     PERCENT
                                        --------      ---------     -------
  PRECIPITATION                           39.39          7862.      100.00

  RUNOFF                                   0.021            4.        0.05

  EVAPOTRANSPIRATION                      32.214         6429.       81.78

  LATERAL DRAINAGE FROM LAYER  2           6.9974        1397.       17.76

  PERCOLATION FROM LAYER  3                0.0002           0.        0.00

  CHANGE IN WATER STORAGE                  0.157           31.        0.40

  SOIL WATER AT START OF YEAR              9.14          1824.

  SOIL WATER AT END OF YEAR                8.66          1728.

  SNOW WATER AT START OF YEAR              0.00             0.

  SNOW WATER AT END OF YEAR                0.64           128.

  ANNUAL WATER BUDGET BALANCE              0.00             0.        0.00
*******************************************************************************




*******************************************************************************
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```
                        MONTHLY TOTALS FOR YEAR    6
-----------------------------------------------------------------------

                           JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                           ------- ------- ------- ------- ------- -------

 PRECIPITATION (INCHES)     5.81    4.27    3.68    3.50    8.20    2.44
                            5.49    2.13    3.22    1.03    5.59    7.10

 RUNOFF (INCHES)            0.083   0.000   0.000   0.000   0.005   0.000
                            0.000   0.000   0.000   0.000   0.000   0.226

 EVAPOTRANSPIRATION         2.009   1.869   3.918   3.334   6.136   5.051
     (INCHES)               5.301   2.319   0.809   2.338   2.110   1.855

 LATERAL DRAINAGE FROM      2.6721  4.6005  1.6334  0.1891  0.4590  0.1397
   LAYER  2 (INCHES)        0.0266  0.0141  0.0092  0.0072  0.0055  6.0142

 PERCOLATION FROM           0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
   LAYER  3 (INCHES)        0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

-----------------------------------------------------------------------
                    MONTHLY SUMMARIES FOR DAILY HEADS
-----------------------------------------------------------------------


 AVG. DAILY HEAD ON          0.02    0.06    0.01    0.00    0.00    0.00
   LAYER  3 (INCHES)         0.00    0.00    0.00    0.00    0.00    0.14

 STD. DEV. OF DAILY HEAD     0.01    0.18    0.01    0.00    0.00    0.00
   ON LAYER  3 (INCHES)      0.00    0.00    0.00    0.00    0.00    0.39
***********************************************************************


***********************************************************************
                        ANNUAL TOTALS FOR YEAR    6
-----------------------------------------------------------------------
                                      (INCHES)    (CU. FT.)    PERCENT
                                      --------    ---------    -------
 PRECIPITATION                         52.46        10470.     100.00

 RUNOFF                                 0.315         63.        0.60

 EVAPOTRANSPIRATION                    37.047        7394.      70.62

 LATERAL DRAINAGE FROM LAYER  2        15.7706       3148.      30.06

 PERCOLATION FROM LAYER  3              0.0002         0.        0.00

 CHANGE IN WATER STORAGE               -0.673        -134.      -1.28

 SOIL WATER AT START OF YEAR            8.66         1728.

 SOIL WATER AT END OF YEAR              8.63         1721.
```

```
   SNOW WATER AT START OF YEAR              0.64          128.

   SNOW WATER AT END OF YEAR                0.00            0.

   \NNUAL WATER BUDGET BALANCE              0.00            0.       0.00

******************************************************************************




******************************************************************************

                       MONTHLY TOTALS FOR YEAR     7
------------------------------------------------------------------------------

                             JAN/JUL FEB/AUG MAR/SEP APR/OCT MAY/NOV JUN/DEC
                             ------- ------- ------- ------- ------- -------

 PRECIPITATION (INCHES)        5.96    8.64    4.58    1.34    6.39    5.10
                               5.48    2.48    3.85    3.20    2.62    6.59

 RUNOFF (INCHES)               0.004   0.021   0.010   0.000   0.183   0.000
                               0.075   0.000   0.000   0.000   0.000   0.003

 EVAPOTRANSPIRATION            1.735   2.069   3.818   2.901   4.237   7.939
      (INCHES)                 5.469   2.651   2.303   3.175   2.290   1.589

   :ERAL DRAINAGE FROM         2.7590  7.9007  1.0435  0.4556  0.1149  0.0845
   LAYER  2 (INCHES)           0.0408  0.0174  0.0106  0.0082  0.0205  2.0749

 PERCOLATION FROM              0.0000  0.0000  0.0000  0.0000  0.0000  0.0000
   LAYER  3 (INCHES)           0.0000  0.0000  0.0000  0.0000  0.0000  0.0000

------------------------------------------------------------------------------
                     MONTHLY SUMMARIES FOR DAILY HEADS
------------------------------------------------------------------------------


 AVG. DAILY HEAD ON              0.02    0.08    0.01    0.00    0.00    0.00
   LAYER  3 (INCHES)             0.00    0.00    0.00    0.00    0.00    0.01

 STD. DEV. OF DAILY HEAD         0.03    0.11    0.00    0.00    0.00    0.00
   ON LAYER  3 (INCHES)          0.00    0.00    0.00    0.00    0.00    0.04

