OPERATIONS MANUAL
AND
PART 2 PERMIT APPLICATION DOCUMENTS
FOR THE
GREENEVILLE/GREENE COUNTY
CLASS III LANDFILL

MAY 28, 1996

ORIGINAL PERMIT BY VAUGHN AND MELTON ENGINEERS
GREENEVILLE, TENNESSEE

REVISED BY PERMIT MODIFICATION

MAY 15, 2012

Revision 1: July, 2012
Revision 2: May 7, 2013
Revision 3: January 28, 2014
Revision 4: February 25, 2014
Revision 5: April 21, 2014

MICHAEL A. CAVELL
No. 00108559
Michael Cavell
4/21/14

Permit Modification Prepared By:

Draper Aden Associates
Engineering • Surveying • Environmental Services

DAA Project Number: 7686-09B

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GREENEVILLE™
TENNESSEE

Certification Statement

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information."

BY: W.T. Daniels DATE: 6/27/13
W.T. Daniels, Mayor

Modification of permit for the Class IV landfill, DML 30-0062. (Vertical Expansion)

1.0 TRANSMITTAL

This document constitutes the Part II Permit Application documents for the Greeneville/Greene County Class III landfill. These documents are submitted for approval by the Tennessee Department of Environment and Conservation, Division of Solid Waste Management, in accordance with Tennessee Rule Chapter0400-11-01, Solid Waste Processing and Disposal. Included in this submittal are the following documents:

- Narrative description of the facility and operations
- Engineering plans
- Closure/Post Closure Plan
- Construction Quality Control Plan

On October 27, 1994, the Geotechnical Investigation and Preliminary Hydrogeologic Report was submitted by S&ME, Inc., as required by Tennessee Rule 0400-11-01-.04 (9) (a). This document was modified on November 7, 1995 following review by the Division of Solid Waste Management and again in March 1996.

This document has been revised in 2014 to include modified final closure grades and closure details, to incorporate two minor permit modifications to the Construction Quality Control and Quality Assurance Plan, and to update the document to acknowledge changes to the operational conditions at the facility. Portions of the original document that are not modified by the 2014 revision maintain their original wording.

1.1 ENGINEERING PLANS

The engineering plans will be referenced throughout this document. Reference will be by parenthesis with the engineering drawing sheet number (e.g., Engr. Sh. 1). The Index of Engineering Drawings is included as Table 1.

TABLE 1 – ENGINEERING PLAN SHEETS

SHT. No	SHEET NAME
1A	TITLE SHEET
1B	ORIGINAL PERMIT SET TITLE SHEET
2	ORIGINAL TOP0GRAPHY & PROPERTY
3	EXISTING TOPOGRAPHY (as of 1996)
4	SUBGRADE PLAN
5	INITIAL DEVELOPMENT PLAN
6	ORIGINAL SUBGRADE WITH MODIFIED CROSS SECTION LOCATIONS
7	LONGITUDINAL CROSS SECTION
8	CROSS SECTIONS
9	CROSS SECTIONS
10	TYPICAL SECTIONS AND GCL INSTALLATION
11	DIVERSION DITCH PROFILE
12	SEDIMENT POND No 2
13	SEDIMENT POND No 2-DETAILS
14	SEDIMENT POND No 2-MODIFICATIONS FOR CLOSURE
15	FINAL GRADE
16	CONSTRUCTION DETAILS
17	EROSION CONTROL DETAILS
18	MISCELLANEOUS DETAILS

2.0 INTRODUCTION

The Town of Greeneville and Greene County jointly own and operate a Class IV, Demolition Waste Landfill. The facility is used by Greene County, Greeneville, Tusculum, Mosheim, and Baileyton, the business community and citizens of Greene County.

The site is adjacent to the recently closed sanitary landfill property. The combined properties include the proposed disposal area, the closed landfill cells, waste wood and brush grinding operation, and the transfer station for solid waste.

The existing scales, maintenance facilities, sanitary and communications facilities, monitoring wells; and the well-known and accessible location allow for an economical operation.

The facility was originally permitted on October 22, 1996. The purpose of the 2014 permit modification is to address the following issues:

A. Modifications to closure grades and details, along with modification to design capacity and anticipated life expectancy

B. Incorporation of two minor permit amendments previously approved to the Construction Quality Control and Quality Assurance Plan

C. In accordance with changes to the Tennessee Solid Waste Processing and Disposal Rules, change of the facility classification from a Class IV landfill to a Class III landfill

D. Minor modifications to operational procedures

2.1 VARIANCE REQUEST

In accordance with Rule 0400-11-01-.01 (5), the original permit application requested and received a variance of the requirements of the rules as follows:

A. Buffer Zone Standards for Siting New Landfills (-0400-11-01-.04 (3) (c) - 100 feet from all Property Lines)

This facility is situated on property recently purchased and/or leased from the adjacent property owners. During negotiations with the property owners the proposed design was described in detail. The steep ridge and existing trees act as a natural buffer and are not to be disturbed by landfill activities. The negotiated property lines were set to satisfy the Owner's land use with full knowledge of the proposed fill limits. The natural buffer (ridge top) varies from 220' to over 400' from the fill limits.

B. Leachate Migration Control Standards (-0400-11-01-.04 (4) (c) 3)

This facility's northern fill slopes are against the closed Class 1 landfill. The Designer proposed that the 2 ft. of 1 x 10^{-7} clay liner is less permeable than 5 ft. of 10^{-5} buffer. The area of Class 1 fill from pre-1990 had a GCL installed which is equivalent to a 2-ft clay cap. (2 ft @ $1x10^{-7}$ > 5 ft @ $1x10^{-5}$, by a factor of four). The original permit documents indicated that the GCL to be used was a Bentomat Claymax, by CETCO Inc.

3.0 OWNERSHIP

The facility is owned jointly by the Town of Greeneville and Greene County.

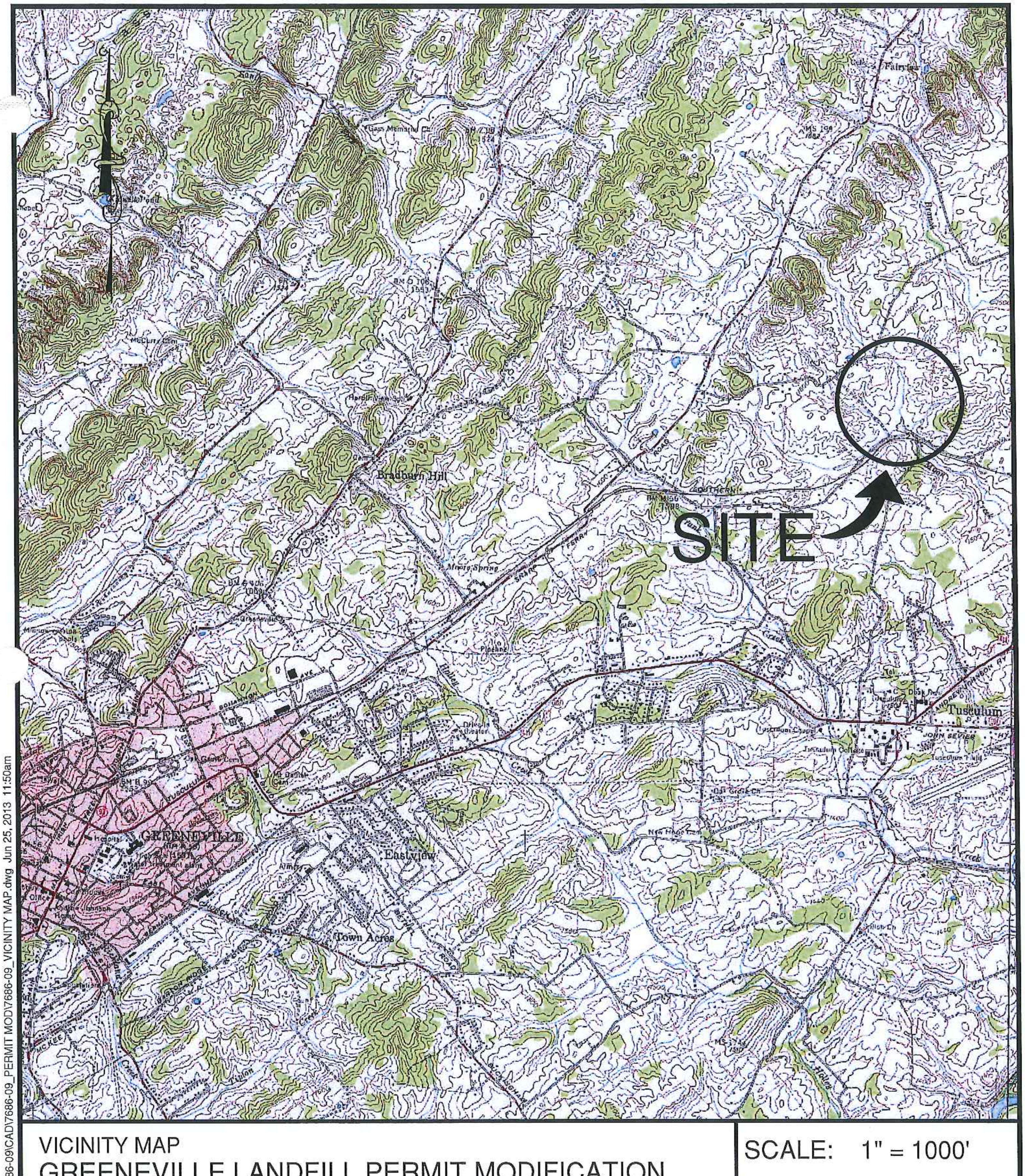
3.1 OPERATOR

Waste Industries is responsible for operating the landfill. Jerry Catron, General Manager Waste Industries is the individual responsible for operation and maintenance of the facility.

4.0 FACILITY LOCATION

The facility is located 2 3/4 miles northeast of Greeneville in Greene County, Tennessee (LAT 36° 11’ 43", LONG 82° 45' 32"). Figure 1 is the Site Location Map. The entrance road is off Old Stage Road approximately 0.7 miles west of Ball Road and 0.9 miles north of Highway 11-E.

The site is approximately 110-acres of which 8.9-acres have been permitted as Class IV landfill. The facility also includes the 38-acre site of an existing closed sanitary landfill (ENGR. SH. 2&3).



VICINITY MAP
GREENEVILLE LANDFILL PERMIT MODIFICATION
GREENEVILLE, TENNESSEE

SCALE: 1" = 1000'

PLAN NO. 7686-09

Draper Aden Associates
Engineering • Surveying • Environmental Services
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA

DESIGNED	MAC
DRAWN	DLD
CHECKED	MAC
DATE	02/13/12

FIGURE

1

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5.0 BUFFER ZONE STANDARDS

5.1 PROPERTY LINES

The property lines and permit boundary are shown on Engineering Sheets 2 and 3. As noted on these sheets, no fill area is closer than 100 feet to the property lines except those properties currently owned by the City and County, and those properties providing permission during property purchase and lease agreements. (Tracts 2 & 4).

5.2 RESIDENCES

As shown on Engineering Sheet 2, the nearest residence is 365 feet from the nearest fill area. This house construction was begun after submission of the Part 1 permit application.

5.3 WELLS

Figure G, Appendix A of the Hydrogeology Report (dated March 3, 1994) indicated the location of private wells within one mile of the facility at the time of the original permit submittal. Figure 2 shows the current location of private wells within one mile of the facility. The nearest private well is 650 feet from the fill area. There are five monitoring wells on the adjacent Class I landfill property.

Monitoring wells B-18, MW#1, and Spring S-2 will constitute the monitoring system for the Class III landfill. The monitoring network is described in more detail in Section 2.1 of the Groundwater Monitoring Plan.

5.4 SPRINGS, STREAMS, LAKES

With the exception of existing storm water and sediment basins, there are no springs, streams, lakes or other bodies of water within 200 feet of the site.

5.5 TOTAL SITE BUFFER

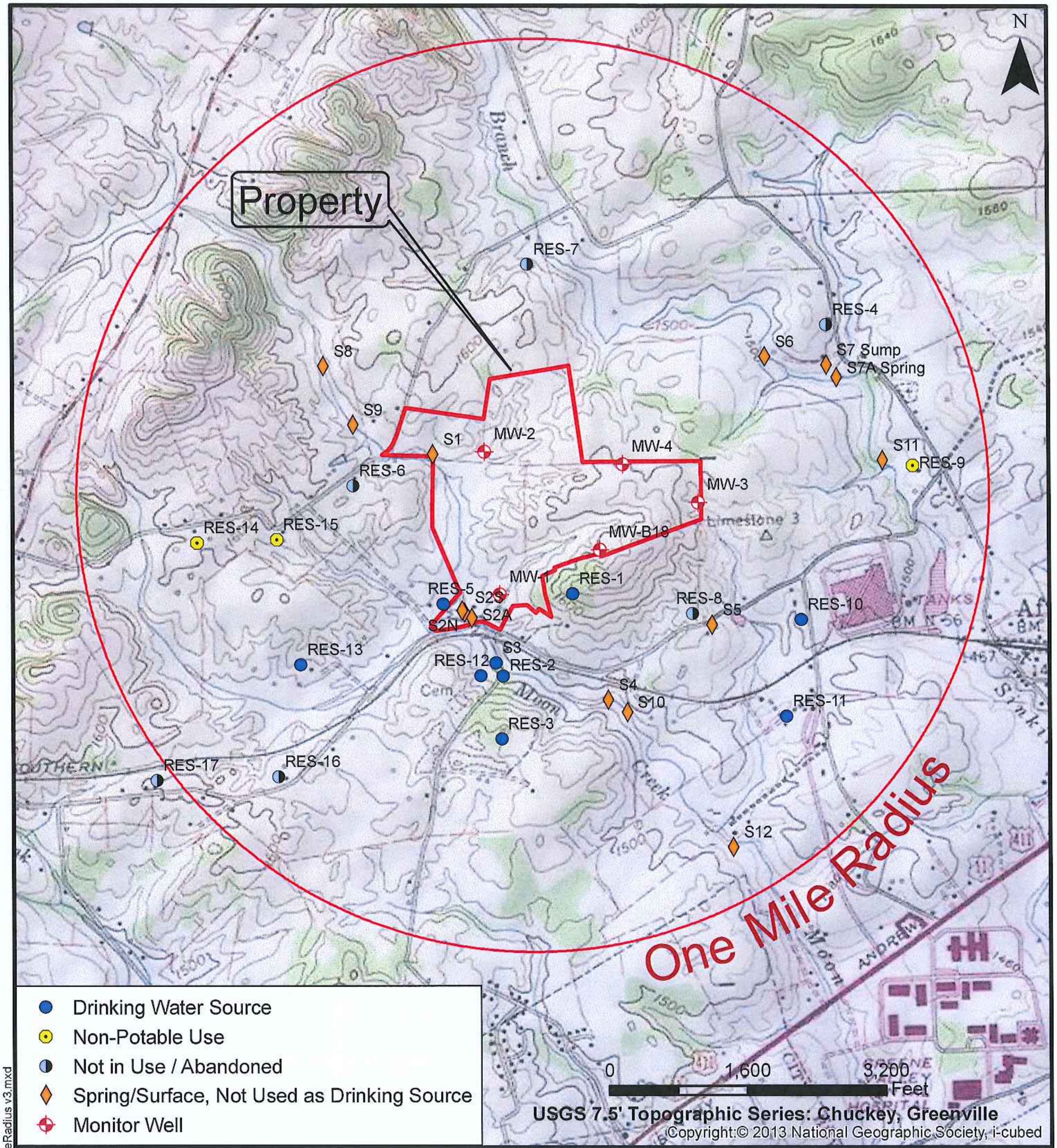
As shown on various Engineering Drawings, no constructed appurtenances are within 50 feet of any property line. Existing property line fences and gates may be replaced or improved. New fences will be installed where shown on the Plans. Existing property access points from public roads have been and will continue to be maintained.

5.6 FLOOD PLAIN

The facility is not located within a 100-year floodplain (see Figure 3 – Flood Zone Map).

5.7 GEOLOGIC BUFFER

The in-situ soil in the area of the Class III landfill was tested for depth to bedrock, soil type, and hydraulic conductivity and was found to meet or exceed the requirements for the five-foot geologic buffer with hydraulic conductivity of less than or equal to 1×10^{-5} cm/sec. The report of the study, which was performed by S&ME, Inc, is included in Appendix 1.



Vicinity Topographic Map and Mile Radius Drinking Water, Well and Spring User Survey

Greeneville / Greene County Landfill
Greene County, Tennessee

SCALE 1" = 1600'

PLAN NO. 7686-09B

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2206 South Main Street
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540-552-0444 Fax: 540-552-0291
Richmond, VA
Charlottesville, VA
Hampton Roads, VA

DESIGNED JES
DRAWN SMF
CHECKED JES
DATE 01-28-14

FIGURE
2

P:\07\600\07686-03\GIS\Fig-2_Topo-MileRadius v3.mxd

6.0 ACCESS CONTROL

Primary access to the facility is provided from Old Stage Road as shown on the Engineering Drawings. All vehicles enter through the main entrance. Existing and proposed fences and gates are utilized to restrict unauthorized access to the property. Gates are locked except during operating hours.

A sign is maintained at the entrance road providing emergency phone numbers. Traffic control and directional signs are used to provide safe and orderly traffic within the facility.

Temporary and permanent access roads have been and will be constructed within the permit boundary as shown on the Engineering Drawings. Landfill access roads are to be at least 20 feet wide and incorporate gravel or crushed stone for base and surface.

Employees of Waste Industries are present whenever the facility is in operation. These employees ensure compliance with these operational requirements and prevent unauthorized use.

7.0 WASTE MATERIAL DESCRIPTION

7.1 SERVICE AREA

This facility will service the individual, business and industrial residents of Greene County, Tennessee including the incorporated towns within the County.

7.2 LANDFILL VOLUME, ANTICIPATED WASTE TONNAGE, AND LIFE EXPECTANCY

As originally designed, the landfill had a total capacity for waste and periodic cover of approximately 341,000 cubic yards. With the modified closure grades, the capacity for waste and periodic cover is anticipated to be 586,873 cubic yards.

The average annual waste tonnage at this facility over the period from 2003 through 2010 has been approximately 7100 tons per year. The Landfill Utilization Factor (LUF), which is a ratio of the tonnage placed in the landfill to the total volume consumed, has been 0.6 tons per cubic yard over the same period. These figures lead to an average annual volume consumption figure of approximately 11,850 cubic yards. As shown in Table 2, a total fill volume of 586,873 CY is available. As of June of 2011, there were approximately 371,333 cubic yards of total capacity remaining in the landfill, using the modified closure grade. If the rate of filling remains relatively constant, these volumes indicate an estimated total remaining landfill life of 31 years, or a closing date of 2042. If a growth factor of 1% is assumed for the incoming tonnage, then the estimated date of fill is 2038 (See Table 3).

Peak daily tonnage at the facility, based on operations to date, is anticipated to be 100 tons per day. Average daily tonnage is anticipated to be no greater than 55 tons per day.

TABLE 2
VOLUMES AND LIFE EXPECTANCY

Total Volume Available	627,205 CY
Volume of final closure cap	40,332 CY
Total volume available for waste and periodic cover	586,873 CY
Volume used on annual basis (historical)	11,850 CY
Volume remaining, 2011	371,333 CY
Remaining life expectancy, from 2011	31.3 Years

TABLE 3
LIFE EXPECTANCY AT 1% GROWTH RATE

End of Year	Annual Waste and Cover Volume	Cumulative Volume Used	Volume Remaining
2011	11500	233315	353,558
2012	11615	244930	341,943
2013	11731	256661	330,212
2014	11848	268510	318,363
2015	11967	280477	306,396
2016	12087	292563	294,310
2017	12207	304771	282,102
2018	12330	317100	269,773
2019	12453	329553	257,320
2020	12577	342130	244,743
2021	12703	354834	232,039
2022	12830	367664	219,209
2023	12958	380622	206,251
2024	13088	393710	193,163
2025	13219	406929	179,944
2026	13351	420280	166,593
2027	13485	433765	153,108
2028	13620	447385	139,488
2029	13756	461140	125,733
2030	13893	475034	111,839
2031	14032	489066	97,807
2032	14173	503238	83,635
2033	14314	517552	69,321
2034	14457	532010	54,863
2035	14602	546612	40,261
2036	14748	561360	25,513
2037	14895	576255	10,618
2038	15044	591300	-4,427

7.3 WASTE DESCRIPTION

Wastes accepted at the facility will be limited to those materials that were described in the original permit and the Solid Waste Regulations for a Class IV landfill. Wastes included in the list of acceptable wastes for a Class III landfill, but not for a Class IV landfill, will not be accepted.

The following wastes will be acceptable Wastes at this facility:

1. Construction and demolition wastes, consisting of wastes resulting from construction, remodeling, repair and demolition of structures, road building and utilities;
2. Automotive tires that have been shredded, chipped, chopped, sliced, or otherwise rendered not whole to effectively prevent floating
3. Silica sand, or partially fused silica sand;
4. Other similar wastes as approved in writing by the Department, in advance of acceptance at the landfill

8.0 OPERATIONS MANAGEMENT

8.1 PERSONNEL

The daily operations are performed under the direction of the designated Facility Manager. The Facility Manager ensures that operations at the site are performed in accordance with this document, the engineering drawings and applicable state and federal regulations. The Facility Manager also ensures that the services, tests, investigations reporting records outlined in Sections 8.2 and 8.3 are completed. The Facility Manager is Mr. Jerry Catron; phone numbers are: 423-639-3011 (landfill), or -423-581-5655 (Waste Industries office).

A Construction Superintendent supervises the construction activities including excavation, clay liner construction, geosynthetic clay liner (GCL) installation, fill operations, final cover, drainage, and silt control. This individual will also be responsible for road maintenance, pond maintenance, equipment maintenance and other related activities. GCL installation was performed as part of the initial construction of the Class IV (now Class III) landfill and is complete; it is not anticipated that any more GCL material will be placed. The construction superintendent is Mr.. Jerry Catron He can be reached at -423-581-5655.

The daily operations are performed by an estimated two persons at peak fill operations. They include one equipment operator and one clerk.

8.2 TECHNICAL SERVICES & REPORTING

The Facility Manager is responsible for obtaining the professional services necessary to meet the reporting requirements of this document and the state regulations. These include the following:

1) Survey Control: Permanent survey control monuments have been established at this site. If any control points are damaged or need to be moved, replacement monuments must be located and shown on a revised site plan.
2) Construction Surveying: Final grades, elevations for subgrade, geologic buffer and final cover shall be certified by a registered land surveyor.
3) Groundwater Testing: As noted in the Groundwater Monitoring Plan (GMP), groundwater must be sampled by trained technicians and samples tested by a certified laboratory. Copies of all test results and chain-of-command shall be submitted to TDEC.

8.3 RECORDS

1) Daily Reports - Quantities and source of waste delivered for disposal will be kept on site for the life of the facility.
2) Random Inspection Reports – Reports of random waste inspections will be kept on site for the life of the facility.
3) Annual Report - The annual report will summarize total tonnage for the previous year. In addition, landfill life projections will be made.

4) Groundwater Monitoring Report - Reports of groundwater testing as described in the GMP shall be submitted to the Department of Environment and Conservation and kept on-site for the life of the facility and through the post-closure period.

8.4 SEALING OF BORE HOLES & M.W. #5

Prior to any excavation, all bore holes drilled or dug during subsurface investigation of the site, piezometers, and abandoned wells, either in or within 100 feet of the areas to be filled, were backfilled with a bentonite slurry to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base, or to the ground surface if the site will be excavated less than ten feet below grade.

8.5 EQUIPMENT

Major construction work related to access roads, excavation, clay liner, closure, or drainage may be contracted to qualified construction companies. Daily site operations including waste fill, progression of excavation, buffer preparation and drainage will be performed by equipment and operators dedicated to on-site operations. At a minimum, this equipment will include 1 tracked loader.

Routine maintenance of equipment is performed on-site. Major repair work is conducted off-site. The Facility Manager ensures that a preventative maintenance program for all equipment is followed. When equipment breakdown occurs, arrangements are made to rent adequate equipment, to purchase a replacement, or use other city/county equipment as needed. Replacement equipment will be available within 24 hours of primary equipment breakdown.

8.6 COMMUNICATIONS

Telephone service is available at this facility. The primary facility phone number is 423-639-3011.

8.7 SHELTER AND SANITARY FACILITIES

Shelter, drinking water, and sanitary (hand washing and toilet) facilities are available to all personnel at the facility administration office and maintenance building. Drinking water is from the Town of Greeneville's water system.

8.8 SURVEY CONTROL

Horizontal and vertical control surveys have been performed and permanent monuments set for this facility. Engr. Sh.-2 and 3 indicate the locations, and elevations of the permanent concrete monument (CM) and benchmarks (BM).

Temporary controls will be established as needed during operations to facilitate operations.

8.9 FACILITIES

There are several facilities and operations at the site, including the following:

1. Vehicle scale and scale house;
2. Maintenance building, for equipment maintenance and repair.
3. Solid Waste Transfer Station;
4. Class I landfill – closed;
5. Mulch processing and stockpiling areas;
6. Composting facility;
7. Class IV landfills (2), closed
8. Soil stockpiles.

8.10 OPERATIONS

The incoming waste stream is controlled at the gate/scale house area. Waste loads will be directed to the tipping floor of the transfer station for all waste not permitted in the Class III landfill. Demolition waste will be directed to the face of the fill. This is the same procedure used for several years at the previously permitted facility. Appropriate signing will be installed to properly direct vehicles to the disposal area.

The equipment operator at the face of the fill will direct the unloading of each incoming load. Waste will be unloaded as close to the working face as possible with proper concern for the safety of the public and protection of vehicles.

Waste material will be pushed by tracked loader up the working face and compacted by tread loading. The working face shall be kept to neat lines within the permitted fill boundaries. The working face will be confined to the smallest practical area. When filling in areas that have constructed liners or buffers, the operators shall take care to prevent damage to the covering soils.

At least every fourteen days the working areas shall be covered with a minimum of six inches of compacted soil or shale material providing cover characteristics equivalent to local soils, or other similar material as approved in writing by the Department. When the final fill elevation is reached, the final closure cap shall be constructed in accordance with the provisions of Rule - 0400-11-01-.04 (8) of the Tennessee Solid Waste Processing and Disposal Rules.

8.11 INITIAL WASTE FILL RESTRICTIONS

During initial filling operations, the operator shall place select waste over the side slopes of the existing sanitary landfill. In areas of GCL application and areas over the constructed clay liner, no large items capable of penetrating the liner shall be placed.

9.0 STORM WATER AND EROSION CONTROL

9.1 DESIGN, INSPECTION, AND MAINTENANCE

Stormwater flow calculations are included in Appendix 3, "Drainage and Stormwater Control Calculations".

Channels and berms intercept flows and direct them around or away from active fill areas. Various methods of velocity control are used in the channels depending on slopes and volumes. Check dams and rip-rap are to be used where noted on the engineering drawings. Construction details of the various methods are shown on the Drawings. All channels, either permanent or temporary, will be stabilized immediately after excavation. Stabilization methods may consist of seeding, rip-rap, or as noted on the engineering plans.

Erosion and sediment control are managed by the use of sediment ponds, silt fence, sediment traps, check dams, and baled hay/fabric erosion checks. Reseeding of disturbed areas is performed in a timely manner to minimize erosion. The storm water control pond is lined with a geosynthetic clay liner (GCL) and an 8-inch thick rock layer in the bottom. Non-limestone rock was used above the GCL. Silt deposits are removed when the carrying capacity of individual ponds is reached. The capacity of existing Sediment Basin #2 was calculated for the revised closure grading. The peak outflow for a 24-hour, 25-year storm was determined to be 3.0 CFS, within the capacity of the downstream channels.

Silt fencing, straw bales, or other appropriate control methods will be installed and maintained down gradient of all excavation, embankment, and stockpiling operations to intercept sediment-laden runoff. Accumulated sediment is removed as soon as possible after storm events to maintain capacity. All sediment control structures shall be inspected on a regular basis as follows:

- After each major storm event - channels and sediment barriers.
- Monthly - channels, sediment barriers, ponds and check dams.
- Annually - channels and ponds.

Repairs to all facilities will be made as needed. Significant repairs should be timed to allow for re-seeding as soon as possible, preferably in the spring and fall.

The storm water conveyance channel at the northern boundary of the Class III fill area, adjoining the closed Class I landfill (SCC-1), which will be created by the modifications to the final closure grade, and the adjacent channels have been designed to minimize the amount of flow in SCC 1, such that the potential for erosion of the previously closed Class I landfill will be kept to a minimum.

All channels and downslope drains for the modified closure grades have been designed to be adequate for a 25-year, 24-hour storm. Slope diversions and downslope drains have factors of safety greater than 1.0 for a 100-year, 24-hour storm.

9.2 STORMWATER MONITORING

Monitoring of stormwater discharges is performed in accordance with the Tennessee Multi-Sector Permit for industrial facilities, Sector L, for landfills.

10.0 GROUNDWATER MONITORING

The Class III Landfill is within the groundwater monitoring boundary of the closed Class I sanitary landfill. The monitoring frequency and parameters will remain the same as set for the post-closure period of the sanitary landfill. Details of groundwater monitoring are presented in the facility Groundwater Monitoring Plan.

11.0 ENVIRONMENTAL CONSIDERATIONS

11.1 DUST CONTROL

Control of dust from earthwork and hauling operations will be necessary. Water shall be sprayed over gravel access roads and dirt haul roads to minimize dust generation. The operator will spray any work area to prevent dust from creating a nuisance or safety hazard to adjacent landowners or persons within the landfill.

11.2 FIRE SAFETY

Demolition waste consists of mostly inert non-combustible material. Fire extinguishers will be maintained on all operating equipment in case of fuel or electric fires. No smoldering material will be accepted for disposal. Non-treated wood waste will be processed at the wood grinder. There is a fire hydrant located near the Scale House that is available for use by the local fire department.

The facility can accept cut or shredded waste tires, which may present a fire hazard. The first defense against a tire fire is watchfulness and careful handling. Landfill personnel will be instructed to separate and cover any burning tires if possible without endangering personal safety and to immediately call for assistance from the Landfill Supervisor. A stockpile of cover soil is maintained at the working face, which can be used to cover a tire fire. The fire hydrant mentioned in the preceding paragraph is also available if it is necessary to call the fire department for assistance.

11.3 FLOODING

The facility is not located within a 100-year flood plain. The facility is also not located such that there are major upstream areas that could produce local flooding within the active landfill areas. The sloping areas to the south of the fill area are intercepted by the roadside channel along the south access road and diverted into the sediment basin.

11.4 WETLANDS

No wetlands are located within or adjacent to the property boundaries of this facility. A permanent stream flows along the eastern boundary of the overall site; approximately 700 feet from the demolition fill area.

11.5 THREATENED AND ENDANGERED SPECIES

No threatened or endangered species are known to be present at the proposed facility.

11.6 AIRPORT SAFETY

The proposed facility is not located within 10,000 feet of any airport.

11.7 GAS MONITORING

The filling of this facility with demolition waste is not anticipated to generate methane gas. In accordance with Rule -0400-11-01-.04 (5) (c), no program for monitoring the migration or venting of methane gas will be necessary.

11.8 INSPECTION PROGRAM

The landfill operations personnel shall be trained to observe incoming waste. Only waste materials permitted in Class IV landfills, as described in the original permit documents, will be directed to the disposal area. All other material shall be taken to the transfer station or to other designated areas (tires and waste wood). Materials that are not acceptable by any of the operations at the facility will be prevented from using the facility and will be turned away. Inspection begins when incoming waste is at the scale and will be further observed when unloaded as well as during the spreading and compaction operations.

Random Inspection Program -The owner or operator of a permitted landfill shall implement a program at the facility for detecting and preventing the disposal of regulated hazardous waste, unauthorized special waste, PCB's and, at this facility, any Class I, or II waste material. This program includes at a minimum:

- Random inspection of five percent of the daily incoming loads
- Inspection of suspicious loads
- Records of all inspections
- Training of facility personnel to recognize regulated hazardous waste as well as other waste designations
- Procedures for notifying the proper authorities if a regulated hazardous waste is identified at the facility, including verbal notification of the TDEC Johnson City Field Office, followed by written notification if requested.