******************************************************************************


******************************************************************************

                       ANNUAL TOTALS FOR YEAR     7
------------------------------------------------------------------------------
                                        (INCHES)     (CU. FT.)    PERCENT
                                        --------     ---------    -------
  PRECIPITATION                           56.23        11223.     100.00
```

APPENDIX E

Manufacturers Literature

LAW ENVIRONMENTAL, INC.
a professional engineering and
earth science consulting firm

JOB NO.________ SHEET________ OF________
JOB NAME William L Bonnell
BY SBM DATE 12/5/90
CHECKED BY DAP DATE 12/6/90

Moisture Vapor Transmission (MVT) for the GUNDLE 40-mil HDPE = $\frac{0.04\,g}{m^2 \cdot day}$

$$\frac{0.04\,g}{\cancel{m^2} \cdot \cancel{day}} \times \frac{1\,\cancel{m^2}}{100^2\,cm^2} \times \frac{1\,\cancel{day}}{24\,\cancel{hr}} \times \frac{1\,\cancel{hr}}{3600\,sec} = \frac{4.63 \times 10^{-11}\,g}{cm^2 - sec}$$

MVT ÷ Density of water (1g/cm³) = 40-mil HDPE permeability

$$\frac{4.63 \times 10^{-11}\,\cancel{g}}{cm^2 - sec} \times \frac{cm^3}{1\,\cancel{g}} = \underline{\underline{4.63 \times 10^{-11}\,cm/sec}}$$

LAW ENVIRONMENTAL, INC.
a professional engineering and earth science consulting firm

JOB NO. [illegible]
JOB NAME [illegible]
BY [illegible] DATE [illegible]
CHECKED BY [illegible] DATE [illegible]

[illegible] HDPE (by Poly-Flex)

Water Vapor Transmission (WVT) = $\frac{0.025\,g}{100\,in^2-day}$

[illegible] $(1\,g/cm^3)$ = permeability

$$\frac{0.025\,g}{100\,in^2-day} \times \frac{1\,day}{24\,hr} \times \frac{1\,hr}{3600\,sec} \times \frac{1\,in^2}{(2.54)^2\,cm^2} \div \frac{1\,g}{cm^3}(H_2O\ den.) = \underline{\underline{4.48 \times 10^{-10}\,cm/sec}}$$

APPENDIX F

Boring Logs for Wells BN-GW-2S and BN-GW-2D

TEST BORING RECORD

Page 1 of 1

BN-GW-02S

ELEV.	DEPTH (FEET)	DESCRIPTION				PENETRATION RESISTANCE (BLOWS PER FOOT) 0 10 20 40 60 80 100
		Red, soft, SANDY CLAY, some mica, no foliation (weathered quartz-mica schist), dry (SC) HNU < background				
	5			1	5	
		Dark brown SANDY CLAY, some medium to coarse sand, some mica, good foliation (weathered quartz-mica schist), dry (SC) HNU < background				
	10			2	10	
			▽			
	15	BORING TERMINATED AT 13.5 FT.		3	20	

REMARKS:

Groundwater noted on rods at 12 feet below land surface

BORING NUMBER: BN-GW-02S
DATE DRILLED: 9/20/89
PROJECT NUMBER: 32-97182

ATEC Associates, Inc.

TEST BORING RECORD

Page 1 of 1

BN-GW-02D

ELEV.	DEPTH (FEET)	DESCRIPTION			PENETRATION RESISTANCE (BLOWS PER FOOT) 0 10 20 40 60 80 100
		Black and white soft SANDY CLAY, some mica, slight foliation, (weathered quartz-mica schist), dry (SC) HNU < background			
	5		1	15	
		Black, grey, white, firm SANDY CLAY, some mica, good foliation(weathered quartz-mica schist), dry (SC) HNU < background			
	10		2	16	
			▽		
	15		3	18	
		No samples collected below 15 feet			
	20				
	25				
	30				
	35				
	40	BORING TERMINATED AT 39.5 FT			

REMARKS:

Groundwater encountered at a depth of 12 feet below land surface on rods.

BORING NUMBER: BN-GW-02D
DATE DRILLED: 9/20 & 9/21/89
PROJECT NUMBER: 32-97182

ATEC Associates, Inc.

APPENDIX G

Ditch Sizing Calculations

RUN-OFF CALCULATIONS AND DITCH DESIGN

Prior to sizing the ditches, peak discharge rates were calculated using the SCS method outlined in "Urban Hydrology for Small Watersheds." Parameters used to determine discharge rates are as follows:

- Precipitation (inches) for a peak storm event (P) - Precipitation was determined for the 25-year, 24-hour storm.
- Acreage of the watershed (A)
- SCS curve number (CN) - CN is an indication of the amount of precipitation that is expected to run off the watershed.
- Flow length and slope of watershed - These parameters are used to calculate the time of concentration (T_c), the time it takes for run-off to travel from the hydraulically most distant part of the watershed to the point of reference.

The peak flow for the chosen storm event is determined for each reference point using this information.

The ditches, as designed in this appendix, were sized using Manning's Equation. Parameters used in Manning's Equation are as follows: discharge (Q) in cubic feet per second, flow area (A) in square feet, hydraulic radius (R) in feet, channel slope (S) in feet per feet and channel roughness coefficient (n). Q was taken as the design flow determined by the run-off calculations.

Solving Manning's equation for an unknown ditch size is an iterative process. The ditch size (bottom width (b), flow depth (d) and side slopes (z:1)), slope, and lining material was assumed, providing the A, R, S, and Manning's "n" parameters. With this information, Q was determined, and the calculated Q was compared to the design Q. The assumed values were adjusted as required until the calculated Q equaled the design Q. The velocity is then checked to ensure that it does not exceed the maximum allowable velocity for the lining material.

Many different variations of ditch size, slope, and lining could be used to achieve the same Q. The designer uses engineering judgement to produce a design that meets the flow requirements and is constructable and economical.

The ditches, A, B, C, and D, refer to the ditches within each drainage basin area and are shown on a map comprising the final page of this appendix.

RUN-OFF CALCULATIONS AND DITCH DESIGN

WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA
Project No. 55-0649.32

By Jennifer Miller
Date 7-10-91

Checked by Desiré Pierson
Date 7-10-91

RUN-OFF CALCULATIONS

References:

1. "Urban Hydrology for Small Watersheds," Technical Release #55, U.S. Soil Conservation Service, Jan. 1075.
2. "Soil and Water Conservation Engineering," Third Edition, 1981.
3. Final Grading Plan

Design Storm: 25-year, 24-hour; Rainfall(P) = 6.75 in.

Drainage Areas: A - drainage area, acres

Discharge Point	A
A	1.66
B	2.27
C	3.60
D	2.44

Run-off Volumes:

CN - SCS curve number
S - Potential abstraction, inches
Qr - Accumulated run-off, inches
P - Accumulated rainfall, inches

Soil is Cecil-Madison series (U.S.D.A. Soil Survey, Coweta Co., GA)
Soil Group B (Georgia DOT Erosion and Sediment Control Manual)
Therefore, use curve number(CN) 58 (Attached sheet)

$S = (1000/CN) - 10$ $S =$ 7.241 in.

$Qr = (P-0.2S)^2/(P+0.8S)$ $Qr =$ 2.241 in.

Times of Concentration:

L = length of travel (ft)
dh = change in height (ft)
S = average slope
V = velocity (ft/s)
Tc = L/V (hr)

Area	Overland			In Channel			Tc
	L	S	V	L	S	V	
A	220	0.07	1.70	365	0.014	3.1	0.07
B	370	0.04	1.40	140	0.043	3.7	0.08
C	520	0.04	1.30	185	0.011	3.5	0.13
D	510	0.04	1.40	320	0.019	3.8	0.12

RUN-OFF CALCULATIONS AND DITCH DESIGN

WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA
Project No. 55-0649.32

By: Jennifer Miller
Date 7-10-91

Checked by Cecily Pruson
Date 7-10-91

RUN-OFF CALCULATIONS (cont'd)

Peak Run-off:

Q(peak) = q*A*Qr
q - from Fig. 5-2, Ref. 1; (csm/in)
A - drainage area; (sq. mi.)
Qr - run-off volume (in)
Q(peak) = q * A(ac)/640 acres per sq mi * Qr

Discharge Point	Tc	q	A (ac)	Qr	Q(peak)
A	0.07	1000	1.66	2.24	5.81
B	0.09	1000	2.27	2.24	7.93
C	0.13	930	3.60	2.24	11.72
D *	0.12	940	2.44	2.24	8.04

* - Cumulative discharge at D is B+C+D = 27.69 cfs

DITCH CALCULATIONS

Assumptions:

Use Manning's Equation $Q = 1.49*A*R\,\hat{}\,(2/3)*S\,\hat{}\,(1/2)/n$
n(grass) = 0.030

Definitions:

Q - flow rate, cu.ft/s
A - area of flow, sq.ft.
R - hydraulic radius, ft
n - roughness coefficient
z:1 - channel side slope
V - channel velocity (Q/A), ft/s
d - depth of flow, ft
b - bottom width of trapezoidal channel, ft (if b=0, channel is V-shaped)
s - slope of channel, ft/ft

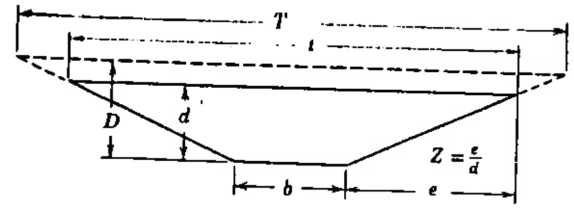
Discharge Point	Q	b	d	s	n	z	A	V
A	5.81	2	0.59	0.013	0.030	2.0	1.88	3.10
B	7.93	2	0.65	0.017	0.030	2.0	2.13	3.72
C	11.72	2	0.88	0.011	0.030	2.0	3.32	3.53
D	27.69	10	0.64	0.013	0.030	2.0	7.20	3.85

Ditches as designed are adequate:

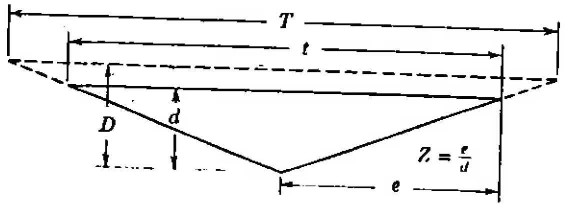
z=2, b=2, d=2 (A,B and C)
z=2, b=10, d=2 (D)

All ditches are grass-lined.

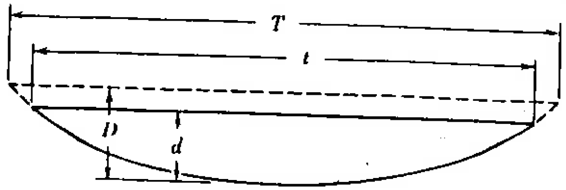
Note: Freeboard = $D-d$ for all sections



Trapezoidal cross section



Triangular cross section



Parabolic cross section

Cross-Sectional Area a	Wetted Perimeter, p	Hydraulic Radius $R=\frac{a}{p}$	Top Width
$bd + Zd^2$	$b + 2d\sqrt{Z^2+1}$	$\frac{bd + Zd^2}{b + 2d\sqrt{Z^2+1}}$	$t = b + 2dZ$ $T = b + 2DZ$
Zd^2	$2d\sqrt{Z^2+1}$	$\frac{Zd}{2\sqrt{Z^2+1}}$ or $\frac{d}{2}$ approx.	$t = 2dZ$ $T = \frac{D}{d}t$
$\frac{2}{3}td$	$t + \frac{8d^2}{3t}$	$\frac{t^2d}{1.5t^2 + 4d^2}$ or $\frac{2d}{3}$ approx.	$t = \frac{a}{0.67d}$ $T = t\left(\frac{D}{d}\right)^{\frac{1}{2}}$

Fig. 7.1. Channel cross section, wetted perimeter, hydraulic radius, and top width formulas.

APPENDIX B

Manning Velocity Formula

Table B.1 Roughness Coefficient *n* for Manning Formula

Line No.	*Type and Description of Conduits*	n *Values*[a]		
		Min.	*Design*	*Max.*
	Channels. Lined			
1	Asphaltic concrete, machine placed		0.014	
2	Asphalt, exposed prefabricated		0.015	
3	Concrete	0.012	0.015	0.018
4	Concrete, rubble	0.017		0.030
5	Metal, smooth (flumes)	0.011		0.015
6	Metal, corrugated	0.021	0.024	0.026
7	Plastic	0.012		0.014
8	Shotcrete	0.016		0.017
9	Wood, planed (flumes)	0.010	0.012	0.015
10	Wood, unplaned (flumes)	0.011	0.013	0.015
	Channels, Earth			
11	Earth bottom, rubble sides	0.028	0.032	0.035
	Drainage ditches, large, no vegetation			
12	(*a*) <0.8 m, hydraulic radius	0.040		0.045
13	(*b*) 0.8–1.2 m, hydraulic radius	0.035		0.040
14	(*c*) 1.2–1.5 m, hydraulic radius	0.030		0.035
15	(*d*) >1.5 m, hydraulic radius	0.025		0.030
16	Small drainage ditches	0.035	0.040	0.040
17	Stony bed, weeds on bank	0.025	0.035	0.040
18	Straight and uniform	0.017	0.0225	0.025
19	Winding, sluggish	0.0225	0.025	0.030
	Channels, Vegetated (grassed waterways) (See Chapter 7)			
	Dense, uniform stands of green vegetation more than 250 mm long			
20	(*a*) Bermuda grass	0.04		0.20
21	(*b*) Kudzu	0.07		0.23
22	(*c*) Lespedeza, common	0.047		0.095
	Dense, uniform stands of green vegetation cut to a length less than 60 mm			

(Table B.1, Soil and Water Conservation Engineering, Third Edition, 1981)

Table B.1 Roughness Coefficient *n* for Manning Formula

Line No.	*Type and Description of Conduits*	n *Values*[a]		
		Min.	*Design*	*Max.*
23	(*a*) Bermuda grass, short	0.034		0.11
24	(*b*) Kudzu	0.045		0.16
25	(*c*) Lespedeza	0.023		0.05
26	Sorghum, 1-m rows	0.04		0.15
27	Wheat, mature poor	0.08		0.15
	Natural Streams			
28	(*a*) Clean, straight bank, full stage, no rifts or deep pools	0.025		0.033
29	(*b*) Same as (*a*) but some weeds and stones	0.030		0.040
30	(*c*) Winding, some pools and shoals, clean	0.035		0.050
31	(*d*) Same as (*c*), lower stages, more ineffective slopes and sections	0.040		0.055
32	(*e*) Same as (*c*), some weeds and stones	0.033		0.045
33	(*f*) Same as (*d*), stony sections	0.045		0.060
34	(*g*) sluggish river reaches, rather weedy or with very deep pools	0.050		0.080
35	(*h*) Very weedy reaches	0.075		0.150
	Pipe			
36	Asbestos cement		0.009	
37	Cast iron, coated or uncoated	0.011	0.013	0.015
38	Clay or concrete drain tile (102-305 mm dia.)	0.011	0.013	0.020
39	Concrete or clay vitrified sewer pipe	0.01	0.014	0.017
40	Corrugated plastic tubing	0.014	0.016	0.018
41	Metal, corrugated, ring	0.021	0.025	0.026
42	Metal, corrugated, helical	0.013	0.015	
43	Steel, riveted and spiral	0.013	0.016	0.017
44	Wood stave	0.010	0.013	
45	Wrought iron, black	0.012		0.015
46	Wrought iron, galv.	0.013	0.016	0.017

[a] Selected from numerous sources.

(Table B.1, Soil and Water Conservation Engineering, Third Edition, 1981)

Table 7.2 Permissible Velocities for Vegetated Channels

	Permissible Velocity For Erosion Resistant Soils (m/s) (fps)		
	% Slope in Channel		
Cover	*0–5*	*5–10*	*Over 10*
Bermuda grass	2.4 (8)[a]	2.1 (7)[a]	1.8 (6)[a]
Blue grama Buffalo grass Kentucky bluegrass Smooth brome Tall fescue	2.1 (7)[a]	1.8 (6)[a]	1.5 (5)[a]
Annual crops for temporary protection Alfalfa Crabgrass Kudzu Lespedeza sericea Weeping lovegrass	1.1 (3.5)[b]	NR[c]	NR
Grass mixture	1.5 (5)[b]	1.2 (4)[b]	NR

[a] Moderately resistant soils reduce velocities 0.3 m/s (1 fps). Easily eroded soils reduce velocities 0.6 m/s (2 fps).

[b] Easily eroded soils reduce velocities 0.3 m/s (1 fps).

[c] Not recommended.

Source: Modified from Ree (1949).

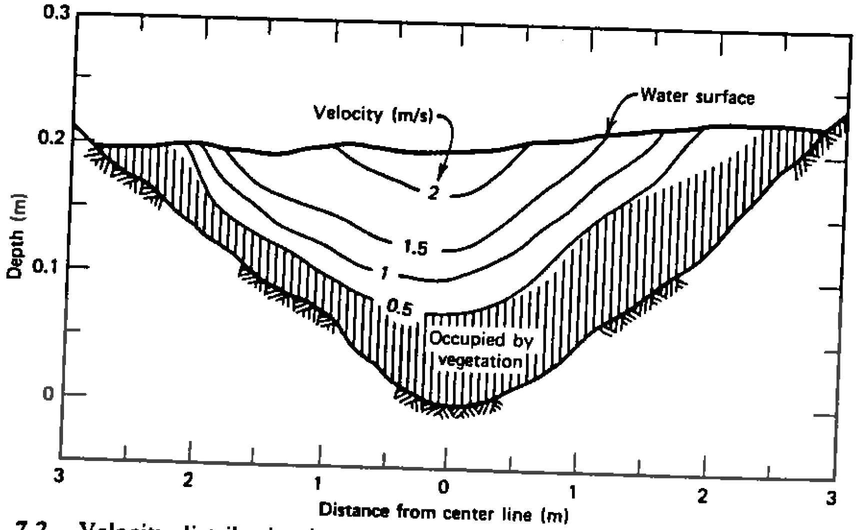


Fig. 7.2. Velocity distribution in a grass-lined channel. (Redrawn from Ree, 1949.)

Table 2-2.--Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land[1]: without conservation treatment : with conservation treatment	72 62	81 71	88 78	91 81
Pasture or range land: poor condition good condition	68 39	79 61	86 74	89 80
Meadow: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch good cover[2]	45 25	66 55	77 70	83 77
Open Spaces, lawns, parks, golf courses, cemeteries, etc. good condition: grass cover on 75% or more of the area fair condition: grass cover on 50% to 75% of the area	 39 49	 61 69	 74 79	 80 84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious).	81	88	91	93
Residential:[3] Average lot size — Average % Impervious[4] 1/8 acre or less — 65 1/4 acre — 38 1/3 acre — 30 1/2 acre — 25 1 acre — 20	 77 61 57 54 51	 85 75 72 70 68	 90 83 81 80 79	 92 87 86 85 84
Paved parking lots, roofs, driveways, etc.[5]	98	98	98	98
Streets and roads: paved with curbs and storm sewers[5] gravel dirt	 98 76 72	 98 85 82	 98 89 87	 98 91 89

---

[1] For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.

[2] Good cover is protected from grazing and litter and brush cover soil.

[3] Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

[4] The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

[5] In some warmer climates of the country a curve number of 95 may be used.

then computed by dividing the total overland flow length by the average velocity.

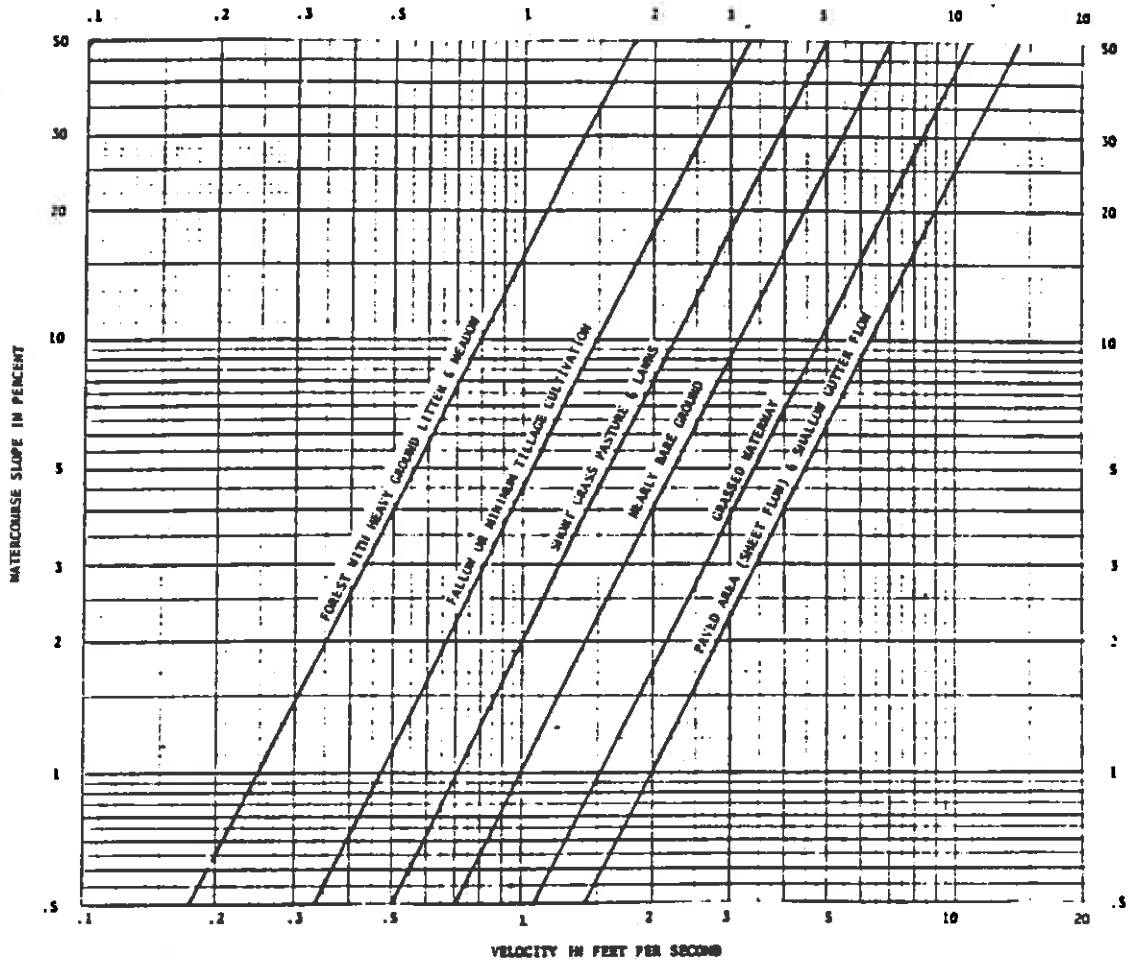


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

Graphical Method of Determining Peak Discharge

The curve of T_c vs. peak discharge in csm per inch of runoff shown in figure 5-2 was developed from table 5-3 for zero T_t. It can be used for a watershed where the runoff can be represented by one curve number, i.e., the land use, soils, and cover are similar and are distributed uniformly throughout the watershed. This procedure is limited to peak discharge determination (hydrograph not required) for a watershed where valley routing is not required. The peak discharge can be calculated from figure 5-2 using T_c in hours, runoff in inches from a 24-hour rainfall, and drainage area in square miles.

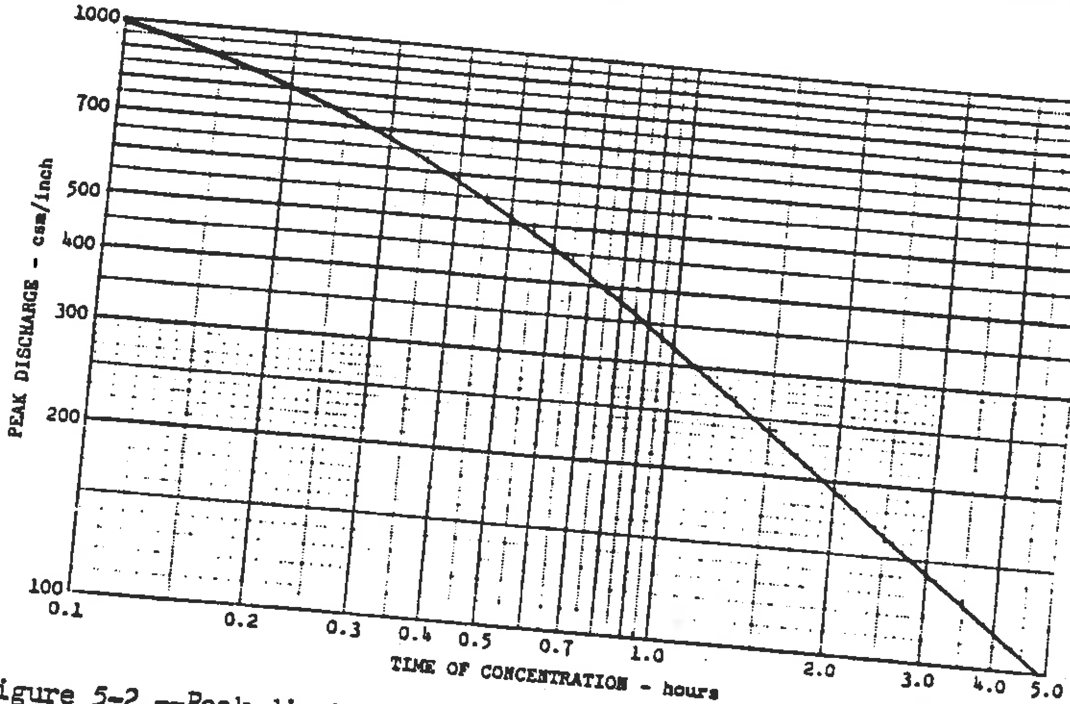
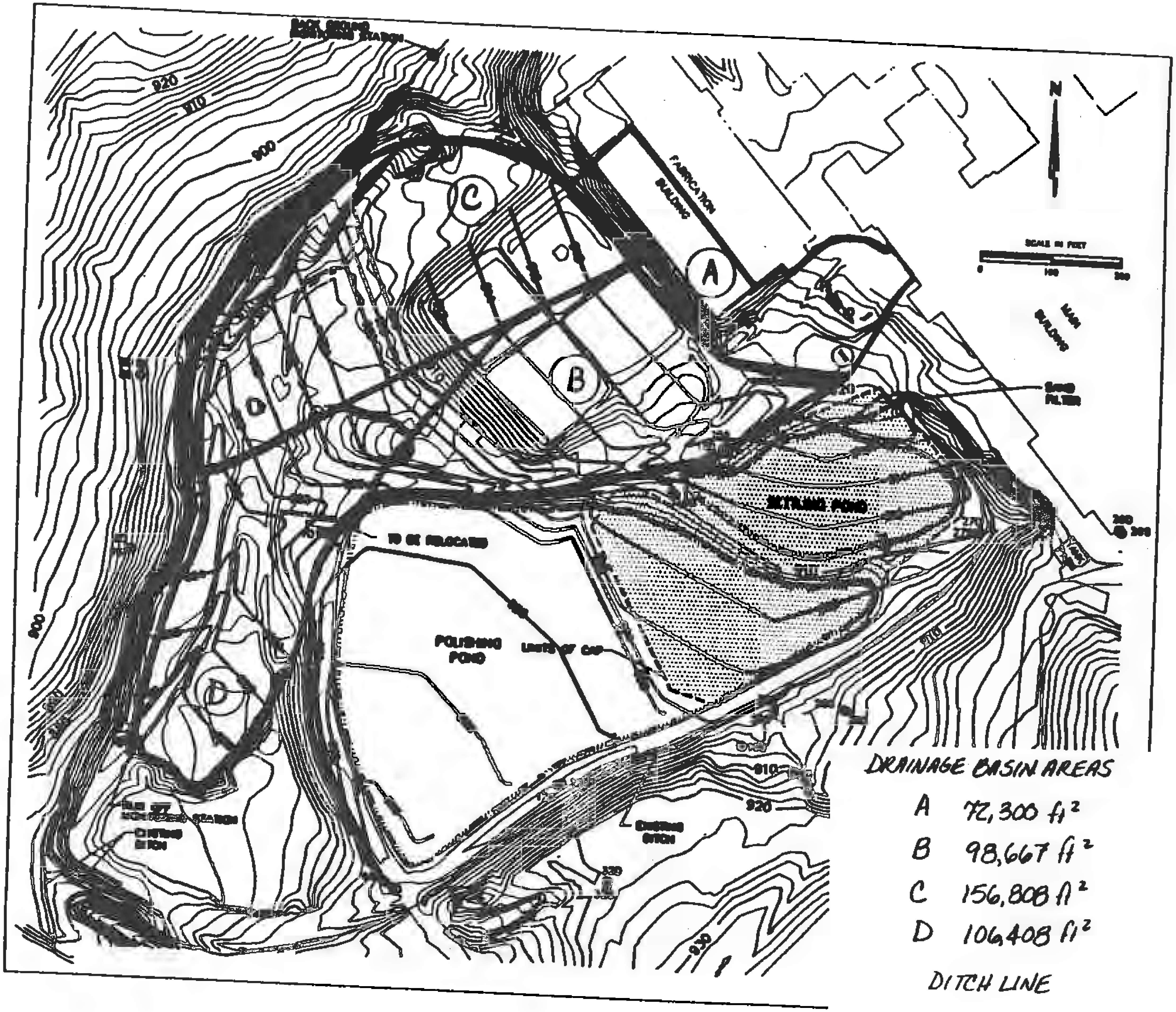


Figure 5-2.--Peak discharge in csm per inch of runoff versus time of concentration (T_c) for 24-hour, type-II storm distribution.

Example 5-2

A developer wishes to install a planned unit development in the uppermost part of a watershed. An ordinance in the township requires that a planned unit development not increase the 100-year-frequency flood flow at the downstream end of the development. The following basic data have been determined for present and future conditions:

Drainage area = 960 acres (1.5 mi^2)
CN (present) = 80
CN (future) = 85
T_c (present) = 0.9 hr
T_c (future) = 0.6 hr
P_{24} (24-hour, 100-year frequency rainfall) = 6.0 in.


BACK GROUND
MONITORING STATION
N
SCALE IN FEET
0
100
200
MAIN
BUILDING
FABRICATION
BUILDING
SAND
FILTER
SETTLING POND
TO BE RELOCATED
POLISHING
POND
LIMITS OF CAP
EXISTING
DITCH
EXISTING
DITCH
A
B
C
D
920
910
900
900
910
920
930
DRAINAGE BASIN AREAS
A 72,300 ft²
B 98,667 ft²
C 156,808 ft²
D 106,408 ft²
DITCH LINE

APPENDIX G

Ditch Sizing Calculations

RUN-OFF CALCULATIONS AND DITCH DESIGN

Prior to sizing the ditches, peak discharge rates were calculated using the SCS method outlined in "Urban Hydrology for Small Watersheds." Parameters used to determine discharge rates are as follows:

- Precipitation (inches) for a peak storm event (P) - Precipitation was determined for the 25-year, 24-hour storm.
- Acreage of the watershed (A)
- SCS curve number (CN) - CN is an indication of the amount of precipitation that is expected to run off the watershed.
- Flow length and slope of watershed - These parameters are used to calculate the time of concentration (T_c), the time it takes for run-off to travel from the hydraulically most distant part of the watershed to the point of reference.

The peak flow for the chosen storm event is determined for each reference point using this information.

The ditches, as designed in this appendix, were sized using Manning's Equation. Parameters used in Manning's Equation are as follows: discharge (Q) in cubic feet per second, flow area (A) in square feet, hydraulic radius (R) in feet, channel slope (S) in feet per feet and channel roughness coefficient (n). Q was taken as the design flow determined by the run-off calculations.

Solving Manning's equation for an unknown ditch size is an iterative process. The ditch size (bottom width (b), flow depth (d) and side slopes (z:1)), slope, and lining material was assumed, providing the A, R, S, and Manning's "n" parameters. With this information, Q was determined, and the calculated Q was compared to the design Q. The assumed values were adjusted as required until the calculated Q equaled the design Q. The velocity is then checked to ensure that it does not exceed the maximum allowable velocity for the lining material.

Many different variations of ditch size, slope, and lining could be used to achieve the same Q. The designer uses engineering judgement to produce a design that meets the flow requirements and is constructable and economical.

The ditches, A, B, C, and D, refer to the ditches within each drainage basin area and are shown on a map comprising the final page of this appendix.

RUN-OFF CALCULATIONS AND DITCH DESIGN

WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA
Project No. 55-0649.32

By Jennifer Miller
Date 7-10-91

Checked by Desing Pierson
Date 7-10-91

RUN-OFF CALCULATIONS

References:

1. "Urban Hydrology for Small Watersheds," Technical Release #55, U.S. Soil Conservation Service, Jan. 1075.
2. "Soil and Water Conservation Engineering," Third Edition, 1981.
3. Final Grading Plan

Design Storm: 25-year, 24-hour; Rainfall(P) = 6.75 in.

Drainage Areas: A - drainage area, acres

Discharge Point	A
A	1.66
B	2.27
C	3.60
D	2.44

Run-off Volumes:

CN - SCS curve number
S - Potential abstraction, inches
Qr - Accumulated run-off, inches
P - Accumulated rainfall, inches

Soil is Cecil-Madison series (U.S.D.A. Soil Survey, Coweta Co., GA)
Soil Group B (Georgia DOT Erosion and Sediment Control Manual)
Therefore, use curve number(CN) 58 (Attached sheet)

$S = (1000/CN) - 10$ $S =$ 7.241 in.

$Qr = (P-0.2S)^2/(P+0.8S)$ $Qr =$ 2.241 in.

Times of Concentration:

L = length of travel (ft)
dh = change in height (ft)
S = average slope
V = velocity (ft/s)
Tc = L/V (hr)

Area	Overland			In Channel			Tc
	L	S	V	L	S	V	
A	220	0.07	1.70	365	0.014	3.1	0.07
B	370	0.04	1.40	140	0.043	3.7	0.08
C	520	0.04	1.30	185	0.011	3.5	0.13
D	510	0.04	1.40	320	0.019	3.8	0.12

RUN-OFF CALCULATIONS AND DITCH DESIGN

WILLIAM L BONNELL COMPANY, INC.
NEWNAN, GEORGIA
Project No. 55-0649.32

By Jennifer Miller
Date 7-10-91

Checked by Cecij Preson
Date 7-10-91

RUN-OFF CALCULATIONS (cont'd)

Peak Run-off:

Q(peak) = q*A*Qr
q - from Fig. 5-2, Ref. 1; (csm/in)
A - drainage area; (sq. mi.)
Qr - run-off volume (in)
Q(peak) = q * A(ac)/640 acres per sq mi * Qr

Discharge Point	Tc	q	A (ac)	Qr	Q(peak)
A	0.07	1000	1.66	2.24	5.81
B	0.09	1000	2.27	2.24	7.93
C	0.13	930	3.60	2.24	11.72
D *	0.12	940	2.44	2.24	8.04

* - Cumulative discharge at D is B+C+D = 27.69 cfs

DITCH CALCULATIONS

Assumptions:

Use Manning's Equation - Q = 1.49*A*R^(2/3)*S^(1/2)/n
n(grass) = 0.030

Definitions:

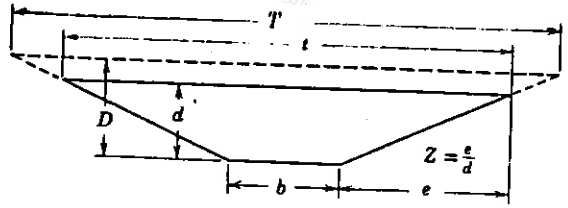
Q - flow rate, cu.ft/s
A - area of flow, sq.ft.
R - hydraulic radius, ft
n - roughness coefficient
z:1 - channel side slope
V - channel velocity (Q/A), ft/s
d - depth of flow, ft
b - bottom width of trapezoidal channel, ft
(if b=0, channel is V-shaped)
s - slope of channel, ft/ft

Discharge Point	Q	b	d	s	n	z	A	V
A	5.81	2	0.59	0.013	0.030	2.0	1.88	3.10
B	7.93	2	0.65	0.017	0.030	2.0	2.13	3.72
C	11.72	2	0.88	0.011	0.030	2.0	3.32	3.53
D	27.69	10	0.64	0.013	0.030	2.0	7.20	3.85

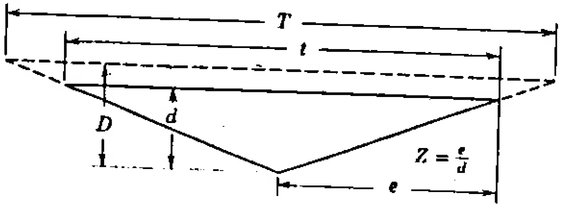
Ditches as designed are adequate:
z=2, b=2, d=2 (A,B and C)
z=2, b=10, d=2 (D)

All ditches are grass-lined.

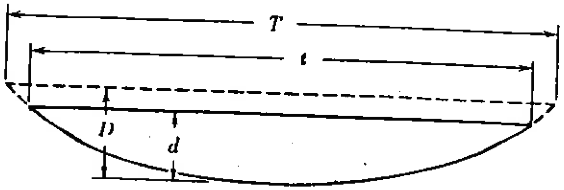
Note: Freeboard = $D-d$ for all sections



Trapezoidal cross section



Triangular cross section



Parabolic cross section

Cross-Sectional Area a	Wetted Perimeter, p	Hydraulic Radius $R = \frac{a}{p}$	Top Width
$bd + Zd^2$	$b + 2d\sqrt{Z^2+1}$	$\frac{bd + Zd^2}{b + 2d\sqrt{Z^2+1}}$	$t = b + 2dZ$ $T = b + 2DZ$
Zd^2	$2d\sqrt{Z^2+1}$	$\frac{Zd}{2\sqrt{Z^2+1}}$ or $\frac{d}{2}$ approx.	$t = 2dZ$ $T = \frac{D}{d}t$
$\frac{2}{3}td$	$t + \frac{8d^2}{3t}$	$\frac{t^2 d}{1.5t^2 + 4d^2}$ or $\frac{2d}{3}$ approx.	$t = \frac{a}{0.67d}$ $T = t\left(\frac{D}{d}\right)^{\frac{1}{2}}$

Fig. 7.1. **Channel cross section, wetted perimeter, hydraulic radius, and top width formulas.**

(Figure 7.1 Soil and Water Conservation Engineering

APPENDIX B

Manning Velocity Formula

Table B.1 Roughness Coefficient *n* for Manning Formula

Line No.	Type and Description of Conduits	n Values^a		
		Min.	*Design*	*Max.*
	Channels, Lined			
1	Asphaltic concrete, machine placed		0.014	
2	Asphalt, exposed prefabricated		0.015	
3	Concrete	0.012	0.015	0.018
4	Concrete, rubble	0.017		0.030
5	Metal, smooth (flumes)	0.011		0.015
6	Metal, corrugated	0.021	0.024	0.026
7	Plastic	0.012		0.014
8	Shotcrete	0.016		0.017
9	Wood, planed (flumes)	0.010	0.012	0.015
10	Wood, unplaned (flumes)	0.011	0.013	0.015
	Channels, Earth			
11	Earth bottom, rubble sides	0.028	0.032	0.035
	Drainage ditches, large, no vegetation			
12	(*a*) <0.8 m, hydraulic radius	0.040		0.045
13	(*b*) 0.8–1.2 m, hydraulic radius	0.035		0.040
14	(*c*) 1.2–1.5 m, hydraulic radius	0.030		0.035
15	(*d*) >1.5 m, hydraulic radius	0.025		0.030
16	Small drainage ditches	0.035	0.040	0.040
17	Stony bed, weeds on bank	0.025	0.035	0.040
18	Straight and uniform	0.017	0.0225	0.025
19	Winding, sluggish	0.0225	0.025	0.030
	Channels, Vegetated (grassed waterways) (See Chapter 7)			
	Dense, uniform stands of green vegetation more than 250 mm long			
20	(*a*) Bermuda grass	0.04		0.20
21	(*b*) Kudzu	0.07		0.23
22	(*c*) Lespedeza, common	0.047		0.095
	Dense, uniform stands of green vegetation cut to a length less than 60 mm			

(Table B.1, Soil and Water Conservation Engineering, Third Edition, 1981)

Table B.1 Roughness Coefficient *n* for Manning Formula

Line No.	*Type and Description of Conduits*	n *Values*[a]		
		Min.	*Design*	*Max.*
23	(*a*) Bermuda grass, short	0.034		0.11
24	(*b*) Kudzu	0.045		0.16
25	(*c*) Lespedeza	0.023		0.05
26	Sorghum, 1-m rows	0.04		0.15
27	Wheat, mature poor	0.08		0.15
	Natural Streams			
28	(*a*) Clean, straight bank, full stage, no rifts or deep pools	0.025		0.033
29	(*b*) Same as (*a*) but some weeds and stones	0.030		0.040
30	(*c*) Winding, some pools and shoals, clean	0.035		0.050
31	(*d*) Same as (*c*), lower stages, more ineffective slopes and sections	0.040		0.055
32	(*e*) Same as (*c*), some weeds and stones	0.033		0.045
33	(*f*) Same as (*d*), stony sections	0.045		0.060
34	(*g*) sluggish river reaches, rather weedy or with very deep pools	0.050		0.080
35	(*h*) Very weedy reaches	0.075		0.150
	Pipe			
36	Asbestos cement		0.009	
37	Cast iron, coated or uncoated	0.011	0.013	0.015
38	Clay or concrete drain tile (102-305 mm dia.)	0.011	0.013	0.020
39	Concrete or clay vitrified sewer pipe	0.01	0.014	0.017
40	Corrugated plastic tubing	0.014	0.016	0.018
41	Metal, corrugated, ring	0.021	0.025	0.026
42	Metal, corrugated, helical	0.013	0.015	
43	Steel, riveted and spiral	0.013	0.016	0.017
44	Wood stave	0.010	0.013	
45	Wrought iron, black	0.012		0.015
46	Wrought iron, galv.	0.013	0.016	0.017

[a] Selected from numerous sources.

(Table B.1, Soil and Water Conservation Engineering, Third Edition, 1981)

Table 7.2 Permissible Velocities for Vegetated Channels

	Permissible Velocity For Erosion Resistant Soils (m/s) (fps)		
		% Slope in Channel	
Cover	*0–5*	*5–10*	*Over 10*
Bermuda grass	2.4 (8)[a]	2.1 (7)[a]	1.8 (6)[a]
Blue grama Buffalo grass Kentucky bluegrass Smooth brome Tall fescue	2.1 (7)[a]	1.8 (6)[a]	1.5 (5)[a]
Annual crops for temporary protection Alfalfa Crabgrass Kudzu Lespedeza sericea Weeping lovegrass	1.1 (3.5)[b]	NR[c]	NR
Grass mixture	1.5 (5)[b]	1.2 (4)[b]	NR

[a] Moderately resistant soils reduce velocities 0.3 m/s (1 fps). Easily eroded soils reduce velocities 0.6 m/s (2 fps).

[b] Easily eroded soils reduce velocities 0.3 m/s (1 fps).

[c] Not recommended.

Source: Modified from Ree (1949).

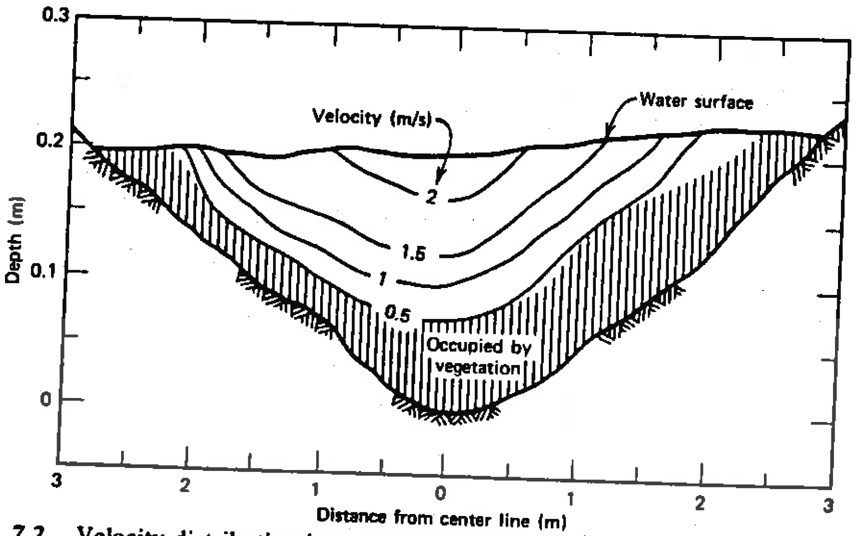


Fig. 7.2. Velocity distribution in a grass-lined channel. (Redrawn from Ree, 1949.)

Table 2-2.--Runoff curve numbers for selected agricultural, suburban, and urban land use. (Antecedent moisture condition II, and $I_a = 0.2S$)

LAND USE DESCRIPTION	HYDROLOGIC SOIL GROUP			
	A	B	C	D
Cultivated land[1]: without conservation treatment	72	81	88	91
: with conservation treatment	62	71	78	81
Pasture or range land: poor condition	68	79	86	89
good condition	39	61	74	80
Meadow: good condition	30	58	71	78
Wood or Forest land: thin stand, poor cover, no mulch	45	66	77	83
good cover[2]	25	55	70	77
Open Spaces, lawns, parks, golf courses, cemeteries, etc.				
good condition: grass cover on 75% or more of the area	39	61	74	80
fair condition: grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial districts (72% impervious).	81	88	91	93
Residential:[3]				
Average lot size / Average % Impervious[4]				
1/8 acre or less / 65	77	85	90	92
1/4 acre / 38	61	75	83	87
1/3 acre / 30	57	72	81	86
1/2 acre / 25	54	70	80	85
1 acre / 20	51	68	79	84
Paved parking lots, roofs, driveways, etc.[5]	98	98	98	98
Streets and roads:				
paved with curbs and storm sewers[5]	98	98	98	98
gravel	76	85	89	91
dirt	72	82	87	89

[1] For a more detailed description of agricultural land use curve numbers refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, Aug. 1972.

[2] Good cover is protected from grazing and litter and brush cover soil.

[3] Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.

[4] The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

[5] In some warmer climates of the country a curve number of 95 may be used.

then computed by dividing the total overland flow length by the average velocity.

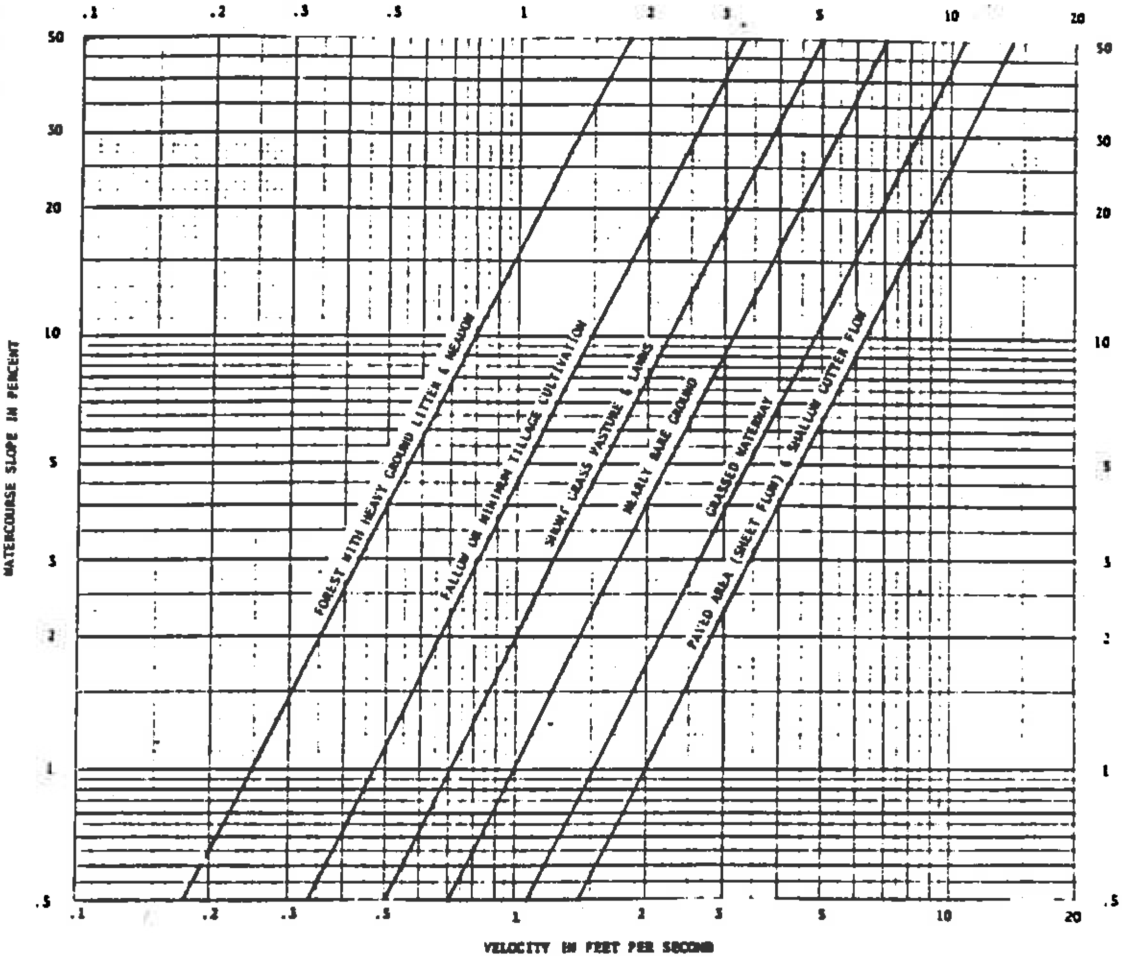


Figure 3-1.--Average velocities for estimating travel time for overland flow.

Storm sewer or road gutter flow

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

Graphical Method of Determining Peak Discharge

The curve of T_c vs. peak discharge in csm per inch of runoff shown in figure 5-2 was developed from table 5-3 for zero T_t. It can be used for a watershed where the runoff can be represented by one curve number, i.e., the land use, soils, and cover are similar and are distributed uniformly throughout the watershed. This procedure is limited to peak discharge determination (hydrograph not required) for a watershed where valley routing is not required. The peak discharge can be calculated from figure 5-2 using T_c in hours, runoff in inches from a 24-hour rainfall, and drainage area in square miles.

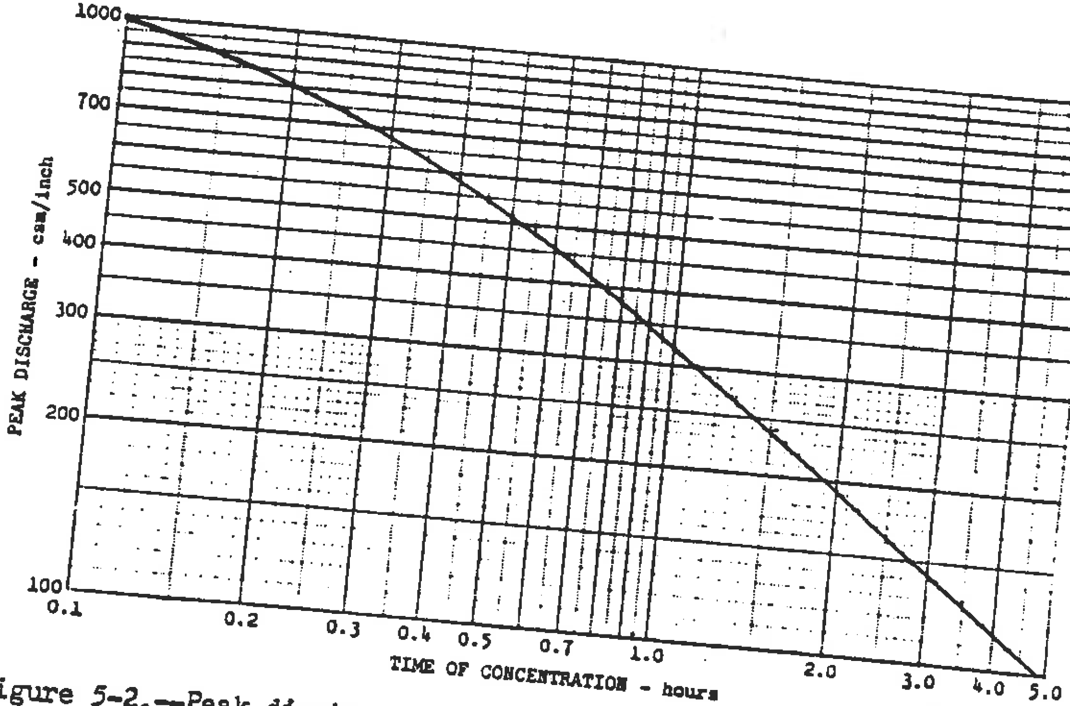


Figure 5-2.—Peak discharge in csm per inch of runoff versus time of concentration (T_c) for 24-hour, type-II storm distribution.

Example 5-2

A developer wishes to install a planned unit development in the uppermost part of a watershed. An ordinance in the township requires that a planned unit development not increase the 100-year-frequency flood flow at the downstream end of the development. The following basic data have been determined for present and future conditions:

Drainage area = 960 acres (1.5 mi^2)

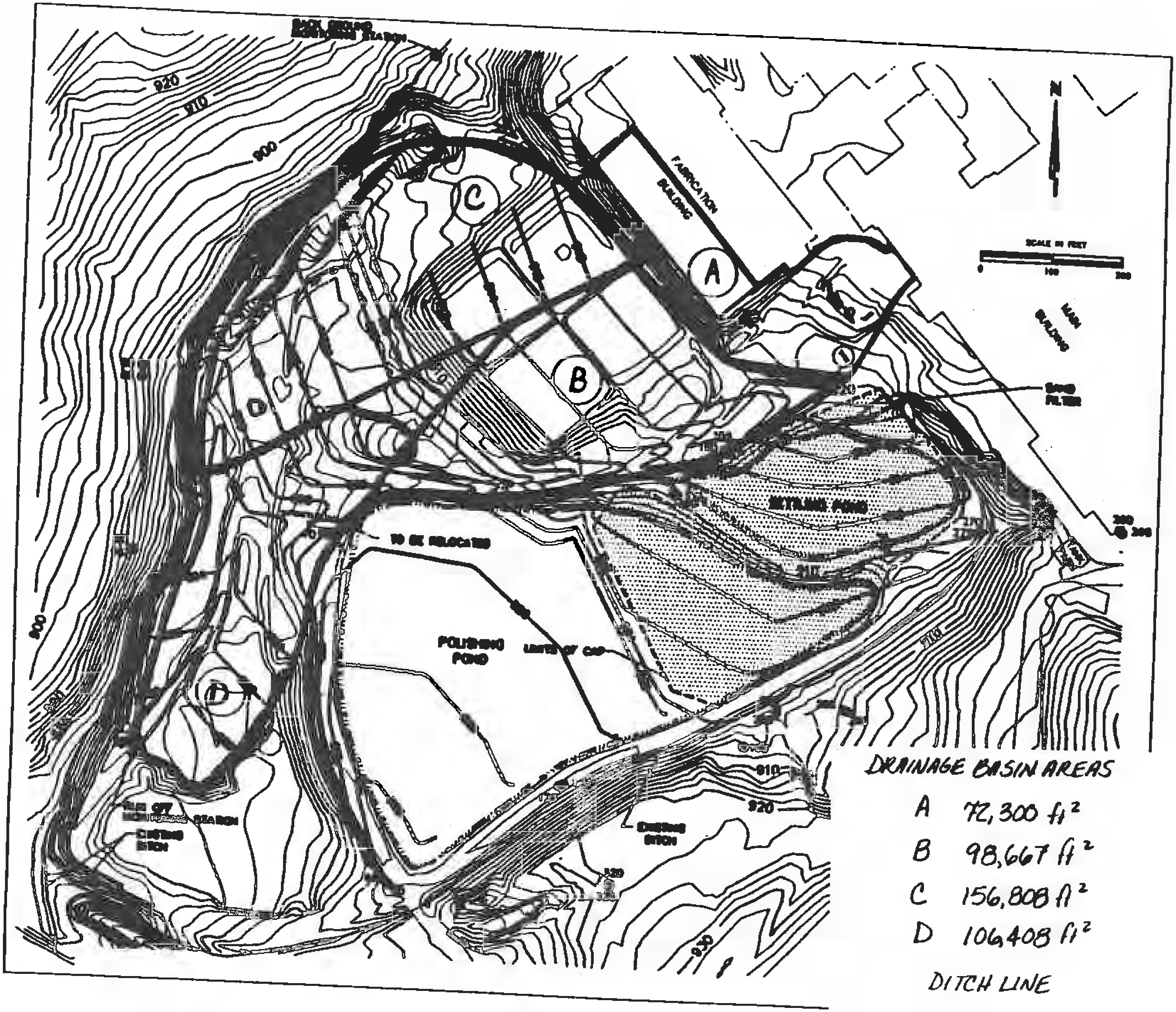
CN (present) = 80

CN (future) = 85

T_c (present) = 0.9 hr

T_c (future) = 0.6 hr

P_{24} (24-hour, 100-year frequency rainfall) = 6.0 in.


N
SCALE IN FEET
0
100
200
MAIN BUILDING
FABRICATION BUILDING
SAND FILTER
SETTLING POND
POLISHING POND
LIMITS OF CAP
TO BE RELOCATED
EXISTING DITCH
A
B
C
D
900
910
920
930
DRAINAGE BASIN AREAS
A 72,300 ft²
B 98,667 ft²
C 156,808 ft²
D 106,408 ft²
DITCH LINE

APPENDIX H

CrOH Sludge Sand Drying Bed Area
Soil Loss Calculation

CrOH SLUDGE SAND DRYING BED AREA
SOIL LOSS CALCULATION

$A = R\ K\ L\ S\ C\ P$

where A = average annual soil loss, in tons/acre

R = rainfall and run-off erosivity index

K = soil erodability factor, tons/acre

L = slope-length factor

S = slope-steepness factor

C = cover-management factor

P = practice factor

A = 0.32 tons/acre per year

where R = 300 (Table B-2.1, Manual for Erosion and Sediment Control in Georgia, 1990)

K = 0.32 (Table 5.4, Soil and Water Conservation Engineering, Third Edition, 1981, silty clay loam)

LS = 0.83 (Table B-2.2, Manual for Erosion and Sediment Control in Georgia, 1990, 8% and 70 ft.)

C = 0.004 (Table 5.5, Soil and Water Conservation Engineering, Third Edition, 1981, Established Grass and Legume Meadow)

P = 1.0 (Table 5.6, Soil and Water Conservation Engineering, Third Edition, 1981, Up and Down Slope)

Table B-2.1 — Rainfall-Erosion Index Factor "R" Values

County	R
Appling	350
Atkinson	350
Bacon	350
Baker	350
Baldwin	250
Banks	300
Barrow	300
Bartow	300
Ben Hill	350
Berrien	350
Bibb	300
Bleckley	300
Brantley	350
Brooks	350
Bryan	350
Bulloch	300
Burke	250
Butts	300
Calhoun	350
Camden	350
Candler	300
Carroll	300
Catoosa	250
Charlton	350
Chatham	350
Chattahoochee	350
Chattooga	300
Cherokee	300
Clarke	250
Clay	350
Clayton	300
Clinch	350
Cobb	300
Coffee	350
Colquitt	350
Columbia	250
Cook	350
Coweta	300
Crawford	300
Crisp	350
Dade	250
Dawson	300
Decatur	350
DeKalb	300
Dodge	300
Dooly	300
Dougherty	350
Douglas	300
Early	350
Echols	350
Effingham	350
Elbert	250
Emanuel	300
Evans	350
Fannin	250
Fayette	300
Floyd	300
Forsyth	300
Franklin	300
Fulton	300
Gilmer	300
Glascock	250
Glynn	350
Gordon	300
Grady	350
Greene	250
Gwinnett	300
Habersham	350
Hall	300
Hancock	250
Haralson	300
Harris	350
Hart	300
Heard	350
Henry	300
Houston	300
Irwin	350
Jackson	300
Jasper	300
Jeff Davis	350
Jefferson	250
Jenkins	300
Johnson	300
Jones	300
Lamar	300
Lanier	350
Laurens	300

Table B-2.2. — Slope Effect Table (Topographic Factor, LS) — Sheet 1 of 2

Percent	Slope Length in Feet													
Slope	10	20	40	60	80	100	110	120	130	140	150	160	180	200
0.2	0.04	0.05	0.06	0.07	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.10	0.10
0.3	0.04	0.05	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11
0.4	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11
0.5	0.05	0.06	0.08	0.08	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12
1.0	0.06	0.08	0.10	0.11	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.16
2.0	0.10	0.12	0.15	0.17	0.19	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.25
3.0	0.14	0.18	0.22	0.25	0.27	0.29	0.30	0.30	0.31	0.32	0.32	0.33	0.34	0.35
4.0	0.16	0.21	0.28	0.33	0.37	0.40	0.42	0.43	0.44	0.46	0.47	0.48	0.51	0.53
5.0	0.17	0.24	0.34	0.41	0.48	0.54	0.56	0.59	0.61	0.63	0.66	0.68	0.72	0.76
6.0	0.21	0.30	0.43	0.52	0.60	0.67	0.71	0.74	0.77	0.80	0.82	0.85	0.90	0.95
8.0	0.31	0.44	0.63	0.77	0.89	0.99	1.04	1.09	1.13	1.17	1.21	1.25	1.33	1.40
10.0	0.43	0.61	0.87	1.06	1.23	1.37	1.44	1.50	1.56	1.62	1.68	1.73	1.84	1.94
12.0	0.57	0.81	1.14	1.40	1.61	1.80	1.89	1.98	2.06	2.14	2.21	2.28	2.42	2.55
14.0	0.73	1.03	1.45	1.78	2.05	2.29	2.41	2.51	2.62	2.72	2.81	2.90	3.08	3.25
16.0	0.90	1.27	1.80	2.20	2.54	2.84	2.98	3.11	3.24	3.36	3.48	3.59	3.81	4.01
18.0	1.09	1.54	2.17	2.66	3.07	3.43	3.60	3.76	3.92	4.06	4.21	4.34	4.61	4.86
20.0	29	1.82	2.58	3.16	3.65	4.08	4.28	4.47	4.65	4.83	5.00	5.16	5.47	5.77
25.0	1 86	2.63	3.73	4.56	5.27	5.89	6.18	6.45	6.72	6.97	7.22	7.45	7.90	8.33
30.0	2.52	3.56	5.03	6.16	7.11	7.95	8.34	8.71	9.07	9.41	9.74	10.06	10.67	11.25
40.0	4.00	5.66	8.00	9.80	11.32	12.65	13.27	13.86	14.43	14.97	15.50	16.31	16.98	17.90
50.0	5.64	7.97	11.27	13.81	15.94	17.82	18.69	19.53	20.32	21.09	21.83	22.55	23.91	25.21
60.0	7.32	10.35	14.64	17.93	20.71	23.15	24.28	25.36	26.40	27.39	28.36	29.29	31.06	32.74

Table 5.3 Frequency of Annual and Single-Storm Erosion Index $\overline{R}$

Location	Return Period in Years			
	2	5	10	20
ANNUAL EROSION INDEX, *R*				
Little Rock, Ark.	308	422	510[a]	569
Indianapolis, Ind.	166	225	275[a]	302
Devils Lake, N.D.	56	90	120[a]	142
SINGLE-STORM EROSION INDEX, *R*				
Little Rock, Ark.	69	115	158	211
Indianapolis, Ind.	41	60	75	90
Devils Lake, N.D.	27	39	49	59

[a] Interpolated values.

Source: Wischmeier and Smith (1965).

C = cropping-management factor, which is the ratio of soil loss for given conditions to soil loss from cultivated continuous fallow as given in Table 5.5,

P = conservation practice factor, which is the ratio of soil loss for a given practice to that for up and down the slope farming as given in Table 5.6.

The index factor R found by Wischmeier (1959) to be most highly correlated with soil loss for a fallow condition (see (6) in Table 5.1), was a product of the kinetic energy of the storm and the maximum 30-min intensity. This product

Table 5.4 *K*. Soil-Erodibility Factor by Soil Texture in t/a[a]

Textural Class	Organic Matter Content (%)		
	0.5	2	4
Fine sand	0.16	0.14	0.10
Very fine sand	0.42	0.36	0.28
Loamy sand	0.12	0.10	0.08
Loamy very fine sand	0.44	0.38	0.30
Sandy loam	0.27	0.24	0.19
Very fine sandy loam	0.47	0.41	0.33
Silt loam	0.48	0.42	0.33
Clay loam	0.28	0.25	0.21
Silty clay loam	0.37	0.32	0.26
Silty clay	0.25	0.23	0.19

[a] Selected from USDA-EPA, Vol. I (1975) and are estimated averages of specific soil values. For more accurate values by soil types use local recommendations of Soil Conservation Service or state agencies. (1 t/a = 2.24 Mg/ha)

Table 5.5 Ratio of Soil Loss from Crops to Corresponding Loss from Continuous Fallow[a]

Cover, Sequence, and Management	Crop Yields		Crop-Stage Period[b]				
	Meadow (tons)	Corn (bu)	0 (%)	1 (%)	2 (%)	3 (%)	4 (%)
1st-yr corn after meadow, *RdL*[c]	2	60	15	30	27	15	22
2nd-yr corn after meadow, *RdL*	3	70	32	51	41	22	26
2nd-yr corn after meadow, *RdR*[d]	3	70	60	65	51	24	65