11.9 SCAVENGING

No scavenging will be allowed at the facility.

11.10 LITTER CONTROL

The control of windblown litter is necessary to prevent unsightly conditions and problems with neighboring landowners. The nature of demolition waste should minimize the amount of light paper and plastic material. No additional controls are proposed at this facility. If necessary, litter fences can be used. At the conclusion of each day of operation, all wastes resulting from the operation shall be collected for proper disposal.

12.0 SITE PREPARATION

12.1 SEDIMENT CONTROL

The locations and dimensions of the various types of sediment control shall be in accordance with the Engineering Drawings and where located by the construction layout staking. Reference is made to Section 9, Stormwater and Erosion Control.

Sediment control structures shall be installed prior to any surface disturbance within the area for which they are necessary to control sedimentation and erosion. All sediment control structures shall be maintained in accordance with the Tennessee Erosion and Sediment Control Regulations, latest edition. Accumulations of sediment which threaten damage to the structures or which impair their effectiveness shall be removed.

12.2 CLEARING AND GRUBBING

Clearing and grubbing shall be limited to those ground surfaces where excavation, embankments, or fill are to be placed or as otherwise shown on the Drawings. The areas may be extended outside the actual lines of excavation, embankment, or fills to provide sufficient space to perform the work. In no case shall the work be within 50 feet of a property line.

12.3 STRIPPING

All areas to be excavated or receive embankment or fill must have sod and topsoil removed. Cleared topsoil material suitable for subsequent use as final cover shall be stockpiled where indicated on the Plans. Sediment control shall be required for all areas used for topsoil storage. Stockpiles shall be seeded as soon as practical.

12.4 STORMWATER BASIN

12.4.1 CONSTRUCTION

The locations, dimensions, and volumes of each storm water control basin shall be in accordance with the Engineering Drawings. Appendix 3 provides the design calculations and detailed construction specifications for each basin. The basins shall be constructed prior to the beginning of construction of the upgradient fill area. Borrow material needed for the containment berms may come from the excavation of fill areas. The provisions of Section 12.0 must be met. Overflow structures, spillways, drains and erosion control shall be installed prior to diverting water to the basins or beginning substantial upgradient earthwork activities.

Sediment Basin No. 2 is lined with a geosynthetic clay liner (GCL), in accordance with the original permit, to prevent formation of solution channels to underlying rock formations. The GCL is covered with 8 inches of stone to protect the liner during removal of accumulated sediment. The foundation preparation for the GCL as well as the installation details was in accordance with the manufacturer’s recommendations. Appendix 1 covers the CQA requirements for the GCL.

The GCL is keyed into the side slopes of the basin to prevent pullout. The top two feet on the side slopes are covered with 6" - 8" size rip-rap. The rip-rap extends up to the 100-year flood level. This rip-rap will prevent burrowing animals from damaging the GCL.

All stone and rip-rap in contact with the GCL shall not be limestone. Sandstone, granite, or other non-limestone/dolomite rock may be used.

Sediment Pond No. 2 has been evaluated for performance with the modified final closure grades and will be adequate to the new configuration. Results of the analysis are included in Appendix 3.

12.4.2 MAINTENANCE

The berms, spillways, and influent channels must be maintained to prevent erosion of soil and rip-rap. The vegetation shall be kept mowed to prevent the growth of trees and brush. Annual inspections should be made to prevent burrowing animals from inhabiting the berms. Displaced rip-rap shall be replaced as needed.

Overflow structures and outlet pipes need to be kept free from obstruction. Accumulated sediment, vegetation, and animal dens must be kept out of these structures.

Accumulated sediment shall be removed from the ponds as needed. The ponds are designed to function with 60% of the capacity reserved for sediment accumulation. When this level is reached the pond shall be dewatered and the sediment removed. Cleanout elevation is approximately 1525.4 ft. A marker will be placed on the outlet riser to indicate the cleanout elevation. Reference is made to Section 9, Stormwater Management.

12.5 ROCK PINNACLES

Rock pinnacles within the fill area must be covered to provide adequate buffer. This buffer must be constructed of approved clay soils that will meet the hydraulic conductivity requirement of k = $1x10^{-5}$cm/s (maximum).

Embankment construction shall be in accordance with Section 12.8. Testing requirements will be in accordance with Appendix 1, Sections A2-4.0 and A2-5.0.

Details showing the extent of fill around the known pinnacles area included in the cross-sections of the Plans (Engr. Sheets 16-25).

12.6 DRAINAGE CHANNELS

12.6.1 CONSTRUCTION

The construction of perimeter channels around embankments and fills shall be constructed prior to surface water being directed to them. Check dams, rip-rap and other control structures shall be installed during channel construction. The locations and dimensions of the channels, at each location, is noted and detailed in the Engineering Drawings. Channel linings, as shown on the

Engineering Drawings, shall be installed immediately after the subgrade and side slope excavation is completed. Reference is made to Section 9, Stormwater Management.

12.6.2 MAINTENANCE

Channels shall be maintained to assure the free flow of water. Check dams shall be kept clean of accumulated sediment until a satisfactory sod is established. If erosion continues, additional check dams, rip-rap or other velocity control measures will be taken.

12.7 ACCESS ROAD AND HAUL ROADS

12.7.1 ACCESS ROAD

The engineering plans indicate the location of the primary access road to and through the site. The access road shall be at least 20 feet wide with drainage channels where necessary. The base shall consist of 4-6 inches of #2 aggregate. The aggregate shall be compacted with a vibratory or smooth-drum roller, or equivalent.

The access road shown to the south of the Class III area will become the primary access road to the fill area at the point in fill operations when the working face is no longer accessible from the western face. The road will be widened and surfaced to accommodate two-way landfill traffic at that time.

12.7.2 MAINTENANCE

Proper maintenance of the access road is crucial to the efficient and safe operation of this facility. Roads shall be maintained to provide positive drainage without erosion and to minimize rutting. Aggregate cover shall be kept at the 4-inch thick layer to protect the underlying subgrade.

Roadway channels and culverts shall be kept free of erosion and sedimentation. Excessive erosion shall be controlled with temporary rip-rap or other velocity control methods detailed on the plans.

12.8 EARTH EXCAVATION, EMBANKMENT & STOCKPILING

This work consists of all necessary excavation, transporting the materials from excavation to stockpiles or embankment areas, and construction of embankment.

12.8.1 EXCAVATION

Excavation shall include excavation to the lines and grades shown on the drawings.

12.8.2 EMBANKMENT

This work shall consist of constructing embankments, including preparation of the area upon which they are to be placed; the placing and compacting of approved material where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits, and other depressions in reasonably close, conformity with the lines, grades and typical cross-sections shown on the Plans. Only materials conforming to Section 205 of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, and as approved by the engineer, shall be used in the construction of embankments and backfills.

Before embankment construction in any area is begun, clearing and grubbing, and stripping shall have been performed.

The original ground surface, or the surface of any embankment layer in place, shall not be in frozen condition, and shall be free of snow, ice, and mud when a subsequent layer is placed thereon.

All depressions or holes below the natural ground surface, whether caused by grubbing or otherwise, shall be filled with material approved for embankment construction as described above and compacted to ground surface before embankment construction is started.

When the embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when the embankment is to be built one-half width at a time, the slopes that are steeper than 4(H):l(V) as measured at right angles to the fill shall be continuously benched over those areas as the work is brought up in layers. Benching shall be of sufficient width to permit the operation of placing and compacting equipment. Each successive cut shall begin at the intersection of the original ground and the vertical side of the previous cut. Material thus cut shall be recompacted along with the new embankment material.

Perishable materials such as brush, roots, stumps, parts of trees, etc. shall not be incorporated or buried in the embankments.

Embankments shall be so constructed that adequate surface drainage will be provided at all times. Embankment materials shall be placed in horizontal layers not to exceed ten inches in depth before compaction, and each layer shall be compacted to a density not less than 95 per cent of maximum density.

Maximum density and optimum moisture will be determined in accordance with the "Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort, ASTM D698-07e1". The determination of the density of the soil in place will be in accordance with an approved AASHTO method. Each layer of embankment shall be compacted to required density and approved before material for the next succeeding layer is placed.

Placing and compacting areas shall be kept separate.

When a minimum of 98 per cent of maximum density is required, the moisture content of the material being compacted shall meet both the following conditions: (1) The moisture content shall be within the range of values at which 98 per cent of the maximum density can be obtained as indicated by the moisture-density relationship curve and (2) the moisture content shall not exceed the optimum moisture content to the extent that the material pumps under loads applied by the construction equipment.

12.8.3 STOCKPILING

This work consists of properly stockpiling excavated soils and topsoil at the locations shown on the plans. Adequate volumes of materials will be stockpiled to provide adequate cover material, and topsoil for seeding. Volumes shall include those quantities needed to provide material during winter months and periods of inclement weather.

All stockpiles that are to remain longer than 30 days shall be stabilized and seeded. Silt fence and/or baled hay barriers shall be installed where applicable around stockpiles to control siltation. Channels and berms shall be located to avoid erosion of stockpiles.

TABLE 4

SOIL & FILL VOLUMES

Excavation (initial construction)	-	29,064 CY
Embankment (Buffer over Rock and Road) (initial construction)	-	3,930 CY
Monthly & Intermediate Cover (116 CY / mo x 12 mo. x 46 yr)	-	64,032 CY
Total Available Volume for waste and cover		627,205 CY
inal Cover (10.0 ac x 2.5 ft depth)	-	40,332 CY
Waste and Periodic Cover	-	586,873 CY
Soil Quantity Required	-	79,230 CY

- On-site excavation is shown in the cross sections. Shallow cuts to the left of the baseline Sta. 3+50 thru Sta. 11+100. From Sta. 11+50 thru 14+00 large excavations are proposed in the wider, available area.
- There are available, stockpile (22,000 c.y., as of September 2011) and unexcavated soils within the property boundaries of the adjacent sanitary landfill that may be used to satisfy part or all of the required soil quantity listed in the Table. Soil tests will be run as needed on soils used for final cover or other restricted purposes.
- Total life expectancy of landfill from opening date in 1996 to estimated date of final acceptance of waste in 2042 is 46 years.

12.9 FINAL CLOSURE COVER INSTALLATION

This work shall consist of constructing the final cover, including the minimum 18-inch low-permeability (1 x 10^{-5} cm/sec) layer, and the minimum 12-inch vegetative layer. The final cover is to be installed on the approved final grades of the fill including side slopes in accordance with the applicable provisions of the Closure/Post Closure Plan. Table 4 summarizes the soil quantities needed for minimum cover standards.

12.10 VEGETATIVE COVER

The vegetative cover shall be installed immediately after placement of the vegetation support soil on all final cover. All disturbed areas including the drainage system shall be seeded as soon as practicable after construction.

Table 5 includes the seed mixture schedule for this facility. Groups 1, 2 and 3 are to be used on all completed areas depending on time of year unless noted otherwise as follows: Table 6 presents the results of soil borrow area testing that was performed as part of the original permit submittal.

Group 4 shall be used on all completed slopes 4H:1V or steeper.

Groups 5, 6 and 7 shall be used for temporary seeding only. Conditions receiving temporary seeding include: winter season, temporary stockpiles, temporary berms or cut faces, temporary haul roads. Temporary shall mean a period of time not to exceed 180 days.

The operator may request changes in the seeding mixture or type of cover established as final development of the property is planned.

Fertilizers and liming will be in accordance with soil testing performed at the time of seeding. A copy of the soil test results shall be submitted to the Division of Solid Waste Management.

TABLE 5

SEEDING SCHEDULE

GROUP	SEEDING DATES	SEED	QUANTITY BY WEIGHT (LB. / AC.)
1	Feb. 1 – June 1	Kentucky 31 Fescue English Rye Korean Lespedeza	80 5 15
2	June 1 – Aug. 15	Kentucky 31 Fescue English Rye Korean Lespedeza German Millet	55 20 15 10
3	Aug. 15 – Dec. 1	Kentucky 31 Fescue English Rye White Clover	70 20 10
4	Feb. 1 – Dec. 1	Crown Vetch Kentucky 31 Fescue English Rye	25 70 5
5	Jan. 1 – May 1	Italian Rye Korean Lespedeza Summer Oats	33 33 34
6	May 1 – July 1	Sudan-Sorghum or Starr-Millet	100
7	July 15 – Jan. 1	Balboa Rye Italian Rye	67 33

Based on Tennessee Erosion and Sediment Control Handbook

Soil Tests (Borrow)
Sample for Original Borrow Pit
Greeneville Landfill Closure Project

Table 6 - Soil Tests (Borrow)
(Figure 4 from original permit)

Sample Number	Proctor Type	Depth, ft.	Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Limit	Specific Gravity	Permeability cm/sec	U.S.C.S. Classification	Dry Density pcf
Bag 1	Standard	Subgrade	29.0	65	48	17	2.64	$2x10^{-8}$	MH	90.2
Bag 1	Standard	Subgrade	30.6	65	48	17	2.64	$6x10^{-8}$	MH	88.2
Bag 1	Standard	Subgrade	32.9	65	48	17	2.64	$2x10^{-8}$	MH	85.9
Bag 2	Standard	Subgrade	22.0	52	38	14	2.62	$4x10^{-8}$	MH	99.0
Bag 2	Standard	Subgrade	23.9	52	38	14	2.62	$2x10^{-8}$	MH	97.0
Bag 2	Standard	Subgrade	26.0	52	38	14	2.62	$5x10^{-8}$	MH	93.5
Bag 2	Modified	Subgrade	18.2	52	38	14	2.62	$8x10^{-8}$	MH	110.5
Bag 2	Modified	Subgrade	20.0	52	38	14	2.62	$1x10^{-8}$	MH	108.0
Bag 2	Modified	Subgrade	22.5	52	38	14	2.62	$5x10^{-7}$	MH	102.0
Bag 2	Modified	Subgrade	24.9	52	38	14	2.62	$3x10^{-7}$	MH	97.5
Bag 3A	Modified	Subgrade	27.2	76	55	21	2.63	$3x10^{-7}$	MH	96.2
Bag 3A	Modified	Subgrade	30.1	76	55	21	2.63	$3x10^{-7}$	MH	92.0
Bag 3A	Modified	Subgrade	31.2	76	55	21	2.63	$2x10^{-7}$	MH	90.0
Bag 4	Modified	Subgrade	-	80	58	22	2.61	-	MH	-
Bag 5	Modified	Subgrade	31.2					$2x10^{-7}$	MH	90.5
Bag 5	Modified	Subgrade	33.5					$1x10^{-7}$	MH	88.1
Bag 5	Modified	Subgrade	35.2					$2x10^{-7}$	MH	85.7

Notes:

APPENDIX 1
GEOTECHNICAL AND HYDROGEOLOGIC REPORT
BY S&ME, INC

REVISED REPORT OF GEOTECHNICAL INVESTIGATION AND HYDROGEOLOGIC INVESTIGATION GREENEVILLE DEMOLITION LANDFILL SITE

GREENEVILLE, TENNESSEE
S&ME PROJECT NO. 1404-94-051-A

Prepared For:

Vaughn and Melton, Inc.
Greeneville, Tennessee

Prepared By:

S&ME, Inc.
P.O. Box 1118 TCAS
Blountville, Tennessee 37617

November 7, 1995

S&ME

November 7, 1995

Vaughn and Melton
219 West Depot Street
Greeneville, Tennessee 37743

Attention: Mr. Stephen D. Robbins, P.E.
Vice President

Subject: **REVISED REPORT OF GEOTECHNICAL INVESTIGATION AND HYDROGEOLOGIC INVESTIGATION**
Greeneville Demolition Landfill Site
Greeneville, Tennessee
V&M Project No. 29201-07
S&ME Project No. 1404-94-051-A

Dear Mr. Robbins:

S&ME, Inc., has completed the geological/hydrogeological and geotechnical investigation for the subject site. Our preliminary report, dated October 27, 1994, has been amended in accordance with the letter dated December 9, 1994, from Mr. Randy Curtis, Tennessee Department of Environment and Conservation Division of Solid Waste Management, to Mayor G. Thomas Love, Town of Greeneville. Drilling was conducted to determine the general subsurface profile and to obtain geological and hydrogeological information. Soil samples were obtained during drilling operations and submitted for laboratory testing to evaluate the in-place soils for geologic buffer material and the remolded soils for use as cover material. Bedrock cores were obtained from the proposed detention pond area and also from the area underlying the proposed landfill. Electrical resistivity was conducted to supplement field measurements of the bedrock characteristics. A dye tracing study was conducted to determine the direction of groundwater flow in order to establish a site groundwater monitoring strategy. Findings of our revised geological/hydrogeological, geotechnical investigation, and laboratory testing are in our report.

S&ME, Inc., appreciates the opportunity to provide our geotechnical services and geological/hydrogeological evaluations. Please contact us if you need additional information or clarification.

Very truly yours,
S&ME, INC.

Pamela C. Henninger
Pamela C. Henninger, Ph.D., P.G.
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PCH/KCD/JJB/mc/59

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APPENDICES

EXECUTIVE SUMMARY

S&ME, Inc., has completed a geotechnical/hydrogeological investigation at the subject site located adjacent to the southeast perimeter of the existing Greeneville Landfill, Greene County, Tennessee. The proposed fill area encompasses 10.25 acres. The investigation was conducted in order to determine the suitability of the site as a Class IV Disposal Facility for demolition/construction wastes. Initially, soil samples were obtained from 17 test borings. Subsequently, a portion of the proposed fill area was excavated for borrow material. Soil samples were then obtained from 5 additional test borings. Also, a boring was drilled by air rotary drilling methods for installation of a monitoring well. Representative soil samples were selected for laboratory analysis of grain size, natural moisture content, Standard Proctor compaction, cation exchange capacity, and Atterberg limits tests. Hydraulic conductivities were determined for bulk samples (i.e., remolded) and for relatively undisturbed (Shelby) tube samples. Bedrock cores were obtained from three test borings.

Hydraulic conductivities for the relatively undisturbed (Shelby) tube samples obtained from soil borings prior to and subsequent to excavation ranged from 2×10^{-7} cm/s to 1×10^{-5} cm/s. These values satisfy the requirement for a minimum 5-foot geologic buffer having a maximum saturated hydraulic conductivity of 1×10^{-5} cm/s between the base of the fill and the seasonal high water table of the uppermost unconfined aquifer or the top of the formation for a confined aquifer.

Hydraulic conductivities for bulk remolded samples, representative of borrow material to be excavated for emplacement of demolition/construction waste, ranged from 2×10^{-7} cm/s to 3×10^{-7} cm/s. These values indicated suitability of the borrow material for landfill cover material. The material was subsequently excavated and has been used as landfill cover material. Additional soil test borings were conducted after the material was excavated. The depths to bedrock ranged from 12.5 feet to 23.0 feet, exceeding the 5-foot geologic buffer requirement.

Groundwater was encountered in the test boring (B-1, bedrock core) located within the proposed detention pond area and also in the test boring (B-18) drilled to install the background monitoring well. Based on our calculations using water level data and on our dye tracing study, groundwater occurs within the bedrock and flows to the northwest along a prominent joint set and southwest along the strike of bedrock and of a fault. Solution pitting observed within one of the bedrock cores (B-12) supports the determination that groundwater underlying the proposed landfill site is within the underlying bedrock.

Voids were not encountered within the overburden material at the subject site. Voids observed in the bedrock cores were restricted to a limited area near the overburden/bedrock interface. Bedrock was competent below this zone, with recoveries ranging from 80% to 100% and Rock Quality Designations (RQDs) ranging from 47% to 88%. There was no indication of collapse features.

The dominant weathering process at the site appears to be the chemical dissolution of the carbonate radical by slightly acid groundwater. This weathering process is focused in joints and along bedding; however, conduit flow is not indicated.

Our geotechnical/hydrogeological investigation indicates that the subject site is suitable for use as a Class IV Disposal Facility. In general, ample soil is present to meet the requirements for a 5-foot geologic buffer. The groundwater is below the overburden/bedrock interface within the landfill site area. Bedrock cores and test boring information indicate that the site is stable.

1.0 INTRODUCTION

The proposed fill area for the subject site consists of 10.25 acres, situated adjacent to the southern perimeter of the existing Greeneville Landfill in Greene County, Tennessee. The subject site has been proposed for use as a Class IV Disposal Facility, which would accept demolition/construction wastes. In order to evaluate a site for suitability as a Class IV Disposal Facility, the Tennessee Department of Environment and Conservation (TDEC) Division of Solid Waste Management (DSWM) requires that drilling be conducted in order to determine the hydrogeological conditions, subsurface profile, and to obtain soil samples for laboratory testing. Test borings are required to be located in an approximately equivalent triangular grid pattern in order to obtain representative information. Additionally, DSWM required for the subject site that 1) bedrock cores be obtained from the proposed detention pond area and also from the area underlying the landfill site, 2) a background monitoring well be installed, 3) an electrical resistivity survey be conducted, 4) a dye tracing study be conducted, and 5) water levels be obtained from selected monitoring wells.

Standard Test Boring (STB) soil samples are required to be obtained at 5-foot intervals. Soil samples are also required to be obtained from bulk samples and from relatively undisturbed (Shelby) tube samples. STB soil samples are required to be laboratory tested for grain size analysis, natural moisture content, Standard Proctor compaction, cation exchange capacity, and Atterberg limits. Bulk samples are required to be tested for hydraulic conductivity to determine the suitability of excavated soils for cover material. The relatively undisturbed (Shelby) tube samples are required to be evaluated to determine if soils at the proposed base elevation of the landfill meet the required minimum 5-foot layer of geologic buffer, which is specified as exhibiting a maximum saturated hydraulic conductivity of 1×10^{-5} cm/s between the base of the fill and the seasonal high water table of the uppermost unconfined aquifer or the top of the formation for a confined aquifer.

Because the subject site is located in an area of karst terrain, DSWM required 1) a rock core extending 50 feet into rock to be located beneath the proposed detention pond area, 2) a rock core extending 50 feet into rock in a representative area beneath the proposed landfill, and 3) a rock core extending 20 feet into rock at a location within the fill area on trend with the sinkholes in the wooded area adjacent to the southern perimeter of the site. Additionally, DSWM required that detailed geology be determined for the subject site area, with special attention to the location of sinkholes and structural features in the bedrock, such as faults. DSWM required that a dye tracing study be conducted and water levels be obtained where possible to determine the groundwater flow direction in order to establish a groundwater monitoring strategy for the site.

2.0 PHYSIOGRAPHY AND GEOLOGY

2.1 SITE DESCRIPTION

The proposed Greeneville Demolition Landfill site is located adjacent to the southern perimeter of the existing Greeneville Landfill on the north side of Old Stage Road, Greene County, Tennessee (Figure 1, Appendix A). The proposed fill area is 10.25 acres and is almost rectangular in shape. The site is situated on a hill slope which drains westwardly toward a ravine separating it from the existing, closed portion of the Greeneville Landfill (Figure 2, Appendix A). The ravine is typically dry. However, during periods of substantial precipitation, the ravine directs surface water toward Moon Creek, located south of the site on the south side of Old Stage Road. The site was previously open pastureland with a ground cover of grasses and weeds. Borrow material has been removed from the site. The removal of material changed the topography to a lower elevation (Figure 3, Appendix A).

2.2 PHYSIOGRAPHY

The subject site is located within the Valley and Ridge Physiographic Province of Tennessee. The province consists of a succession of northeast-trending ridges and valleys created by differential weathering of the underlying bedrock. The more resistant bedrock consists of dolomite, shale, and sandstone units. Between ridges, broad, rolling valleys are formed on less-resistant shale, dolomite, and limestone units. Sinkholes (closed depressions) typify the topographic expression in areas underlain by limestone and dolomite. As indicated on Figure 2 (Appendix A), four sinkholes were identified within the wooded area south of the perimeter of the proposed fill area. Three of the sinkholes are along the same trend and the fourth sinkhole is located at the southeastern corner of the proposed fill area next to the location of test boring B-18.

The most common process of sinkhole evolution is the migration of overburden material through rock fractures to underlying voids in the bedrock, with subsequent formation of a depression as the overburden material continues to migrate downward into the voids. In areas where a conduit groundwater flow regime predominates, overburden material may be repeatedly removed from the voids to allow for additional soil to accumulate, enlarging the sinkhole depression at the ground surface. However, where a diffuse groundwater flow regime is present, downward migration of overburden material into underlying voids in the bedrock is relatively slow, and surficial drainage accommodates accumulation of colluvial soils within the topographically lower areas, with subsequent infilling and stabilization. This latter process is evident at the subject site. The topographically lower areas are located within the ravine bordering the west side of the subject site. Soils are thick within these areas, mostly ranging from 17.0 feet to 53.2 feet (B-2 through B-14). There were no voids encountered within the overburden material during drilling operations.

2.3 GEOLOGY

Geologic materials underlying the subject site were determined based on nearby bedrock outcrops and on samples obtained from 22 test borings extended by use of a hollow-stem auger drilling rig. Geologic information was also obtained from a test boring (B-18) extended by an air rotary drilling rig. Test boring locations are provided in Figure 1 and Figure 2 (Appendix A). Test boring records are included in Appendix B. Test borings B-1 through B-18 were drilled prior to the excavation of surficial materials for borrow. After the borrow material was excavated, test borings B-19 through B-23 were drilled in the lower portion of the excavated area. The geologic materials encountered consist primarily of residuum comprised of yellowish red silt and clay with limestone or dolomite bedrock fragments locally. Fine sand laminae were observed within the yellowish red silt and clay in test borings B-1, B-12, and B-19. The intervals containing the fine sand laminae were each less than one-half foot in thickness. Bedrock fragments observed within samples obtained at the base of test borings consisted mostly of limestone, except in test borings B-20 and B-22, which contained chert fragments at the base of the test borings. Bedrock outcrops observed north of the subject site on the adjacent existing Greeneville Landfill and at topographically higher areas within the subject site consist predominantly of limestone with some cryptocrystalline quartz lenses. Chert nodules were observed in some of the bedrock outcrops within the wooded area south of the proposed fill area perimeter. The limestone is mostly dark gray with numerous laminae and with calcite infillings of fractures.

Measurements of outcrop bedrock attitudes indicate the strike trending N50°E, with dip measurements ranging from 78° to 98° to the southeast. Bedrock within the two 50-foot cores consisted of limestone with calcite-infilled fractures approximately 1 mm thick, dipping mostly at higher angles than the bedding features. The measured bedding dips ranged from 33° to 45° throughout the cores from test borings B-1 and B-17 and within the upper portion of the core from test boring B-12. Within the lower portion of the core obtained from B-12, at a depth of 51 feet, the bedding dip ranged from 69° to 80°. Also, calcite-filled fractures dipping 84° to 85° orthogonally to bedding planes were observed throughout the rock core in test boring B-1 and also in the fractured upper portion of the rock core from test boring B-12 and the lower portion of the rock core from test boring B-17. Joint sets trending N50°W, N70°W, and N10°W were observed within the bedrock outcrops in the wooded area south of the proposed fill area perimeter. The dips of the joint planes were obscured by weathering of the rock.

DSWM requested that S&ME, Inc., conduct an investigation to account for the exposed "rock spine" extending through the southwestern portion of the site. Measurements of bedrock orientation indicated that the "rock spine" was on trend with the strike of the bedrock (N50°E), the exposed beds interpreted as being more resistant to erosion than those to the north within the proposed fill area. Two test probes (TP-1 and TP-2 (shown on Figure 2, Appendix A) were conducted by drilling auger probes into the area adjacent and parallel to the "rock spine". The depths to auger refusal were 13.0 feet for TP-1 and 4.5 feet for TP-2.

Additionally, S&ME, Inc., supplemented this interpretation by conducting an electrical resistivity survey extending from the "rock spine" toward the proposed fill area at locations where borehole data was available (TP-1, TP-2, B-4, and B-16). The electrical resistivity survey was conducted using a Bison Model 2350 Resistivity Meter. Electrical resistivity field data and the electrical resistivity contour map (Figure A) are provided in Appendix D.

Higher resistivity measurements typically correlated with bedrock closer to the surface, as observed at the locations for test probes TP-1, TP-2, and the measurement close to the rock exposure at one end of the "rock spine". The resistivities mapped as contours corresponded approximately to the strike orientation of the bedrock, as measured in nearby outcrops. Results of the electrical resistivity survey data are therefore supportive of the interpretation that the "rock spine" is part of a geologic bed which is interpreted to be more resistant to erosion than rock to the north within the proposed fill area.

The Geologic Map of East Tennessee (1953) compiled by John Rodgers and also the Geologic Map of Tennessee (1966) compiled by the State of Tennessee assign the geologic unit underlying the subject site to the Cambrian/Ordovician Knox Group. The Ordovician Sevier Shale occurs approximately 0.5 mile to 1 mile west of the subject site. Based on the numerous laminae and observation of numerous cryptozoans, the bedrock exposures and upper portions of the bedrock cores obtained at the subject site may be designated as the lower portion of the Knox Group, consisting of the Conococheague

Formation. Also, in unpublished maps provided by Dr. Don W. Byerly (currently a professor at the University of Tennessee Department of Geological Sciences), bedrock underlying the site is assigned to the Conococheague Formation. Bedrock underlying the areas to the northwest, northeast, and southeast are assigned by Dr. Byerly to the Jonesboro Limestone.

Dr. Byerly interprets that limestone of the Conococheague Formation was thrust upward along a fault trending southwest-northeast onto the Jonesboro Limestone. Available measurements provided by Dr. Byerly and also measurements of outcrops obtained during the present investigation indicate that the Jonesboro Limestone dips steeply 75° to 85°, whereas dips range from 20° to 50° within the Conococheague Formation. The dip inclination varies within the area because of close proximity to the projected fault within the area, as identified by Dr. Byerly. Bedrock was encountered at a depth of 33 feet in test boring B-12. A bedrock core was then obtained to a depth of 83 feet. There is a notable change in the dip inclination at a depth of 51 feet: dips within the upper portion of the core are approximately 45°, whereas dips within the core below 51 feet range from 69° to 80°. Also, the rock is highly fractured from 52 feet to 53 feet within the core. This could be indicative of the fault trace, with Conococheague limestone (upthrown) in the upper portion and Jonesboro limestone (downthrown) in the lower portion.

Bedrock was encountered at a depth of 20 feet in test boring B-1, located beneath the proposed detention pond area. Within the core, slickensides were observed along a fracture within a depth to 20 feet to 25 feet, and offsets along vertical, calcite-infilled fractures were also noted. These features may also be indicative of the fault trace.

Bedrock was encountered at a depth of 21 feet in test boring B-17, located along trend and downhill from three sinkholes. Calcite-infilled fractures dipping approximately 85°

orthogonally to bedding were noted at a depth of 41 feet to 42.6 feet, at the base of the core. These features may also be indicative of proximity to the fault trace.

Bedrock assigned to the Conococheague Formation is generally difficult to distinguish from bedrock assigned to the Jonesboro Limestone. These units are distinguished within the subject site area based on tracing basal formational contacts and formational unit thicknesses regionally. Descriptions of the Conococheague Formation and the Jonesboro Limestone are provided in two, unpublished Ph.D. dissertations: "Structural Geology Along a Segment of the Pulaski Fault, Greene County, Tennessee" (1966), by Don W. Byerly; and "Lithostratigraphy and Structural Geology of a Portion of the Dunham Ridge Thrust Block, Greene and Washington Counties, Tennessee" (1969), by Robert L. Little. Byerly (1966) and Little (1969) both describe the lower 200 to 300 feet of the Jonesboro Limestone as a section containing numerous beds of fine- to medium-grained, cross-bedded sandstone, ranging up to 18 to 24 inches in thickness. No sandstone was observed in bedrock cores obtained from the subject site. However, sandstone cobbles and boulders were observed in a trenched area along the southeastern perimeter of the proposed fill area. The remainder of the Jonesboro Limestone is described as a primarily dark bluish gray, dolomitic, fine- to medium-grained limestone that weathers to a characteristic medium bluish gray. Byerly (1966) describes the unit as medium-bedded. Little (1969) describes the unit as thick-bedded. Both references identify thin layers which impart a "ribboned" effect, due either to irregularly crenulated laminae of silty clay (Little, 1969) or thin layers of dolomite (Byerly, 1966). Chert is sparse in the Jonesboro Limestone. The thickness of the Jonesboro Limestone in the Greeneville area is approximately 2,000 feet.