3rd- or more yr corn, *RdL*	—	70	36	63	50	26	30
Small grain w/meadow seeding:							
(1) In disked corn residues							
After 1st-corn after meadow	2	60	—	30	18	3	2
After 2nd corn after meadow	2	60	—	40	24	5	3
(2) On disked corn stubble, *RdR*							
After 1st corn after meadow	2	—	—	50	40	5	3
After 2nd corn after meadow	2	—	—	80	50	7	3
Established grass and legume meadow	3	—	—	—	0.4	—	—

[a] Portion of 100-line published table (Wischmeier, 1960).

[b] Crop-stage periods are defined below:

0 Turnplowing to seedbed preparation.
1 Seedbed—first month after seeding.
2 Establishment—second month after seeding.
3 Growing cover—from 2 months after seeding to harvest.
4 Stubble or residue—harvest to plowing or new seedbed.

[c] *RdL*, crop residues left and incorporated by plowing.

[d] *RdR*, crop residues removed.

Source: Smith and Wischmeier (1962).

Table 5.6 Recommended Conservation Practice Factors P^a

Percent Slope	P_c *Contouring (maximum slope length in m)*	P_{sc} *Strip Cropping*[b]	P_{tc} *Terracing and Contouring*[c]
Parallel to Field Boundary	0.8[d]	—	—
1.1–2	0.6 (150)	0.30	—
2.1–7	0.5 (100)	0.25	0.10
7.1–12	0.6 (60)	0.30	0.12
12.1–18	0.8 (20)	0.40	0.16
18.1–24	0.9 (18)	0.45	—

[a] Factor for up and down slope is 1.0.

[b] A system using 4-year rotation of corn, small grain, meadow, meadow. Use with terraces for farm planning.

[c] Recommended only for computing soil loss from the field or loss to the terrace channel with upslope plowing.

[d] For slopes up to 12% only.

Source: Wischmeier and Smith (1965).

the soil loss from the standard length of 22 m (73 ft) and 9 percent slope. These factors can be calculated from the equations

$$L = (l/22)^x \tag{5.4}$$

and

$$S = \frac{(0.43 + 0.30s + 0.043s^2)}{6.574} \tag{5.5}$$

where x = a constant, 0.5 for slopes >4 percent, 0.4 for 4 percent, and 0.3 for <3 percent
l = slope length in m,
s = field slope in percent.

The product LS can be read directly from Fig. 5.7 for $x = 0.5$. The slope length is measured from the point where surface flow originates (usually the top of the ridge) to the outlet channel or a point down slope where deposition begins.

The cropping-management factor C includes the effects of cover, crop sequence, productivity level, length of growing season, tillage practices, residue management, and the expected time distribution of erosive rainstorms. The

APPENDIX I

Ground-Water Monitoring Program

E-5 GENERAL MONITORING PROGRAM REQUIREMENTS

E-5a Description of Wells

Seventy-six ground-water quality monitoring wells have been installed in the uppermost aquifer at the facility. The installation of these wells is discussed in Section E-1b. A summary of the well types and construction details is presented in Table E-1.1. The locations of these wells are shown on Figure E-1.1. The construction of individual wells is shown on the well construction diagrams in Appendix E-1.2.

The William L Bonnell Company will be in detection monitoring for the CrOH landfill and the ALOH sludge/soil mixing area. The facility will be in compliance, and corrective action monitoring for the Hazardous Waste Management Area (HWMA) consisting of the former CrOH sand drying beds, polishing pond and the settling pond. Table E-5.1 is a summary of the detection/compliance/corrective action monitoring system. Specific monitoring wells have been proposed as point of compliance (POC) monitoring wells and as corrective action performance monitoring wells.

E-5b Description of Sampling and Analysis Procedures

Revised Sampling and Analysis Procedures for the facility are included in Appendix C of the Revised Ground-Water Monitoring Plan (Appendix E-1.8). The monitoring wells will be sampled and analyzed in accordance with the Revised Sampling and Analysis Procedures.

E-5c Procedures for Establishing Background Water Quality

Monitoring well GW-13S will provide upgradient, background water quality for the ALOH sludge/soil mixting area and the waste management area consisting of the former CrOH sand drying beds, the settling pond and the polishing pond. Monitoring well GW-18S will provide upgradient, background water quality for the CrOH landfill. A minimum of one year of quarterly interim status data will be collected from the wells to develop background water quality in accordance with the Revised Ground-Water Monitoring Plan (Appendix E-1.8). At a minimum, the initial background values will be determined by taking the arithmetic mean and variance of the individual parameters analyzed during the first year of interim status monitoring. Also, analytical results for chromium or other constituents, as necessary, obtained for delisting purposes may be used to establish background values on well GW-13S. During detection and compliance monitoring, quadruplicate samples from each respective background well will be collected semi-annually and analyzed for pH, specific conductance, total organic carbon, total organic halogens and total chromium. The results of detection and compliance monitoring from the background wells will be verified with the initial (first year) background results using the students t-Test with a 0.01 level of significance except for pH where a 0.025 level of significance will be used.

E-5d Statistical Procedures

Ground-water quality data will be collected from the background and proposed POC monitoring wells during detection and compliance monitoring. These data will be used to determine if statistically significant evidence of contamination exists (detection monitoring) or contamination increases (compliance monitoring) for the parameters or hazardous constituents specified in the permit. The statistical comparisons will be made using the Students' t-test as described in 40 CFR 264 Appendix IV to the 0.01 level of significance. Non-detects will be handled by substituting the detection limit value for constituents not detected. These values will be obtained from the US EPA "Test Methods for Evaluating Solid Waste" third edition SW-846.

E-7 DESCRIPTION OF COMPLIANCE MONITORING PROGRAM

The chromium hydroxide sands drying beds, settling pond and polishing pond have been combined into a single hazardous waste management area (HWMA). Chromium has been detected in the ground water at the chromium hydroxide sand drying beds above the ground-water protection standard. A compliance monitoring program will be implemented at the proposed point of compliance wells for this HWMA. Details of this monitoring program are described below.

E-7a Description of Monitoring Program

E-7a(1) Description of Wastes Previously Handled at the Facility

The Bonnell facility operates a chemical conversion coating wastewater treatment system which produces a listed hazardous waste (F019) sludge. This F019 listed waste is managed in the regulated units at the facility. The hazardous constituent in the F019 waste is chromium.

E-7a(2) Characterization of Contaminated Ground Water

A complete description and characterization of contaminated ground water at this HWMA is provided in Section E-4.

E-7a(3) List of Hazardous Constituents to be Monitored

The identification of site-specific hazardous constituents for compliance monitoring was based on an evaluation of the waste managed in the regulated units (Section E-7a(1)) and an analysis of the ground-water quality from the interim status monitoring. The only detected Appendix IX constituent that is related to the waste in the regulated unit and present in ground-water is total chromium. Appendix IX analyses from well GW-15D are pending. If additional hazardous constituents are identified in samples analyzed for Appendix IX constituents, an application will be made to modify the permit accordingly.

E-7a(4) Proposed Concentration Limits

The maximum allowable concentration (ground-water protection standard) for chromium is defined in 40 CFR 264.94 Table 1 at 0.05 mg/l. This value will be used as the concentration limit at the point of compliance.

E-7a(5) Description of the Monitoring System

Compliance monitoring will be performed at the following proposed point of compliance monitoring wells: GW-6S, GW-7S, GW-12S and GW-27S. Well GW-13S will provide background water quality. These wells are shown on Figure E-1.1. Construction details for these wells are summarized on Table E-1.1. The construction of individual wells is shown on the well construction diagrams in Appendix E-1.2.

The ground-water direction and rate of ground-water flow in the uppermost aquifer will be determined annually. For this purpose, ground-water elevations will be measured in all wells in the facility.

E-7a(6) Description of Proposed Sampling and Statistical Analysis Procedures

The sampling and analysis will be performed using the procedures described in the Revised Sampling and Analysis Plan (Appendix E-1.8). The samples will be analyzed for pH, specific conductance, and total chromium (site specific hazardous constituent). The results of the analyses will be compared to the ground-water protection standards using the statistical procedures described in Section E-5d above.

To assess whether additional hazardous constituents are present in the uppermost aquifer, a point of compliance monitoring well will be sampled annually and analyzed for Appendix IX constituents using the procedures described in the Revised Sampling and Analysis Plan (Appendix E-1.8).

E-7a(7) Procedures to be Implemented if Ground-Water Protection Standards are Exceeded at Point of Compliance

If the concentration of any hazardous constituent exceeds the ground-water protection standard at any POC monitoring well, the following procedures will be implemented:

- o The Director of Georgia EPD will be notified in writing within seven days.
- o A report will be submitted to the Director of Georgia EPD within 90 days and an application will be made for a permit modification to establish a corrective action program as required by 40 CFR 264.99(h)(2).

E-7b Engineering Feasibility Plan for Corrective Action Program

The William L Bonnell Company will take corrective action to ensure that hazardous constituents from the hazardous waste management units (HWMUs) detected in the ground water do not exceed their respective concentration limits at the point-of-compliance. To date, only one hazardous constituent (chromium) associated with the HWMUs has been detected above the ground-water protection standard. The chromium contaminant plume has been described in Section E-4.

The source of the chromium plume described in Section E-4 is believed to be the former CrOH Sand Drying Beds. This unit is part of a waste management area which also includes the settling pond and polishing pond. Corrective action for chromium contaminated ground water in the vicinity of the former CrOH Sand Drying Beds will include closure of the unit (source control), and if necessary, ground-water recovery and associated treatment, and corrective action monitoring to determine the effectiveness of the corrective action program.

To date, no release of hazardous constituents above the concentration limits established under 40 CFR 264.93 has occurred from the Aluminum Hydroxide Mixing Area. Except for the ALOH Mixing Area, each HWMU will be closed with a engineered cover. The ALOH Mixing Area will be closed as a land treatment unit. Closure plans for each HWMUs are provided in Section I. If hazardous constituents are detected above the proposed concentration limits during detection or compliance monitoring (Section E-6) being performed at the ALOH Mixing Area or CrOH landfill, a corrective action program similar to that of the CrOH sand drying beds will be developed for those areas where exceedences have occurred.

The proposed methods of corrective action use proven construction techniques for dealing with ground-water contamination. Execution of the Corrective Action Program should restore ground-water quality without producing any adverse environmental conditions. For details of the Corrective Action Plan for the CrOH sand drying beds, refer to Section E-8.

TABLE E-1.1
SUMMARY OF BORING AND WELL CONSTRUCTION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	DATE COMPLETED	DRILLING METHOD	BIT OR AUGER DIAMETER (INCHES)	WELL TYPE	BORING DEPTH (FEET)	APPROX. DEPTH OF SCREENED INTERVAL (FEET)	DEPTH TO TOP OF SAND PACK (FEET)	DEPTH TO TOP OF BENTONITE SEAL (FEET)	UNIT SCREENED:	TOP OF CASING ELEVATION (FEET,MSL)
1S	09/16/89	HOLLOW STEM AUGER	8.0	II	32.0	21.0-31.0	17.0	15.0	Water Table	933.46
1D	09/16/89	HOLLOW STEM AUGER	8.0	II	65.5	54.5-64.5	52.0	37.0		933.73
*2S	09/20/89	HOLLOW STEM AUGER	8.0	II	13.5	2.5-12.5	1.0	0.9	Water Table	919.74
*2D	09/21/89	HOLLOW STEM AUGER	8.0	II	39.5	29.5-39.5	19.0 —	16.0		919.53
3S	09/18/89	HOLLOW STEM AUGER	8.0	II	19.0	4.5-14.5	3.5	2.5	Water Table	912.82
3D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
4S	09/19/89	HOLLOW STEM AUGER	8.0	II	28.0	18.0-28.0	16.0	14.0	Water Table	909.26
4D	05/01/90	HOLLOW STEM AUGER	8.25	II	35.0	24.8-34.8	22.8	20.8	Water Table/TOR	909.04
5S	09/20/89	HOLLOW STEM AUGER	8.0	II	30.0	20.0-30.0	9.0	7.0	Water Table	909.26
5D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
6S	09/20/89	HOLLOW STEM AUGER	8.0	II	23.0	10.0-20.0	9.0	7.5	Water Table	906.05
6D	05/03/90	HOLLOW STEM AUGER	8.25	II	43.8	33.4-43.4	31.4	29.4	Top of Rock	905.77
7S	09/20/89	HOLLOW STEM AUGER	8.0	II	23.0	9.0-19.0	8.0	6.0	Water Table	902.31
7D	09/22/89	HOLLOW STEM AUGER	8.0	II	47.5	37.0-47.0	34.0	30.0	Top of rock	902.82
8S	09/20/89	HOLLOW STEM AUGER	8.0	II	15.0	3.0-13.0	2.0	1.0	Water Table	891.46
8D	09/20/89	HOLLOW STEM AUGER	8.0	II	39.5	29.5-39.5	24.5	7.6	Top of rock	891.08
9S	09/19/89	HOLLOW STEM AUGER	8.0	II	15.0	3.2-13.0	1.8	0.8	Water Table	882.74
9D	05/05/90	HOLLOW STEM AUGER	8.25	II	50.0	37.8-47.8	35.8	33.8	Top of Rock	881.37
10S	05/24/90	HOLLOW STEM AUGER	8.25	II	10.0	3.2-8.2	1.2	0.2	Water Table/TOR	907.67
10D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
11S	09/19/89	HOLLOW STEM AUGER	8.0	II	29.0	18.0-28.0	13.5	11.5	Water Table	950.63
11D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
12S	09/25/89	HOLLOW STEM AUGER	8.0	II	13.0	2.5-12.5	1.5	1.0	Water Table	906.48
12D	05/04/90	HOLLOW STEM AUGER	8.25	II	38.0	27.7-37.7	25.7	23.7	Top of rock	906.69
13S	11/29/89	HOLLOW STEM AUGER	9.0	II	25.0	15.0-25.0	13.0	10.5	Water Table	952.40
13D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
14S	11/30/89	HOLLOW STEM AUGER	9.0	II	28.0	13.0-23.0	10.0	8.0	Water Table	947.31
14D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
15S	04/19/90	HOLLOW STEM AUGER	8.25	II	20.1	9.7-19.7	7.7	5.7	Water Table	920.92
15D	04/18/90	HOLLOW STEM AUGER	8.25	II	49.9	38.5-48.5	37.0	35.0	Top of rock	920.80
16S	04/16/90	HOLLOW STEM AUGER	8.25	II	14.9	4.4-14.4	2.4	0.4	Water Table	912.14
16D	04/17/90	HOLLOW STEM AUGER	8.25	II	32.0	20.1-30.1	19.0	17.0	Top of rock	912.98
17S	04/27/90	HOLLOW STEM AUGER	8.25	II	26.2	20.8-25.8	18.8	16.8	Water Table	912.51
17D	04/27/90	HOLLOW STEM AUGER	8.25	II	35.0	24.9-34.9	22.0	20.0	Water Table/TOR	912.28
18S	05/01/90	HOLLOW STEM AUGER	8.25	II	20.8	10.3-20.3	8.3	6.3	Water Table	903.50
18D	05/01/90	HOLLOW STEM AUGER	8.25	II	35.0	24.2-34.2	22.1	20.1	Top of rock	903.58
19S	04/26/90	HOLLOW STEM AUGER	8.25	II	31.2	20.8-30.8	18.8	16.8	Water Table	906.83
19D	04/20/90	HOLLOW STEM AUGER	8.25	II	43.0	32.8-42.8	30.8	28.8	Top of rock	906.67
20S	04/30/90	HOLLOW STEM AUGER	8.25	II	15.5	5.1-15.1	3.1	1.1	Water Table	880.01
20D	04/30/90	HOLLOW STEM AUGER	8.25	II	40.0	29.6-39.6	27.6	25.6	Top of rock	879.69

SUMMARY OF BORING AND WELL CONSTRUCTION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	DATE COMPLETED	DRILLING METHOD	BIT OR AUGER DIAMETER (INCHES)	WELL TYPE	BORING DEPTH (FEET)	APPROX. DEPTH OF SCREENED INTERVAL (FEET)	DEPTH TO TOP OF SAND PACK (FEET)	DEPTH TO TOP OF BENTONITE SEAL (FEET)	UNIT SCREENED*	TOP OF CASING ELEVATION (FEET, MSL)
21S	05/03/90	HOLLOW STEM AUGER	8.25	II	15.3	4.9-14.9	2.9	0.9	Water Table	871.73
21D	05/03/90	HOLLOW STEM AUGER	8.25	II	40.6	30.2-40.2	28.2	26.2	Top of rock	871.65
22S	05/04/90	HOLLOW STEM AUGER	8.25	II	24.6	14.1-24.1	12.1	10.1	Water Table	901.95
22D	05/04/90	HOLLOW STEM AUGER	8.25	II	43.8	38.3-43.3	36.3	34.3	Top of rock	902.46
23S	05/04/90	HOLLOW STEM AUGER	8.25	II	22.1	11.7-21.7	9.7	7.7	Water Table	912.47
23D	05/04/90	HOLLOW STEM AUGER	8.25	II	41.0	30.3-40.3	28.3	26.3	Top of rock	913.14
24S	NOT INSTALLED	—	—	—	—	—	—	—	—	—
24D	05/03/90	HOLLOW STEM AUGER	8.25	II	39.0	28.0-38.0	26.0	24.0	Water Table/TOR	925.73
25S	05/01/90	HOLLOW STEM AUGER	8.25	II	15.0	4.5-14.5	2.5	0.5	Water Table	920.72
25D	05/02/90	HOLLOW STEM AUGER	8.25	II	41.0	30.3-40.3	28.3	26.3	Top of rock	920.48
26S	05/21/90	HOLLOW STEM AUGER	8.25	II	21.9	11.5-21.5	9.5	7.5	Water Table	931.15
26D	05/22/90	HOLLOW STEM AUGER	8.25	II	46.0	35.1-45.1	33.1	31.0	Top of rock	931.40
27S	05/22/90	HOLLOW STEM AUGER	8.25	II	11.7	1.3-11.3	0.3	0.0	Water Table	911.82
27D	05/22/90	HOLLOW STEM AUGER	8.25	II	30.0	18.8-28.8	16.8	14.8	Top of rock	911.91
28S	05/23/90	HOLLOW STEM AUGER	8.25	II	12.7	2.3-12.3	0.3	0.0	Water Table	909.31
28D	05/24/90	HOLLOW STEM AUGER	8.25	II	29.0	18.4-28.4	16.4	14.4	Top of rock	909.51
29S	05/24/90	HOLLOW STEM AUGER	8.25	II	12.6	2.2-12.2	0.2	0.0	Water Table	904.70
29D	05/24/90	HOLLOW STEM AUGER	8.25	II	21.5	16.1-21.1	14.1	12.1	Top of rock	904.86
30D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
31D	7/10/90	HOLLOW STEM AUGER	8.0	II	37.0	27.0-37.0	25.0	22.5	Water Table/TOR	928.44
32D	7/10/90	HOLLOW STEM AUGER	8.0	II	45.0	35.0-45.0	33.1	30.2	Top of rock	922.14
32S	7/10/90	HOLLOW STEM AUGER	8.0	II	35.0	25.0-35.0	23.0	20.3	Water Table	922.31
33D	7/12/90	HOLLOW STEM AUGER	8.0	II	30.0	19.7-29.7	16.8	14.3	Water Table/TOR	939.59
34D	7/14/90	HOLLOW STEM AUGER	8.0	II	35.0	20.0-35.0	19.0	16.5	Top of rock	938.94
35D	7/16/90	HOLLOW STEM AUGER	8.0	II	24.0	14.0-24.0	11.5	9.5	Water Table/TOR	921.90
36S	08/07/90	HOLLOW STEM AUGER	8.0	II	25.0	5.0-25.0	13.0	10.5	Water Table	940.80
36D	08/07/90	HOLLOW STEM AUGER	8.0	II	40.4	35.0-40.0	33.0	30.5	Top of rock	940.84
37S	08/08/90	HOLLOW STEM AUGER	8.0	II	18.0	8.0-18.0	6.0	3.0	Water Table	932.24
37D	08/08/90	HOLLOW STEM AUGER	8.0	II	63.0	53.0-63.0	51.0	48.0	Top of rock	932.04
38S	08/09/90	HOLLOW STEM AUGER	8.0	II	20.5	23.0-33.0	20.5	18.0	Water Table	962.24
38D	08/09/90	HOLLOW STEM AUGER	8.0	II	52.0	41.0-51.0	41.0	39.0	Top of rock	962.29
39D	08/13/90	HOLLOW STEM AUGER	8.0	II	35.2	25.0-35.0	23.0	20.0	Top of rock	927.56
40D	08/17/90	HOLLOW STEM AUGER	7.0	II	26.0	16.0-26.0	14.2	11.0	Top of rock	937.86
41D	08/17/90	HOLLOW STEM AUGER	7.0	II	28.0	18.0-28.0	16.0	13.0	Top of rock	937.79

SUMMARY OF BORING AND WELL CONSTRUCTION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	DATE COMPLETED	DRILLING METHOD	BIT OR AUGER DIAMETER (INCHES)	WELL TYPE	BORING DEPTH (FEET)	APPROX. DEPTH OF SCREENED INTERVAL (FEET)	DEPTH TO TOP OF SAND PACK (FEET)	DEPTH TO TOP OF BENTONITE SEAL (FEET)	UNIT SCREENED*	TOP OF CASING ELEVATION (FEET, MSL)
OS-1D	07/09/90	HOLLOW STEM AUGER	8.0	H	30.0	20.0-30.0	17.5	15.3	Top of rock	868.49
OS-1S	07/09/90	HOLLOW STEM AUGER	8.0	H	15.0	5.0-15.0	4.0	2.0	Water Table	868.45
OS-2D	07/11/90	HOLLOW STEM AUGER	8.0	H	28.5	18.7-28.7	16.7	14.7	Top of rock	884.34
OS-2S	07/11/90	HOLLOW STEM AUGER	8.0	H	16.0	6.0-16.0	5.0	3.0	Water Table	884.85
OS-3D	07/12/90	HOLLOW STEM AUGER	8.0	H	44.8	35.8-44.8	32.7	14.3	Top of rock	865.54
OS-3S	07/12/90	HOLLOW STEM AUGER	8.0	H	15.0	5.0-15.0	4.0	2.2	Water Table	865.39
OS-4D	07/12/90	HOLLOW STEM AUGER	8.0	H	45.0	35.0-45.0	33.0	30.5	Top of rock	878.79
OS-4S	07/12/90	HOLLOW STEM AUGER	8.0	H	16.0	6.0-16.0	4.5	2.2	Water Table	878.36
OS-5D	07/19/90	HOLLOW STEM AUGER	8.0	H	70.0	60.0-70.0	57.5	55.0	Top of rock	876.82
OS-5S	07/17/90	HOLLOW STEM AUGER	8.0	H	35.0	19.0-29.0	17.0	14.5	Water Table	879.32

NOTES:

Water Table = Screen interval generally spans the surface of the fluctuating water table.
Top of rock = Bottom of screen interval generally located at auger refusal depth (top of rock).
TOR = Top of Rock

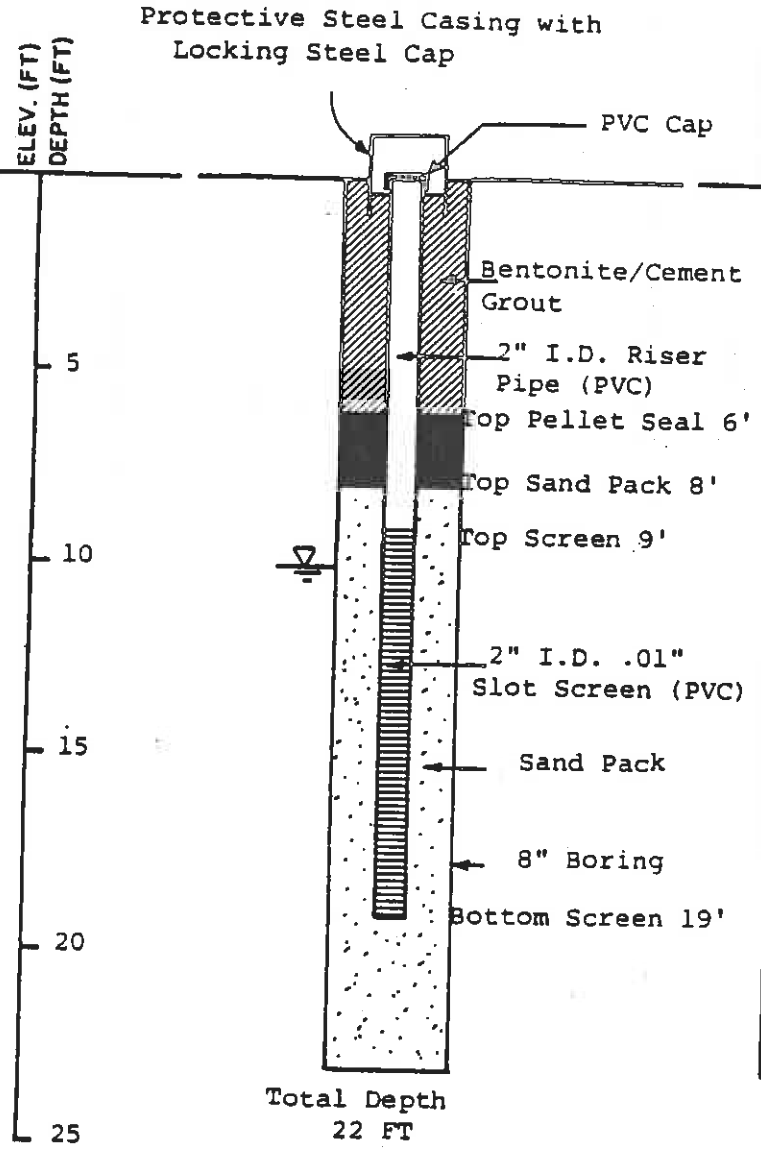
* Well 2S and 2D were destroyed during interim closure of the sand drying beds near the settling pond.

APPENDIX E-1.2

Test Boring Records and Well Construction Diagrams

MONITORING WELL CONSTRUCTION DRAWING AND SOIL BORING RECORD

MONITORING WELL BN-GW-07S DATE DRILLED 9/20/89



DEPTH (FT)	DESCRIPTION	"N" VALUE
	Orange, brown, soft SANDY SILT, some fine to coarse sand, trace mica (fill), dry (ML)	15
	No samples collected below 10 ft.	5

BORING TERMINATED AT 23 FT.

SCALE
0 5 FT

LEGEND

∇	Water Level (rods)
SCALE:	1" = 5'

ATEC Associates, Inc.

PROJECT

WILLIAM L. BONNELL CO., INC.
NEWNAN, COWETA COUNTY, GA
ATEC PROJECT NO. 32-97182

BN-GW-12S

ELEV.
DEPTH (FEET)
DESCRIPTION
PENETRATION RESISTANCE (BLOWS PER FOOT)
0 10 20 40 60 80 100

Brown soft SANDY SILT, some fine to coarse sand, trace mica, trace clay, no foliation, moist (ML)

5

10

BORING TERMINATED AT 13 FT.

15

Standard Penetration Test cancelled by rain during installation of BN-GW-12S Description above made by examination of cuttings.

REMARKS:

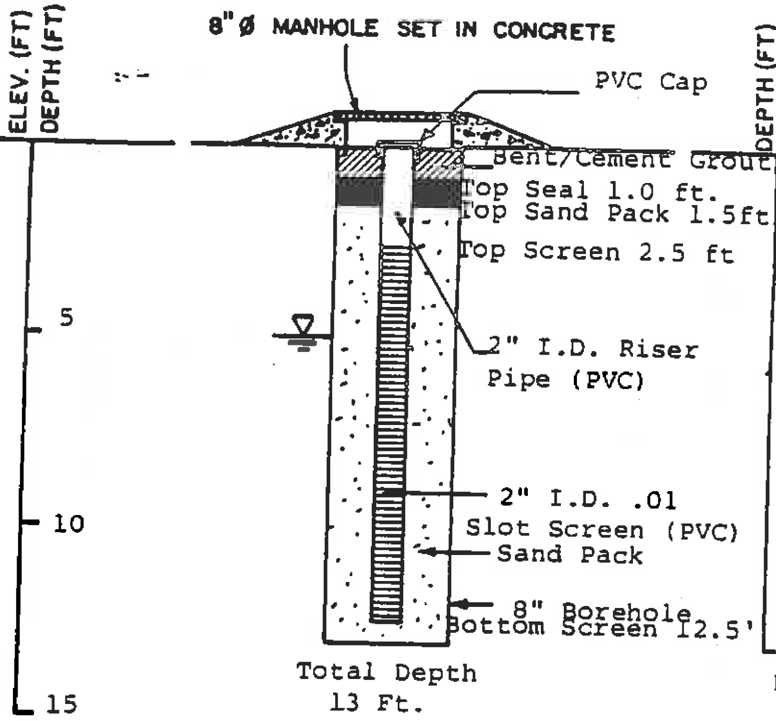
Groundwater noted on rods at 5 feet below land surface

BORING NUMBER: BN-GW-12S
DATE DRILLED: 9/25/89
PROJECT NUMBER: 32-97182

ATEC Associates, Inc.

MONITORING WELL CONSTRUCTION DRAWING AND SOIL BORING RECORD

MONITORING WELL BN-GW-12S DATE DRILLED 9/25/89



DEPTH (FT)	DESCRIPTION	"N" VALUE
	Brown, soft, SANDY SILT, some fine to coarse sand, trace mica, trace clay, no foliation, moist (ML) HNU < background	

BORING TERMINATED AT 13 FT

NOTE: Standard Penetration Test cancelled by rain during installation of BN-GW-12S. Description above made by examination of cuttings.

SCALE
0 5 FT

LEGEND

⊽ Water Level (rods)

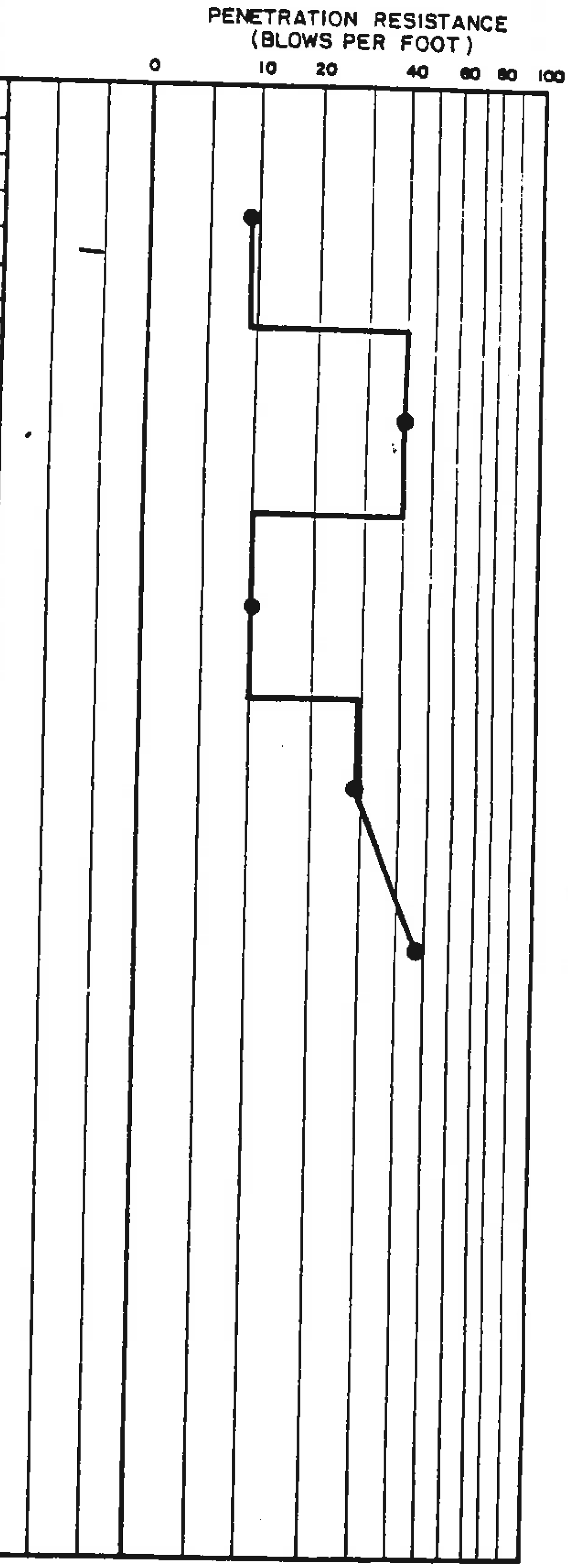
SCALE: 1" = 5 FT

ATEC Associates, Inc.

PROJECT

WILLIAM L. BONNELL CO., INC.
NEWNAN, COWETA COUNTY, GA.
ATEC PROJECT NO. 32-97182

ELEV.	DEPTH (FEET)	DESCRIPTION
	5	Red-brown firm SILT and CLAY little coarse sand. Micaceous, some black organic material. Moist (ML)
	10	Weathered mica schist sampled as: white-pink-black mottled hard SILT and fine to medium SAND. Dry (MH)
	15	Orange-brown stiff SILT with some medium SAND, micaceous. Some black SILT. Dry (MH)
	20	Weathered mica-feldspar quartz schist. Sampled as: Gray-brown very stiff micaceous SILT and fine SAND. Some medium sand. Moist (ML)
		Same as above - saturated good foliation.
	25	Boring Terminated at 25 Ft.
	30	

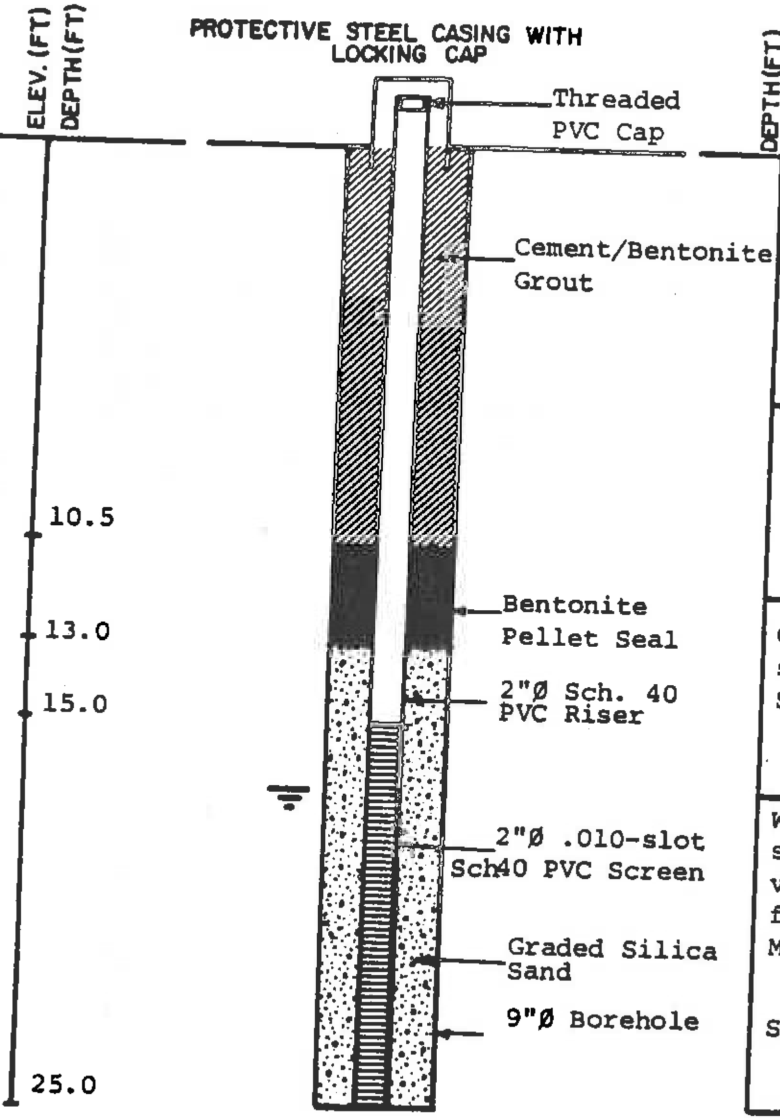


REMARKS: Groundwater noted on rods at 20 Ft.
Water table at 17 Ft.

BORING NUMBER: BN-GW-13S
DATE DRILLED: 11/29/89
PROJECT NUMBER: 32-97182

ATEC Associates, Inc.

MONITORING WELL CONSTRUCTION DRAWING AND SOIL BORING RECORD
MONITORING WELL MW-135 DATE DRILLED



DEPTH(FT)	DESCRIPTION
	Red-brown fiem SILT and clay, little coarse sand. Micaceous, some black organic material moist (ML).
	Weathered mica schist sampled as: white-pint-black motled hard SILT and fine to medium SAND. Dry (MH)
	Orange-brown stiff SILT with some medium SAND, micaceous. Some black SILT. Dry (MH)
	Weathered mica-feldspar quartz schist samples as: Grey-brown very stiff micaceous SILT and fine SAND. Some Medium sand. Moist (ML) Same as above, good foliation

BORING TERMINATED AT 25 Ft.

LEGEND

≡ Water Table

SCALE: Horz. - Not to Scale
Vert. - 1" = 5'

ATEC Associates, Inc.

PROJECT
WILLIAM L. BONNELL CO., INC.
Newnan, Coweta County, GA

ATEC Project No. 32-97182

Atlanta Environmental Management, Inc.
Monitoring Well Log

Date: 5/22/90

Owner: William L. Bonnell Co.
Well No: MW-27S
Location: William L. Bonnell Co.
Newnan, GA
Driller: Layne Environmental
Geologist: Ron Yarborough
Drilling Method: 8 1/4" hollow-stem augers

Screened From: 1.27 ft. to 11.27 ft
Gravel Pack: 20-30 mesh to 0.27 ft
Bentonite Seal: surface ft. to 0.27 ft
Concrete Seal from ______ ft. to surface
Water Level: 4.2 ft. below well top
Well top elevation: 911.82 ft. AMSL

Depth (feet) From	To	Lithology	Remarks
		See well log for MW-BN-27D	
		Well installed to monitor the upper part of the	
		unconfined aquifer. The well is screened above	
		and below the water table	

Project: William L. Bonnell

Location: Newnan, Georgia

Well Number: MW-27S

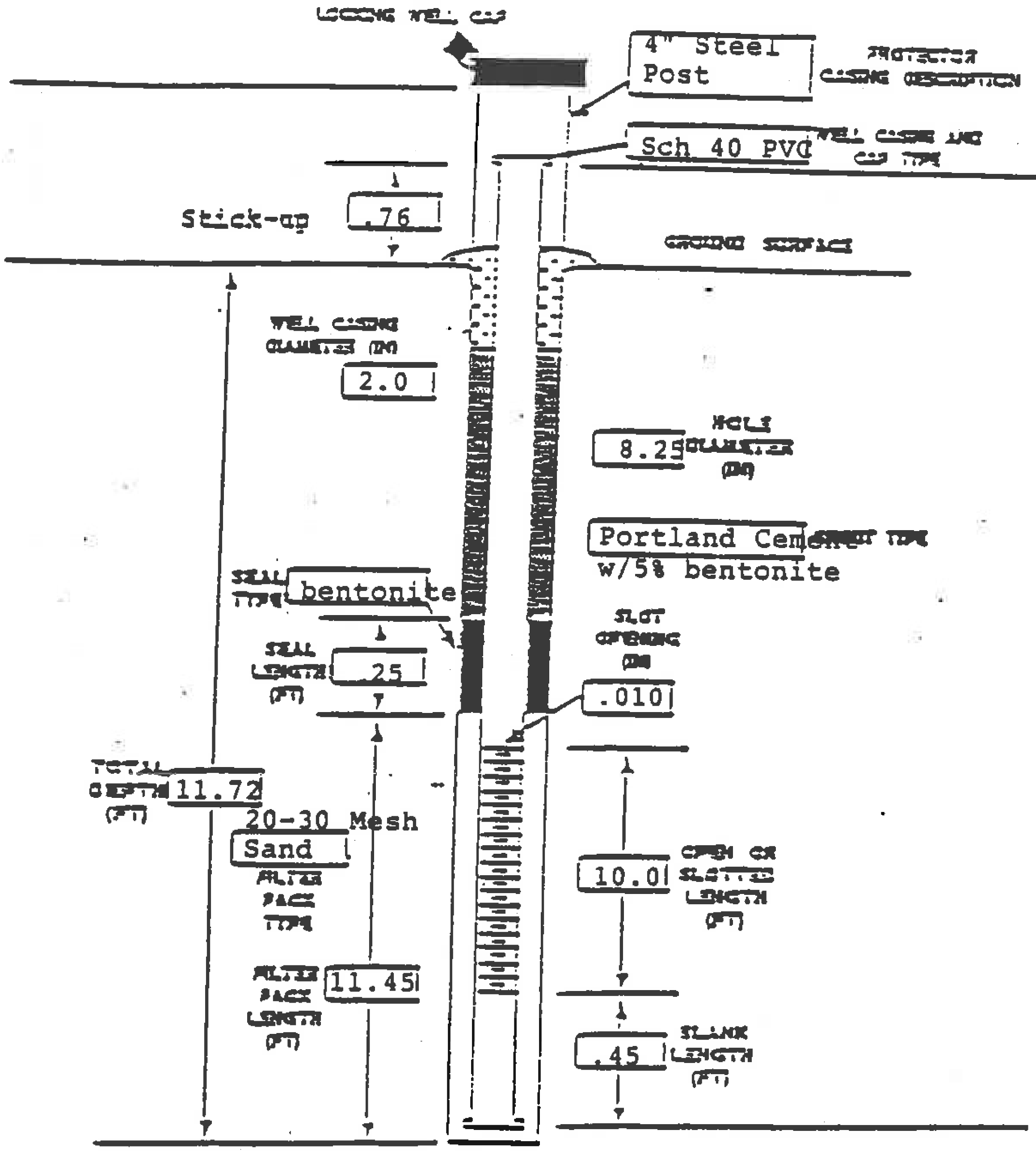
Date Installed: 5/22/90

W.L. - 4.20

Elevation: 911.82

☐ Ground ☒ Casing ☐ Protector Casing

☐ Above Ground Level ☒ Above Mean Sea Level



COMMENTS: Well was installed using 8.25" hollow stem augers. After installation well was developed using a Waterra mechanical pump.

Page ________ of ________

APPENDIX E-1.8

Revised Ground-Water Monitoring Plan

REVISED

GROUND-WATER QUALITY MONITORING PLAN

Prepared for

THE WILLIAM L BONNELL COMPANY
Newnan, Georgia

Prepared by

LAW ENVIRONMENTAL, INC.
Kennesaw, Georgia

October, 1990

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REVISED GROUND-WATER MONITORING PLAN

1.0 INTRODUCTION

Ground-water monitoring began at the William L Bonnell facility in September 1989. Since that time, seventy-six monitoring wells have been installed at the facility. In accordance with the February 1, 1990 Consent Order, a Groundwater Monitoring Plan for the facility was prepared (by ATEC Environmental Consultants) to comply with interim status standards (40 CFR 265 Subpart F). The Plan was submitted to the Georgia Environmental Protection Division (EPD) on March 16, 1990.

The following monitoring wells were selected by ATEC for interim status monitoring of the regulated units:

GW-1D GW-1S GW-3S GW-4S GW-5S
GW-6D GW-6S GW-7D GW-7S GW-11S
GW-12S GW-13S GW-14S GW-15D GW-15S
GW-16D GW-16S GW-17D GW-17S

Monitoring wells GW-8S, GW-8D and GW-9S were also sampled as part of interim status monitoring although not specified in the plan. The hazardous waste management units to be monitored at the site are the aluminum hydroxide (AlOH) mixture area, the chromium hydroxide (CrOH) landfill, the CrOH sand drying beds, the settling pond and the polishing pond (Figure 1). For monitoring purposes, the CrOH sand drying beds, the settling pond, and the polishing pond have been combined into a waste management area. Based on a reevaluation of the hydrogeologic conditions at the site (Section 3.0) and the circumscribing of three regulated units into one waste management area, a revised ground-water monitoring program will be implemented at the site in November 1990. This document presents the revised ground-water monitoring plan for the subject facility in accordance with the requirements of 40 CFR 265 Subpart F.

2.0 GROUND-WATER MONITORING WELLS

Seventy-six Type II ground-water quality monitoring wells have been installed at the facility. Additional wells are planned. A summary of the well construction details is presented in Table 1. The locations of these wells are shown on Figure 1. The construction details for each well are shown on the well construction diagrams presented in Appendix A.

In August 1989, ten temporary wells were installed by ATEC to determine the direction of ground-water flow and to assist in permanent well locations for the delisting petition and site monitoring. Details of the temporary well installation and the rationale for the proposed permanent well placement were presented in the ATEC report, "Protocol Report, Groundwater Monitoring Program" dated September 8, 1989, and the addendum to this report dated September 14, 1989. The proposed permanent well locations and rationale were reviewed during a meeting with the Georgia EPD on September 12, 1989.

As a result of this meeting, the Georgia EPD and Bonnell Company agreed that shallow and deep well pairs would be installed at locations where the saturated thickness of the residual soil overlying the bedrock was greater than 35 feet. Most well locations have two wells: one "shallow" well which monitors the ground-water surface of the uppermost aquifer, and one, "deep" well which monitors the deeper portions of the uppermost aquifer. If the saturated thickness of the residual soil was less than 35 feet, only one "shallow" well was installed at that location. Following this protocol, ATEC installed eleven shallow and four deep permanent ground-water monitoring wells in September 1989, at the locations previously agreed upon with the Georgia EPD on September 12, 1989.

Since September 1989, additional monitoring wells have been installed in the saturated residual soils at the facility to characterize the site hydrogeology and to obtain ground-water samples. Grain size analyses were performed on 18 soil samples collected from the soil borings to assist in classifying the soils. Grain size distribution curves are provided in Appendix B.

Monitoring wells GW-2D and GW-2S were damaged and abandoned during the partial closure of the chromium hydroxide sand drying beds. These wells were not replaced Because additional monitoring wells exist immediately downgradient of these wells. Monitoring wells GW-11S, GW-13S and GW-14S are located hydraulically upgradient of the facility and provide background water quality. Monitoring wells GW-3S, GW-15D, GW-15S, GW-16D, GW-16S, GW-7D, GW-7S, GW-12S, GW-6D, GW-6S, GW-4S, GW-5S, GW-17D and GW-17S are located hydraulically downgradient of the following regulated units: the chromium hydroxide landfill, the chromium hydroxide sand drying beds, the settling pond and the polishing pond. These upgradient and downgradient wells and wells GW-1D and GW-1S were selected by ATEC in the referenced Ground-Water Monitoring Plan for interim status monitoring of the regulated units. Additional wells located at the base of the Aluminum Hydroxide mixing area (GW-8S, GW-8D, and GW-9S) were also sampled for interim status monitoring.

2.1 Well Types and Installation

The general procedure for installing the permanent monitoring wells was to advance a borehole using 4 1/4-inch I.D. hollow-stem augers. Upon completion of the borehole, a monitoring well was installed. Monitoring wells were constructed of 2-inch diameter threaded PVC riser with 0.010-slot well screen. In the shallow wells, the bottom of the screens were generally set about 8 feet below the water level at the time of boring. The exceptions are those wells where water was encountered very close to the ground surface. Where a deep well was nested with a shallow one, the bottom of the deep screen would generally be set to the top of bedrock, (auger refusal depth).

Graded sand was placed between the well casing and borehole wall to form a filter pack around the well screen. The filter pack was installed to a depth of about 2 feet above the top of screen. A 2-foot thick bentonite seal was placed above the filter pack and the wells were grouted to ground surface with a cement-bentonite grout. All wells were completed with covers equipped with locking protective caps.

During the monitoring well installation, augers and split spoons were steam-cleaned between borings. Well materials were decontaminated by steam-cleaning followed by a deionized water rinse, a propanol rinse, and a final deionized water rinse.

At most well locations, the native soil material had a tendency to flow into the augers. Two methods were used, where necessary, to overcome this problem. The first involved "charging" the augers with potable water in order to counteract the formational hydraulic pressure. In some cases the hole was drilled using a wooden plug in the lead auger to prevent material from rising in the augers. Upon reaching the desired depth, the plug was knocked out of the augers and the well installed. This method did not allow split spoon samples to be collected, and was only used when samples could not be collected for other reasons (safety considerations during rain) or when the holes had to be redrilled. Despite the use of these methods, in some wells it was not possible to install a filter pack completely free of native soil material.

2.2 Well Development

Drilling and well installation processes cause some localized alteration of the subsurface conditions. In order to remove suspended sediment, to draw formation water into the well, and to restore the formation to normal conditions, each well was developed. In most of the wells, the well development resulted in removal of some silt from the sand pack, with a corresponding clarification of the ground water in the well. However, due to the amount of clay and silt in the formation, it was not possible to develop all of the wells to the point where the ground water was free of suspended particles (silt and clay).

3.0 HYDROGEOLOGY

3.1 Regional Geology

The site lies within the Inner Piedmont section of the Southern Piedmont Physiographic Province of Georgia (McConnell and Abrams, 1984). The province is characterized by low rolling hills, narrow stream valleys, and a dendritic drainage pattern. The province is bounded on the northwest by the Northern Piedmont Province at the Brevard fault zone in northwestern Atlanta and on the southeast by the Atlantic Coastal Plain Province at the Fall Line in central Georgia.

The rocks of the Inner Piedmont consist primarily of gneiss and schists that have been metamorphosed to amphibolite or higher grade. The rocks of the Newnan area primarily belong to the Atlanta Group (McConnell and Abrams, 1984). The Atlanta Group contains several formations that consist of interlayered biotite-plagioclase gneiss, biotite-muscovite schist, granitic gneiss, amphibolite and quartzite with minor sillimanite schist, calc-silicate gneiss, and a banded iron formation.

The rocks have been folded into a large northeast-trending synformal structure with the axis of the fold trending from the Newnan area through the Tucker (Georgia) area. Atkins and Higgins (1980) identified this synform as the folded flank of a large nappe-like structure. They described a stratigraphic sequence with the rocks becoming younger and stratigraphically higher toward the axis of the synform. McConnell and Abrams (1984) believed the sequence was inverted based on the stratigraphic order of similar rocks north of the Brevard fault.

Atkins and Higgins (1980) identified five generations of folding in the Atlanta Group. These structures range from isoclinal, recumbent folds to gentle, upright folds. The large Newnan-Tucker synform was developed during the second generation of folding.

Concurrent with and following the major metamorphic and folding events, the rocks of the Atlanta Group were intruded by numerous granite and minor gabbro plutons. These include the Stone Mountain granite east of Atlanta.