Byerly (1966) describes the Conococheague Formation within the area of the subject site as consisting mainly of alternate thin to medium beds of dark bluish gray limestone and silty dolomite. The lighter colored dolomite forms "ribbons" within the limestone beds.

Oolites and silicified intraformational conglomerates also comprise some of the limestone beds. In the upper portion of the Conococheague Formation, limestone weathers to a distinctive medium bluish gray color, similar in appearance to much of the overlying Jonesboro Limestone. Dark, flinty chert nodules or chertified cryptozoans have been observed to occur locally throughout the section. A 50-foot thick basal sandy zone occurs at the bottom of the lowest sandstone bed of the Conococheague Formation. The sandstone consists of cross-bedded and ripple marked feldspathic sandstones averaging one foot in thickness.

In addition to the fault evident at the subject site, the Pulaski fault zone is located greater than one mile west of the subject site. Although the Valley and Ridge Physiographic Province of Tennessee does experience earthquakes, this tectonic activity is not generally considered to be associated with crustal faulting. Studies of the area indicate that movement along the noted thrust faults identified in the area occurred during the latter part of the Appalachian orogeny, that is, approximately 320 million to 350 million years ago.

Bedrock at the subject site is considered to be stable because there is no evidence of rock collapse and because evidence indicates that potential sinkholes identified within the ravine were formed as a result of the downward migration of overburden material. Voids within the bedrock are located 3 feet to 10 feet below the overburden/bedrock interface. Additional voids were not encountered. Surface runoff within focused drainageways is evidently the dominant weathering process at the subject site. The solution of bedrock is slow compared to the focused surface drainage, which has resulted in soils infilling potential sinkholes.

2.4 HYDROGEOLOGY

Groundwater flow at the site is interpreted to occur under gravity-induced head at atmospheric pressure, that is, under typical water-table conditions. Because the groundwater occurs within limestone, it is understood that groundwater flows primarily along bedding planes and fractures enlarged by solution, which constitute zones of secondary porosity. Public water supply intakes are beyond a two-mile radius from the site.

Groundwater was encountered at a depth of 70 feet (elevation 1496.2 feet MSL) within the bedrock at test boring B-18. A monitoring well was installed in test boring B-18 to be used as the background monitoring well for the site. Groundwater was encountered at the overburden/bedrock interface, at a depth of 19.5 feet (elevation 1501.03 feet MSL), within test boring B-1 (beneath the proposed detention pond area) during drilling operations at the subject site. Groundwater was not encountered within any of the other test borings. However, moist residuum was encountered above the residuum/bedrock interface within most of the test borings.

Water elevations from the two existing monitoring wells (MW-1 and MW-5, installed for monitoring the adjacent landfill site) and from the newly installed monitoring well within test boring B-18 were used to help determine the groundwater flow direction by using the 3-point solution method (Table II, Appendix E). Water elevations are provided in Table III (Appendix E). Based on our calculations and assuming that the groundwater from the selected wells is connected within a flow network, the groundwater flow direction is approximately N53°W. This direction closely approximates the orientation of one of the joint sets measured in nearby bedrock outcrops, N50°W. A potentiometric map (Figure 4, Appendix A) was developed from the water level measurements obtained on October 5, 1995.

A dye tracing study was conducted in order to assist in determining the groundwater flow direction. Approval of our "Application for Authorization for Class V Underground Injection Well" (included in Appendix E) was granted by the TDEC Division of Water Supply. In order to test for the presence of any type of dye in the groundwater, a background test was conducted by installing carbon dye packets within the 14 monitoring points: the new monitoring well in test boring B-18; 3 existing monitoring wells at the Greeneville Landfill site; 3 residential wells; the production well at Alltrista Zinc Products; and near or within 6 springs. A listing of the monitoring points is provided in Table IV, Appendix E. Also, the locations of the monitoring points are shown on Figure B, Appendix E. The carbon dye packets were analyzed by Ewers Water Consultants, Inc. (EWC), located in Richmond, Kentucky. The background analysis indicated the presence of a blue dye. Therefore, dye injection was postponed until September 29, 1995, to allow the blue dye to dissipate.

On September 29, 1995, five gallons of dilute Uranine Liquid tracing dye (Acid Yellow 73) were injected into the monitoring well in test boring B-18 at the subject site. Pumping was conducted at monitoring wells MW-1 and MW-5 during dye injection procedures in order that non-flowing water would not falsely indicate non-detection. The dye packets were collected from monitoring wells MW-1 and MW-5 after dye injection procedures and replaced with clean dye packets. The dye packets were collected from all of the monitoring points on October 5, 1995, and sent to EWC for analysis. The results of the analyses are provided in Table III, Appendix E.

Results of the dye injection study indicate that groundwater flow is to the northwest. Acid Yellow 73 dye was detected in the dye packet obtained on September 29, 1995, from monitoring well MW-5. Acid Yellow 73 dye was detected in the dye packets obtained on October 5, 1995, from monitoring well MW-5, monitoring point 8 (Pickett spring), and monitoring point 9 (Moon Creek downstream from Pickett spring). The direction of groundwater flow indicated by the dye tracing study is to the northwest (toward monitoring well MW-5) and to the southwest (toward Pickett spring). It is our interpretation that groundwater flow directions are controlled primarily by the joint set oriented approximately N50°W and the bedrock strike, which is the same trend as the fault strike.

3.0 SUBSURFACE INVESTIGATION

S&ME, Inc., conducted 22 test borings at the subject site in order to determine the depth to bedrock and to obtain soil samples for laboratory testing. Initial test borings (B-1 through B-15) drilled in September, 1994, were located in an approximate equivalent triangular grid pattern having an approximate 200-foot spacing between holes. Test borings were thus located to obtain representative information from locations on the hill slope, within the ravine bordering the west perimeter of the subject site, and within the area considered for placement of the detention pond.

In February, 1995, DSWM requested that two auger test probes (TP-1 and TP-2 on Figure 2, Appendix A) be conducted near a "rock spine" to determine the depth to rock and an additional test boring (B-16 on Figure 2, Appendix A) near a rock outcrop. This information was supplemented by our electrical resistivity survey described in Section "2.3 GEOLOGY". As requested in the DSWM letter of December 9, 1994, an additional core from test boring B-17 and a monitoring well installed in test boring B-18, were completed in February, 1995, and May, 1995, respectively.

In September, 1995, DSWM required that additional test borings to bedrock be conducted in the fill area where borrow material had been excavated (B-19 through B-22) and also from the area where the demolition landfill would abut the existing landfill (B-23). He indicated that information from the test borings must demonstrate that a sufficient depth of geologic buffer material still remained after the excavation. Additionally, he required that another relatively undisturbed (Shelby) tube sample be obtained in order to demonstrate that the remaining material exhibited a hydraulic conductivity commensurate with those obtained previously. Location coordinates and elevations were provided by the Vaughn and Melton surveying crew. Test boring coordinates and elevations Table V) and the Test Boring Records are provided in Appendix B.

3.1 DRILLING PROCEDURES

S&ME, Inc., conducted the 22 test borings and 2 auger test probes at the subject site utilizing a Mobile B-57 or a Mobile B-61 hollow-stem auger drill rig. An air rotary drill rig was used to extend test boring B-18 for installation of the monitoring well. Test borings B-1, B-12, and B-17 were advanced by the standard test boring method to bedrock, and then extended by coring into bedrock. Test borings were located approximately in a triangular grid pattern, as recommended by DSWM in Technical Guidance Document 001. A 200-foot or closer spacing was maintained between most of the test boring locations (Figure 2, Appendix A). Test boring locations were offset from the equivalent triangular grid pattern in order to obtain the most representative sample information and also to include exploration of two areas having the potential for sinkhole features (B-5 and B-9).

Soil test borings were advanced using hollow-stem augering techniques to depths ranging from 9.0 feet to 53.2 feet. Standard penetration tests (ASTM D-1586) were conducted at 5-foot intervals (or less) to obtain standard penetration resistance values and to obtain split-spoon samples. The standard penetration resistance provides an indication of the density and consistency of the in-place soils and can be utilized with empirical correlations to estimate physical properties and engineering characteristics for most soils. A registered geologist examined the split-spoon samples to provide detailed descriptions in the test boring records (Appendix B). Selected samples were submitted for laboratory testing.

In addition to the split-spoon samples, 5 bulk samples and 5 relatively undisturbed (Shelby) tube samples (using ASTM D-1587) were obtained from the test borings. The bulk samples were obtained from auger cuttings in order to evaluate the suitability as potential landfill cover materials. The undisturbed tube samples were obtained near the projected base elevation to assist in evaluating the suitability of in-place material as geologic buffer material.

3.2 SUBSURFACE PROFILE

Soils present at the subject site prior to excavation consisted of Dunmore silty clay loam (based on published data in the "Soil Survey - Greene County Tennessee", 1958, USDA Soil Conservation Service). The soils were developed on limestone residuum. Prior to excavation, thicknesses of residuum generally ranged from 9.0 feet to 53.2 feet, but mostly ranged from approximately 20 feet to 30 feet. One area of exception was near the "rock spine", where test auger probes (TP-1 and TP-2) indicated the depth to bedrock to range from 13.0 feet to 4.5 feet, respectively. Within the northeasternmost portion of the proposed landfill site, bedrock was encountered at a depth of 9.0 feet, much more shallow than within most areas in the remainder of the site. The top of bedrock elevations generally increase with increasing ground surface elevations. Test borings drilled within the area which had been excavated indicated thicknesses of residuum ranging from 12.5 feet to 23.0 feet. After excavation, rock outcrops were exposed at approximately 5 isolated locations. Geologic buffer material to the required thickness of 5 feet will be used to cover the exposures prior to infilling with demolition waste material. Figure 5 and Figure 6 (Appendix A) provide cross-sectional maps indicating the bedrock profile along cross-section A-A′ and cross-section B-B′, respectively.

Test borings B-1 and B-12 were extended 50 feet into bedrock and test boring B-17 was extended 20 feet into bedrock using diamond-bit coring techniques. Bedrock was encountered at a depth of 20.0 feet in test boring B-1. A bedrock core was then obtained to a depth of 70 feet. The rock consists of dark gray limestone with numerous calcite-infilled fractures approximately 1 mm to 2 mm in thickness. The calcite-infilled fractures are inclined approximately 84°, in contrast to the dip of bedding features, approximately

33° to 49°. Between depths of 20 feet to 25 feet in the core, slickensides were observed along one fracture plane and calcite-infilled fractures were commonly offset. Few calcite-infilled fractures were observed below 55 feet. A void or highly fractured rock was encountered between 30 feet and 32 feet. Solution pitting was observed at 40.5 feet and between 48.0 feet and 48.5 feet. Three soil-filled fractures were observed between 50.0 feet and 50.5 feet. Recoveries were 100% throughout the core. Rock Quality Designations (RQDs) ranged from 52% to 83%.

Bedrock was encountered at a depth of 33 feet in test boring B-12. A bedrock core was then obtained to a depth of 83 feet. The rock consists of medium gray limestone. From depths between 33 feet and 51 feet, dips of bedding features within the core are approximately 45°. Dips of bedding features within the core below 51 feet range from 69° to 80°. Voids were encountered at depths ranging from 36 feet to 37 feet, from 38 feet to 38.5 feet, and from 40 feet to 41.5 feet. Highly fractured rock was encountered from 52 feet to 53 feet. Solution pitting and highly fractured rock was observed from 81.0 feet to 83.0 feet. Recoveries ranged from 80% to 100% and RQDs ranged from 47% to 88%.

Bedrock was encountered at a depth of 21 feet in test boring B-17. A bedrock core was then obtained to a depth of 42.6 feet. The rock consists of medium gray limestone. Dips of bedding features within the upper portion of the core range from 35° to 45°. Calcite-filled fractures, dipping approximately 85° were observed from 41.0 feet to 42.6 feet. Recovery was 100% and the RQD was 82%.

3.3 ELECTRICAL RESISTIVITY SURVEY

The resistivity survey was conducted using the Wenner electrode array, in which four electrodes, spaced at regular distance intervals, are connected to the resistivity meter with the current electrodes (I) on the outside and the potential electrodes (P) on the inside. The sequence is I_1-P_1-P_2-I_2. Smaller distance intervals between electrodes are selected if the bedrock is known to be relatively close to the ground surface. Based on test borehole depths to rock, the selected distance interval between electrodes was 10 feet. The unit of resistivity is ohms-times-length; therefore, the resistivities reported are expressed as ohm-feet.

3.4 LABORATORY PROCEDURES

Laboratory testing performed on soil samples obtained from the test borings consisted of Atterberg limits, natural moisture content determinations, Standard Proctor compaction, permeability, and cation exchange capacity. Atterberg limits tests and natural moisture content determinations were conducted on representative split-spoon samples obtained from standard penetration testing, from bulk samples obtained from the auger cuttings of selected borings, and from relatively undisturbed (Shelby) tubes obtained from selected borings. Natural moisture content determinations, standard Proctor compaction, and remolded permeability tests were performed on bulk samples collected from soil test boring locations within areas where soil was designated for use as borrow for cover material. Permeability tests were also conducted on relatively undisturbed (Shelby) tube samples of soil. Laboratory test results are presented in Appendix C.

3.5 LABORATORY TEST RESULTS

Atterberg limits tests (ASTM D-4318) provide information utilized to determine the classification of soils. Atterberg limits testing was performed on 4 bulk samples, 3 relatively undisturbed (Shelby) tube samples from material which was subsequently excavated, and 1 relatively undisturbed (Shelby) tube sample from residuum remaining after excavation. Liquid limits obtained from the Atterberg limits tests indicate values ranging from 38 percent to 60 percent. Natural soil moistures were obtained from 26 soil samples. The natural soil moisture values ranged from 22.1 percent to 62.0 percent. Moisture content generally increased with sample depth. Plasticity index values ranged from 19 to 34. Standard Proctor compaction testing (ASTM D-698) was performed on 4 bulk samples obtained from soil test borings to determine the suitability of soils as landfill cover material. Standard Proctor maximum dry densities ranged from 98.4 to 103.4 pounds per cubic foot (pcf) at optimum moisture contents ranging from 19.7 percent to 23.1 percent. The higher maximum dry densities correspond to the drier optimum compaction moistures. Natural soil moistures were significantly higher than the optimum compaction moistures.

Falling head permeability tests (ASTM D-5084) were performed on 4 bulk soil samples (remolded) and on 4 relatively undisturbed (Shelby) tube soil samples (including the sample obtained from the area of excavation) to determine the coefficient of permeability of these soils in a saturated state. Coefficients of permeability for the relatively undisturbed (Shelby) tube samples obtained from samples prior to excavation ranged from 6×10^{-7} cm/s to 1×10^{-5} cm/s. The coefficient of permeability for the relatively undisturbed (Shelby) tube samples obtained from sample within the excavated area was 2×10^{-7} cm/s. Coefficients of permeability for the remolded bulk samples ranged from 2×10^{-7} cm/s to 3×10^{-7} cm/s. Samples were remolded at moistures ranging from approximately 3 percent to 5 percent higher than optimum compaction moistures. The samples were compacted with the standard Proctor compaction energy and permeability samples were obtained from the compacted specimens.

Grain size analyses were conducted on representative soil samples using U.S. Standard Sieve Sizes. Results of the grain size analyses were used in conjunction with results of the Atterberg limits tests to aid in classification of the materials in accordance with the Unified Soil Classification System. Laboratory test results indicated that the representative soils at the site are elastic silts and clays with Unified Soil Classification System designations of CH and CL.

Cation exchange capacity tests were performed on 3 soil samples to determine the clay mineral's ability to adsorb cations (positive ions). The results of the tests indicate the number of equivalent weight of an ion adsorbed per 100 grams of soil. Cation exchange capacities for the soils tested ranged from 11.4 to 14.8 milliequivalents per 100 grams.

4.0 SUMMARY AND CONCLUSIONS

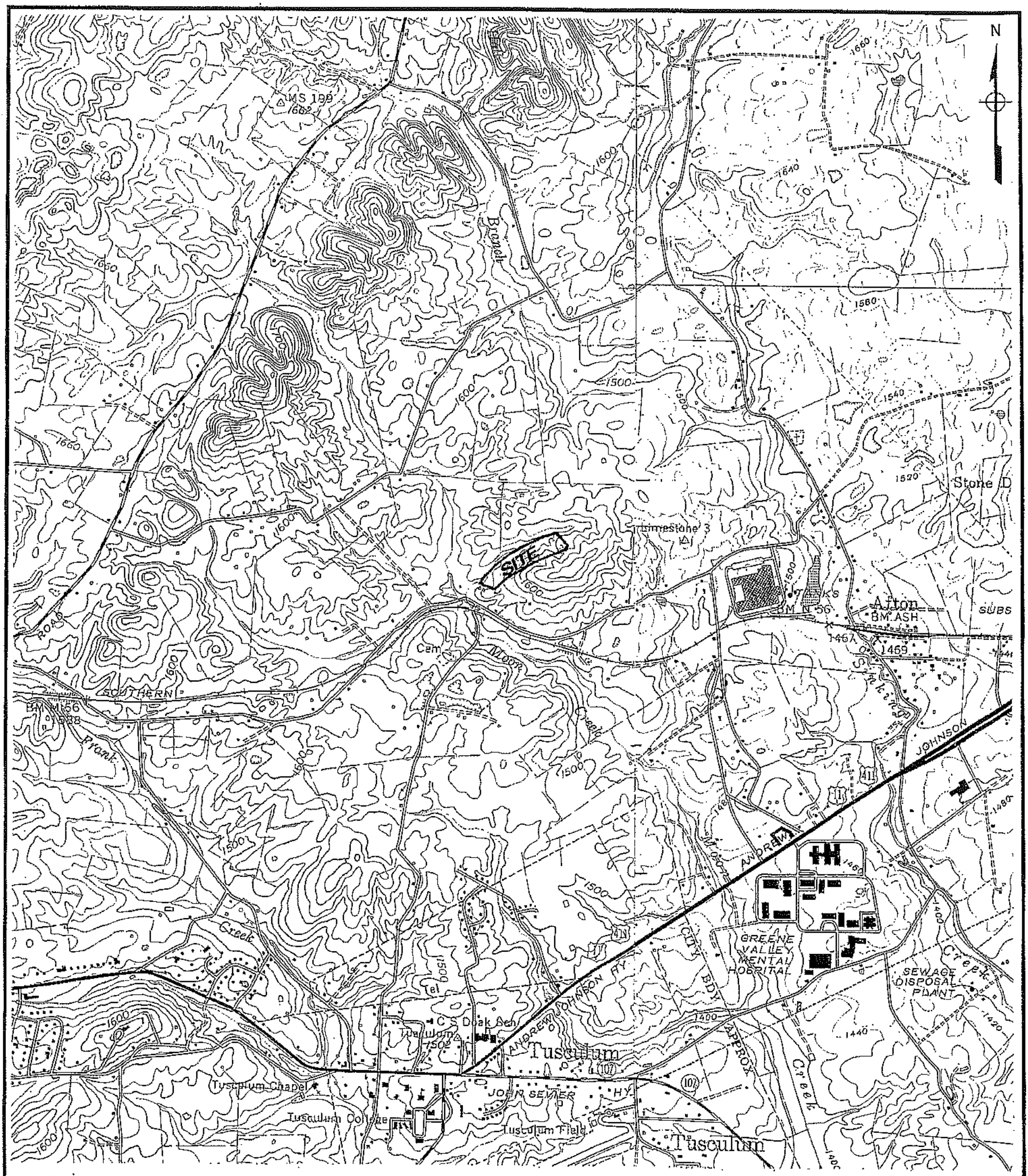
Representative soil samples were obtained from 22 test borings located within the subject site. Initial test borings were located on an approximately equivalent triangular grid pattern having an approximate 200-foot spacing between holes. After excavation of material to be used for borrow, additional test borings drilled to confirm that sufficient geologic buffer material remained underlying the proposed fill area. Three of the test borings were extended into bedrock to obtain geologic/hydrogeologic information. Soil samples were obtained by split-spoon sampling methods, bulk sampling methods, and relatively undisturbed (Shelby) tube sampling methods using hollow-stem auger drilling equipment. Air rotary drilling methods were used for the test boring established for installation of the background monitoring well.

For a Class IV Disposal Facility, it is required that a geologic buffer thickness of at least 5 feet be present below the proposed landfill base. The geologic buffer must have a maximum saturated hydraulic conductivity of 1×10^{-5} cm/s between the base of the fill and the seasonal high water table of the uppermost unconfined aquifer. Soils within the proposed landfill subgrade at the subject site meet this requirement. The relatively undisturbed (Shelby) tube samples obtained from the geologic buffer zone exhibit hydraulic conductivities ranging from 2×10^{-7} cm/s to 1×10^{-5} cm/s. Isolated outcrops at the site will be covered with 5 feet of geologic buffer in order to comply with Rule 1200-1-7-.04(3)(c). The uppermost unconfined aquifer is within the bedrock underlying the site. Evidence of solution pitting, indicative of the presence of groundwater, within the bedrock core at test boring location B-12, underlying the proposed landfill site, supports our interpretation that groundwater is within the bedrock underlying the proposed landfill area.

Representative soil samples were obtained for laboratory analysis of grain size, natural moisture content, Standard Proctor compaction, cation exchange capacity, and Atterberg limit tests. Natural soil moistures were observed to increase with depth, exhibiting greatest moistures close to the soil/bedrock interface. The soils consist primarily of yellowish red silty clay and are classified under the Unified Soil Classification System as mostly CH. Only some of the soils are classified as CL.

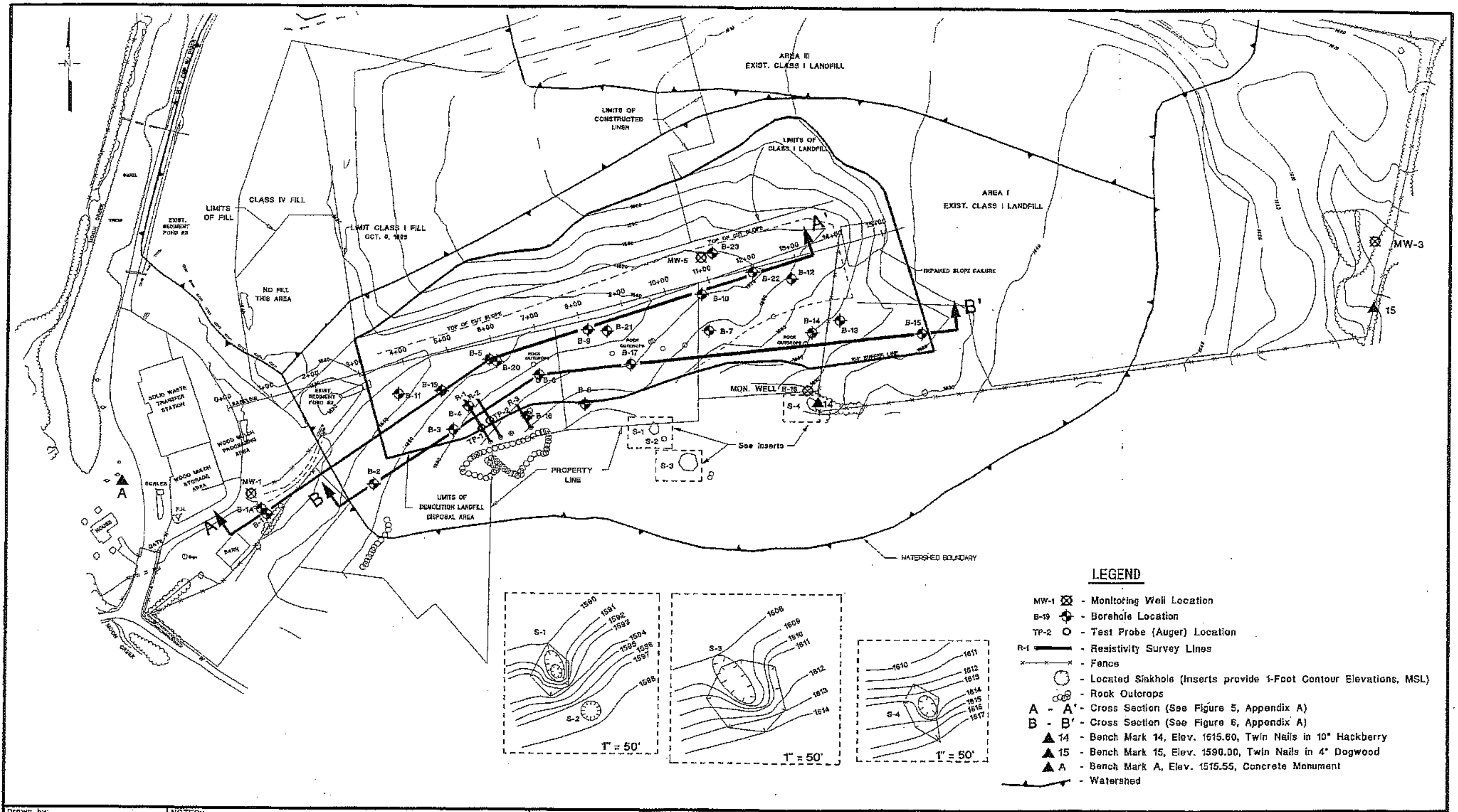
Bedrock was encountered at depths ranging from 9.0 feet to 53.2 feet. Bedrock underlying the site consists predominantly of limestone. Surface drainage is directed away from the subject site by ravines. There are no areas of internal drainage and there are no active sinkholes. Test borings were placed in two locations where the topography was low near the ravine bordering the northern perimeter of the subject site. No voids were encountered within the overburden material. Voids encountered in the bedrock were restricted to a limited area near the overburden/bedrock interface. Bedrock was competent below this zone, with recoveries ranging from 80% to 100% and RQDs ranging from 47% to 88%.

The subject site meets the requirements for a Class IV Disposal Facility. The projected base elevation of the landfill allows for the required minimum 5-foot layer of geologic buffer, with a maximum saturated hydraulic conductivity of 1×10^{-5} cm/s between the base of the fill and the seasonal high water table of the uppermost unconfined aquifer or the top of the formation for a confined aquifer. Isolated outcrops at the site will be covered with 5 feet of geologic buffer in order to comply with Rule 1200-1-7-.04(3)(c). Based on results of our calculations using water levels and from the dye tracing study, we interpret the groundwater flow direction to be to the northwest (along a dominant joint set direction) and southwest (along strike of the bedrock and of a fault). The site is therefore readily monitored using the background monitoring well in test boring B-18, one of the existing wells (MW-5) located downgradient to the northwest, and Pickett spring located downgradient to the southwest. Evidence for site stability includes the lack of voids in overburden material, no active tectonics which would indicate a potential for earthquakes, and a predominance of high RQD values in bedrock observed to be competent.

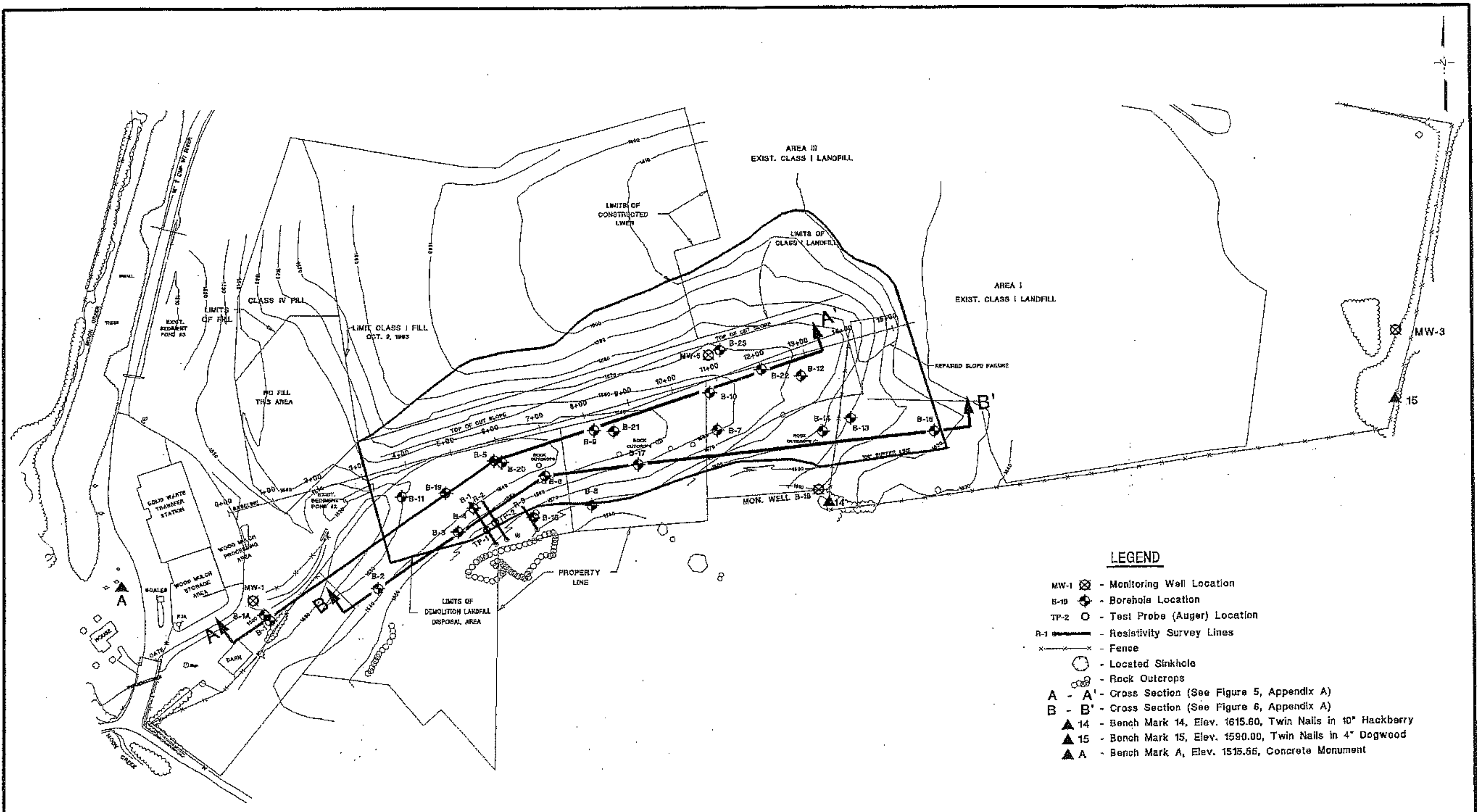


NOTE: Developed from Greeneville, TN and Chucky, TN USGS 7.5-Minute Quads.

PROJECT		
SITE LOCATION MAP GREENEVILLE DEMOLITION LANDFILL SITE GREENEVILLE, TENNESSEE	S&ME ENVIRONMENTAL SERVICES ENGINEERING TESTING	SCALE: 1" = 2000' JOB NO.: 1404-94-051-A FIG. NO.: Figure 1



Drawn by: B.C.B.	NOTES:	S&ME ENVIRONMENTAL SERVICES ENGINEERING TESTING TRI-CITIES BRANCH, BLOUNTVILLE, TENNESSEE	SITE & BORING LOCATION PLAN SHOWING ORIGINAL TOPOGRAPHY GREENEVILLE DEMOLITION LANDFILL GREENEVILLE, TENNESSEE
Revised:			
Date: 10-26-95	Plan developed from Vaughn & Melton file 29201-07.		PROJECT NO.: 1404-94-051-A
Scale: 1" = 200'	Approved by: PCH		DRAWING NO.: Figure 2



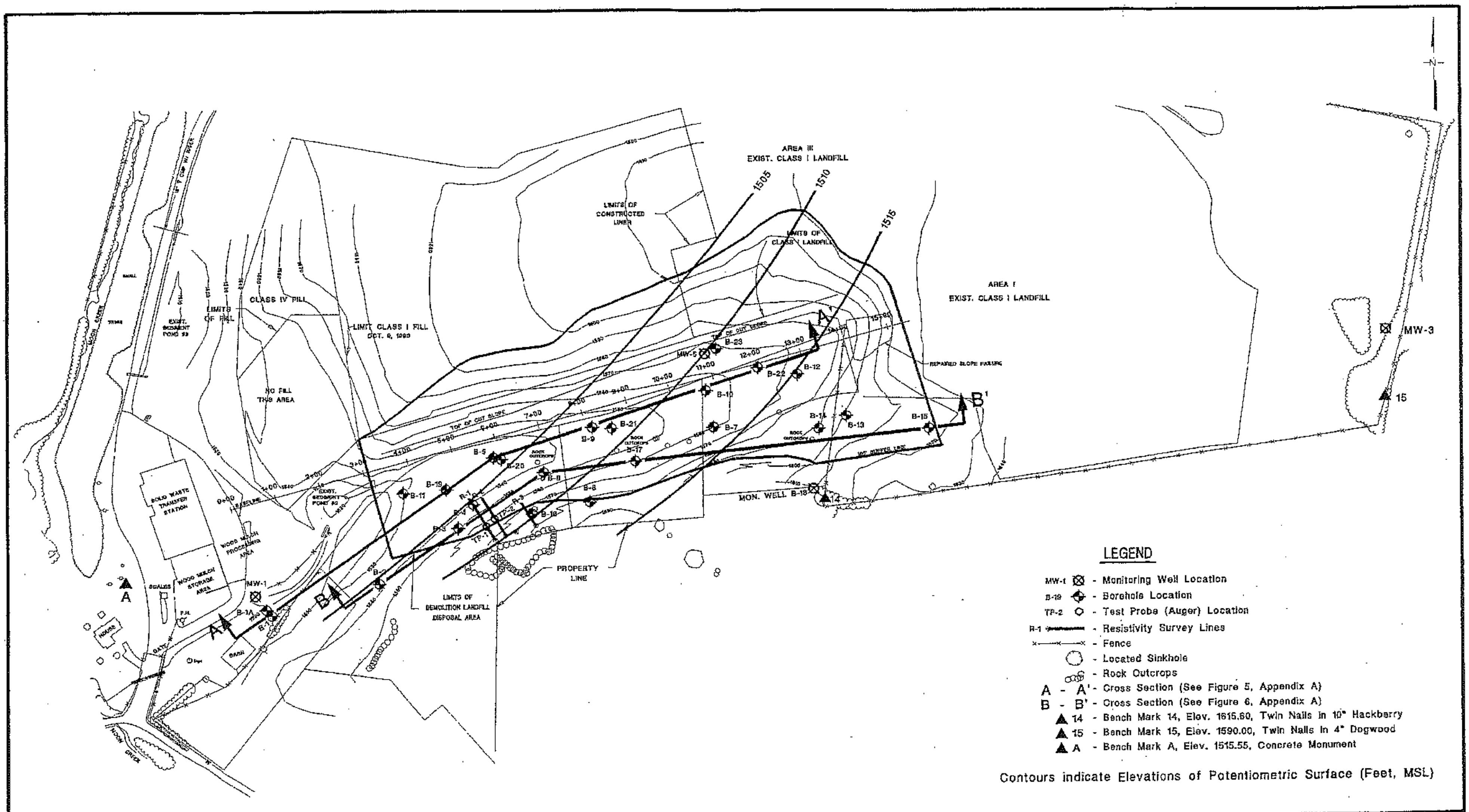
Drawn by: B.C.B.
Revised:
Date: 10-26-95
Scale: 1" = 200'

NOTES:
Plan developed from Vaughn & Melton file 29201-07.
Approved by: PCH

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING TESTING
TRI-CITIES BRANCH, BLOUNTVILLE, TENNESSEE

SITE & BORING LOCATION PLAN
SHOWING EXISTING TOPOGRAPHY
GREENEVILLE DEMOLITION LANDFILL
GREENEVILLE, TENNESSEE

PROJECT NO.: 1404-94-051-A
DRAWING NO.: Figure 3



Drawn by:	B.C.B.	NOTES:
Revised:		The Potentiometric Map is based on water elevations obtained on 10-5-95.
Date:	10-26-95	Plan developed from Vaughn & Melton file 29201-07.
Scale:	1" = 200'	Approved by: PCH

S&ME
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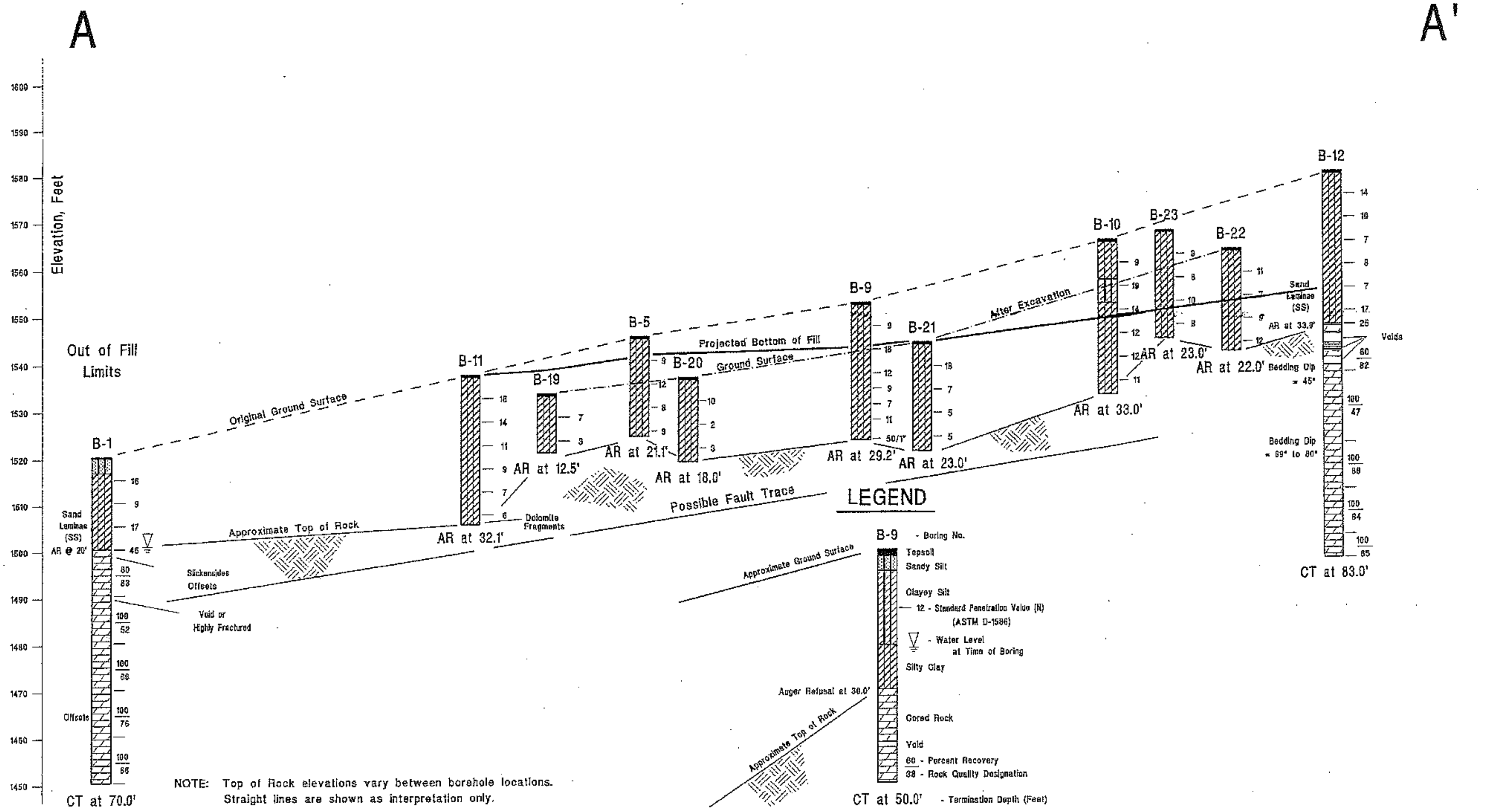
ENGINEERING TESTING
TRI-CITIES BRANCH, BLOUNTVILLE, TENNESSEE

POTENTIOMETRIC MAP
GREENEVILLE DEMOLITION LANDFILL
GREENEVILLE, TENNESSEE

PROJECT NO.: 1404-94-051-A

DRAWING NO.: Figure 4



NOTE: Top of Rock elevations vary between borehole locations. Straight lines are shown as interpretation only.

Drawn by: B.C.B.

Revised:

Date: 10-12-94

Scale: 1" = 100' Hort.
1" = 20' Vert.

NOTES:

Test Borings B-19, B-20, B-21, B-22, and B-23 were drilled after the area was excavated for borrow. Test Boring B-23 is offset 71 feet left (north) of centerline to show material abutting the existing landfill slope.

Approved by: PCH

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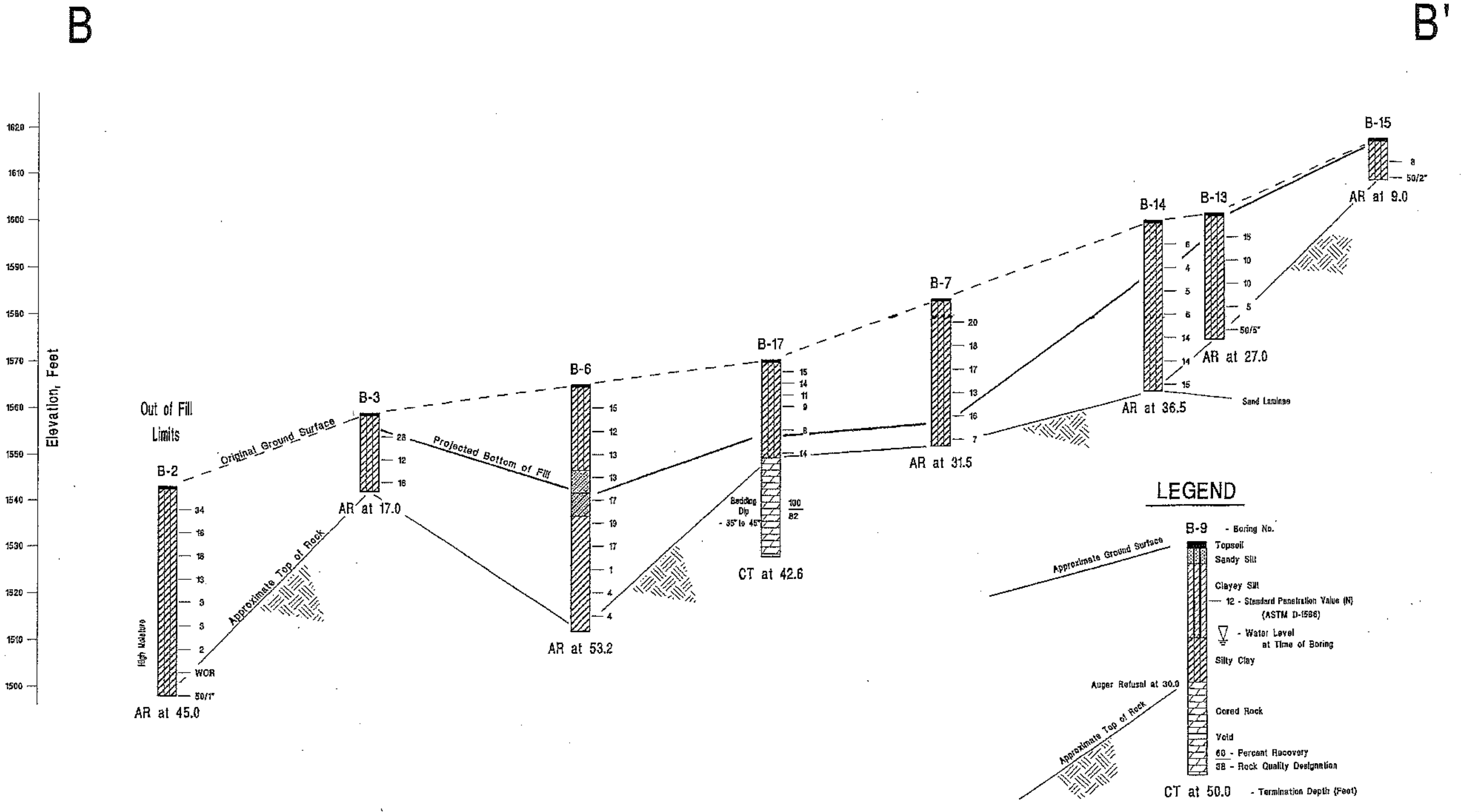
ENGINEERING TESTING

TRI-CITIES BRANCH, BLOUNTVILLE, TENNESSEE

CROSS SECTIONAL MAP A - A'
GREENEVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE

PROJECT NO.: 1404-94-051-A

DRAWING NO.: Figure 5



Drawn by:	B.C.B.
Revised:	
Date:	10-12-94
Scale:	1" = 100' Hort. 1" = 20' Vert.

NOTES:

Excavation for borrow material was not conducted within the area in Cross Section B - B'. Top of Rock elevations vary between borehole locations. Straight lines are shown as interpretation only.

Approved by: PCH

S&ME
ENVIRONMENTAL SERVICES ENGINEERING TESTING
TRI-CITIES BRANCH, BLOUNTVILLE, TENNESSEE

CROSS SECTIONAL MAP B - B'
GREENEVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE

PROJECT NO.: 1404-94-051-A

DRAWING NO.: Figure 6

LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPES

(Shown in Graphic Log)

■	Topsoil
⁘	Gravel
░	Sand
▥	Silt
▨	Clay
▤	Organic
░	Sandy
▥	Silty
▨	Clayey
▥	Silty Sand
▨	Clayey Sand
▥	Sandy Silt
▥	Clayey Silt
▨	Sandy Clay
▨	Silty Clay
▨	Partially Weathered Rock
▦	Cored Rock

WATER LEVELS

(Shown in Water Level Column)

▽ = Water Level At Termination Of Boring

▼ = Water Level Taken After 24 Hours

◀ = Loss Of Drilling Water

HC = Hole Cave

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Soft	0 to 2
Soft	3 to 4
Firm	5 to 8
Stiff	9 to 15
Very Stiff	16 to 30
Hard	31 to 50
Very Hard	Over 50

RELATIVE DENSITY OF COHESIONLESS SOILS

RELATIVE DENSITY	STD. PENETRATION RESISTANCE BLOWS/FOOT
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

SAMPLER TYPES

(Shown in Samples Column)

■	Shelby Tube
☒	Split Spoon
I	Rock Core
☐	No Recovery

TERMS

Standard Penetration Resistance – The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586

REC – Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

RQD – Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks exluded) Divided by the Total Length of the Core Run Times 100%.

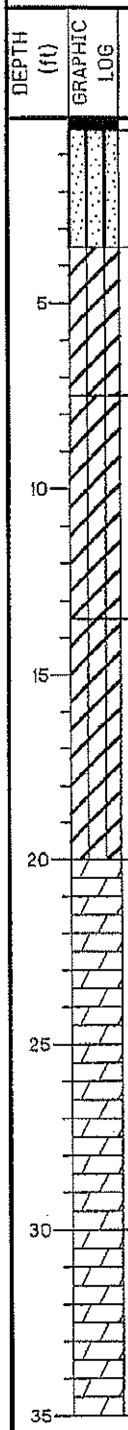
S&ME

Tri-Cities Branch
2153 Highway 75
P.O. Box 1118 TCAS
Blountville, T.N.
37617
(615) 323-2101

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD B-1**

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1520.53__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*70.0__FEET*
DATE DRILLED:	*9-8-94*	**WATER LEVEL @ T.O.B.:**	*19.5 Feet*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



Soil Description

Topsoil

RESIDUUM - Reddish Brown Sandy **SILT** (CH)

RESIDUUM - Reddish Brown Silty **CLAY** (CH)
with Dolomite Fragments

RESIDUUM - Reddish Brown Silty **CLAY** (CH)

RESIDUUM - Yellowish Red Silty **CLAY** (CH)
with Sand Laminae from 14.0 to 14.5 feet

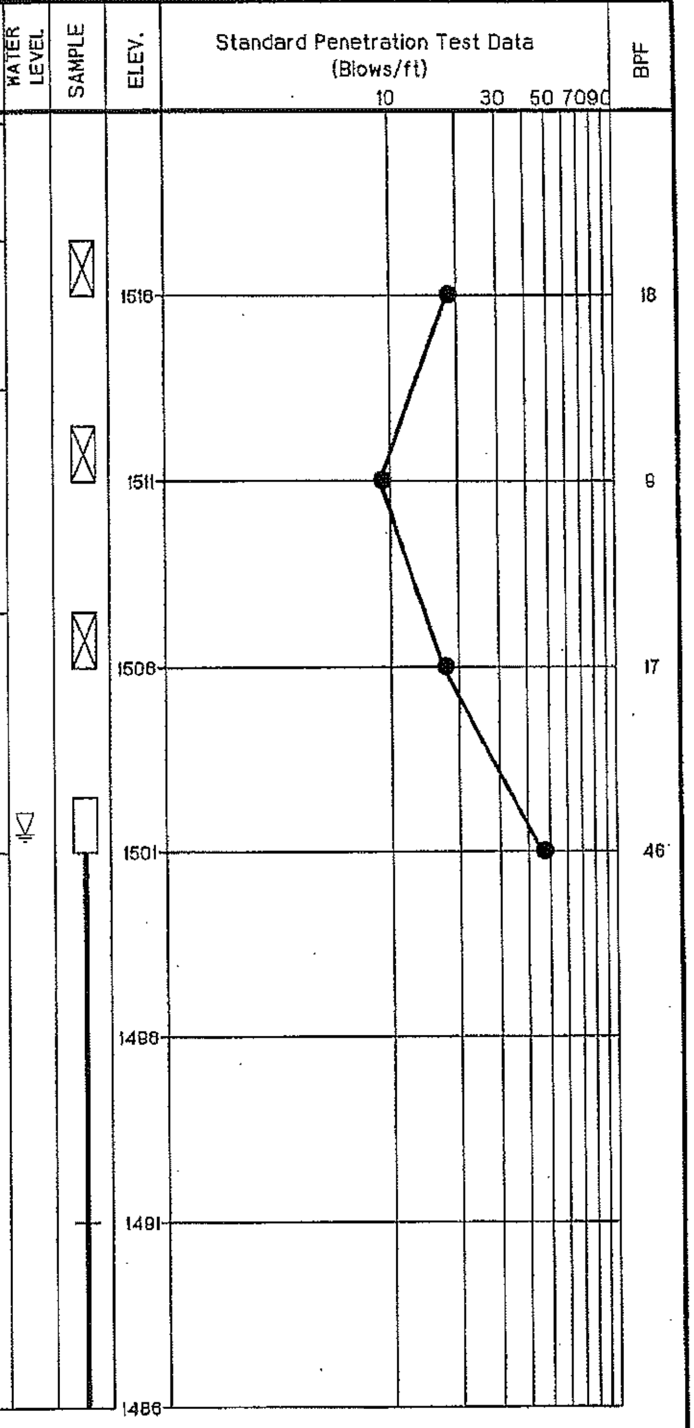
Auger Refusal at 20.0 Feet
Dark Gray **LIMESTONE** with beds dipping 49° and calcite-infilled fractures dipping 84°.

Calcite-infilled fractures are cross-cutting and exhibit offsets.

Slickensides on fracture planes noted within 20.0 feet to 25.0 feet.

REC = 80% RQD = 83%

Dark Gray **LIMESTONE** with beds dipping 49°. Calcite-infilled fractures highly fractured or voided from 30.0 feet to 32.0 feet



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WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

S&ME

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Blountville, T.N.
37617
(615) 323-2101

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**B-1**

PROJECT NO. : *1404-94-051-A*	**ELEVATION:** *1520.53__FEET_MSLD*	**NOTES:**
LOGGED BY: *PCH*	**BORING DEPTH:** *70.0__FEET*	Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
DATE DRILLED: *9-8-94*	**WATER LEVEL ◘ T.O.B.:** *19.5 Feet*	
DRILLING METHOD: *3 1/4" HSA*	**DRILL RIG:** *Mobile B-61*	

DEPTH (ft)	Soil Description	ELEV.
	REC = 100% RQD = 52%	
40	Dark Gray **LIMESTONE** with calcite-infilled fractures. Solution pitting noted at 40.5 feet and also from 48.0 feet to 48.5 feet	1481
45		1476
	REC = 100% RQD = 66%	
50	Dark Gray **LIMESTONE** with cross-cutting Calcite-infilled fractures. Note: Three soil-filled fractures were encountered from 50.0 feet to 50.5 feet.	1471
55	Note: Beds dipping more gently at 33° to 40°. No steeply dipping Calcite-infilled fractures.	1466
	REC = 100% RQD = 76%	
60	Dark Gray **LIMESTONE** with beds dipping 45°.	1461
65		1456
	REC = 100% RQD = 66%	
	Coring Terminated at 70.0 Feet	
70		1451

Standard Penetration Test Data (Blows/ft) 10 30 50 70 90 — BPF

WATER LEVEL SAMPLE

WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
HOLE CAVE

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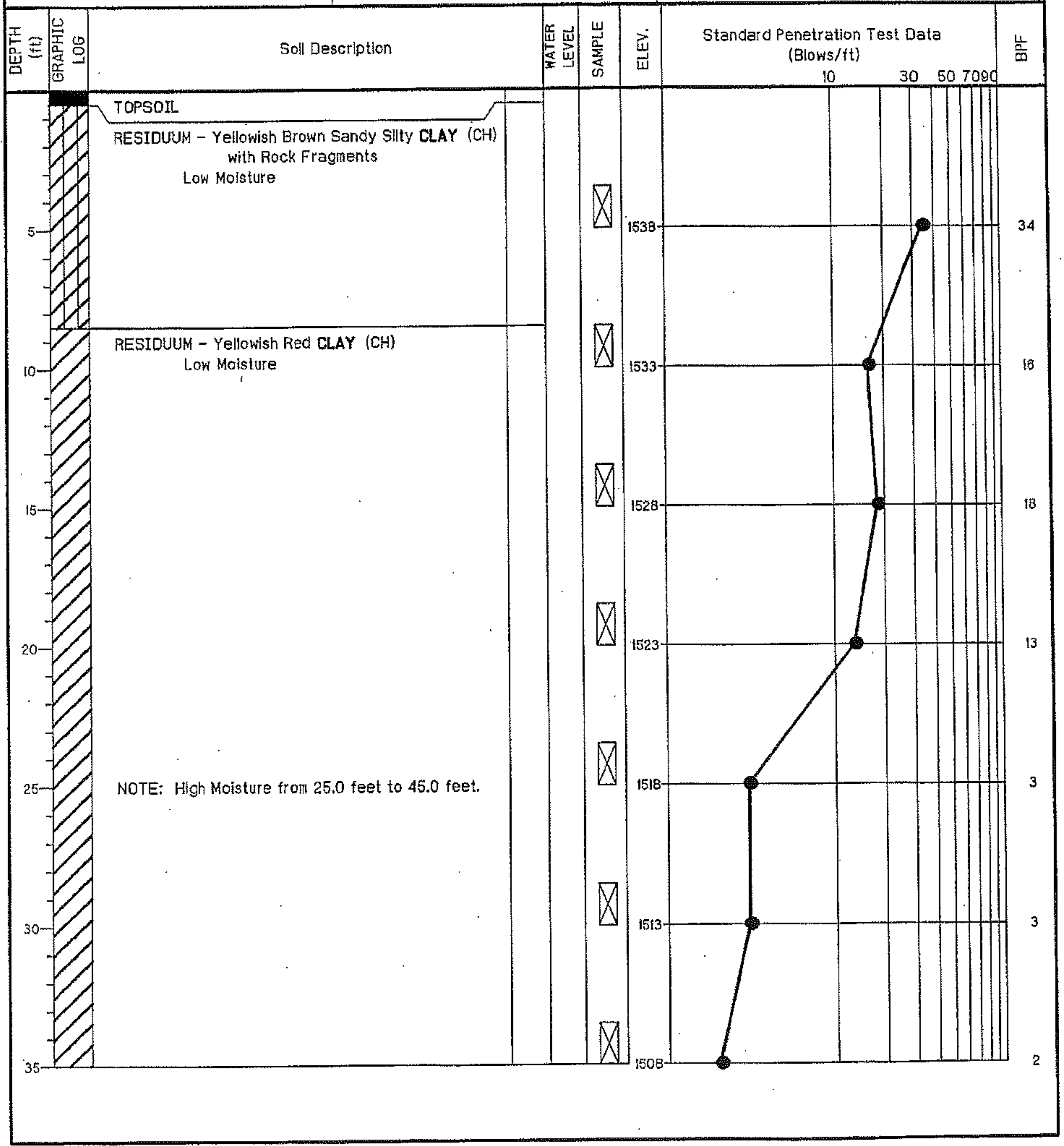
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-2

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1542.8__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*45.0__FEET*
DATE DRILLED:	*6-23-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
Bag sample collected from 10 to 30 ft.



TOPSOIL

RESIDUUM - Yellowish Brown Sandy Silty **CLAY** (CH) with Rock Fragments
Low Moisture

RESIDUUM - Yellowish Red **CLAY** (CH)
Low Moisture

NOTE: High Moisture from 25.0 feet to 45.0 feet.

ELEV.	BPF
1538	34
1533	16
1528	18
1523	13
1518	3
1513	3
1508	2

Page : 1 of : 2

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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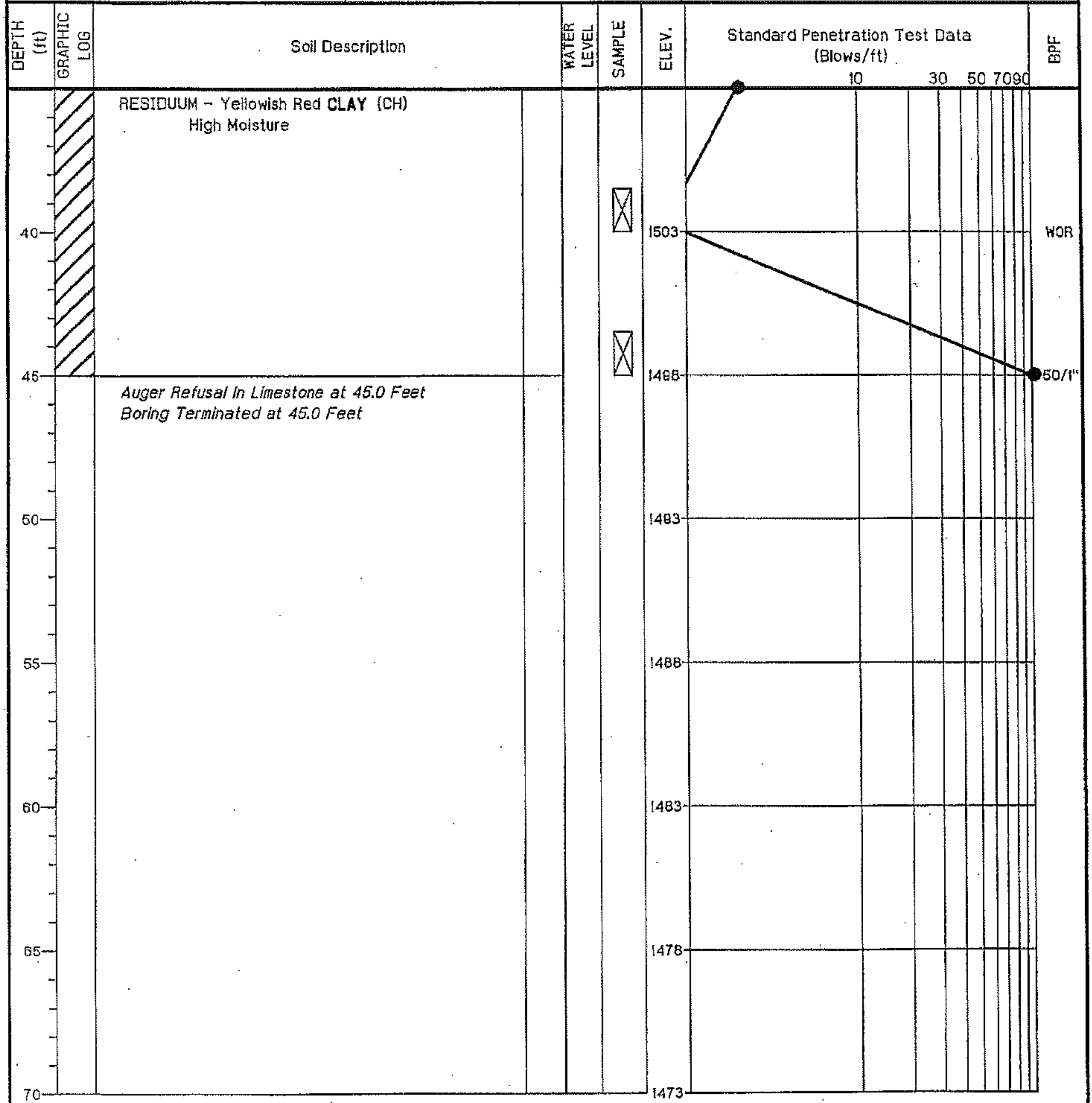
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-2

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1542.8__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*45.0__FEET*
DATE DRILLED:	*6-23-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
Bag sample collected from 10 to 30 ft.



RESIDUUM - Yellowish Red **CLAY** (CH)
High Moisture

Auger Refusal In Limestone at 45.0 Feet
Boring Terminated at 45.0 Feet

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-3

PROJECT NO.: *1404-94-051-A*

LOGGED BY: *PCH*

DATE DRILLED: *6-23-94*

DRILLING METHOD: *3 1/4" HSA*

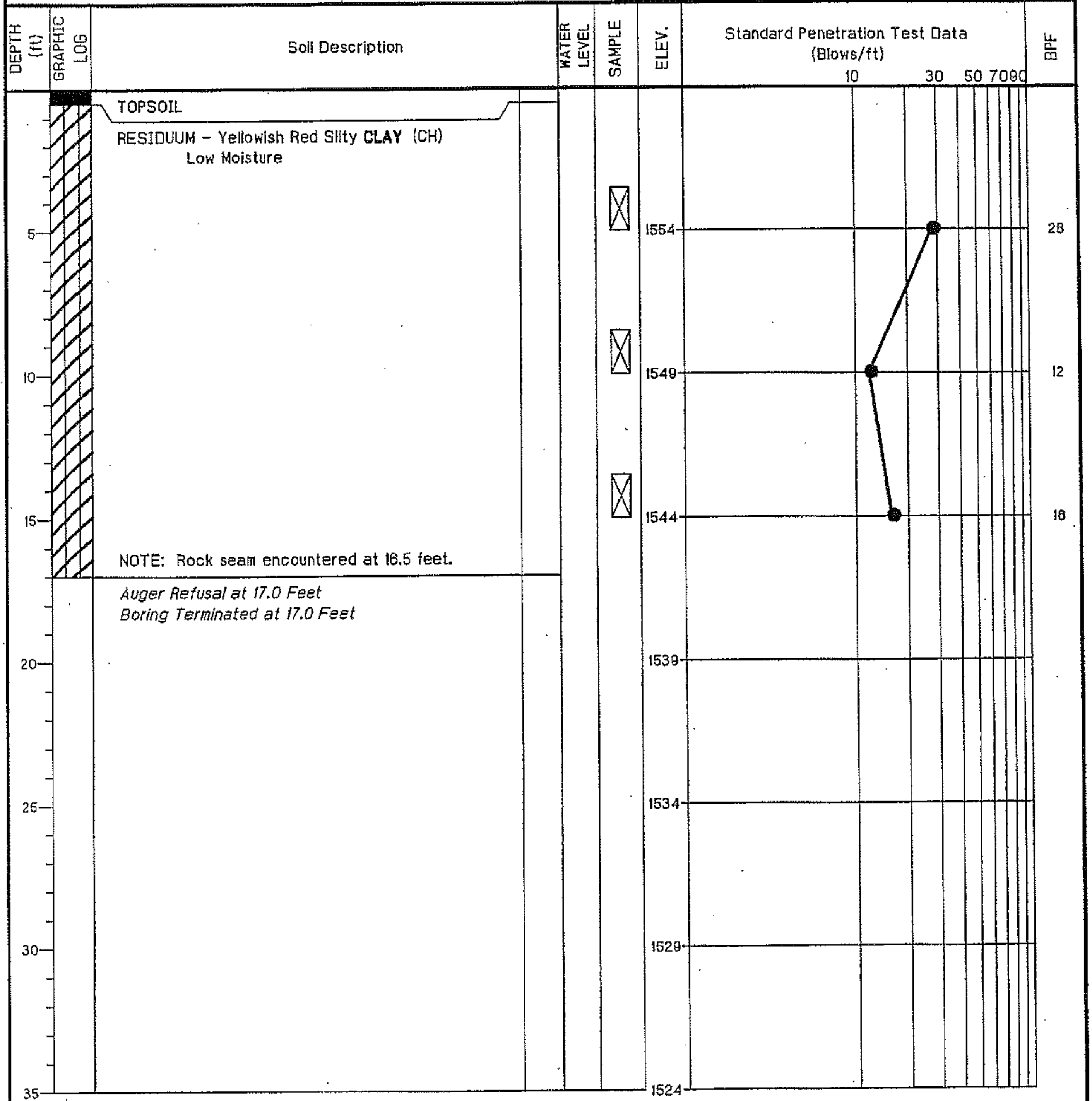
ELEVATION: *1558.6__FEET_MSLD*

BORING DEPTH: *17.0__FEET*

WATER LEVEL @ T.O.B.: *Dry*

DRILL RIG: *Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



TOPSOIL

RESIDUUM - Yellowish Red Silty **CLAY** (CH)
Low Moisture

NOTE: Rock seam encountered at 16.5 feet.