Bedrock in the Piedmont province is typically overlain by residual soils and partially weathered rock (PWR). These soils and PWR are the residual product of in-place physical and chemical weathering of the parent rock. The typical Piedmont subsurface soil profile consists of clayey soils near the ground surface, where soil weathering is more advanced, underlain by sandy silts and silty sands that generally become harder or more dense with depth. Much of the residual soils (often referred to as saprolite) retains the relic structure of the parent rock. The boundary between the soil and bedrock is not sharply defined. Partially weathered rock is a transition zone normally encountered between the residual soils and underlying rock. Weathering of the rock is facilitated by fractures and joints. The number and size of fractures usually diminish with increasing depth into rock. The presence of hard rock and PWR is quite irregular and erratic over short horizontal distances. Also, it is not uncommon to find lenses and boulders of hard rock and zones of PWR within the residual soil mantle, well above the general bedrock level.

3.2 Regional Hydrogeology

Ground water in the Piedmont Province is present in the residual soils at a depth of a few feet to tens of feet below the land surface and within the underlying crystalline rock (Cressler et.al., 1983). Ground water usually occurs in pore spaces in the residual soils and in fractures and weathered zones within shallow rock. In deep, unweathered rock, the quantity of ground water available depends on the number of fractures and the degree to which they are interconnected. Gneiss, schists and amphibolites may have variable openings and yield small to moderate quantities of water. Zones of greater yield are often related to variations in lithology. Several wells in the region have yielded large quantities from fracture zones encountered beneath a thick layer of relatively dry, competent rock (Cressler, et.al., 1983).

Horizontal ground-water flow generally follows ground-surface topography, but may be locally affected by bodies of surface water (creeks, lakes, rivers, and ponds), weathered zones, fractures and joints. Ground-water flow in the deeper bedrock generally follows the regional flow pattern, but locally follows fractures and joints in the rock. Ground-water recharge is from precipitation percolating downward through the residual soils, fractures in the rock and exposed rock on ridges and highlands. Ground water discharges locally into creeks, streams, lakes, and wells. Ground water discharges regionally into rivers.

The Newnan area primarily obtains drinking water from two surface-water sources, White Oak Creek and Line Creek. The City of Newnan used four water-supply wells for public drinking water until 1973. The wells are presently inactive, but have not been abandoned. The wells range in depth from 350 to 500 feet. The wells were installed into a bedrock (gneiss/schist) water-bearing unit and were reported to yield approximately 20 gallons per minute each. Ground water from the fractured bedrock in the Newnan area is potentially used to supply drinking and irrigation water for some area businesses and residences. Some of the public schools, private residences, country clubs, churches, and private businesses in Newnan have water supply wells on record with the Georgia Geologic Survey (Cressler et al 1983). As of 1983, over 64 wells were on record. With the exception of the four inactive Newnan public water supply wells, it is not known how many of these wells are currently active.

3.3 Site Geology

The rock formations that underlie the site, in descending order, are the Clarkston Formation, the Stonewall Formation and Wahoo Creek Formation of the Atlanta Group (McConnell and Abrams, 1984). The Clarkston Formation consists primarily of biotite-muscovite schist interlayered with hornblende-plagioclase amphibolite. The Stonewall Formation consists of interlayered fine-grained biotite gneiss, amphibolite and biotite schist. The Wahoo Creek Formation consists of medium-grained muscovite gneiss, amphibolite, mica schist and calc-silicate gneiss. Based on the available literature, thicknesses of the formations are currently unknown and are probably quite variable in the vicinity of the site.

Numerous soil borings, three exploratory rock coreholes and 76 monitoring wells have been installed on or in the vicinity of the site. Boring and well construction data are summarized on Table 1. Locations of the borings and wells are shown on Figure 1. The boring logs and well construction diagrams are presented in Appendix A.

The borings drilled at the site encountered residual soil and partially-weathered rock (PWR) from ground surface to depths ranging from about 10 to 75 feet below the ground surface. Near the ground surface, the residual soils consist of loose to firm, red-brown and tan, micaceous, silty fine to medium sands. The silty fine to medium sands extend from the ground surface to depths ranging from 4 to 15 feet below the ground surface. The red-brown sands encountered in the borings generally grade into a loose to very dense, brown, tan and greenish-gray, micaceous, silty fine to coarse sand. These silty fine to coarse sands were encountered to depths of about 16 to 75 feet below the ground surface. The residual soils are underlain by PWR. The PWR is typically gray, tan and white micaceous silty fine to medium sand with rock fragments. PWR is defined as material having a Standard Penetration Test resistance greater than 100 blows per foot. Rock underlies the PWR. For the purposes of this report, the contact between PWR and rock is defined as drill refusal.

Approximately 50 to 70 feet of rock was cored in the three exploratory borings (C-1, C-2, and C-3) performed at the site. The rock encountered in these borings consisted primarily of soft to hard, gray, black and white garnet-quartz-plagioclase-biotite-muscovite gneiss. The rock generally had a well-defined foliation that dipped at a low to moderate angle from the horizontal. The rock was slightly to severely weathered and slightly to highly fractured. The fractures occurred primarily at low to moderate angles (from the horizontal) in the core.

Top of rock (refusal) elevations encountered in the site borings are summarized in Table 2. The top of rock surface at the site generally follows the ground-surface topography in subdued relief and generally slopes toward the west and southwest. Apparent troughs in the top-of-rock surface are located near tributaries and valleys. A top of rock surface contour map based on refusal elevations is provided on Figure 2.

3.4 Site Hydrogeology

Due to the hydraulic communication between the ground water in the residual soils, PWR, and the weathered and fractured bedrock, the uppermost aquifer at the site extends from the ground-water surface down to competent rock. Competent rock is defined as drill core yielding greater than 90% recovery (REC) and greater than 80% rock quality designation (RQD) where severe weathering is not evident. The interrelationship of the various water-bearing units in the uppermost aquifer are shown on the hydrogeologic cross-sections A-A', B-B' and C-C' (Figure 4). Hydrogeologic cross section locations are shown on Figure 3.

Ground water occurs at the site under unconfined (water table) conditions at depths ranging from about 3 to 25 feet below the ground surface. Based on July 23, 1990, ground-water and surface water elevations, the direction of ground-water flow at the site is primarily toward the southwest. Figure 5 shows the estimated ground-water surface elevation contours and ground-water flow directions in the residual soils of the uppermost aquifer. Ground-water elevation data obtained from the site monitoring wells is summarized on Table 3.

The observed horizontal hydraulic gradients in the ground water range from about 0.025 to 0.077 feet/feet. Both upward and downward vertical hydraulic gradients were observed in ground-water elevations measured in site monitoring well clusters. A downward hydraulic gradient was generally observed in well clusters located adjacent to the settling pond and polishing pond. Upward hydraulic gradients were observed in well clusters located adjacent to creeks.

The estimated flow velocities at the site were calculated using a modified Darcy's equation:

V = ki/n_e where:
V = horizontal flow velocity;
k = hydraulic conductivity;
i = hydraulic gradient; and
n_e = effective porosity

The logarithmic average of in-situ hydraulic conductivity tests (slug tests) for the residual soils (silty sands) at the site is about 8.9×10^{-4} feet/minute (Table 4). Using the range of measured hydraulic gradients and an estimated effective porosity for silty sands of about 0.25 (Fetter, 1981), the resulting ground-water flow velocities in the silty sands at the site are estimated to range from about 50 to 150 feet/year.

To estimate the hydraulic conductivity of the rock, in-situ packer tests were performed in the three rock coreholes. Hydraulic conductivities ranged from less than 2×10^{-7} to 1.6×10^{-3} feet/minute (Table 5) with a logarithmic average of about 1.1×10^{-5} feet/minute. Since there are no monitoring wells installed into bedrock with which to measure hydraulic gradients, the ground-water flow directions and velocities for the bedrock cannot be calculated.

4.0 SAMPLING AND ANALYSIS PLAN

A revised Sampling and Analysis Plan has been prepared and is included as Appendix C of this document. The Sampling and Analysis Plan includes procedures for well purging, sample collection and preservation, sample shipment, chain of custody and laboratory analyses.

4.1 Monitoring Wells

Monitoring well GW-13S will provide background water quality for the chromium hydroxide sand drying beds, settling pond, polishing pond and aluminum hydroxide mixing area. Monitoring well GW-18S will provide background water quality for the chromium hydroxide landfill. The following downgradient monitoring wells will be monitored:

- o Aluminum hydroxide mixing area: GW-8S, GW-8D, GW-9S and an additional shallow monitoring well to be installed at a location shown on Figure 1.
- o Chromium hydroxide landfill: GW-4S, GW-5S and GW-17S.
- o Chromium hydroxide sand drying beds, settling pond and polishing pond: GW-27S, GW-6S, GW-7S, GW-7D and GW-12S

4.2 Sampling Schedule

Initially, the monitoring wells identified in Section 4.1 will be sampled quarterly for one year beginning in November, 1990. The samples will be analyzed for the following parameters:

1. Drinking water quality parameters:

    Arsenic
    Barium
    Cadmium
    Chromium
    Fluoride
    Lead
    Mercury
    Nitrate (as N)
    Selenium
    Silver
    Endrin
    Lindane

Methoxychlor
Toxaphene
2,4-D
2,4,5-TP Silvex
Radium
Gross Alpha
Gross Beta
Turbidity
Coliform Bacteria

2. Ground-water quality parameters:

   Chloride
   Iron
   Manganese
   Phenols
   Sodium
   Sulfate

3. Ground-water indicator parameters:

   pH
   Specific Conductance
   Total Organic Carbon
   Total Organic Halogens

Four replicate measurements of the ground-water indicator parameters will be obtained quarterly for each sampling event for the first year of monitoring.

After the first year, the monitoring wells will be sampled semiannually for the ground-water indicator parameters and potential waste constituents managed in the regulated units. The monitoring wells will be sampled annually for the ground-water quality parameters until interim status monitoring is concluded. Ground-water elevations will be measured in the monitoring well each time a sample is obtained.

5.0 DATA EVALUATION

The initial values of the parameters in the background wells will be established from the first year of sampling. The arithmetic mean and variance of the replicate samples of ground water indicator parameters will be calculated.

After the first year of monitoring, samples from the background and downgradient wells will be collected at a frequency specified in Section 4.2. The arithmetic mean and variance of the newly collected replicate samples will be calculated. The results from each well will then be statistically compared with the first year of results from the background well(s). The students' t-test at a 0.01 level of significance will be used to determine if a statistically significant increase (or decrease for pH) from the initial background concentrations has occurred. A 0.025 level of significance will be used for pH. Non detects will be replaced by a value equal to the detection limit.

If a statistically significant increase (or decrease for pH) is found in a background well, the results will be reported to the director of Georgia Environmental Protection Division. If a statistically significant increase (or decrease for pH) is found in a downgradient well, additional samples will be collected from the wells from which the statistically significant difference occurred. The samples will be split in two and each split will be analyzed to determine if the statistically significant difference was a result of laboratory error. If the statistically significant difference is confirmed, the Director of Georgia EPD will be informed and a ground-water assessment program will be implemented.

Ground-water elevation data will be evaluated annually. The direction of ground-water flow and the hydraulic gradient will be determined. If necessary, the number, location or depth of wells used in the monitoring program will be modified to bring the ground-water monitoring system into compliance with 40 CFR 265.91(a).

6.0 REPORTING

Records of all ground-water elevation data, analytical data and statistical data will be maintained throughout the active life of the Bonnell facility and throughout the post-closure care period. During the first year of interim status monitoring, the results of each sampling will be reported to the director of Georgia EPD within 15 days. Any parameter whose concentration exceeds the EPA Interim Status Drinking Water Standard (40 CFR 265 Appendix III) will be separately identified.

An annual report of ground-water monitoring activities at the facility will be prepared and submitted to the director of Georgia EPD no later than March 1 of the following calendar year. This report will contain the results of the previous year's sampling and analysis activities, including ground-water elevations with flow directions and gradients, ground-water quality data, and statistical evaluations of the data. Any statistically significant differences in the data from the background data will be identified.

7.0 GROUND-WATER QUALITY ASSESSMENT PROGRAM

A Ground-Water Assessment Plan has been prepared to determine the rate and extent of contamination at the chromium hydroxide sand drying beds, settling pond and polishing pond area. If contamination is confirmed at the aluminum hydroxide mixing area or the chromium hydroxide landfill from the procedures described above, a ground-water assessment plan will be prepared to determine the rate and extent of contamination and the concentrations of hazardous constituents in the ground water for the regulated unit affected. The Ground-Water Assessment Plan prepared for these units will specify the following items:

- The number, locations and depths of additional monitoring wells to be installed for the assessment.
- The sampling procedures and analytical methods for the constituents to be monitored.
- Procedures for evaluating existing and newly acquired data.
- A schedule of implementation.

A determination of ground-water quality beneath the regulated unit will be made as soon as is technically feasible and a report will be submitted to the Director of Georgia EPD within 15 days of this determination. If it is determined that no contamination exists, the interim status monitoring system will be reinstated. If it is determined that hazardous waste from the regulated unit have entered the ground water, then the ground water will continue to be monitored until final closure of the regulated unit.

SUMMARY OF BORING AND WELL CONSTRUCTION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	DATE COMPLETED	DRILLING METHOD	BIT OR AUGER DIAMETER (INCHES)	WELL TYPE	BORING DEPTH (FEET)	APPROX. DEPTH OF SCREENED INTERVAL (FEET)	DEPTH TO TOP OF SAND PACK (FEET)	DEPTH TO TOP OF BENTONITE SEAL (FEET)	UNIT SCREENED*	TOP OF CASING ELEVATION (FEET,MSL)
1S	09/16/89	HOLLOW STEM AUGER	8.0	II	32.0	21.0-31.0	17.0	15.0	Water Table	933.46
1D	09/16/89	HOLLOW STEM AUGER	8.0	II	65.5	54.5-64.5	52.0	37.0		933.73
*2S	09/20/89	HOLLOW STEM AUGER	8.0	II	13.5	2.5-12.5	1.0	0.9	Water Table	919.74
*2D	09/21/89	HOLLOW STEM AUGER	8.0	II	39.5	29.5-39.5	19.0	16.0		919.53
3S	09/18/89	HOLLOW STEM AUGER	8.0	II	19.0	4.5-14.5	3.5	2.5	Water Table	912.82
3D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
4S	09/19/89	HOLLOW STEM AUGER	8.0	II	28.0	18.0-28.0	16.0	14.0	Water Table	909.26
4D	05/01/90	HOLLOW STEM AUGER	8.25	II	35.0	24.8-34.8	22.8	20.8	Water Table/TOR	909.04
5S	09/20/89	HOLLOW STEM AUGER	8.0	II	30.0	20.0-30.0	9.0	7.0	Water Table	909.26