Auger Refusal at 17.0 Feet
Boring Terminated at 17.0 Feet

Page : 1 of : 1

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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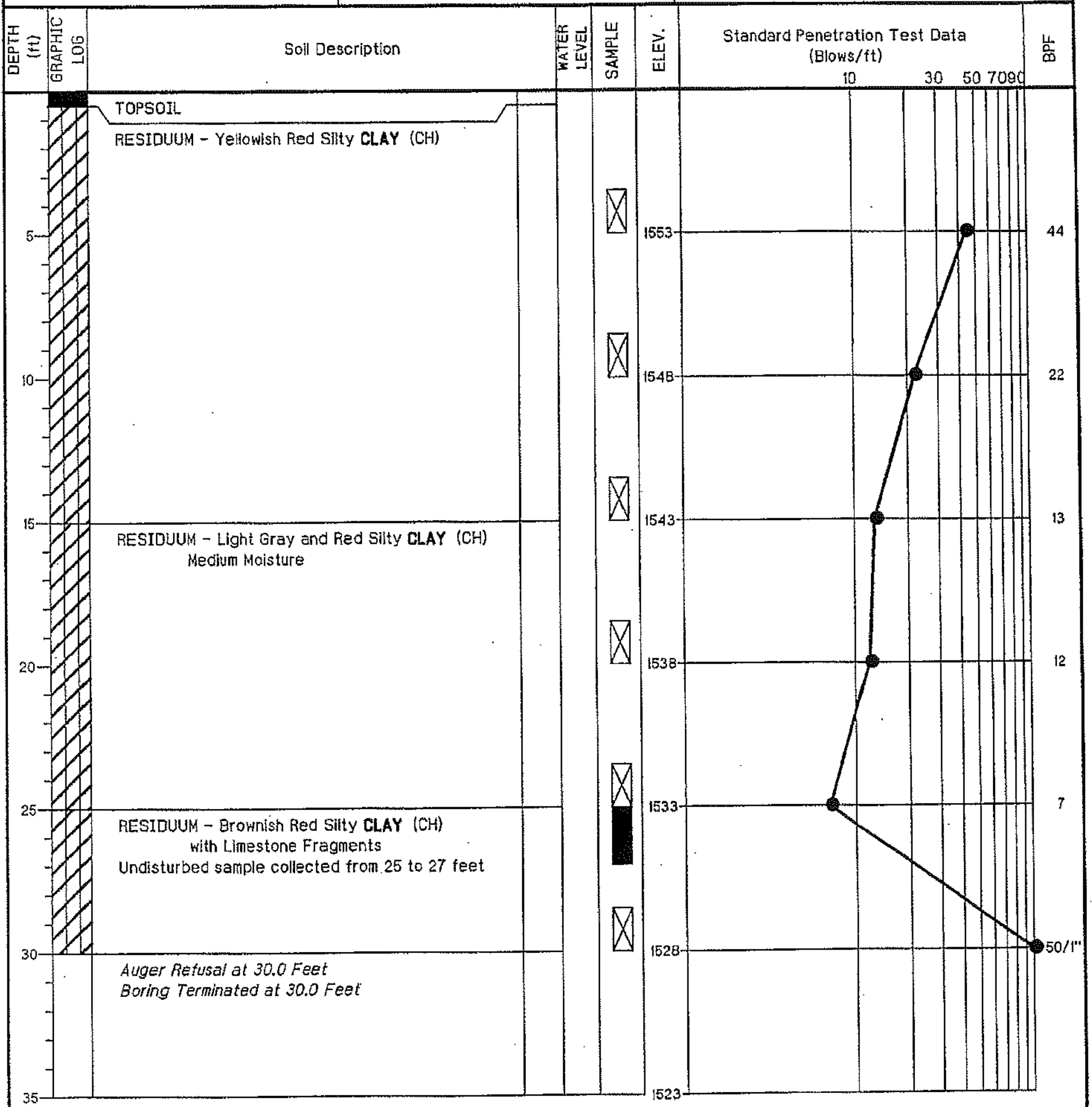
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-4

PROJECT NO. :	*1404-94-051-A*	**ELEVATION:**	*1558.1__FEET_MSLD*	**NOTES:** Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug. Bag sample collected from 5 to 30 ft.
LOGGED BY:	*PCH*	**BORING DEPTH:**	*30.0__FEET*	
DATE DRILLED:	*6-27-94*	**WATER LEVEL @ T.O.B.:**	*Dry*	
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*	



TOPSOIL

RESIDUUM - Yellowish Red Silty **CLAY** (CH)

RESIDUUM - Light Gray and Red Silty **CLAY** (CH)
Medium Moisture

RESIDUUM - Brownish Red Silty **CLAY** (CH)
with Limestone Fragments
Undisturbed sample collected from 25 to 27 feet

Auger Refusal at 30.0 Feet
Boring Terminated at 30.0 Feet

WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
HOLE CAVE

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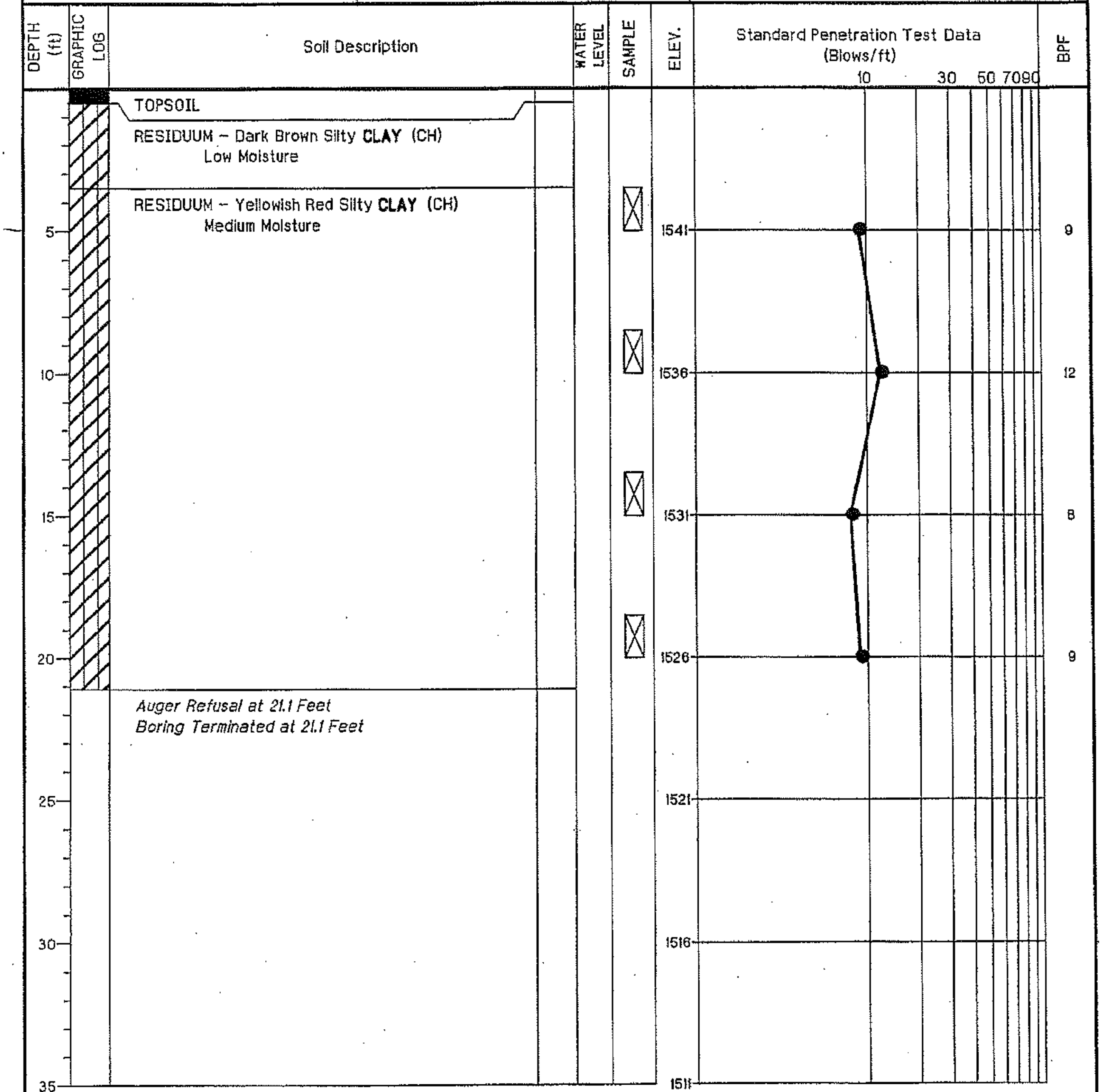
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-5

PROJECT NO.: *1404-94-051-A*
ELEVATION: *1545.8__FEET_MSLD*
LOGGED BY: *PCH*
BORING DEPTH: *21.1__FEET*
DATE DRILLED: *6-28-94*
WATER LEVEL @ T.O.B.: *Dry*
DRILLING METHOD: *3 1/4" HSA*
DRILL RIG: *Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
Bag sample collected from 3.5' - 21.1'



TOPSOIL

RESIDUUM - Dark Brown Silty **CLAY** (CH)
Low Moisture

RESIDUUM - Yellowish Red Silty **CLAY** (CH)
Medium Moisture

Auger Refusal at 21.1 Feet
Boring Terminated at 21.1 Feet

Page : 1 of : 1

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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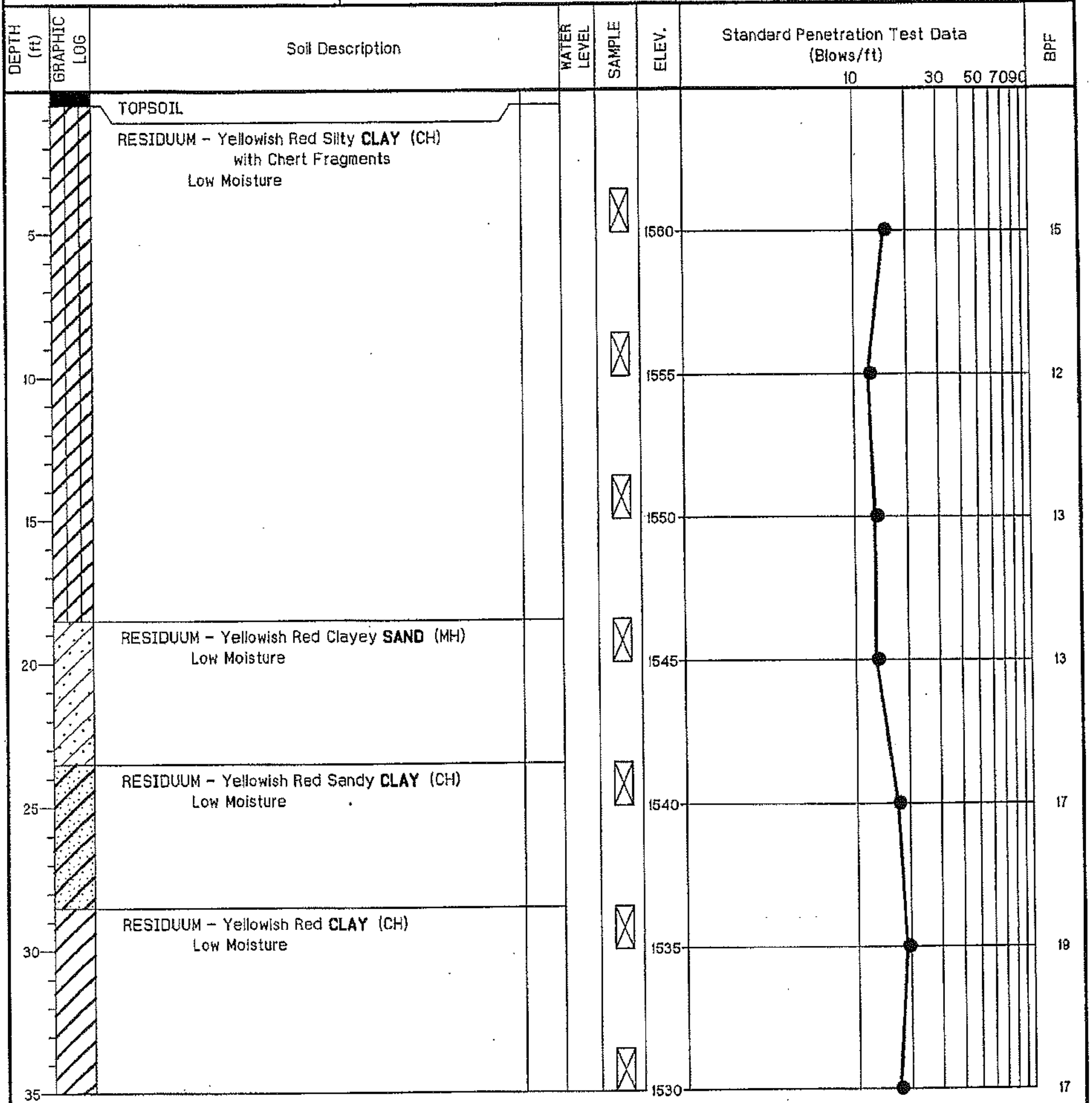
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	TEST BORING RECORD	B-6

PROJECT NO.: *1404-94-051-A*	**ELEVATION:** *1564.7__FEET_MSLD*	**NOTES:** Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
LOGGED BY: *PCH*	**BORING DEPTH:** *53.2__FEET*	
DATE DRILLED: *6-28-94*	**WATER LEVEL @ T.O.B.:** *Dry*	
DRILLING METHOD: *3 1/4" HSA*	**DRILL RIG:** *Mobile B-57*	



TOPSOIL

RESIDUUM - Yellowish Red Silty **CLAY** (CH)
with Chert Fragments
Low Moisture

RESIDUUM - Yellowish Red Clayey **SAND** (MH)
Low Moisture

RESIDUUM - Yellowish Red Sandy **CLAY** (CH)
Low Moisture

RESIDUUM - Yellowish Red **CLAY** (CH)
Low Moisture

ELEV.	BPF
1560	15
1555	12
1550	13
1545	13
1540	17
1535	19
1530	17

Page : 1 of : 2

∵ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
⁑ HOLE CAVE

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PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-6

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1564.7__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*53.2__FEET*
DATE DRILLED:	*6-28-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.

DEPTH (ft) | GRAPHIC LOG | Soil Description | WATER LEVEL | SAMPLE | ELEV. | Standard Penetration Test Data (Blows/ft) | BPF

RESIDUUM - Yellowish Red **CLAY** (CH)
Low Moisture

RESIDUUM - Yellowish Red **CLAY** (CH)
Medium High Moisture

Auger Refusal at 53.2 Feet
Boring Terminated at 53.2 Feet

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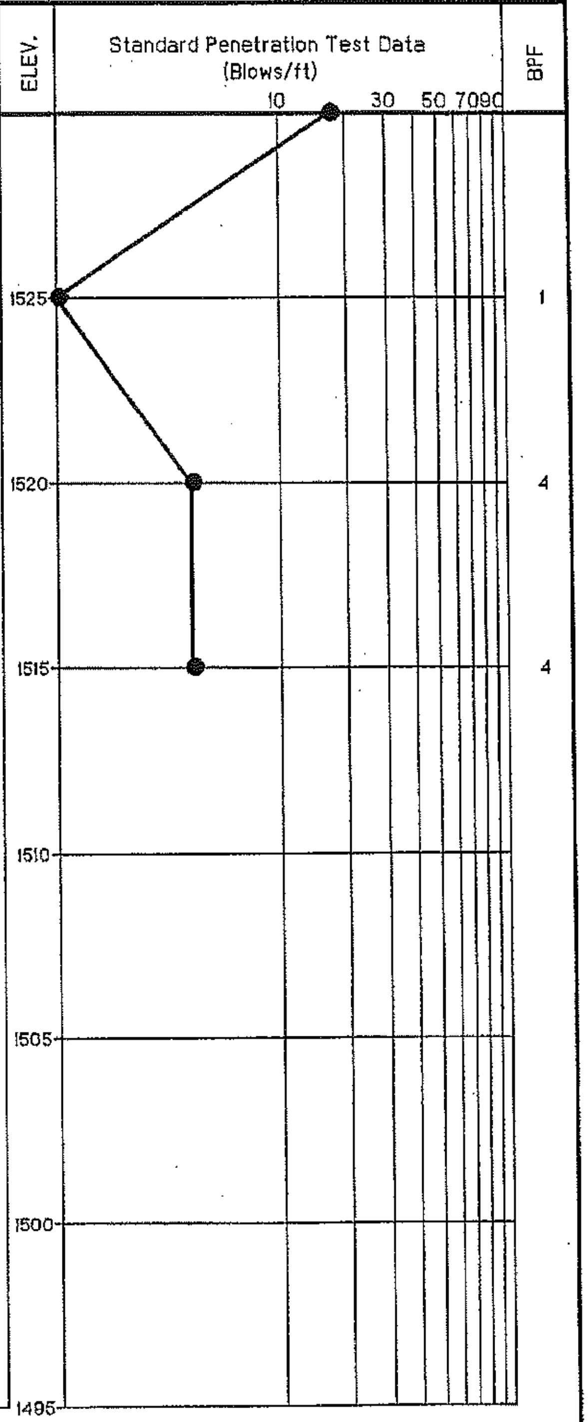

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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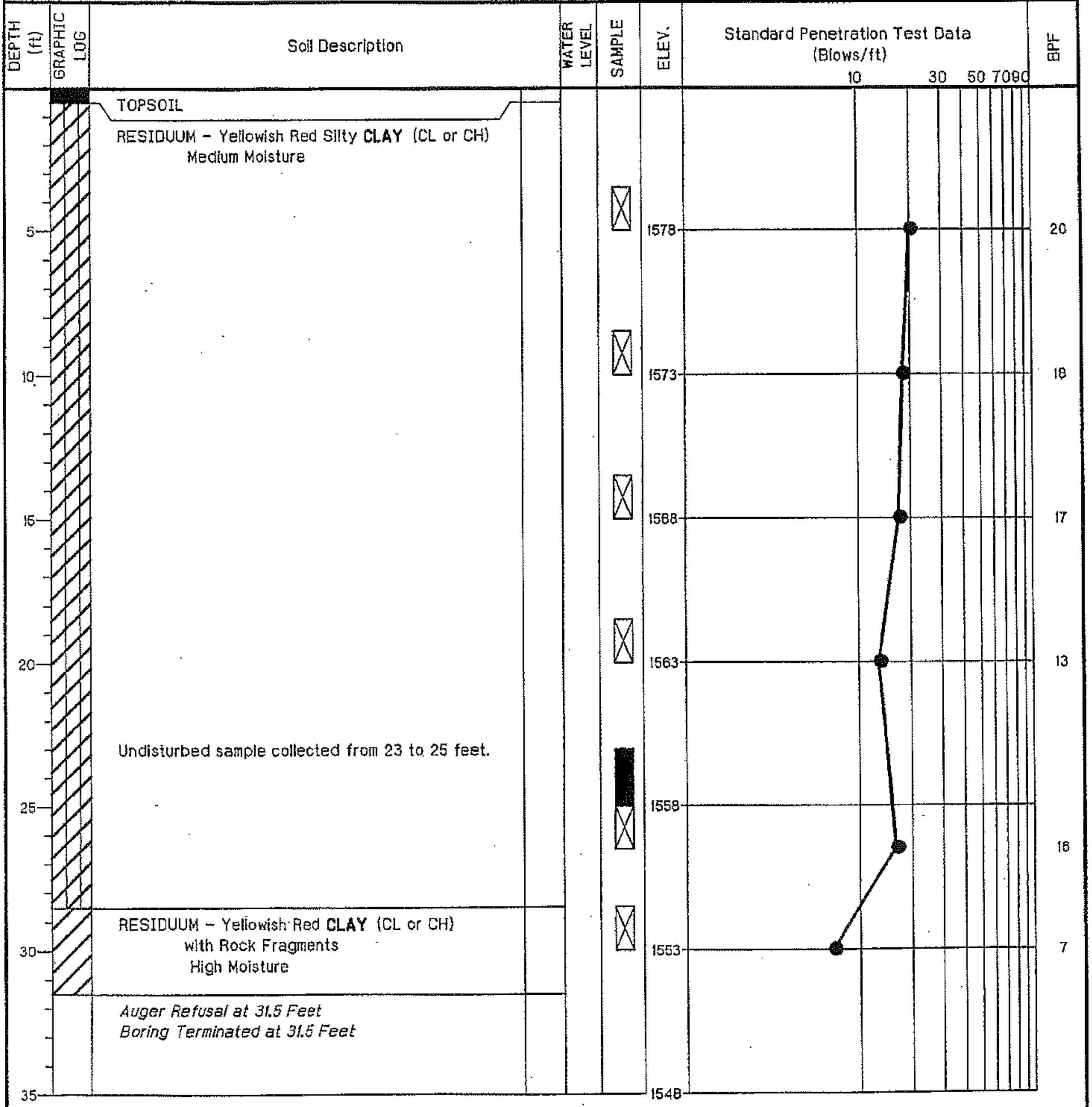
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**B-7**

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1582.9__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*31.5__FEET*
DATE DRILLED:	*6-29-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
Bag sample collected from 5' – 30'



TOPSOIL

RESIDUUM – Yellowish Red Silty **CLAY** (CL or CH)
Medium Moisture

Undisturbed sample collected from 23 to 25 feet.

RESIDUUM – Yellowish Red **CLAY** (CL or CH)
with Rock Fragments
High Moisture

Auger Refusal at 31.5 Feet
Boring Terminated at 31.5 Feet

Page : 1 of : 1

. WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
· HOLE CAVE

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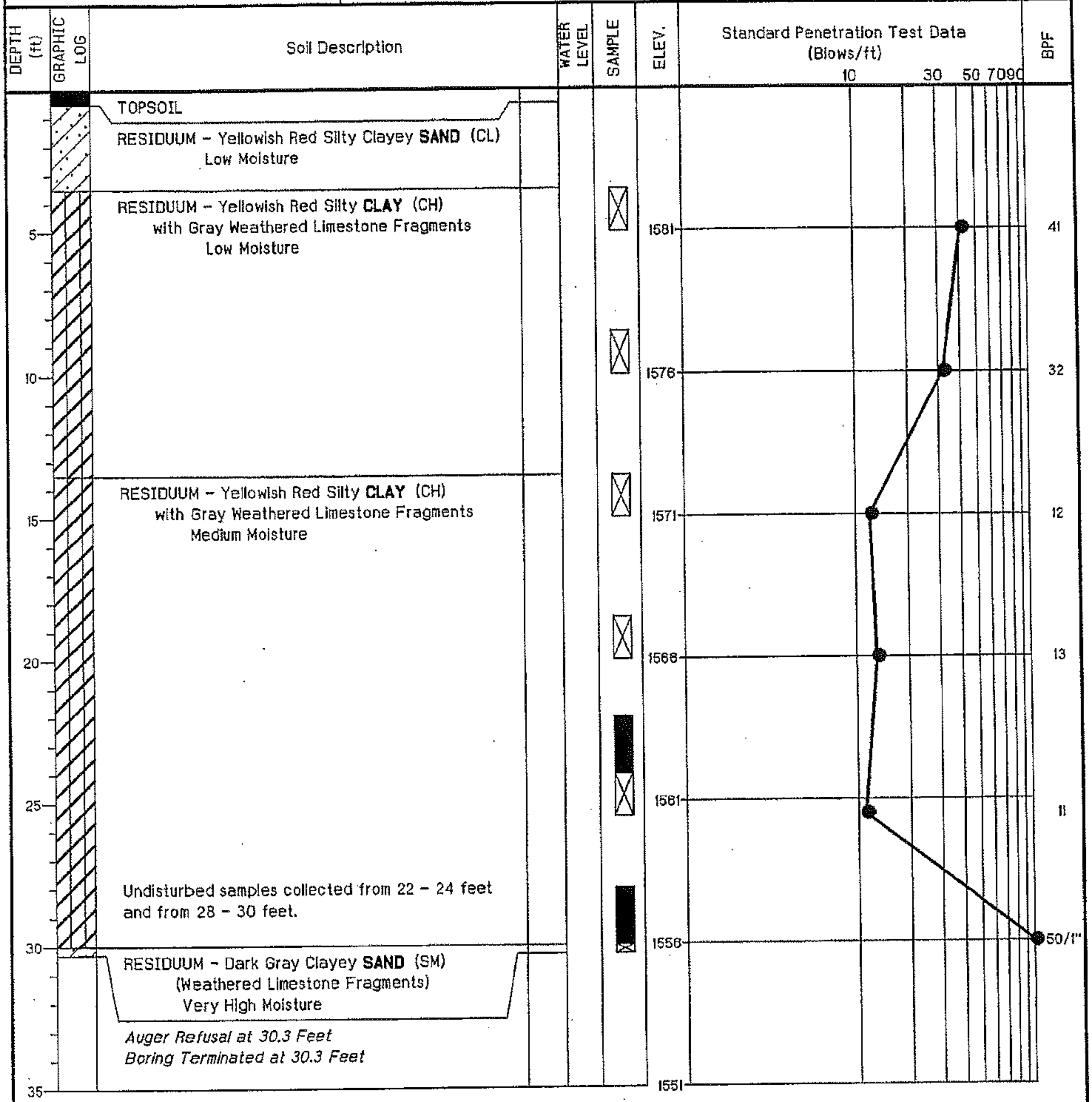
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**B-8**

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1586.3__FEET_MSLD*	**NOTES:** Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug. Bag sample collected from 5' - 30'.
LOGGED BY:	*PCH*	**BORING DEPTH:**	*30.3__FEET*	
DATE DRILLED:	*6-29-94*	**WATER LEVEL & T.O.B.:**	*Dry*	
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*	



TOPSOIL

RESIDUUM - Yellowish Red Silty Clayey **SAND** (CL)
Low Moisture

RESIDUUM - Yellowish Red Silty **CLAY** (CH)
with Gray Weathered Limestone Fragments
Low Moisture

RESIDUUM - Yellowish Red Silty **CLAY** (CH)
with Gray Weathered Limestone Fragments
Medium Moisture

Undisturbed samples collected from 22 - 24 feet and from 28 - 30 feet.