5D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
6S	09/20/89	HOLLOW STEM AUGER	8.0	II	23.0	10.0-20.0	9.0	7.5	Water Table	906.05
6D	05/03/90	HOLLOW STEM AUGER	8.25	II	43.8	33.4-43.4	31.4	29.4	Top of Rock	905.77
7S	09/20/89	HOLLOW STEM AUGER	8.0	II	23.0	9.0-19.0	8.0	6.0	Water Table	902.31
7D	09/22/89	HOLLOW STEM AUGER	8.0	II	47.5	37.0-47.0	34.0	30.0	Top of rock	902.82
8S	09/20/89	HOLLOW STEM AUGER	8.0	II	15.0	3.0-13.0	2.0	1.0	Water Table	891.46
8D	09/20/89	HOLLOW STEM AUGER	8.0	II	39.5	29.5-39.5	24.5	7.6	Top of rock	891.08
9S	09/19/89	HOLLOW STEM AUGER	8.0	II	15.0	3.2-13.0	1.8	0.8	Water Table	882.74
9D	05/05/90	HOLLOW STEM AUGER	8.25	II	50.0	37.8-47.8	35.8	33.8	Top of Rock	881.37
10S	05/24/90	HOLLOW STEM AUGER	8.25	II	10.0	3.2-8.2	1.2	0.2	Water Table/TOR	907.67
10D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
11S	09/19/89	HOLLOW STEM AUGER	8.0	II	29.0	18.0-28.0	13.5	11.5	Water Table	950.63
11D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
12S	09/25/89	HOLLOW STEM AUGER	8.0	II	13.0	2.5-12.5	1.5	1.0	Water Table	906.48
12D	05/04/90	HOLLOW STEM AUGER	8.25	II	38.0	27.7-37.7	25.7	23.7	Top of rock	906.69
13S	11/29/89	HOLLOW STEM AUGER	9.0	II	25.0	15.0-25.0	13.0	10.5	Water Table	952.40
13D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
14S	11/30/89	HOLLOW STEM AUGER	9.0	II	28.0	13.0-23.0	10.0	8.0	Water Table	947.31
14D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
15S	04/19/90	HOLLOW STEM AUGER	8.25	II	20.1	9.7-19.7	7.7	5.7	Water Table	920.92
15D	04/18/90	HOLLOW STEM AUGER	8.25	II	49.9	38.5-48.5	37.0	35.0	Top of rock	920.80
16S	04/16/90	HOLLOW STEM AUGER	8.25	II	14.9	4.4-14.4	2.4	0.4	Water Table	912.14
16D	04/17/90	HOLLOW STEM AUGER	8.25	II	32.0	20.1-30.1	19.0	17.0	Top of rock	912.98
17S	04/27/90	HOLLOW STEM AUGER	8.25	II	26.2	20.8-25.8	18.8	16.8	Water Table	912.51
17D	04/27/90	HOLLOW STEM AUGER	8.25	II	35.0	24.9-34.9	22.0	20.0	Water Table/TOR	912.28
18S	05/01/90	HOLLOW STEM AUGER	8.25	II	20.8	10.3-20.3	8.3	6.3	Water Table	903.50
18D	05/01/90	HOLLOW STEM AUGER	8.25	II	35.0	24.2-34.2	22.1	20.1	Top of rock	903.58
19S	04/26/90	HOLLOW STEM AUGER	8.25	II	31.2	20.8-30.8	18.8	16.8	Water Table	906.83
19D	04/20/90	HOLLOW STEM AUGER	8.25	II	43.0	32.8-42.8	30.8	28.8	Top of rock	906.67
20S	04/30/90	HOLLOW STEM AUGER	8.25	II	15.5	5.1-15.1	3.1	1.1	Water Table	880.01
20D	04/30/90	HOLLOW STEM AUGER	8.25	II	40.0	29.6-39.6	27.6	25.6	Top of rock	879.69

TABLE 1

SUMMARY OF BORING AND WELL CONSTRUCTION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	DATE COMPLETED	DRILLING METHOD	BIT OR AUGER DIAMETER (INCHES)	WELL TYPE	BORING DEPTH (FEET)	APPROX. DEPTH OF SCREENED INTERVAL (FEET)	DEPTH TO TOP OF SAND PACK (FEET)	DEPTH TO TOP OF BENTONITE SEAL (FEET)	UNIT SCREENED*	TOP OF CASING ELEVATION (FEET,MSL)
21S	05/03/90	HOLLOW STEM AUGER	8.25	II	15.3	4.9-14.9	2.9	0.9	Water Table	871.73
21D	05/03/90	HOLLOW STEM AUGER	8.25	II	40.6	30.2-40.2	28.2	26.2	Top of rock	871.65
22S	05/04/90	HOLLOW STEM AUGER	8.25	II	24.6	14.1-24.1	12.1	10.1	Water Table	901.95
22D	05/04/90	HOLLOW STEM AUGER	8.25	II	43.8	38.3-43.3	36.3	34.3	Top of rock	902.46
23S	05/04/90	HOLLOW STEM AUGER	8.25	II	22.1	11.7-21.7	9.7	7.7	Water Table	912.47
23D	05/04/90	HOLLOW STEM AUGER	8.25	II	41.0	30.3-40.3	28.3	26.3	Top of rock	913.14
24S	NOT INSTALLED	—	—	—	—	—	—	—	—	—
24D	05/03/90	HOLLOW STEM AUGER	8.25	II	39.0	28.0-38.0	26.0	24.0	Water Table/TOR	925.73
25S	05/01/90	HOLLOW STEM AUGER	8.25	II	15.0	4.5-14.5	2.5	0.5	Water Table	920.72
25D	05/02/90	HOLLOW STEM AUGER	8.25	II	41.0	30.3-40.3	28.3	26.3	Top of rock	920.48
26S	05/21/90	HOLLOW STEM AUGER	8.25	II	21.9	11.5-21.5	9.5	7.5	Water Table	931.15
26D	05/22/90	HOLLOW STEM AUGER	8.25	II	46.0	35.1-45.1	33.1	31.0	Top of rock	931.40
27S	05/22/90	HOLLOW STEM AUGER	8.25	II	11.7	1.3-11.3	0.3	0.0	Water Table	911.82
27D	05/22/90	HOLLOW STEM AUGER	8.25	II	30.0	18.8-28.8	16.8	14.8	Top of rock	911.91
28S	05/23/90	HOLLOW STEM AUGER	8.25	II	12.7	2.3-12.3	0.3	0.0	Water Table	909.31
28D	05/24/90	HOLLOW STEM AUGER	8.25	II	29.0	18.4-28.4	16.4	14.4	Top of rock	909.51
29S	05/24/90	HOLLOW STEM AUGER	8.25	II	12.6	2.2-12.2	0.2	0.0	Water Table	904.70
29D	05/24/90	HOLLOW STEM AUGER	8.25	II	21.5	16.1-21.1	14.1	12.1	Top of rock	904.86
30D	NOT INSTALLED	—	—	—	—	—	—	—	—	—
31D	7/10/90	HOLLOW STEM AUGER	8.0	II	37.0	27.0-37.0	25.0	22.5	Water Table/TOR	928.44
32D	7/10/90	HOLLOW STEM AUGER	8.0	II	45.0	35.0-45.0	33.1	30.2	Top of rock	922.14
32S	7/10/90	HOLLOW STEM AUGER	8.0	II	35.0	25.0-35.0	23.0	20.3	Water Table	922.31
33D	7/12/90	HOLLOW STEM AUGER	8.0	II	30.0	19.7-29.7	16.8	14.3	Water Table/TOR	939.59
34D	7/14/90	HOLLOW STEM AUGER	8.0	II	35.0	20.0-35.0	19.0	16.5	Top of rock	938.94
35D	7/16/90	HOLLOW STEM AUGER	8.0	II	24.0	14.0-24.0	11.5	9.5	Water Table/TOR	921.90
36S	08/07/90	HOLLOW STEM AUGER	8.0	II	25.0	5.0-25.0	13.0	10.5	Water Table	940.80
36D	08/07/90	HOLLOW STEM AUGER	8.0	II	40.4	35.0-40.0	33.0	30.5	Top of rock	940.84
37S	08/08/90	HOLLOW STEM AUGER	8.0	II	18.0	8.0-18.0	6.0	3.0	Water Table	932.24
37D	08/08/90	HOLLOW STEM AUGER	8.0	II	63.0	53.0-63.0	51.0	48.0	Top of rock	932.04
38S	08/09/90	HOLLOW STEM AUGER	8.0	II	20.5	23.0-33.0	20.5	18.0	Water Table	962.24
38D	08/09/90	HOLLOW STEM AUGER	8.0	II	52.0	41.0-51.0	41.0	39.0	Top of rock	962.29
39D	08/13/90	HOLLOW STEM AUGER	8.0	II	35.2	25.0-35.0	23.0	20.0	Top of rock	927.56
40D	08/17/90	HOLLOW STEM AUGER	7.0	II	26.0	16.0-26.0	14.2	11.0	Top of rock	937.86
41D	08/17/90	HOLLOW STEM AUGER	7.0	II	28.0	18.0-28.0	16.0	13.0	Top of rock	937.79

TABLE 1
SUMMARY OF BORING AND WELL CONSTRUCTION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	DATE COMPLETED	DRILLING METHOD	BIT OR AUGER DIAMETER (INCHES)	WELL TYPE	BORING DEPTH (FEET)	APPROX. DEPTH OF SCREENED INTERVAL (FEET)	DEPTH TO TOP OF SAND PACK (FEET)	DEPTH TO TOP OF BENTONITE SEAL (FEET)	UNIT SCREENED*	TOP OF CASING ELEVATION (FEET, MSL)
OS-1D	07/09/90	HOLLOW STEM AUGER	8.0	II	30.0	20.0-30.0	17.5	15.3	Top of rock	868.49
OS-1S	07/09/90	HOLLOW STEM AUGER	8.0	II	15.0	5.0-15.0	4.0	2.0	Water Table	868.45
OS-2D	07/11/90	HOLLOW STEM AUGER	8.0	II	28.5	18.7-28.7	16.7	14.7	Top of rock	884.34
OS-2S	07/11/90	HOLLOW STEM AUGER	8.0	II	16.0	6.0-16.0	5.0	3.0	Water Table	884.85
OS-3D	07/12/90	HOLLOW STEM AUGER	8.0	II	44.8	35.8-44.8	32.7	14.3	Top of rock	865.54
OS-3S	07/12/90	HOLLOW STEM AUGER	8.0	II	15.0	5.0-15.0	4.0	2.2	Water Table	865.39
OS-4D	07/12/90	HOLLOW STEM AUGER	8.0	II	45.0	35.0-45.0	33.0	30.5	Top of rock	878.79
OS-4S	07/12/90	HOLLOW STEM AUGER	8.0	II	16.0	6.0-16.0	4.5	2.2	Water Table	878.36
OS-5D	07/19/90	HOLLOW STEM AUGER	8.0	II	70.0	60.0-70.0	57.5	55.0	Top of rock	876.82
OS-5S	07/17/90	HOLLOW STEM AUGER	8.0	II	35.0	19.0-29.0	17.0	14.5	Water Table	879.32

NOTES:

Water Table = Screen interval generally spans the surface of the fluctuating water table.
Top of rock = Bottom of screen interval generally located at auger refusal depth (top of rock).
TOR = Top of Rock

* Well 2S and 2D were destroyed during interim closure of the sand drying beds near the settling pond.

SUMMARY OF TOP OF ROCK ELEVATION DATA
THE WILLIAM L BONNEL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	GROUND SURFACE ELEVATION	TOP OF ROCK DEPTH	TOP OF ROCK ELEVATION
4D	906.6	35.0	871.6
6D	904.3	42.5	861.8
7D	900	47.0	853
8D	891	39.5	852
9D	880.1	50.0	830.1
10S	906.6	10.0	896.6
12D	906.9	38.0	868.9
15D	919.0	49.9	869.1
16D	911.4	32.0	879.4
17D	910.9	35.0	875.9
18D	901.5	35.0	866.5
19D	907	43.0	864.0
20D	879.9	40.0	839.9
21D	871.7	40.0	831.7
22D	902.7	43.0	859.7
23D	913.3	41.0	872.3
24D	925.9	39.0	886.9
25D	920.7	41.0	879.7
26D	931.6	46.0	885.6
27D	911.0	30.0	881.0
28D	908.2	29.0	879.2
29D	903.3	21.0	882.3

NOTES:

less than or equal to
greater than or equal to
(1) Reported auger refusal depths assumed to be the same as top of rock depth.
(2) Significant figures for ground surface and top of rock elevations vary due to accuracy of data.

TABLE 2
SUMMARY OF TOP OF ROCK ELEVATION DATA
THE WILLIAM L BONNEL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

BORING NUMBER	GROUND SURFACE ELEVATION	TOP OF ROCK DEPTH	TOP OF ROCK ELEVATION
30D	925.5	27.8	897.7
31D	925.6	37.0	888.6
32D	920.5	45.0	875.5
33D	936.8	30.0	906.8
34D	938.6	35.0	903.6
35D	920.0	24.0	896.0
36D	941.1	40.4	900.7
37D	932.2	63.0	869.2
38D	962.5	52.0	910.5
39D	972.6	35.2	937.4
40D	938.1	26.0	912.1
41D	938.1	28.0	910.1
C1	922	24.0	898
C2	939	75.0	864
C3	878	62.5	816
OS-1D	869.1	30.0	839.1
OS-2D	884.8	28.5	856.3
OS-3D	866.3	44.8	821.5
OS-4D	879.1	45.0	834.1
OS-5D	876.9	70.0	806.9

NOTES:
(1) Reported auger refusal depths assumed to be the same as top of rock depth.
(2) Significant figures for ground surface and top of rock elevations vary due to accuracy of data.

TABLE 3
SUMMARY OF GROUND-WATER ELEVATION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

DATE	WELL	1D	1S	2D	2S	3S	4D	4S	5S	6D	6S	7D	7S	8D	8S	9D
	Datum Elevation	933.73	933.46	919.53	919.74	912.82	910.46	909.04	909.26	905.77	906.05	902.82	902.31	891.08	891.46	881.37
07/23/90	Depth to Water	22.10	21.57	--	--	5.16	23.57	22.11	23.18	16.25	15.88	12.59	10.10	2.75	4.90	5.27
	Water Elevation	911.63	911.89	--	--	907.66	886.89	886.93	886.08	889.52	890.17	890.23	892.21	888.33	886.56	876.10
06/11/90	Depth to Water	21.81	21.23	--	--	5.86	22.60	21.20	22.23	15.46	14.98	11.85	9.36	2.55	4.27	6.47
	Water Elevation	911.92	912.23	--	--	906.96	887.86	887.84	887.03	890.31	891.07	890.97	892.95	888.53	887.19	874.90
10/30/89	Depth to Water	21.68	21.05	8.76	7.01	3.59	--	21.79	22.97	--	15.63	12.26	9.76	2.34	4.76	--
	Water Elevation	912.05	912.41	910.77	912.73	909.23	--	887.25	886.29	--	890.42	890.56	892.55	888.74	886.70	--

NOTE: -- = NOT MEASURED OR NOT INSTALLED. WELLS 2D AND 2S WERE DESTROYED.

TABLE 3
SUMMARY OF GROUND-WATER ELEVATION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

DATE	WELL	9S	10S	11S	12D	12S	13S	14S	15D	15S	16D	16S	17D	17S	18D	18S	19
	Datum Elevation	882.74	907.67	950.63	906.69	906.48	952.40	947.31	920.80	920.92	912.98	912.14	912.28	912.51	903.58	903.50	906
07/23/90	Depth to Water	7.20	6.28	20.95	6.95	6.29	18.10	15.34	13.80	13.45	9.16	7.46	24.82	25.06	16.40	16.12	24
	Water Elevation	875.54	901.39	929.68	899.74	900.19	934.30	931.97	907.00	907.47	903.82	904.68	887.46	887.45	887.18	887.38	882
06/11/90	Depth to Water	6.82	6.10	19.18	6.54	6.12	16.77	13.43	13.88	13.55	8.44	7.30	24.00	24.21	15.47	15.30	23
	Water Elevation	875.92	901.57	931.45	900.15	900.36	935.63	933.88	906.92	907.37	904.54	904.84	888.28	888.30	888.11	888.20	883
10/30/89	Depth to Water	6.88	--	19.93	--	--	--	--	--	--	--	--	--	--	--	--	--
	Water Elevation	875.86	--	930.70	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTE: -- = NOT MEASURED OR NOT INSTALLED. WELLS 2D AND 2S WERE DESTROYED.

TABLE 3
SUMMARY OF GROUND-WATER ELEVATION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

DATE	WELL	19S	20D	20S	21D	21S	22D	22S	23D	23S	24D	25D	25S	26D	26S	27D	27S
	Datum Elevation	906.83	879.69	880.01	871.65	871.73	902.46	901.95	913.14	912.47	925.73	920.48	920.72	931.40	931.15	911.91	911.8
07/23/90	Depth to Water	24.57	9.74	9.03	4.73	5.13	21.49	21.13	21.52	20.59	26.90	13.18	12.82	14.56	13.88	6.68	4.1
	Water Elevation	882.26	869.95	870.98	866.92	866.60	880.97	880.82	891.62	891.88	898.83	907.30	907.90	916.84	917.27	905.23	907.6
06/11/90	Depth to Water	23.61	8.02	7.49	5.05	5.14	19.25	18.68	19.54	17.90	27.64	11.67	10.85	14.27	13.95	6.74	4.2
	Water Elevation	883.22	871.67	872.52	866.60	866.59	883.21	883.27	893.60	894.57	898.09	908.81	909.87	917.13	917.20	905.17	907.6

NOTE: -- = NOT MEASURED OR NOT INSTALLED. WELLS 2D AND 2S WERE DESTROYED.

TABLE 3
SUMMARY OF GROUND-WATER ELEVATION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

DATE	WELL	28D	28S	29D	29S	31D	32D	32S	33D	34D	35D	36D	36S
	Datum Elevation	909.51	909.31	904.86	904.70	928.44	922.14	920.31	936.59	938.94	921.90	940.84	940.80
07/23/90	Depth to Water	5.50	5.59	4.57	3.65	31.57	23.87	22.64	14.60	13.90	19.55	--	--
	Water Elevation	904.01	903.72	900.29	901.05	896.87	898.27	897.67	921.99	925.04	902.35	--	--
06/11/90	Depth to Water	4.95	5.11	3.50	3.34	--	--	--	--	--	--	--	--
	Water Elevation	904.56	904.20	901.36	901.36	--	--	--	--	--	--	--	--

TABLE 3
SUMMARY OF GROUND-WATER ELEVATION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

DATE	WELL	37D	37S	38D	38S	39D	40D	41D
	Datum Elevation	932.04	932.24	962.24	962.24	927.56	937.86	937.79
07/23/90	Depth to Water	--	--	--	--	--	--	--
	Water Elevation	--	--	--	--	--	--	--
06/11/90	Depth to Water	--	--	--	--	--	--	--
	Water Elevation	--	--	--	--	--	--	--

TABLE 3
SUMMARY OF GROUND-WATER ELEVATION DATA
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

DATE	WELL	OS-1D	OS-1S	OS-2D	OS-2S	OS-3D	OS-3S	OS-4D	OS-4S	OS-5D	OS-5S
	Datum Elevation	868.49	868.45	884.34	884.85	865.54	865.39	878.79	878.36	876.82	879.32
07/23/90	Depth to Water	4.95	5.34	8.04	8.12	5.87	4.89	9.11	8.43	17.34	21.29
	Water Elevation	863.54	863.11	876.30	876.73	859.67	860.50	869.68	869.93	859.48	858.03
06/11/90	Depth to Water	--	--	--	--	--	--	--	--	--	--
	Water Elevation	--	--	--	--	--	--	--	--	--	--

TABLE 4
SUMMARY OF HYDRAULIC CONDUCTIVITY DATA
SLUG TEST METHOD
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

MONITORING WELL NUMBER	TEST INTERVAL (FEET)	MATERIAL TESTED	% FINES (**)	COEFFICIENT OF HYDRAULIC CONDUCTIVITY (K)* FT/MIN
9D	37.8 - 47.8	SAND***	25.8	3.4 X 10-5
9S	3.2 - 13.0	SAND	--	3.4 X 10-3
12D	27.7 - 37.7	SAND***	20.8	5.0 X 10-4
12S	2.5 - 12.5	SAND***	22.6	3.0 X 10-3
13S	15.0 - 25.0	SAND	--	1.8 X 10-3
15D	39.0 - 49.0	SAND***	17.8	2.0 X 10-4
15S	9.7 - 19.7	SAND	--	5.3 X 10-3
21D	30.2 - 40.2	SAND	--	6.4 X 10-4
21S	4.9 - 14.9	SAND	--	1.9 X 10-3
27D	18.8 - 28.8	SAND	--	7.5 X 10-4

NOTES:

* CALCULATED USING BOUWER AND RICE METHOD

** PERCENT OF SOIL SAMPLE PASSING A #200 SIEVE (i.e. CLAY AND SILT)

*** GRAIN SIZE ANALYSES PERFORMED ON SOIL SAMPLES COLLECTED FROM THE TEST INTERVAL OF THE WELL

-- NOT ANALYZED

TABLE 4
SUMMARY OF HYDRAULIC CONDUCTIVITY DATA
SLUG TEST METHOD
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

MONITORING WELL NUMBER	TEST INTERVAL (FEET)	MATERIAL TESTED	% FINES (**)	COEFFICIENT OF HYDRAULIC CONDUCTIVITY (K)* FT/MIN
9D	37.8 - 47.8	SAND***	25.8	3.4 X 10-5
9S	3.2 - 13.0	SAND	--	3.4 X 10-3
12D	27.7 - 37.7	SAND***	20.8	5.0 X 10-4
12S	2.5 - 12.5	SAND***	22.6	3.0 X 10-3
13S	15.0 - 25.0	SAND	--	1.8 X 10-3
15D	39.0 - 49.0	SAND***	17.8	2.0 X 10-4
15S	9.7 - 19.7	SAND	--	5.3 X 10-3
21D	30.2 - 40.2	SAND	--	6.4 X 10-4
21S	4.9 - 14.9	SAND	--	1.9 X 10-3
27D	18.8 - 28.8	SAND	--	7.5 X 10-4

NOTES:
- * CALCULATED USING BOUWER AND RICE METHOD
- ** PERCENT OF SOIL SAMPLE PASSING A #200 SIEVE (i.e. CLAY AND SILT)
- *** GRAIN SIZE ANALYSES PERFORMED ON SOIL SAMPLES COLLECTED FROM THE TEST INTERVAL OF THE WELL

-- NOT ANALYZED

TABLE 5
SUMMARY OF HYDRAULIC CONDUCTIVITY DATA
PACKER TEST METHOD
THE WILLIAM L BONNELL COMPANY - NEWNAN, GEORGIA
LAW ENVIRONMENTAL JOB NO. 55-0649

	TEST INTERVAL DEPTH (FT)	GAUGE PRESSURE (PSI)	COEFFICIENT OF HYDRAULIC CONDUCTIVITY (CM/SEC)	COEFFICIENT OF HYDRAULIC CONDUCTIVITY (FT/MIN)
BORING: C-1	26.5 - 39.1	5	<1 X 10-7	<2 X 10-7
		10	<1 X 10-7	<2 X 10-7
		15	<1 X 10-7	<2 X 10-7
	35.5 - 48.1	10	<1 X 10-7	<2 X 10-7
		15	<1 X 10-7	<2 X 10-7
		20	<1 X 10-7	<2 X 10-7
	48.1 - 60.7	10	<1 X 10-7	<1 X 10-7
		20	1.2 X 10-5	2.4 X 10-5
		30	1.6 X 10-4	3.2 X 10-4
	60.7 - 73.3	15	3.6 X 10-4	7.1 X 10-4
		25	3.2 X 10-4	6.3 X 10-4
		35	2.8 X 10-4	5.5 X 10-4
BORING: C-2	85.1 - 97.7	25	7.8 X 10-4	1.5 X 10-3
		35	7.2 X 10-4	1.4 X 10-3
	97.8 - 110.4	15	6.9 X 10-4	1.4 X 10-3
		35	5.8 X 10-4	1.1 X 10-3
		55	5.1 X 10-4	1.0 X 10-3
	106.4 - 119.0	20	7.9 X 10-4	1.6 X 10-3
		40	6.8 X 10-4	1.3 X 10-3
	119.0 - 131.6	25	3.6 X 10-5	7.1 X 10-5
		45	3.6 X 10-5	7.1 X 10-5
		65	3.2 X 10-5	6.3 X 10-5
	130.6 - 143.2	25	2.0 X 10-5	3.9 X 10-5
		50	2.0 X 10-5	3.9 X 10-5
		75	1.9 X 10-5	3.7 X 10-5
BORING: C-3	80.5 - 93.1	25	<1 X 10-7	<2 X 10-7
		35	<1 X 10-7	<2 X 10-7
		45	1.1 X 10-6	2.2 X 10-6
	85.2 - 97.8	25	<1 X 10-7	<2 X 10-7
		35	<1 X 10-7	<2 X 10-7
		45	<1 X 10-7	<2 X 10-7
	97.8 - 110.4	25	<1 X 10-7	<2 X 10-7
		40	<1 X 10-7	<2 X 10-7
		55	<1 X 10-7	<2 X 10-7
	110.4 - 123.0	25	<1 X 10-7	<2 X 10-7
		45	3.5 X 10-6	6.9 X 10-6

APPENDIX J

Financial Assurance for Closure/ Post-Closure and Liability Coverage

Coopers
&Lybrand

certified public accountants

Suite 1000
Seventh and Franklin Building
Richmond, Virginia 23219-2512

telephone (804) 643-0234

in principal areas of the world

October 23, 1990

Tredegar Industries, Inc.
1100 Boulders Parkway
Richmond, VA 23225

Dear Sirs:

We have audited the consolidated financial statements of Tredegar Industries, Inc. and Subsidiaries (the "Company") as of December 31, 1989 and for the year then ended and have issued our report thereon dated January 31, 1990. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with generally accepted auditing standards. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

Subsequent to our audit, which was made for the purpose of enabling us to express an opinion on the aforementioned financial statements, we reviewed the letter submitted by Mr. Norman A. Scher, Executive Vice President of Tredegar Industries, Inc., to the Director, Environmental Protection Division, Georgia Department of Natural Resources, whose administering functions are similar to those required by regulation 40 CFR Parts 264 and 265, and compared the data specified as having been derived from the aforementioned financial statements for the year ended December 31, 1989 to these financial statements. In connection with this procedure, we obtained no knowledge of any matter that would require that the specified data be adjusted.

This letter is solely for the information of, and assistance to, state regulatory agencies in conducting their investigation of the affairs of the Company in connection with regulations similar to 40 CFR Parts 264 and 265 and is not to be used, circulated, quoted, or otherwise referred to, for any other purposes.

Very truly yours,

Coopers & Lybrand

2. The firm identified above guarantees, through the corporate guarantee specified in paragraph 391-3-11-.05, the closure and/or post-closure care of the following facilities which are located in the State of Georgia and which are owned or operated by its subsidiaries. The current cost estimates for the closure and post-closure care so guaranteed are shown for each facility:

	Closure/Post-Closure Cost Estimate
The William L Bonnell Company, Inc. Newnan, Georgia GAD 003273224	$2.3 million

3. In States outside of Georgia, where EPA or some designated authority is administering financial responsibility requirements, this firm is demonstrating financial assurance for the closure and/or post-closure care of the following facilities through the financial test or corporate guarantee specified in Subpart H of 40 CFR Parts 264 and 265 or through a test which is equivalent or substantially equivalent to it. The current closure and/or post-closure cost estimates covered by such a test or guarantee are shown for each facility: NONE.

4. The firm identified above owns or operates the following hazardous waste management facilities for which financial assurance for closure and, if a disposal facility, post-closure care, is not demonstrated either to EPA or a State through the financial test or any other financial assurance mechanism specified in Subpart H of 40 CFR Parts 264 and 265 or equivalent or substantially equivalent State mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility: NONE.

5. This firm (Tredegar) is the owner or operator of the following UIC facilities for which financial assurance for plugging and abandonment is required under 40 CFR Part 144. The current closure cost estimates as required by 40 CFR 144.62 are shown for each facility: NONE.

The total of the current cost estimates for closure and/or post-closure care, listed in the five numbered paragraphs above, is $2.3 million. To the best of my knowledge, this figure is sufficient to execute the closure plans and to perform post-closure care responsibilities for all the facilities listed in paragraphs 1. through 5. above.

This firm is required to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on December 31. The figures for the following items marked with an asterisk are derived from this firm's independently audited, consolidated, year-end financial statements for the latest completed fiscal year, ended December 31, 1989.

Closure/Post-Closure Care and Liability Coverage
($ in Millions)

Alternative I

1.	Sum of current closure and post-closure cost estimates (total of all cost estimates shown in the five numbered paragraphs above).	$ 2.3
2.	Amount of annual aggregate liability coverage to be demonstrated.	$ 8.0
3.	Sum of lines 1 and 2.	$ 10.3
*4.	Total liabilities (if any portion of your closure or post-closure cost estimates is included in your total liabilities, you may deduct that portion from this line and add that amount to lines 5 and 6).	$ 182.8
*5.	Tangible net worth.	$ 154.0
*6.	Net worth............	$ 185.1
*7.	Current assets.......	$ 127.1
*8.	Current liabilities.	$ 49.3
9.	Net working capital (line 7 minus line 8).	$ 77.8
*10.	The sum of net income plus depreciation, depletion, and amortization.	$ 45.7
*11.	Total assets in U.S. (required only if less than 90% of assets are located in the U.S.).	$ N/A

		Yes	No
12.	Is line 5 at least $10 million?	X	___

13.	Is lines 5 at least 6 times line 3?	X	
14.	Is line 9 at least 6 times line 3?	X	
15.	Are at least 90% of assets located in the U.S.? If not, complete line 16.—	X	
16.	Is line 11 at least 6 times line 3?	N/A	
17.	Is line 4 divided by line 6 less than 2.0?	X	
18.	Is line 10 divided by line 4 greater than 0.1?	X	
19.	Is line 7 divided by line 8 greater than 1.5?	X	

I hereby certify that the wording of this letter is substantially the same as the wording specified in paragraph 391-3-11-.05 of the Rules of the Georgia Department of Natural Resources, Environmental Protection Division.

Tredegar Industries, Inc.

By: N A Scher

Norman A. Scher
Its: Chief Financial Officer

Date: 10/22/90

Tredegar
INDUSTRIES

CORPORATE GUARANTEE FOR CLOSURE AND POST-CLOSURE CARE

Guarantee made this October 22, 1990 by Tredegar Industries, Inc. ("Tredegar"), a business corporation organized under the laws of the State of Virginia, herein referred to as guarantor, to the Georgia Department of Natural Resources, Environmental Protection Division ("EPD"), obligee, on behalf of our subsidiary, The William L Bonnell Company, Inc. ("Bonnell"), of 25 Bonnell Street, Newnan, Georgia 30263, herein referred to as principal.

RECITALS

1. Guarantor meets or exceeds the financial test criteria and agrees to comply with the reporting requirements for guarantors as specified in paragraph 391-3-11-.05 of the Rules of the Department of Natural Resources, Environmental Protection Division.

2. Bonnell owns or operates the following hazardous waste management facility covered by this guarantee:

Aluminum Extrusion Plant
Wastewater Treatment Facilities
25 Bonnell Street
Newnan, Georgia 30263
EPA ID#: GAD 003273224

Guarantee is for closure and post-closure care for selected hazardous waste treatment, storage or disposal units at the plant.

3. "Closure plans" and "post-closure plans" as used below refer to the plans maintained as required by paragraph 391-3-11-.05 for the closure and post-closure care of facilities as identified above.

4. For value received from Bonnell, guarantor guarantees to EPD that in the event that Bonnell fails to perform closure and post-closure care of the above facility in accordance with the closure or post-closure plans and other permit or interim status requirements whenever required to do so, the guarantor shall do so or establish a trust fund as specified in paragraph 391-3-11-.05 in the name of Bonnell in the amount of the current closure and/or post-closure cost estimates as specified in paragraph 391-3-11-.05.

5. Guarantor agrees that if, at the end of any fiscal year before termination of this guarantee, the guarantor fails to meet the financial test criteria, guarantor shall send within 90 days, by certified mail, notice to the EPD Director and to Bonnell that he intends to provide alternate financial assurance as specified in paragraph 391-3-11-.05 in the name of Bonnell. Within 120 days after the end of such fiscal year, the guarantor shall establish such financial assurance unless Bonnell has done so.

6. The guarantor agrees to notify the EPD Director by certified mail, of a voluntary or involuntary proceeding under Title 11 (Bankruptcy), U.S. Code, naming guarantor as debtor, within 10 days after commencement of the proceeding.

7. Guarantor agrees that within 30 days after being notified by the EPD Director of a determination that guarantor no longer meets the financial test criteria or that he is disallowed from continuing as a guarantor of closure and/or post-closure care, he shall establish alternate financial assurance as specified in paragraph 391-3-11-.05 in the name of Bonnell unless Bonnell has done so.

8. Guarantor agrees to remain bound under this guarantee notwithstanding any or all of the following: amendment or modification of the closure or post-closure plan, amendment or modification of the permit, the extension or reduction of the time of performance of closure or post-closure, or any other modification or alteration of an obligation of the owner or operator pursuant to paragraph 391-3-11-.05.

9. Guarantor agrees to remain bound under this guarantee for so long as Bonnell must comply with the applicable financial assurance requirements of paragraph 391-3-11-.05 for the above-listed facilities, except that guarantor may cancel this guarantee by sending notice by certified mail to the EPD Director and to Bonnell, such cancellation to become effective no earlier than 120 days after receipt of such notice by both EPD and Bonnell, as evidenced by the return receipts.

10. Guarantor agrees that if Bonnell fails to provide alternative financial assurance as specified in paragraph 391-3-11-.05 and obtain written approval of such assurance from the EPD Director within 90 days after a notice of cancellation by the guarantor is received by the EPD Director from guarantor, guarantor shall provide such alternate financial assurance in the name of Bonnell.

11. Guarantor expressly waives notice of acceptance of this guarantee by the EPD or by Bonnell. Guarantor also expressly waives notice of amendments or modifications of the closure

and/or post-closure plan and of amendments or modifications of the facility permit.

12. Any notice or other communication required by this guarantee shall be deemed sufficient if sent by certified U.S. Mail to the appropriate party at the following address:

Guarantor: Tredegar Industries, Inc.

Address: 1100 Boulders Parkway
Richmond, Virginia 23225
ATTN: Norman A. Scher
Chief Financial Officer

Owner or Operator: The William L Bonnell Company, Inc.

Address: 25 Bonnell Street
Newnan, Georgia 30263
ATTN: Leo F. Harlan

EPD Director: Lonice C. Barrett, Director
Environmental Protection Division
Department of Natural Resources
205 Butler Street, S.E.
Atlanta, Georgia 30334

It shall be the responsibility of each party to notify the other parties in writing of any changes to its address stated above.

I hereby certify that the wording of this guarantee is substantially the same as the wording specified in paragraph 391-3-11-.05 of the Rules of the Georgia Department of Natural Resources, Environmental Protection Division.

Effective date: 10/22/90

Tredegar Industries, Inc.

By: N A Scher

Norman A. Scher
Its: Chief Financial Officer

Signature of witness
or notary:

Tredegar
INDUSTRIES

GUARANTEE FOR LIABILITY COVERAGE

Guarantee made this October 22, 1990 by Tredegar Industries, Inc. ("Tredegar"), a business corporation organized under the laws of the State of Virginia, herein referred to as guarantor, on behalf of our subsidiary, The William L Bonnell Company, Inc. ("Bonnell"), of 25 Bonnell Street, Newnan, Georgia 30263, to any and all third parties who have sustained or may sustain bodily injury or property damage caused by sudden and/or nonsudden accidental occurrences arising from operation of the facility covered by this guarantee.

RECITALS

1. Guarantor meets or exceeds the financial test criteria and agrees to comply with the reporting requirements for guarantors as specified in paragraph 391-3-11-.05 of the Rules of the Department of Natural Resources, Environmental Protection Division, and/or specified in 40 CFR 264.147(g) and 265.147(g).

2. Bonnell owns or operates the following hazardous waste management facility covered by this guarantee:

Aluminum Extrusion Plant
Wastewater Treatment Facilities
25 Bonnell Street
Newnan, Georgia 30263
EPA ID# GAD 003273224

This corporate guarantee satisfies RCRA and Georgia Hazardous Waste Management Act third-party liability requirements for both sudden and nonsudden accidental occurrences in above-named owner or operator facilities for coverage in the amount of $4 million for each occurrence and $8 million annual aggregate.

3. For value received from Bonnell, guarantor guarantees to any and all third parties who have sustained or may sustain bodily injury or property damage caused by sudden and/or nonsudden accidental occurrences arising from operations of the facility covered by this guarantee that in the event that Bonnell fails to satisfy a judgment or award based on a determination of liability for bodily injury or property damage to third parties caused by sudden and/or nonsudden accidental occurrences, arising from the operation of the above-named facilities, or fails to pay an amount agreed to in settlement of a claim arising from or alleged to arise from such injury or damage, the guarantor will satisfy such judgment(s), award(s) or settlement agreement(s) up to the limits of coverage identified above.

4. Such obligation does not apply to any of the following:

(a) Bodily injury or property damage for which Bonnell is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that Bonnell would be obligated to pay in the absence of the contract or agreement.

(b) Any obligation of Bonnell under a workers' compensation, disability benefits, or unemployment compensation law or any similar law.

(c) Bodily injury to:

(1) An employee of Bonnell arising from, and in the course of, employment by Bonnell; or

(2) The spouse, child, parent, brother or sister of that employee as a consequence of, or arising from, and in the course of employment by Bonnell.

This exclusion applies:

(A) Whether Bonnell may be liable as an employer or in any other capacity; and

(B) To any obligation to share damages with or repay another person who must pay damages because of the injury to persons identified in paragraphs (1) and (2).

(d) Bodily injury or property damage arising out of the ownership, maintenance, use, or entrustment to others of any aircraft, motor vehicle or watercraft.

(e) Property damage to:

(1) Any property owned, rented, or occupied by Bonnell;

(2) Premises that are sold, given away or abandoned by Bonnell if the property damage arises out of any part of those premises;

(3) Property loaned to Bonnell;

(4) Personal property in the care, custody or control of Bonnell;

(5) That particular part of real property on which Bonnell or any contractors or subcontractors

working directly or indirectly on behalf of Bonnell are performing operations, if the property damage arises out of these operations.

5. Guarantor agrees that if, at the end of any fiscal year before termination of this guarantee, the guarantor fails to meet the financial test criteria, guarantor shall send within 90 days, by certified mail, notice to the EPD Director and to Bonnell that he intends to provide alternate liability coverage as specified in paragraph 391-3-11-.05 in the name of Bonnell. Within 120 days after the end of such fiscal year, the guarantor shall establish such liability coverage unless Bonnell has done so.

6. The guarantor agrees to notify the EPD Director, by certified mail of a voluntary or involuntary proceeding under Title 11 (Bankruptcy), U.S. Code, naming guarantor as debtor, within 10 days after commencement of the proceeding.

7. Guarantor agrees that within 30 days after being notified by the EPD Director of a determination that guarantor no longer meets the financial test criteria or that he is disallowed from continuing as a guarantor, he shall establish alternate liability coverage as specified in paragraph 391-3-11-.05 in the name of Bonnell, unless Bonnell has done so.

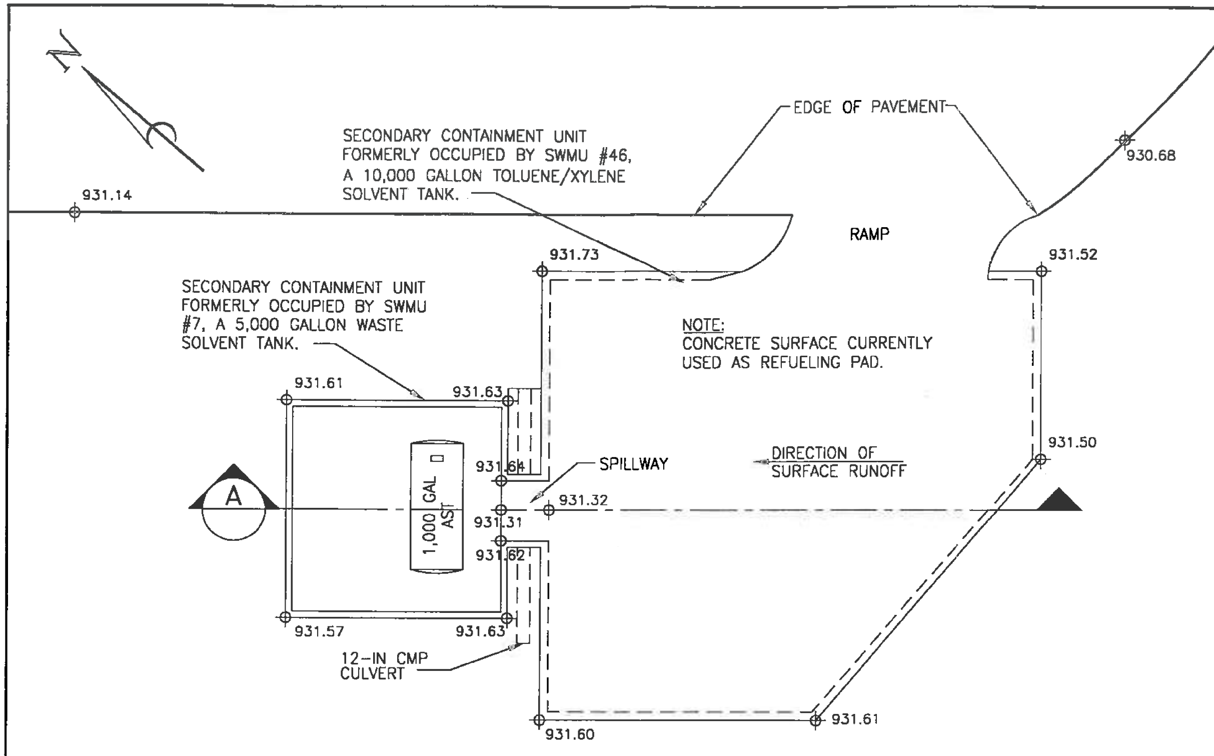
8. Guarantor reserves the right to modify this agreement to take into account amendment or modification of the liability requirements set by paragraph 391-3-11-.05, provided that such modification shall become effective only if the EPD Director does not disapprove the modification within 30 days of receipt of notification of the modification.

9. Guarantor agrees to remain bound under this guarantee for so long as Bonnell must comply with the applicable requirements of paragraph 391-3-11-.05 for the above-listed facility, except as provided in paragraph 9 of this agreement.

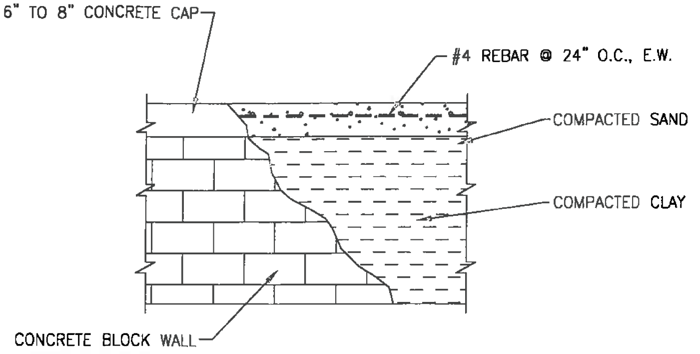
10. Guarantor may terminate this guarantee by sending notice by certified mail to the EPD Director and to Bonnell, provided that this guarantee may not be terminated unless and until Bonnell obtains, and the EPD Director approves, alternate liability coverage complying with paragraph 391-3-11-.05.

11. This guarantee is to be interpreted and enforced in accordance with the laws of Virginia.

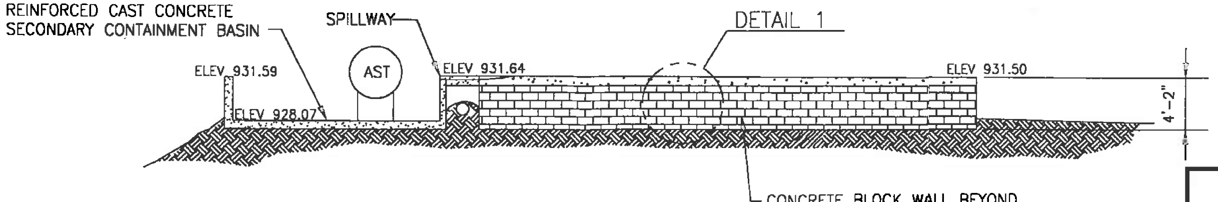
12. Guarantor hereby expressly waives notice of acceptance of this guarantee by any party.



PLAN



DETAIL 1



ELEVATION A-A'

LEGEND

⊕ SPOT ELEVATION – Referenced to TBM established on top northwest corner of concrete headwall at 60-in pipe by Moreland Surveying, Inc. (June 1998). Ref DWG #96-0111-10.

REFERENCES:

Moreland Surveying, Inc.
As-built Survey Data
March 1997; January & June 1998

Zimmerman Technical Services, Inc.
As-built Survey Data
(incidental to engineering work)
November-December 1998

GRAPHIC SCALE

10 5 0 5 10

(IN FEET)

1 inch = 10 ft.

ANDREW ZIMMERMAN
No 19729
1-6-99

Licensed Professional Engineer Seal

Tank Farm Unit
Closure Cap As-built
William L Bonnell Co., Inc.
25 Bonnell Street
Newnan, Georgia 30264

©ZIMMERMAN TECHNICAL SERVICES, INC

12/31/98	DWG #96-0111-11	
DRAWN BY: JLW	CHECKED BY: TWW	APPROVED: ATZ