RESIDUUM - Dark Gray Clayey **SAND** (SM)
(Weathered Limestone Fragments)
Very High Moisture

Auger Refusal at 30.3 Feet
Boring Terminated at 30.3 Feet

ELEV.	BPF
1581	41
1576	32
1571	12
1566	13
1561	11
1556	50/1"

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- WATER LEVEL (T.O.B.)
- WATER LEVEL (24 HR.)
- HOLE CAVE

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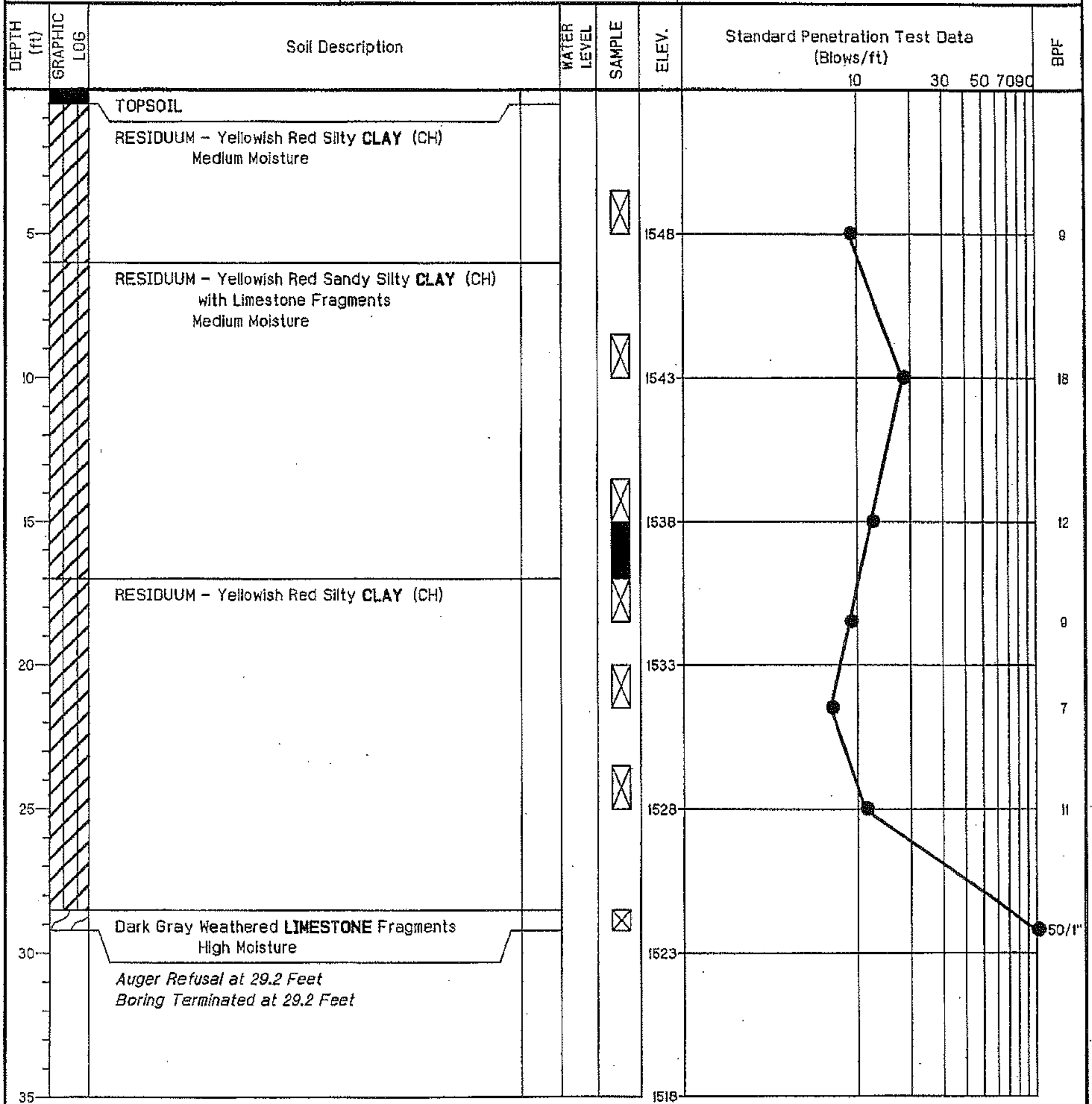
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD B-9**

PROJECT NO. :	*1404-94-051-A*	**ELEVATION:**	*1553.0__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*29.2__FEET*
DATE DRILLED:	*6-29-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*

NOTES:
Overburden was drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
Undisturbed sample obtained from 15' – 17'



TOPSOIL

RESIDUUM – Yellowish Red Silty **CLAY** (CH)
Medium Moisture

RESIDUUM – Yellowish Red Sandy Silty **CLAY** (CH)
with Limestone Fragments
Medium Moisture

RESIDUUM – Yellowish Red Silty **CLAY** (CH)

Dark Gray Weathered **LIMESTONE** Fragments
High Moisture

Auger Refusal at 29.2 Feet
Boring Terminated at 29.2 Feet

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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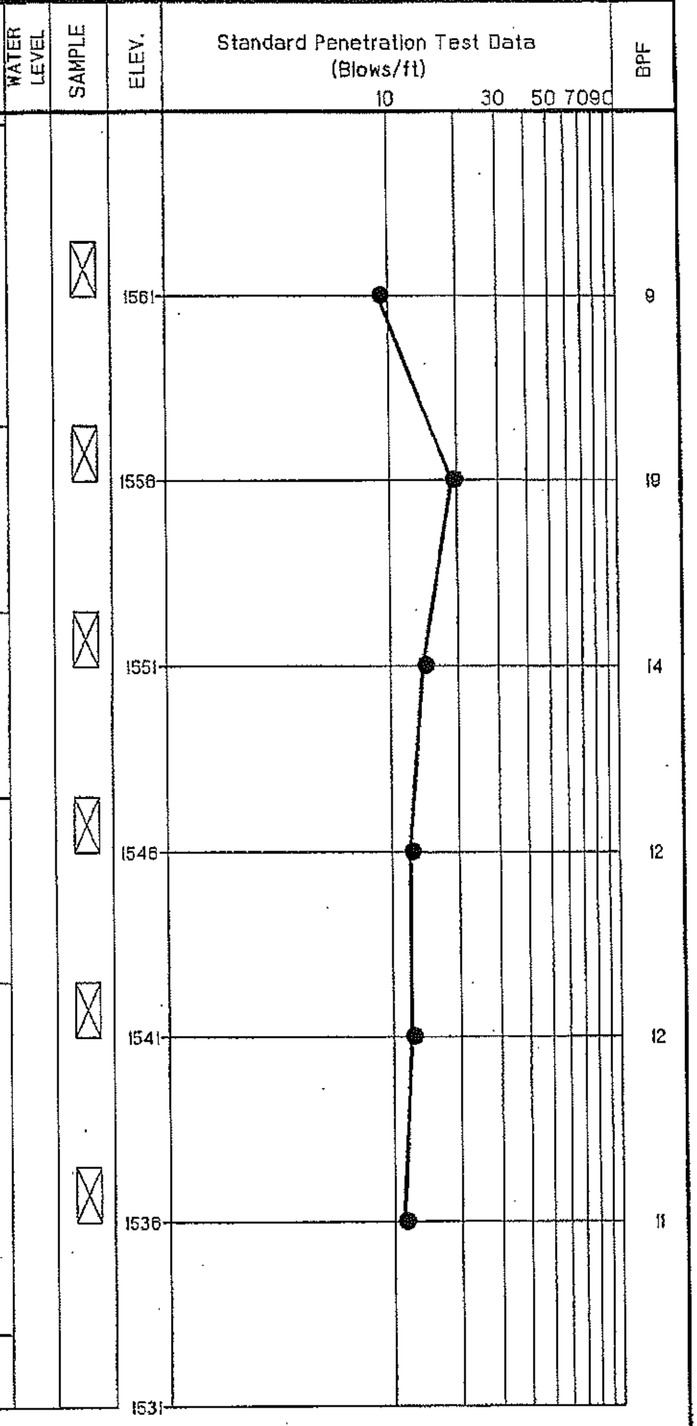
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-10

PROJECT NO.:	1404-94-051-A	**ELEVATION:**	1566.24__FEET_MSLD
LOGGED BY:	PCH	**BORING DEPTH:**	33.0__FEET
DATE DRILLED:	9-10-94	**WATER LEVEL @ T.O.B.:**	Dry
DRILLING METHOD:	3 1/4" HSA	**DRILL RIG:**	Mobile B-61

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.

DEPTH (ft)	Soil Description
	Topsoil
	RESIDUUM - Reddish Brown Silty **CLAY** (CH) (Low Moisture)
5	
	RESIDUUM - Reddish Yellow Clayey **SILT** (MH)
10	
	RESIDUUM - Yellowish Red Silty **CLAY** (CH)
15	
	RESIDUUM - Brownish Red Silty **CLAY** (CH)
20	
	RESIDUUM - Brownish Red Silty **CLAY** (CH) with Dark Gray Dolomite Fragments
25	
	NOTE: High Moisture from 28.5' to 33.0'
30	
	Auger Refusal at 33.0 Feet
35	



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∇ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
Ⅲ HOLE CAVE

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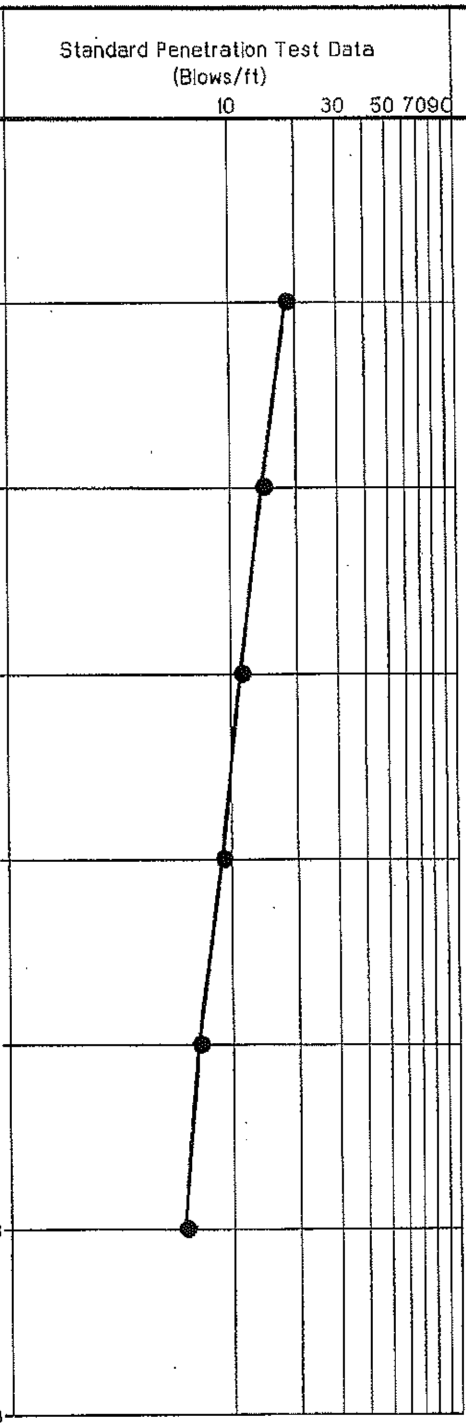
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-11

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1537.79__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*32.1__FEET*
DATE DRILLED:	*9-10-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.

DEPTH (ft)	Soil Description
0	Topsoil
	RESIDUUM - Brownish Red Fine Sandy Silty **CLAY** (CH) with Dark Gray and White Chert Fragments (Low Moisture)
~6.5	RESIDUUM - Yellowish Red Silty **CLAY** (CH)
	NOTE: Medium Moisture from 18.5' to 32.1'
~28.5	RESIDUUM - Reddish Yellow Silty **CLAY** (CH) with Dark Gray Dolomite Fragments
32.1	*Auger Refusal at 32.1 Feet*



DEPTH (ft)	SAMPLE	ELEV.	BPF
5	☒	1533	18
10	☒	1528	14
15	☒	1523	11
20	☒	1518	9
25	☒	1513	7
30	☒	1508	6
35		1503	

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▽ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
HC HOLE CAVE

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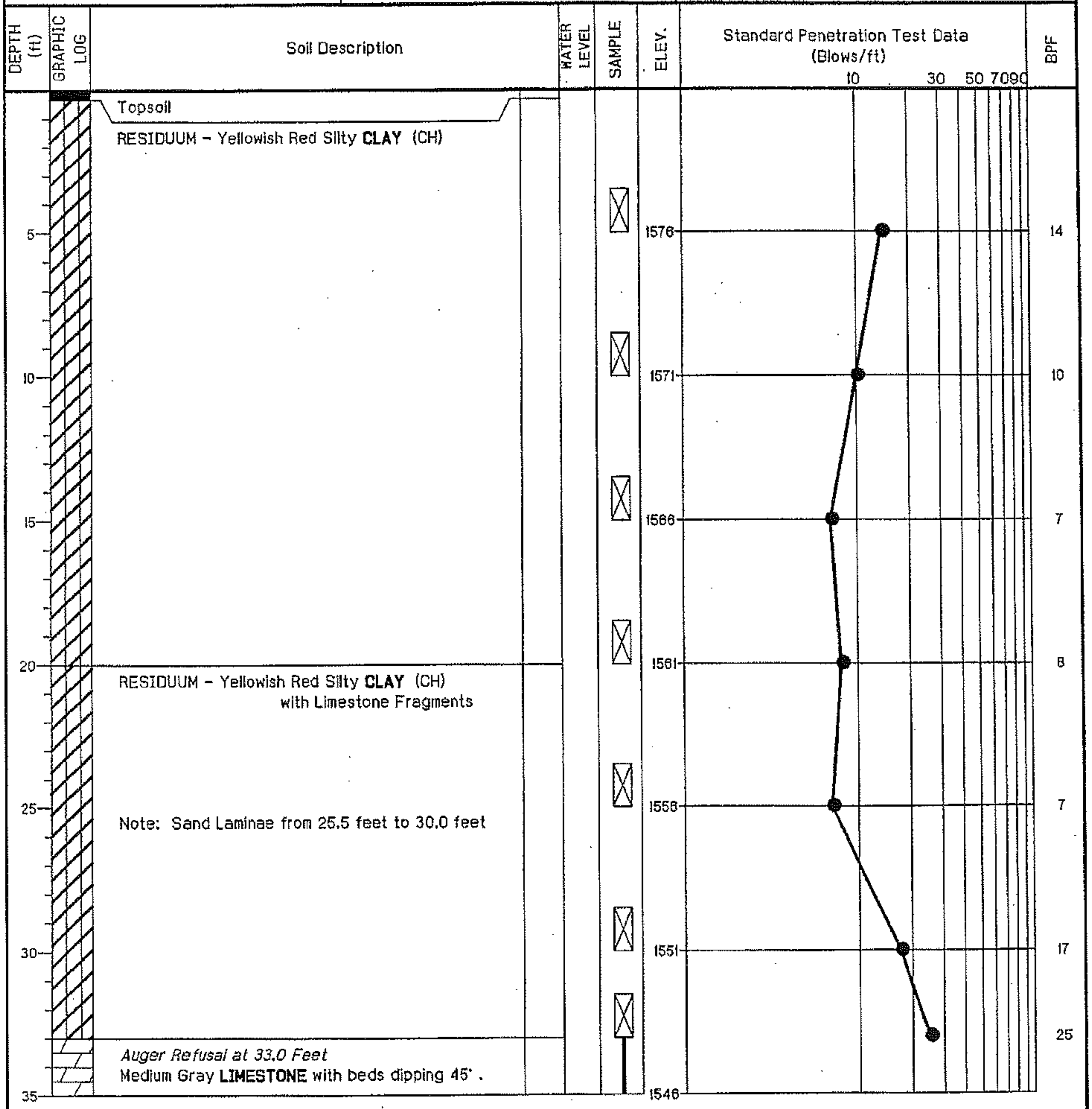
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**B-12**

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1580.66__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*83.0__FEET*
DATE DRILLED:	*9-12-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



Topsoil

RESIDUUM - Yellowish Red Silty **CLAY** (CH)

RESIDUUM - Yellowish Red Silty **CLAY** (CH) with Limestone Fragments

Note: Sand Laminae from 25.5 feet to 30.0 feet

Auger Refusal at 33.0 Feet
Medium Gray **LIMESTONE** with beds dipping 45°.

DEPTH (ft)	ELEV.	BPF
5	1576	14
10	1571	10
15	1566	7
20	1561	8
25	1556	7
30	1551	17
		25

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-12

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1580.66__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*83.0__FEET*
DATE DRILLED:	*9-12-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.

DEPTH (ft)	GRAPHIC LOG	Soil Description	WATER LEVEL	SAMPLE	ELEV.	Standard Penetration Test Data (Blows/ft) 10 30 50 7090	BPF
		Medium Gray **LIMESTONE**					
		Void					
		Medium Gray **LIMESTONE**					
		Void					
40		Medium Gray **LIMESTONE**			1541		
		Void					
		Medium Gray **LIMESTONE** with beds dipping 45°. REC = 80% RQD = 82%					
		Medium Gray **LIMESTONE** with beds dipping 45°.					
45					1536		
50					1531		
		Note: At 51.0 feet, beds dipping 69° to 80°. Highly fractured from 52 feet to 53 feet					
55					1526		
		REC = 100% RQD = 47%					
		Medium Gray **LIMESTONE** with beds dipping 69° to 80°.					
60					1521		
65					1516		
		REC = 100% RQD = 88%					
		Medium Gray **LIMESTONE** with beds dipping 69° to 80°.					
70					1511		

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WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

S&ME

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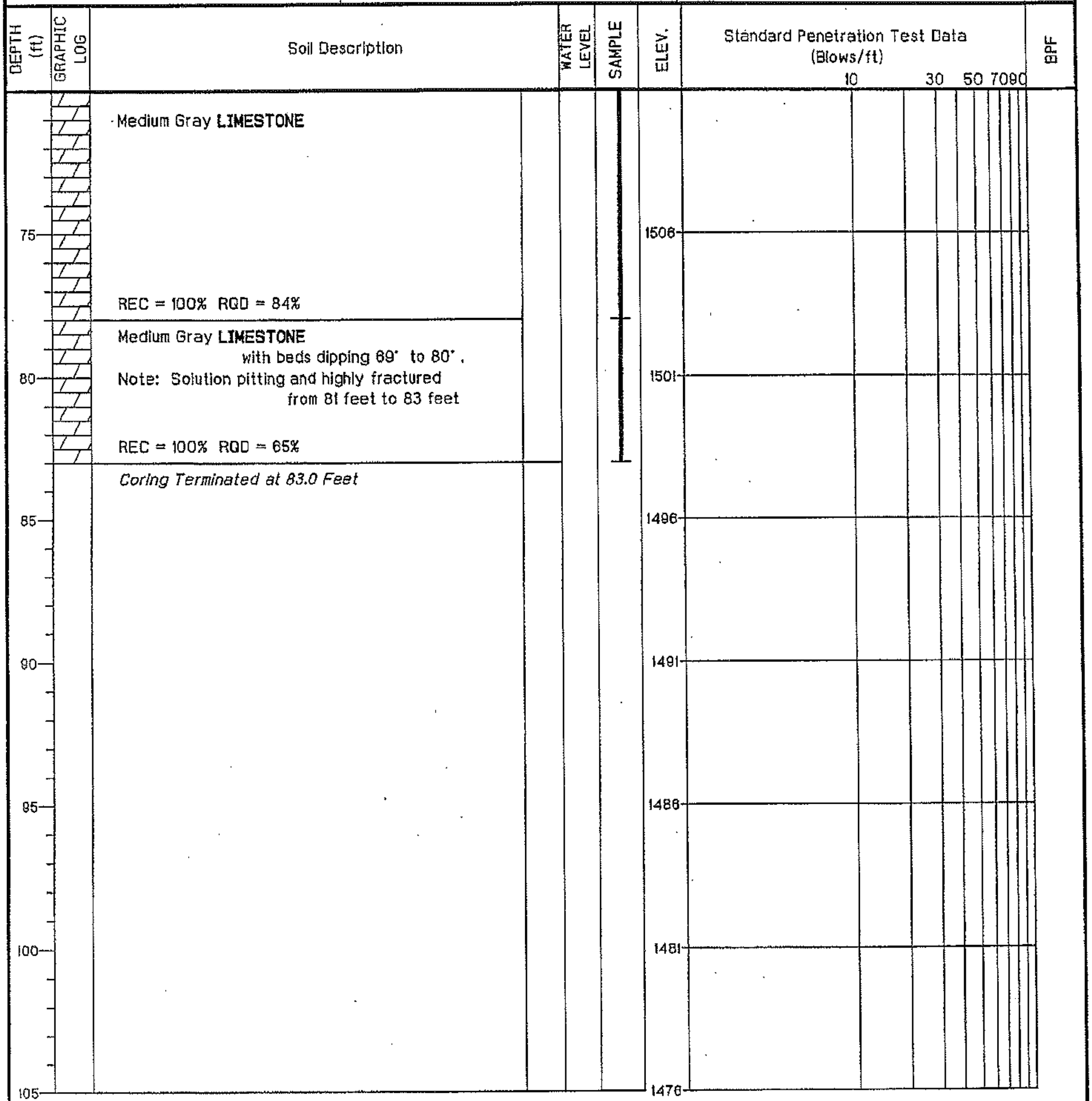
Blountville, T.N.
37617
(615) 323-2101

PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-12

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1580.66__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*83.0__FEET*
DATE DRILLED:	*9-12-94*	**WATER LEVEL @ T.O.B.:**	*Dry*
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



Medium Gray **LIMESTONE**

REC = 100% RQD = 84%

Medium Gray **LIMESTONE**
with beds dipping 69° to 80°.
Note: Solution pitting and highly fractured from 81 feet to 83 feet

REC = 100% RQD = 65%

Coring Terminated at 83.0 Feet

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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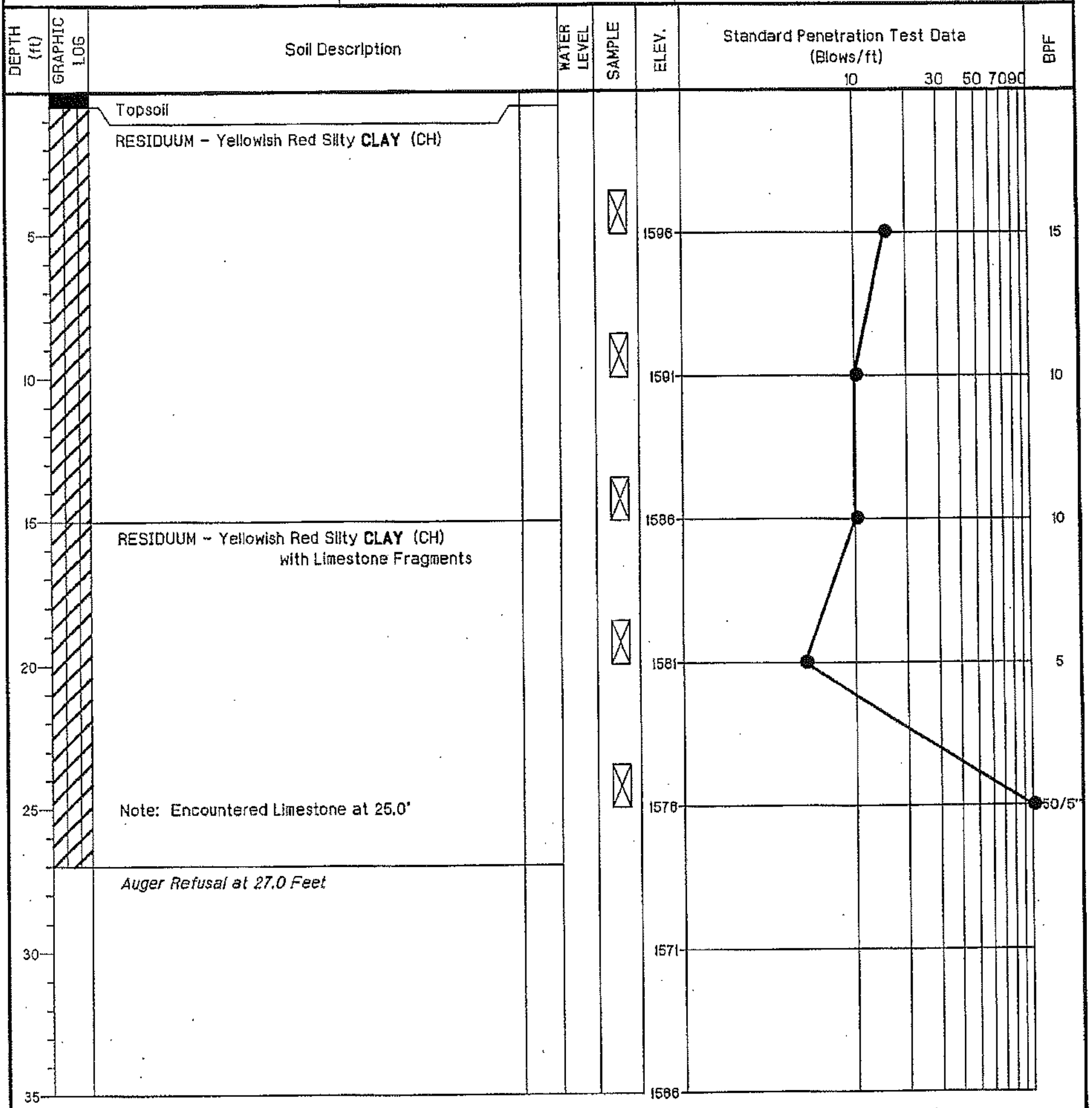
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-13

PROJECT NO.: *1404-94-051-A*
ELEVATION: *1601.06__FEET_MSLD*
LOGGED BY: *PCH*
BORING DEPTH: *27.0__FEET*
DATE DRILLED: *9-14-94*
WATER LEVEL @ T.O.B.: *Dry*
DRILLING METHOD: *3 1/4" HSA*
DRILL RIG: *Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



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WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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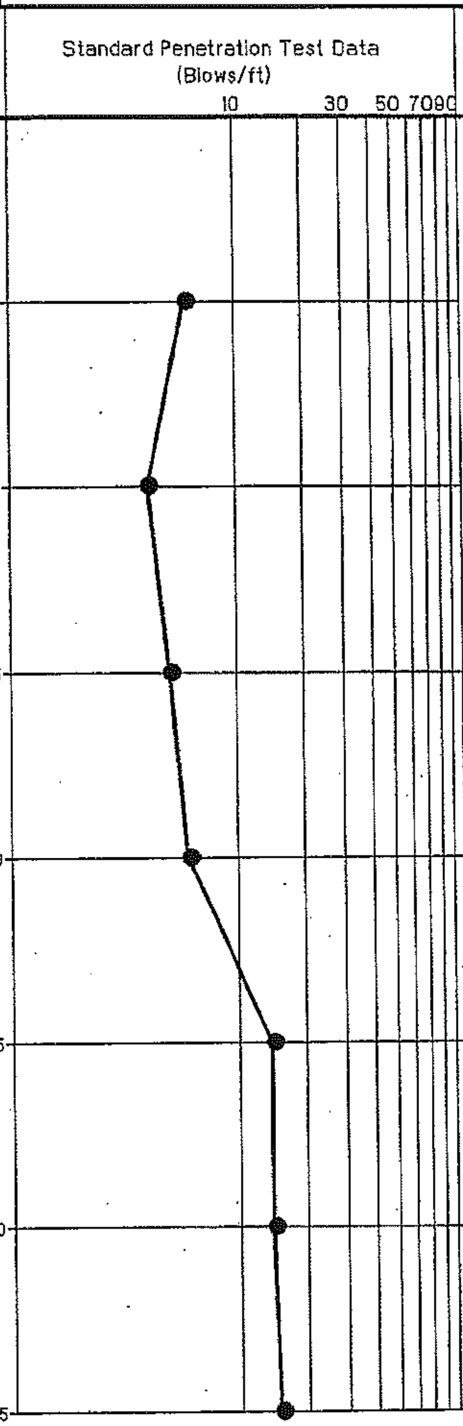
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-14

PROJECT NO.: 1404-94-051-A
ELEVATION: 1599.51__FEET_MSLD
LOGGED BY: PCH
BORING DEPTH: 36.5__FEET
DATE DRILLED: 9-13-94
WATER LEVEL @ T.O.B.: Dry
DRILLING METHOD: 3 1/4" HSA
DRILL RIG: Mobile B-61

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.

DEPTH (ft)	Soil Description	WATER LEVEL	SAMPLE	ELEV.	BPF
	Topsoil				
	RESIDUUM - Yellowish Red Silty **CLAY** (CH)				
5			☒	1595	6
10			☒	1590	4
15			☒	1585	5
20			☒	1580	6
25			☒	1575	14
30	RESIDUUM - Reddish Yellow Silty **CLAY** (CH) with Laminae of very fine Sands. Laminae are approximately 0.1 mm thick.		☒	1570	14
35			☒	1565	15


Standard Penetration Test Data (Blows/ft)

WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
HOLE CAVE

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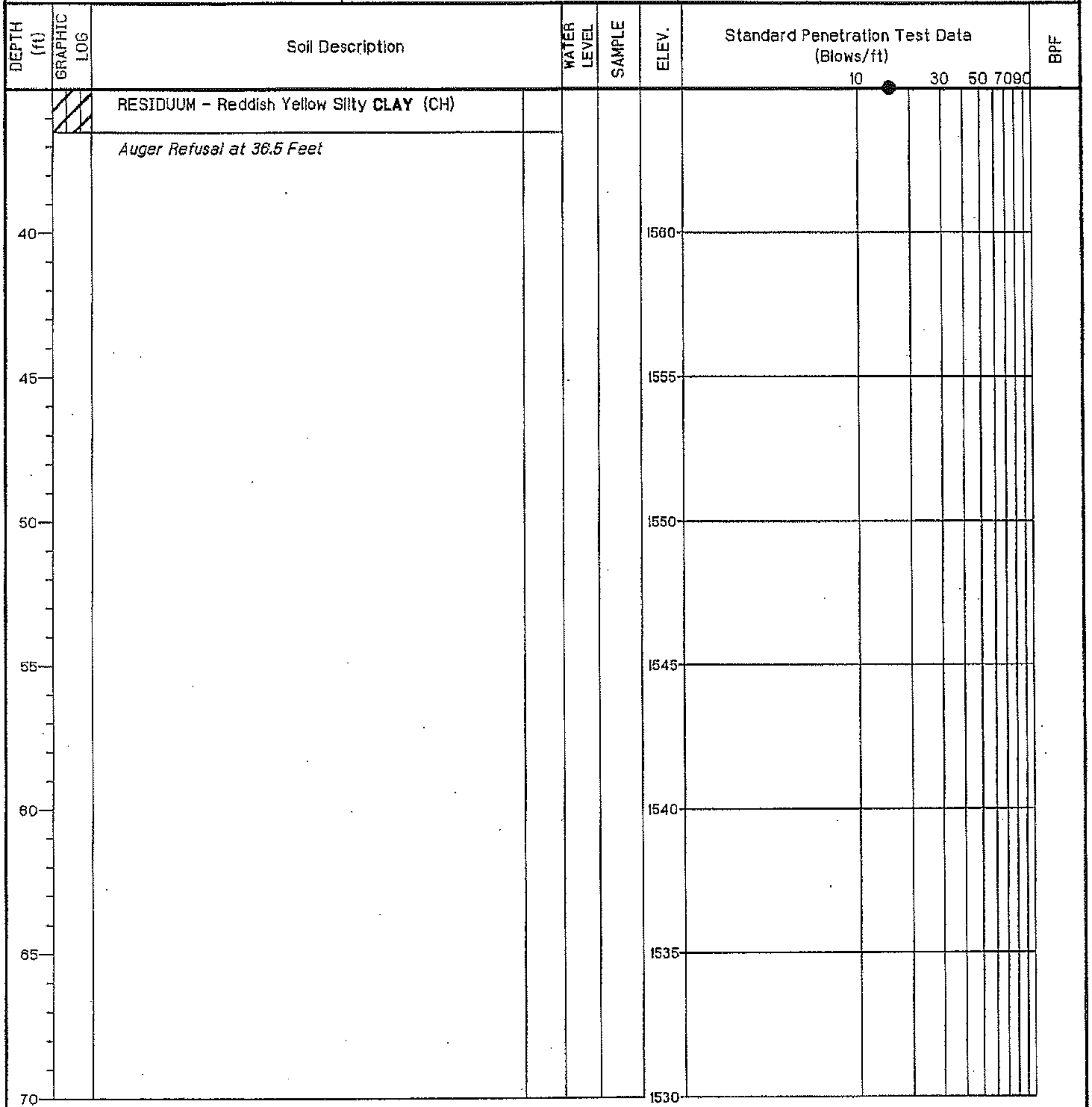
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**B-14**

PROJECT NO. :	*1404-94-051-A*	**ELEVATION:**	*1599.51__FEET_MSLD*	**NOTES:**
LOGGED BY:	*PCH*	**BORING DEPTH:**	*36.5__FEET*	Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
DATE DRILLED:	*9-13-94*	**WATER LEVEL @ T.O.B.:**	*Dry*	
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*	



RESIDUUM - Reddish Yellow Silty **CLAY** (CH)

Auger Refusal at 36.5 Feet

Page : 2 of : 2

WATER LEVEL (T.O.B.)

WATER LEVEL (24 HR.)

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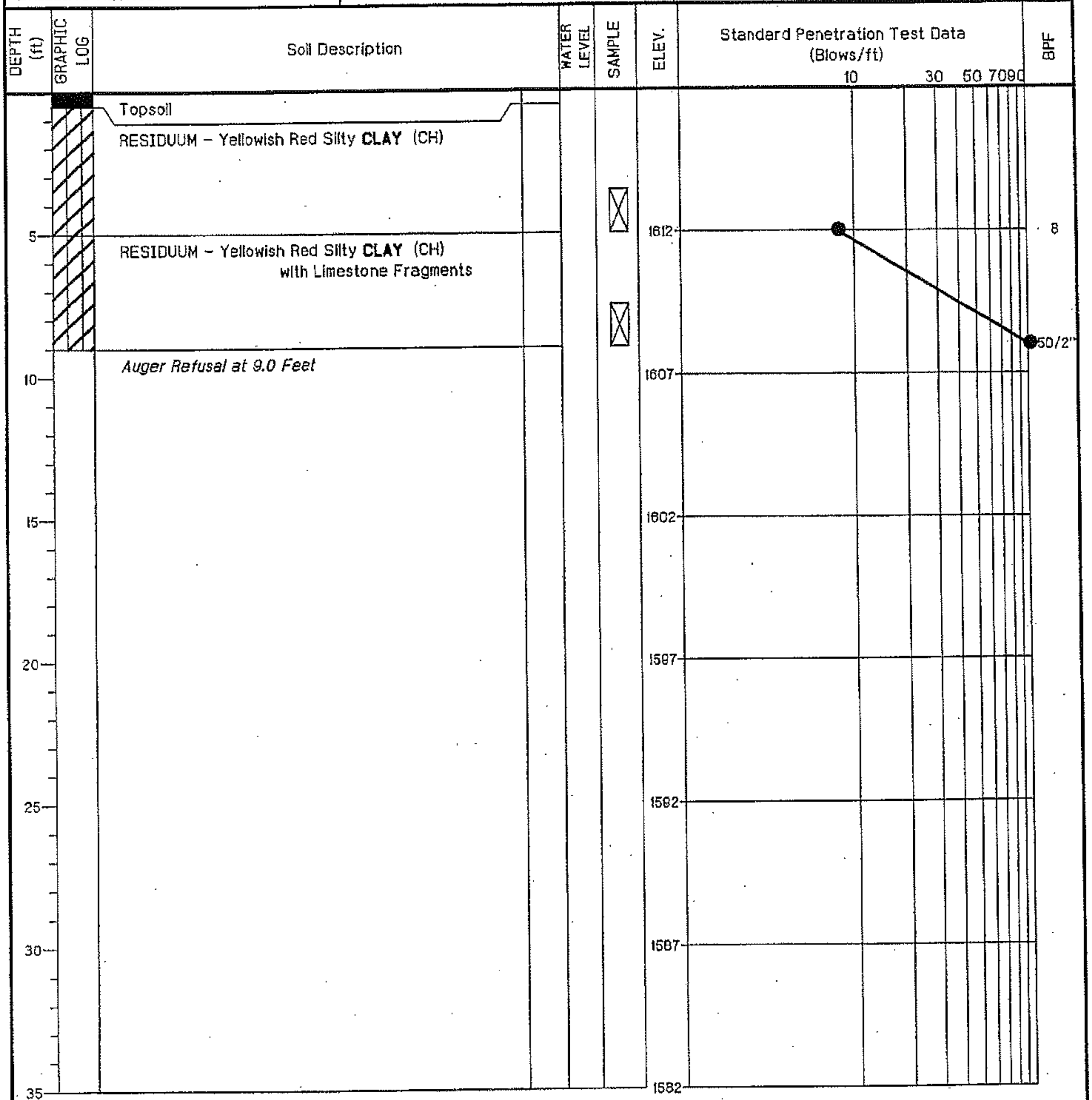
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-15

PROJECT NO.: *1404-94-051-A*
ELEVATION: *1616.77__FEET_MSLD*
LOGGED BY: *PCH*
BORING DEPTH: *9.0__FEET*
DATE DRILLED: *9-14-94*
WATER LEVEL @ T.O.B.: *Dry*
DRILLING METHOD: *3 1/4" HSA*
DRILL RIG: *Mobile B-61*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.

DEPTH (ft)	Soil Description	SAMPLE	ELEV.	BPF
0	Topsoil			
	RESIDUUM - Yellowish Red Silty **CLAY** (CH)	☒	1612	8
5	RESIDUUM - Yellowish Red Silty **CLAY** (CH) with Limestone Fragments	☒		50/2"
9	*Auger Refusal at 9.0 Feet*		1607	



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WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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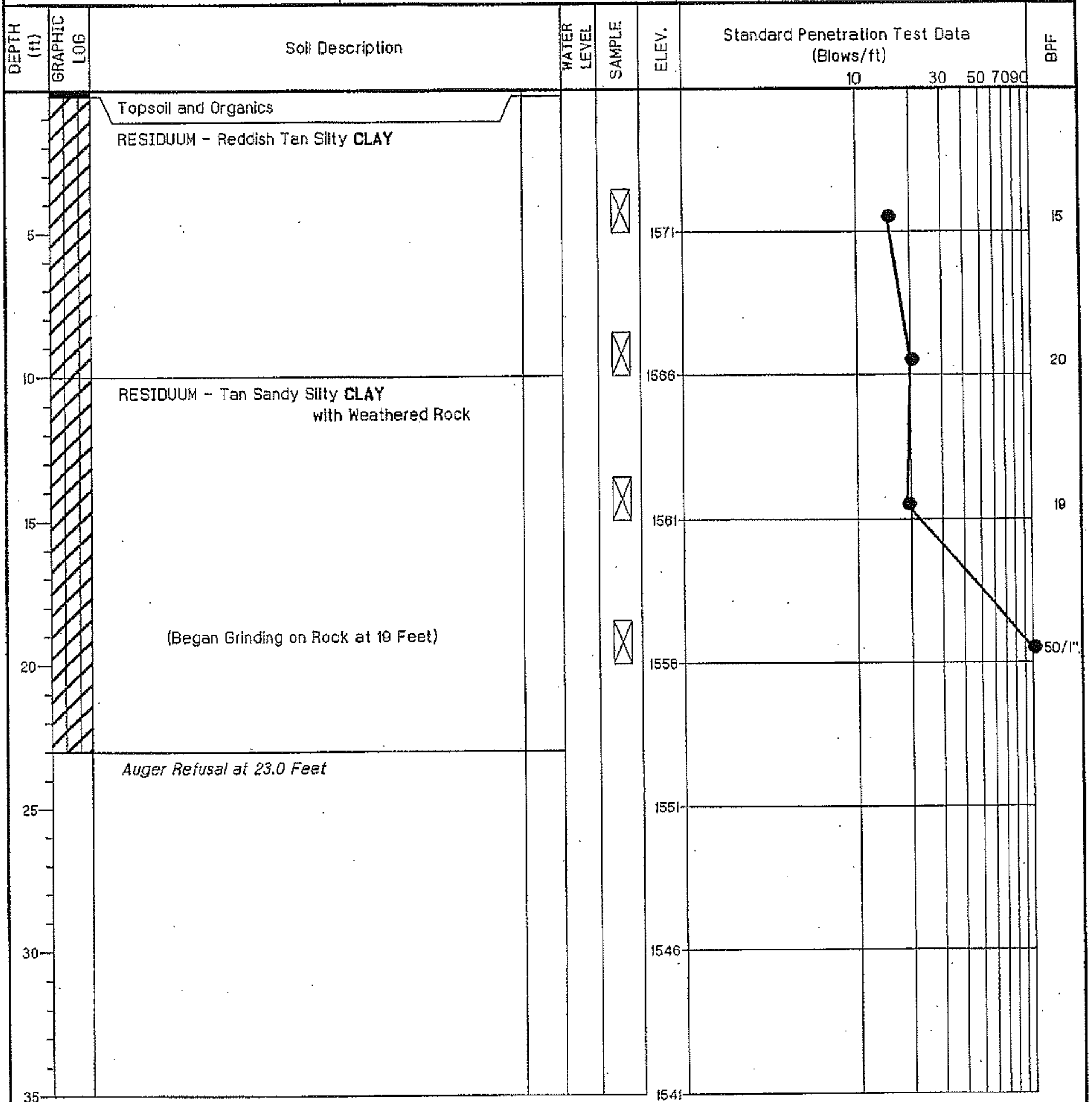
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-16

PROJECT NO.: *1404-94-051-A*
ELEVATION: *1576.3__FEET_MSLD*
LOGGED BY: *PCH*
BORING DEPTH: *23.0__FEET*
DATE DRILLED: *2-22-95*
WATER LEVEL @ T.O.B.: *Dry*
DRILLING METHOD: *3 1/4" HSA*
DRILL RIG: *Mobile B-57*

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



Topsoil and Organics

RESIDUUM - Reddish Tan Silty **CLAY**

RESIDUUM - Tan Sandy Silty **CLAY** with Weathered Rock

(Began Grinding on Rock at 19 Feet)

Auger Refusal at 23.0 Feet

Page : 1 of : 1

∇ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
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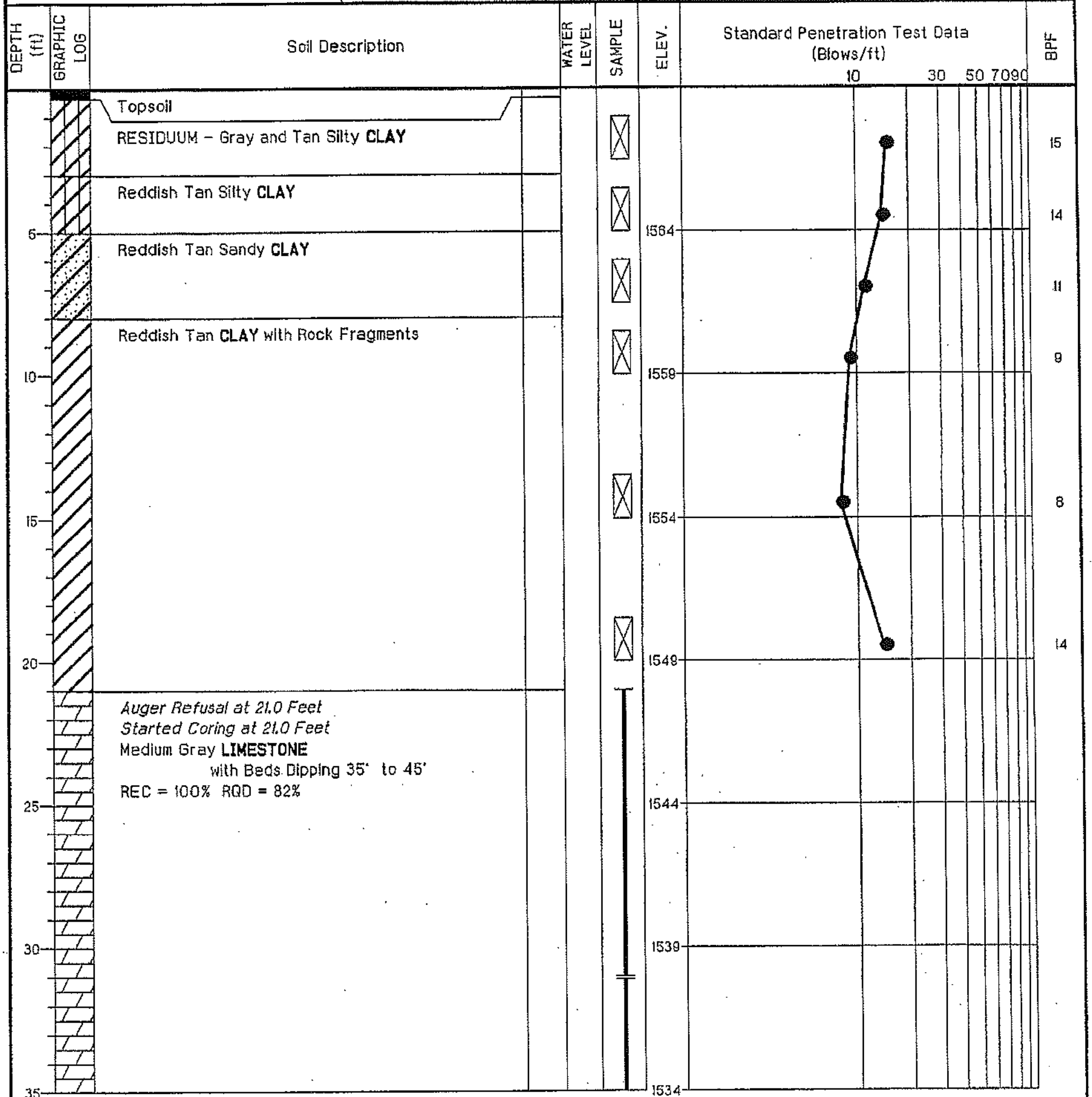
PROJECT: Greeneville Demolition Landfill Site
Greeneville, Tennessee

TEST BORING RECORD B-17

PROJECT NO.:	1404-94-051-A	**ELEVATION:**	1569.2__FEET_MSLD
LOGGED BY:	PCH	**BORING DEPTH:**	42.6__FEET
DATE DRILLED:	2-23-95	**WATER LEVEL @ T.O.B.:**	Dry
DRILLING METHOD:	3 1/4" HSA	**DRILL RIG:**	Mobile B-57

NOTES:
Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.



Topsoil

RESIDUUM - Gray and Tan Silty **CLAY**

Reddish Tan Silty **CLAY**

Reddish Tan Sandy **CLAY**

Reddish Tan **CLAY** with Rock Fragments

Auger Refusal at 21.0 Feet
Started Coring at 21.0 Feet
Medium Gray **LIMESTONE**
with Beds Dipping 35° to 45°
REC = 100% RQD = 82%

WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HC HOLE CAVE

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PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	TEST BORING RECORD	B-17

PROJECT NO. :	*1404-94-051-A*	**ELEVATION:**	*1569.2__FEET_MSLD*	**NOTES:** Overburden drilled with 3 1/4" HSA to bedrock. Boring was backfilled and sealed with a bentonite plug.
LOGGED BY:	*PCH*	**BORING DEPTH:**	*42.6__FEET*	
DATE DRILLED:	*2-23-95*	**WATER LEVEL @ T.O.B.:**	*Dry*	
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*	

DEPTH (ft)	GRAPHIC LOG	Soil Description	WATER LEVEL	SAMPLE	ELEV.	Standard Penetration Test Data (Blows/ft) 10 30 50 7090	BPF
		Medium Gray **LIMESTONE** with Beds Dipping 35° to 45° REC = 100% RQD = 82%					
40		Note: Calcite-filled fractures dipping approximately 85° from 41.0' to 42.6' REC = 100% RQD = 82%			1529		
		Coring Terminated at 42.6 Feet					
45					1524		
50					1519		
55					1514		
60					1509		
65					1504		
70					1499		

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∇ WATER LEVEL (T.O.B.)

▼ WATER LEVEL (24 HR.)

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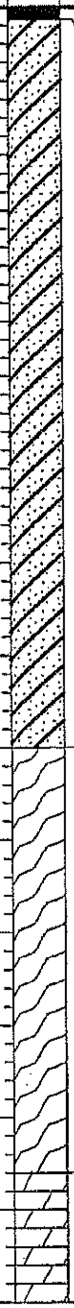
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**GEOLOGIST LOG**	**B-18**

PROJECT NO. :	*1404-94-061-A*	**ELEVATION:**	*1610.58__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*150.0__FEET*
DATE DRILLED:	*5-07-95*	**WATER LEVEL:**	*70.0*
DRILLING METHOD:	*8" Air Rotary*	**DRILL RIG:**	*Air Rotary*

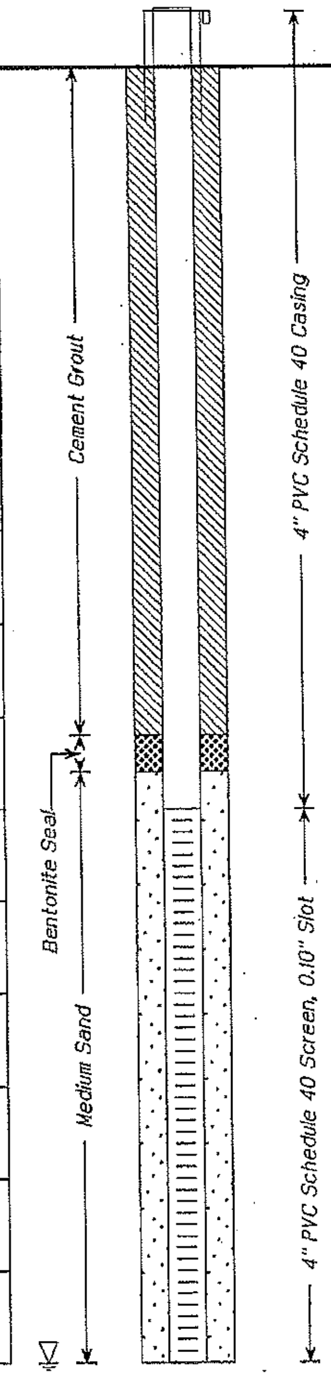
NOTES:

Used 10" Air Rotary Drill to 40 Feet

DEPTH (ft)	GRAPHIC LOG	Description & Remarks	SAMPLE NUMBER	SAMPLE	OVM (ppm)	SPR	ELEV.
0		Topsoil					
		Brown Sandy Silty **CLAY** (Drillers Description)					
5							1606
10							1601
15							1596
20							1591
25							1586
30							1581
35							1576
40		Weathered **LIMESTONE** and Soil Seams					1571
45							1566
50							1561
55							1556
60							1551
		LIMESTONE					
65							1546
70							1541



WELL DIAGRAM



∇ WATER LEVEL (T.O.B.)

▼ WATER LEVEL (24 HR.)

HC HOLE CAVE

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PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**

GEOLOGIST LOG B-18

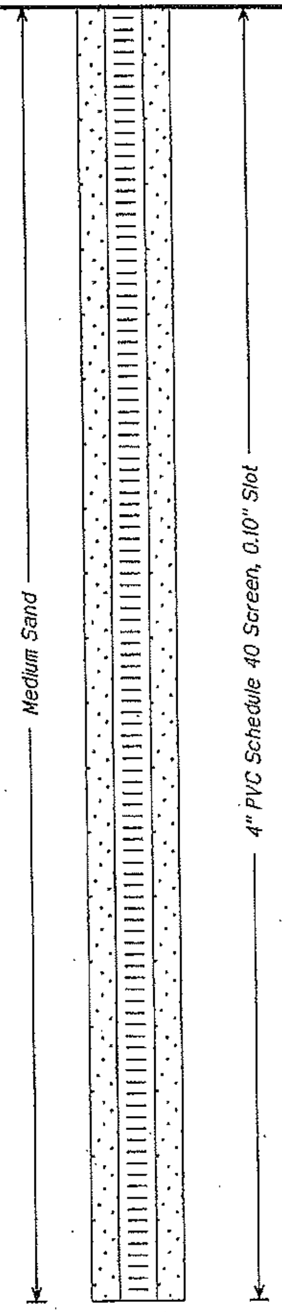
PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1610.58__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*150.0__FEET*
DATE DRILLED:	*5-07-95*	**WATER LEVEL:**	*70.0*
DRILLING METHOD:	*8" Air Rotary*	**DRILL RIG:**	*Air Rotary*

NOTES:

Used 10" Air Rotary Drill to 40 Feet

DEPTH (ft)	GRAPHIC LOG	Description & Remarks	SAMPLE NUMBER	SAMPLE	OVM (ppm)	SPR	ELEV.
		LIMESTONE					
75		Fracture from 75.0 to 75.5 Feet					536
80							1531
85		Fracture from 85.0 to 85.5 Feet					1526
90							1521
95							1516
		Fracture from 98.0 to 98.5 Feet					
100							1511
105							1506
110							1501
115							1496
120							1491
125							1486
		Fracture from 128.0 to 128.5 Feet					
130							1481
135							1476
140							1471

WELL DIAGRAM



WATER LEVEL (T.O.B.)
WATER LEVEL (24 HR.)
HOLE CAVE

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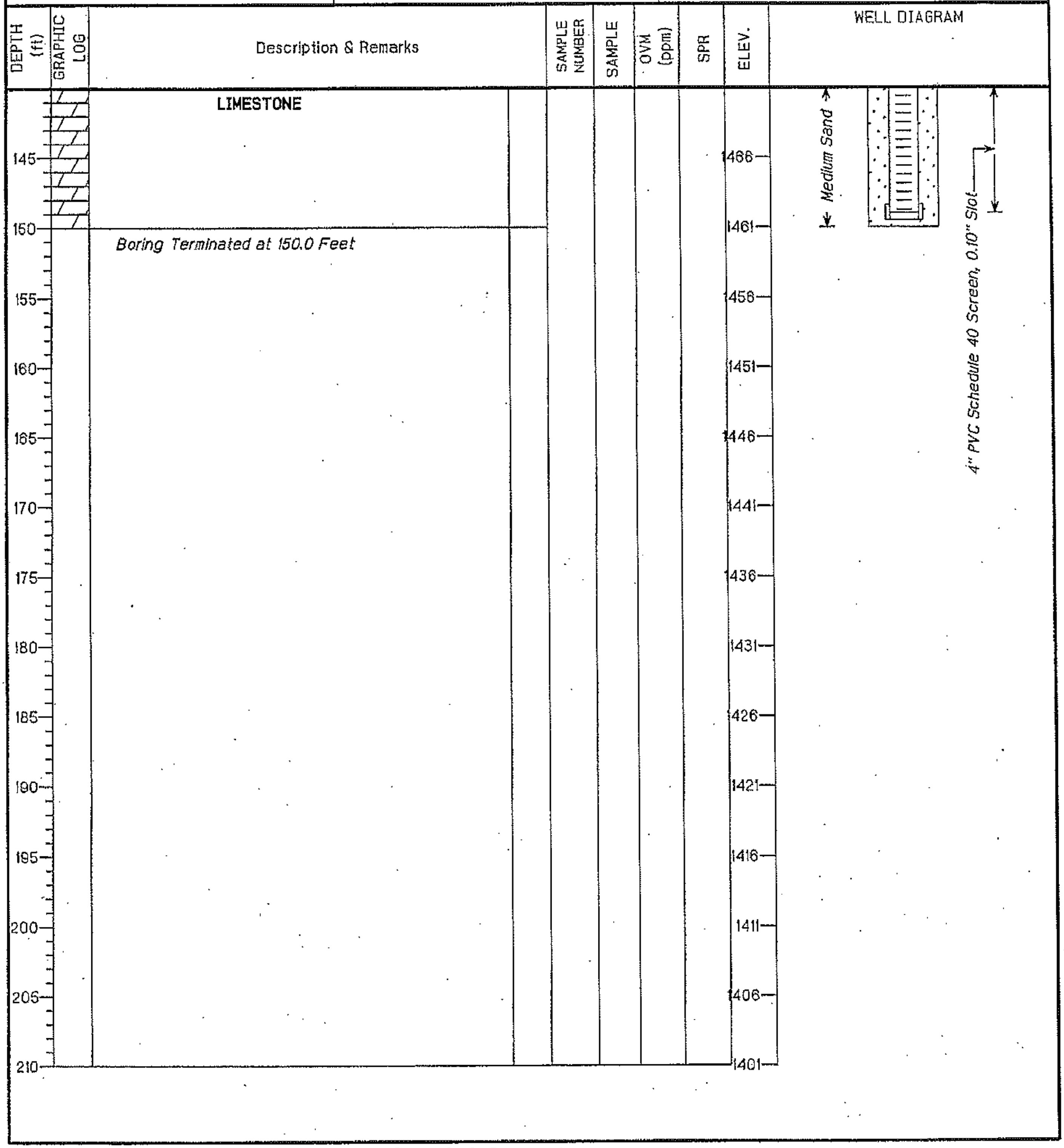
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

GEOLOGIST LOG B-18

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1610.58__FEET_MSLD*
LOGGED BY:	*PCH*	**BORING DEPTH:**	*150.0__FEET*
DATE DRILLED:	*5-07-95*	**WATER LEVEL:**	*70.0*
DRILLING METHOD:	*8" Air Rotary*	**DRILL RIG:**	*Air Rotary*

NOTES:

Used 10" Air Rotary Drill to 40 Feet



LIMESTONE

Boring Terminated at 150.0 Feet

▽ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
HOLE CAVE

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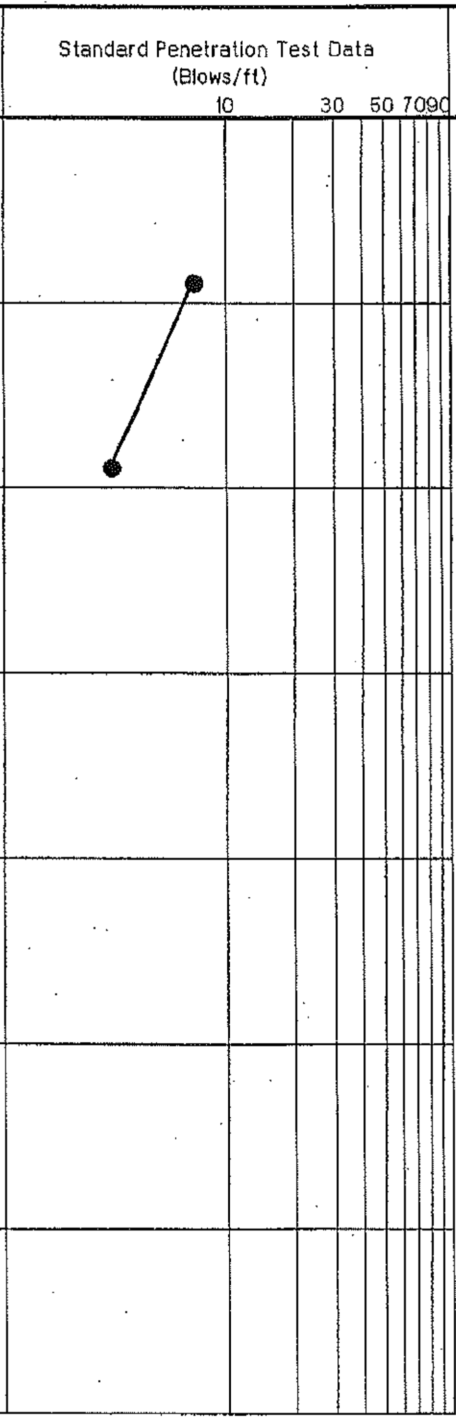
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-19

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1533.8 FEET MSLD*	**NOTES:**
LOGGED BY:	*PCH*	**BORING DEPTH:**	*12.5 FEET*	
DATE DRILLED:	*9-10-95*	**WATER LEVEL @ T.O.B.:**	*Dry*	Boring was backfilled and sealed with a bentonite plug.
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*	

DEPTH (ft)	GRAPHIC LOG	Soil Description	WATER LEVEL	SAMPLE	ELEV.	BPF
0–10	▨	RESIDUUM - Tan Silty **CLAY** (CH) with Scattered Laminae of Fine Sand (Low Moisture)		☒		7
				☒		3
10–12.5	▨	Reddish Tan Silty **CLAY** (CH)				
12.5		*Auger Refusal at 12.5 Feet*				

Depth scale: 5, 10, 15, 20, 25, 30, 35
Elevation scale: 1529, 1524, 1519, 1514, 1509, 1504, 1499



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▽ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
HC HOLE CAVE

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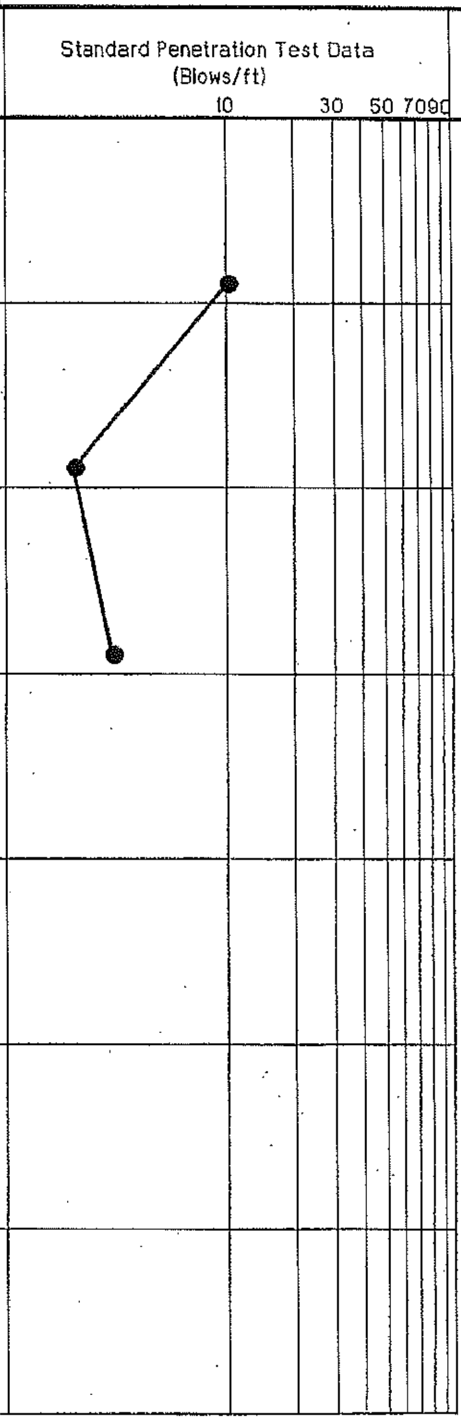
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	TEST BORING RECORD	B-20

PROJECT NO. : 1404-94-051-A	**ELEVATION:** 1537.2__FEET_MSLD	**NOTES:**
LOGGED BY: PCH	**BORING DEPTH:** 18.0__FEET	
DATE DRILLED: 9-10-95	**WATER LEVEL @ T.O.B.:** Dry	Boring was backfilled and sealed with a bentonite plug.
DRILLING METHOD: 3 1/4" HSA	**DRILL RIG:** Mobile B-57	

DEPTH (ft)	GRAPHIC LOG	Soil Description	WATER LEVEL	SAMPLE	ELEV.	BPF
0	▨	RESIDUUM - Reddish Tan Silty **CLAY** (CH) (Low Moisture)				
5	▨			☒ ■	1532	10
10	▨	--- Very Soft Below 8.5 Feet		☒	1527	2
15	▨			☒	1522	3
15–18	▨	Reddish Tan Silty **CLAY** (CH) with Scattered Chert Fragments				
18		*Auger Refusal at 18.0 Feet*				
20					1517	
25					1512	
30					1507	
35					1502	

Standard Penetration Test Data (Blows/ft)



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∇ WATER LEVEL (T.O.B.)

▼ WATER LEVEL (24 HR.)

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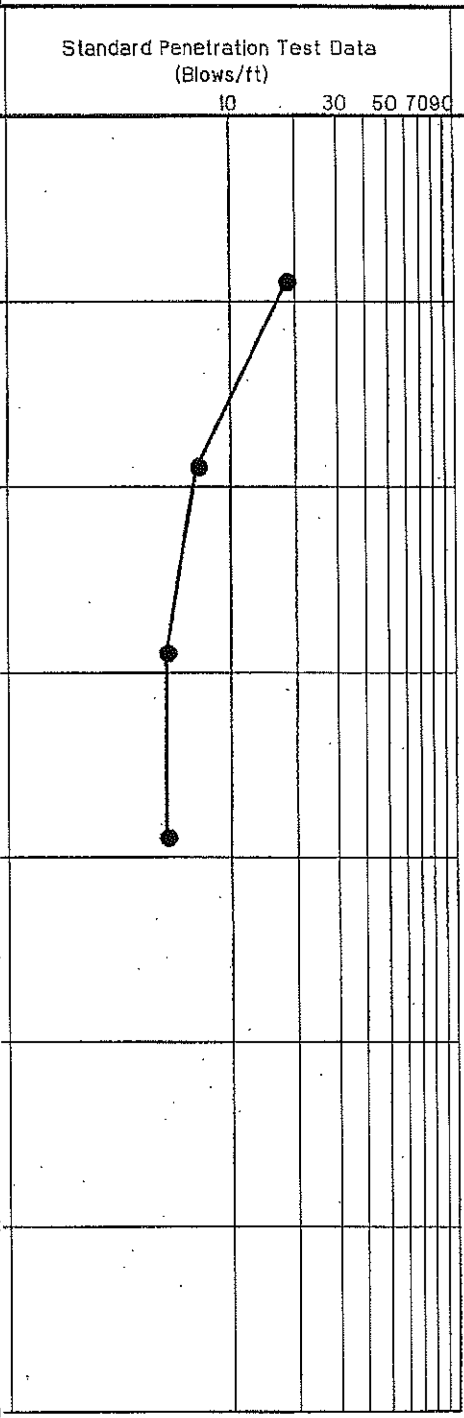
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-21

PROJECT NO. :	*1404-94-051-A*	**ELEVATION:**	*1544.5__FEET_MSLD*	**NOTES:**
LOGGED BY:	*PCH*	**BORING DEPTH:**	*23.0__FEET*	
DATE DRILLED:	*9-10-95*	**WATER LEVEL @ T.O.B.:**	*Dry*	Boring was backfilled and sealed with a bentonite plug.
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-57*	

DEPTH (ft)	Soil Description	ELEV.	BPF
0	RESIDUUM - Reddish Tan Clayey **SILT** (MH) with Manganese Blebs (Low Moisture)		
5		1540	18
10	Reddish Tan Silty **CLAY** (CH)	1535	7
15		1530	5
20	Gray Fine Sandy **CLAY** (CH) (High Moisture)	1525	5
23	*Auger Refusal at 23.0 Feet*		
25		1520	
30		1515	
35		1510	



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- WATER LEVEL (T.O.B.)
- WATER LEVEL (24 HR.)
- HOLE CAVE

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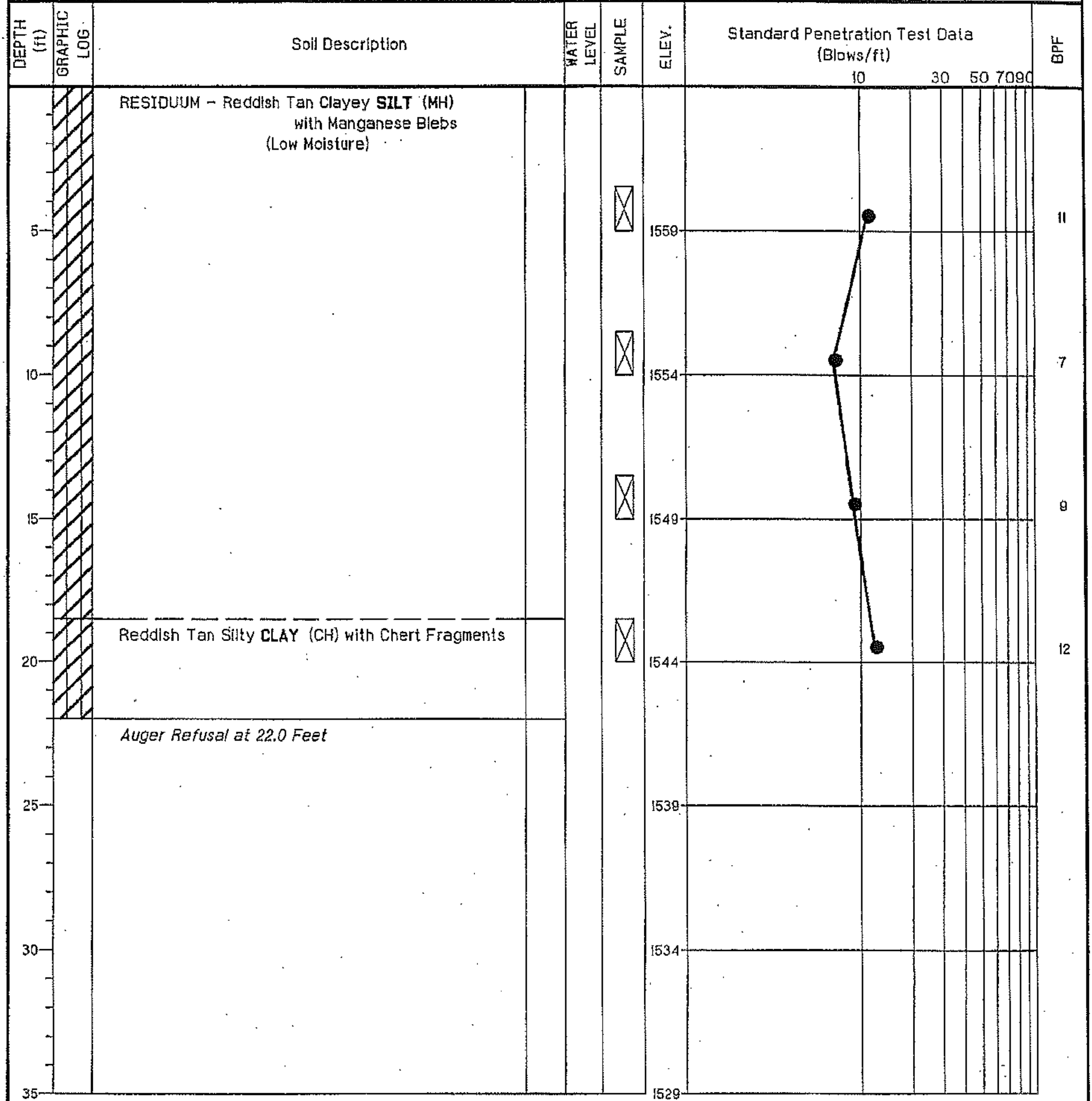
PROJECT: **Greeneville Demolition Landfill Site**
Greeneville, Tennessee

TEST BORING RECORD B-22

PROJECT NO. : *1404-94-051-A*
ELEVATION: *1564.2 FEET MSLD*
LOGGED BY: *PCH*
BORING DEPTH: *22.0 FEET*
DATE DRILLED: *9-10-95*
WATER LEVEL @ T.O.B.: *Dry*
DRILLING METHOD: *3 1/4" HSA*
DRILL RIG: *Mobile B-57*

NOTES:

Boring was backfilled and sealed with a bentonite plug.



RESIDUUM - Reddish Tan Clayey **SILT** (MH) with Manganese Blebs (Low Moisture)

Reddish Tan Silty **CLAY** (CH) with Chert Fragments

Auger Refusal at 22.0 Feet

Page : 1 of : 1

▽ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
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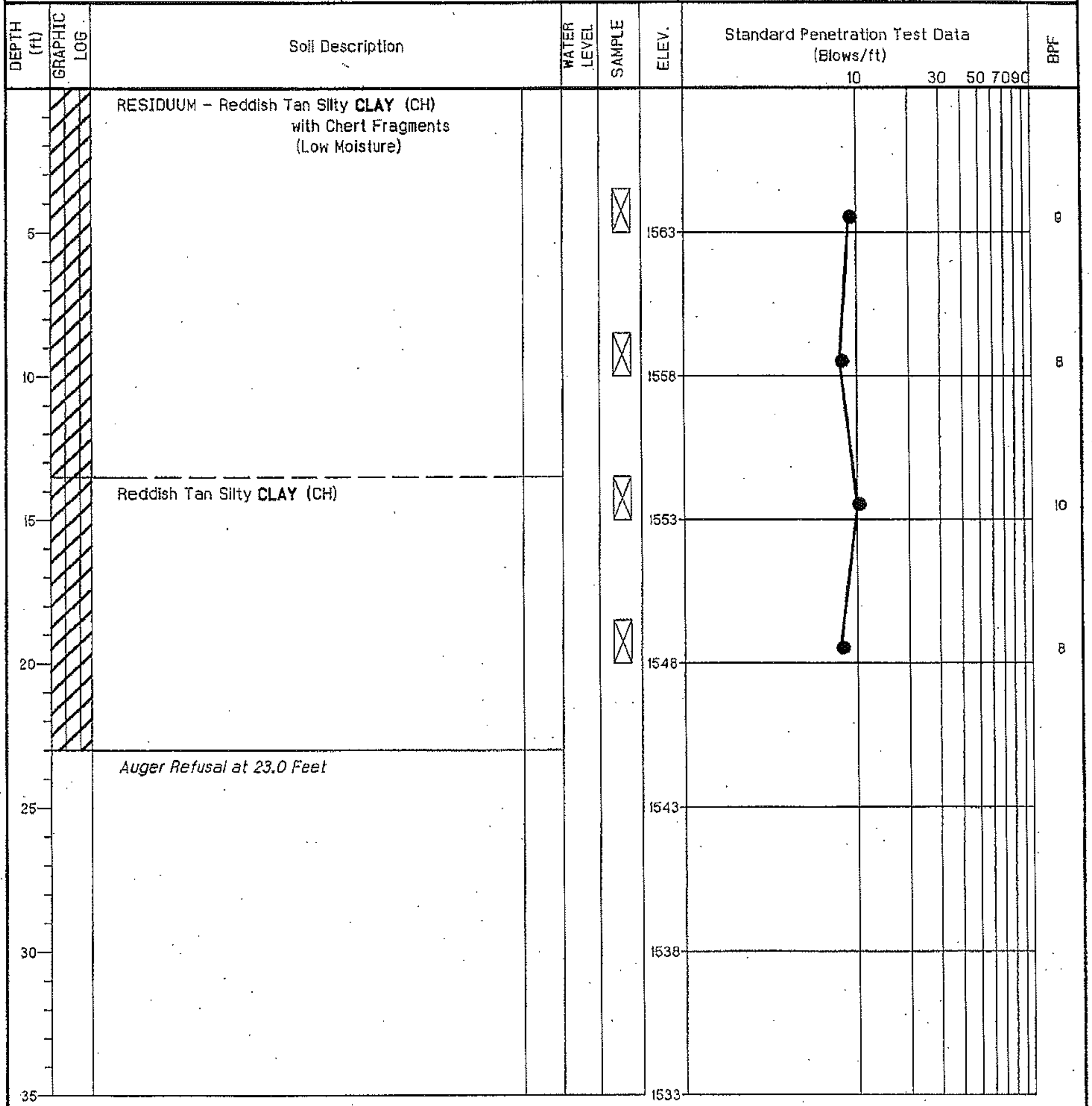
PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**		TEST BORING RECORD	B-23
PROJECT NO.:	*1404-94-051-A*	ELEVATION:	*1568.1__FEET_MSLD*	NOTES:
LOGGED BY:	*PCH*	BORING DEPTH:	*23.0__FEET*	
DATE DRILLED:	*9-10-95*	WATER LEVEL @ T.O.B.:	*Dry*	Boring was backfilled and sealed with a bentonite plug.
DRILLING METHOD:	*3 1/4" HSA*	DRILL RIG:	*Mobile B-57*	



RESIDUUM - Reddish Tan Silty **CLAY** (CH)
with Chert Fragments
(Low Moisture)

Reddish Tan Silty **CLAY** (CH)

Auger Refusal at 23.0 Feet

Page : 1 of : 1

- ∇ WATER LEVEL (T.O.B.)
- ▼ WATER LEVEL (24 HR.)
- HC HOLE CAVE

S&ME

Tri-Cities Branch
2153 Highway 75
P.O. Box 1118 TCAS
Blountville, T.N.
37617
(615) 323-2101

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**TP-1**

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1566.0__FEET_MSLD*	**NOTES:** Auger Probe Boring was backfilled and sealed with a bentonite plug.
LOGGED BY:	*PCH*	**BORING DEPTH:**	*13.0__FEET*	
DATE DRILLED:	*2-22-95*	**WATER LEVEL @ T.O.B.:**	*Dry*	
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*	

DEPTH (ft)	GRAPHIC LOG	Soil Description	WATER LEVEL	SAMPLE	ELEV.	Standard Penetration Test Data (Blows/ft) 10 30 50 7090	BPF
	▨	RESIDUUM - Tan Black Sandy **CLAY**					
5	▨				1561		
10	▨	- - - Auger Grinding on Rock (Driller's Note)			1556		
		Auger Refusal at 13.0 Feet					
15					1551		
20					1546		
25					1541		
30					1536		
35					1531		

Page : 1 of : 1

∇ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
≡ HOLE CAVE

S&ME

Tri-Cities Branch
2153 Highway 75
P.O. Box 1118 TCAS
Blountville, T.N.
37617
(615) 323-2101

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**TEST BORING RECORD**	**TP-2**

PROJECT NO.:	*1404-94-051-A*	**ELEVATION:**	*1566.2__FEET_MSLD*	**NOTES:** Auger Probe Boring was backfilled and sealed with a bentonite plug.
LOGGED BY:	*PCH*	**BORING DEPTH:**	*4.5__FEET*	
DATE DRILLED:	*2-22-95*	**WATER LEVEL @ T.O.B.:**	*Dry*	
DRILLING METHOD:	*3 1/4" HSA*	**DRILL RIG:**	*Mobile B-61*	

DEPTH (ft)	GRAPHIC LOG	Soil Description	WATER LEVEL	SAMPLE	ELEV.	Standard Penetration Test Data (Blows/ft) 10 30 50 7090	BPF
	▨	RESIDUUM - Tan Sandy **CLAY**					
	▨	- - - Auger Grinding on Rock (Driller's Note)					
5		*Auger Refusal at 4.5 Feet*			1561		
10					1556		
15					1551		
20					1546		
25					1541		
30					1536		
35					1531		

Page : 1 of : 1

∇ WATER LEVEL (T.O.B.)

▼ WATER LEVEL (24 HR.)

Ш HOLE CAVE

S&ME

Tri-Cities Branch
2153 Highway 75
P.O. Box 1118 TCAS
Blountville, T.N.
37617
(615) 323-2101

TABLE V

TEST BORING COORDINATES AND ELEVATIONS

TEST BORING	NORTHING	EASTING	ELEVATION
B-1	4052.8565	6892.0514	1520.53
B-2	4118.2902	7131.3396	1542.8
B-3	4242.3502	7304.9239	1558.6
B-4	4294.5661	7338.0104	1558.1
B-5	4399.3908	7382.8564	1545.8
B-6	4366.0993	7493.6076	1564.7
B-7	4465.2698	7869.8872	1582.9
B-8	4300.0026	7596.1125	1586.3
B-9	4465.7634	7600.5204	1553.0
B-10	4545.8418	7852.9971	1566.24
B-11	4320.7290	7183.6822	1537.79
B-12	4581.9472	8053.2783	1580.66
B-13	4489.7528	8161.5805	1601.06
B-14	4461.7186	8100.4323	1599.51
B-15	4461.3027	8343.4464	1616.77
B-16	4273.3152	7468.6359	1576.3
B-17	4390.0635	7696.5899	1569.2
B-18	4333.0246	8092.1797	1610.58
B-19	4328.7225	7278.0532	1533.8
B-20	4395.5685	7399.6069	1537.2
B-21	4463.2209	7643.1108	1544.5
B-22	4596.5107	7966.6072	1564.2
B-23	4638.2962	7875.0946	1568.1

GREENEVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE

SOIL DATA SUMMARY

Project No.: 1404-94-051-A

BORING NUMBER	SAMPLE NUMBER	DEPTH, ft.	MOISTURE CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SPECIFIC GRAVITY	U. S. C. S. CLASSIFICATION	PERMEABILITY cm. / sec.	DRY DENSITY, pcf
B-2	Bag	10.0 - 30.0	26.2							
B-4	Bag	5.0 - 30.0	28.1	59	26	33		CH		
B-5	Bag	3.5 - 21.1	38.1							
B-7	Bag	5.0 - 30.0	39.6	57	29	28		CH		
B-8	Bag	5.0 - 30.0	37.2	52	23	29		CH		
B-4	UD	25.0 - 27.0	36.5				2.558		9.72×10^{-6}	82.9
B-7	UD	23.0 - 25.0	53.9	50	23	27	2.598	CL or CH	2.92×10^{-6}	68.2
B-8	UD	28.0 - 30.0	26.9	38	19	19	2.569	CH		89.8
B-8	UD	22.0 - 24.0	40.8	60	26	34		CH	6.19×10^{-7}	78.7
B-3	2	8.5 - 10.0	36.0							
B-4	2	8.5 - 10.0	37.7							
B-4	3	13.5 - 15.0	36.3							
B-4	4	18.5 - 20.0	23.8							
B-4	5	23.0 - 25.0	46.0							
B-6	7	33.5 - 35.0	38.7							
B-6	8	38.5 - 40.0	35.9							
B-7	4	18.5 - 20.0	40.9							
B-7	5	25.0 - 26.5	29.2							
B-7	6	28.5 - 30.0	62.0							
B-8	2	8.5 - 10.0	22.1							
B-8	5	24.0 - 25.5	41.1							

NOTES:

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GREENEVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE
SOIL DATA SUMMARY

Project No.: 1404-94-051-A

BORING NUMBER	SAMPLE NUMBER	DEPTH, ft.	MOISTURE CONTENT, % *	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	SPECIFIC GRAVITY	U. S. C. S. CLASSIFICATION	PERMEABILITY cm. / sec.	DRY DENSITY, pcf *
B-4	Bag	5.0 - 30.0	27.7	59	26	33		CH	1.88 x 10^{-7}	91.8
B-7	Bag	5.0 - 30.0	25.8	57	29	28		CH	2.34 x 10^{-7}	95.4
B-7	Bag	5.0 - 30.0	27.8	57	29	28		CH	2.71 x 10^{-7}	91.8
B-8	Bag	5.0 - 30.0	24.9	52	23	29		CH	1.83 x 10^{-7}	95.1
B-20	UD	5.0 - 7.0	48.8	60	30	30	2.601	CH	2.01 x 10^{-7}	77.8

NOTES: * Moisture Content and Dry Density Values shown are from remolded permeability test specimens.

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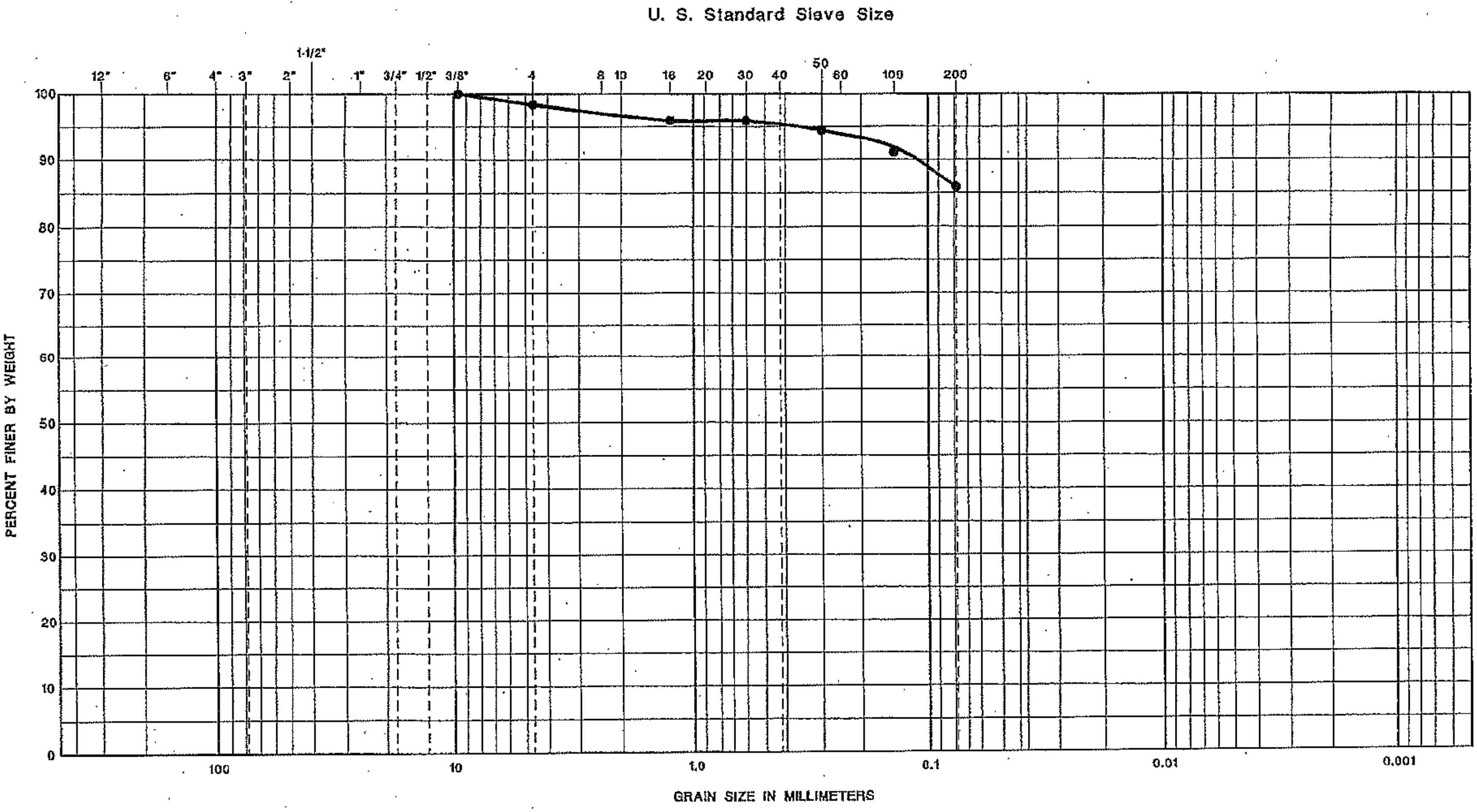

Boulders	Cobbles	Gravel		Sand			Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

BORING NUMBER :	B-4 Bag	LIQUID LIMIT :	59
ELEVATION OR DEPTH, Ft :	5' - 30'	PLASTIC LIMIT :	26
NATURAL MOISTURE, % :	28.1	PLASTICITY INDEX :	33

DESCRIPTION or CLASSIFICATION

Yellowish Red Silty CLAY (CH)

PROJECT No. : 1404-94-051-A

GRAIN SIZE DISTRIBUTION

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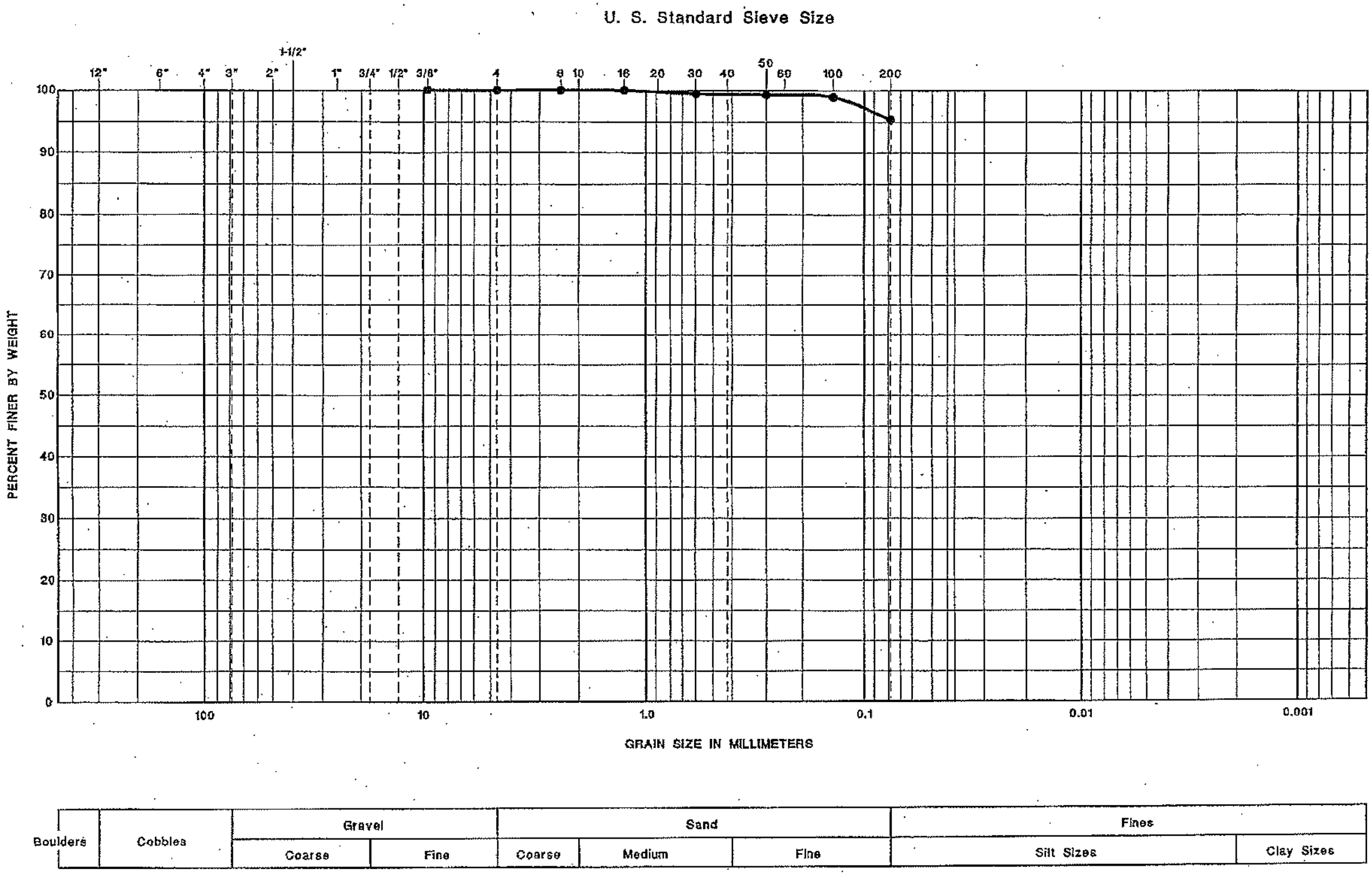


BORING NUMBER : B-7 UD

ELEVATION OR DEPTH, Ft : 23' - 25'

NATURAL STURE, % : 53.9

LIQUID LIMIT : 50

PLASTIC LIMIT : 23

PLASTICITY INDEX : 27

DESCRIPTION or CLASSIFICATION

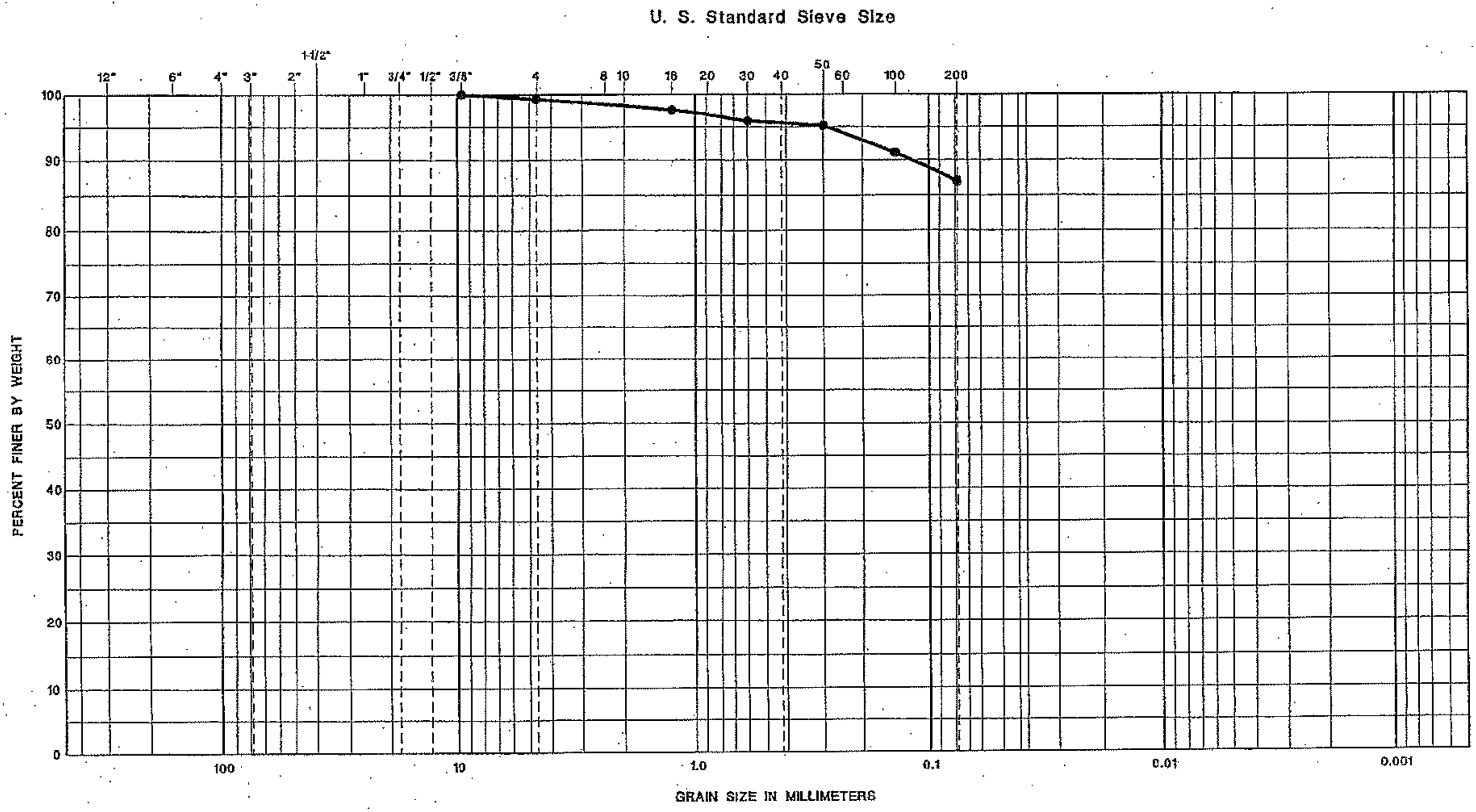
Yellowish Red Silty CLAY (CL or CH)

ROJECT No. : 1404-94-051-A

GRAIN SIZE DISTRIBUTION

S&ME

ENVIRONMENTAL SERVICES ENGINEERING TESTING



Boulders	Cobbles	Gravel		Sand			Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

BORING NUMBER : B-8 Bag

ELEVATION OR DEPTH, Ft : 5' - 30'

NATURAL MOISTURE, % : 37.2

LIQUID LIMIT : 52

PLASTIC LIMIT : 23

PLASTICITY INDEX : 29

DESCRIPTION or CLASSIFICATION

Yellowish Red Silty CLAY (CH)

PROJECT No. : 1404-94-051-A

GRAIN SIZE DISTRIBUTION

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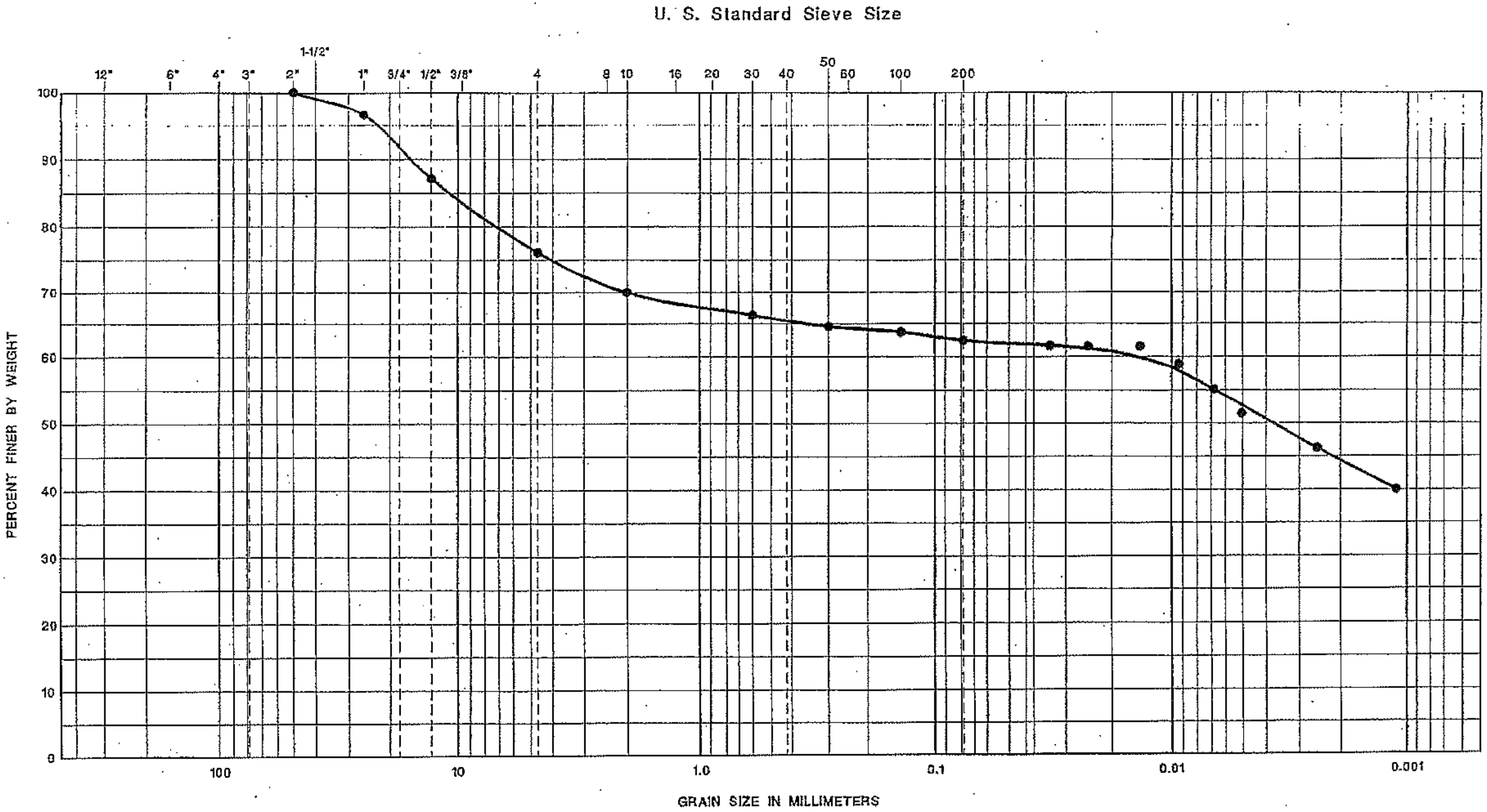

Boulders	Cobbles	Gravel		Sand			Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt Sizes	Clay Sizes

BORING NUMBER : B-20

ELEVATION OR DEPTH, Ft : 5.0' - 7.0'

NATURAL TURE, % : 48.8

LIQUID LIMIT : 60

PLASTIC LIMIT : 30

PLASTICITY INDEX : 30

DESCRIPTION or CLASSIFICATION

Reddish Tan Silty CLAY (CH)

OJECT No. : 1403-94-051-A

GRAIN SIZE DISTRIBUTION

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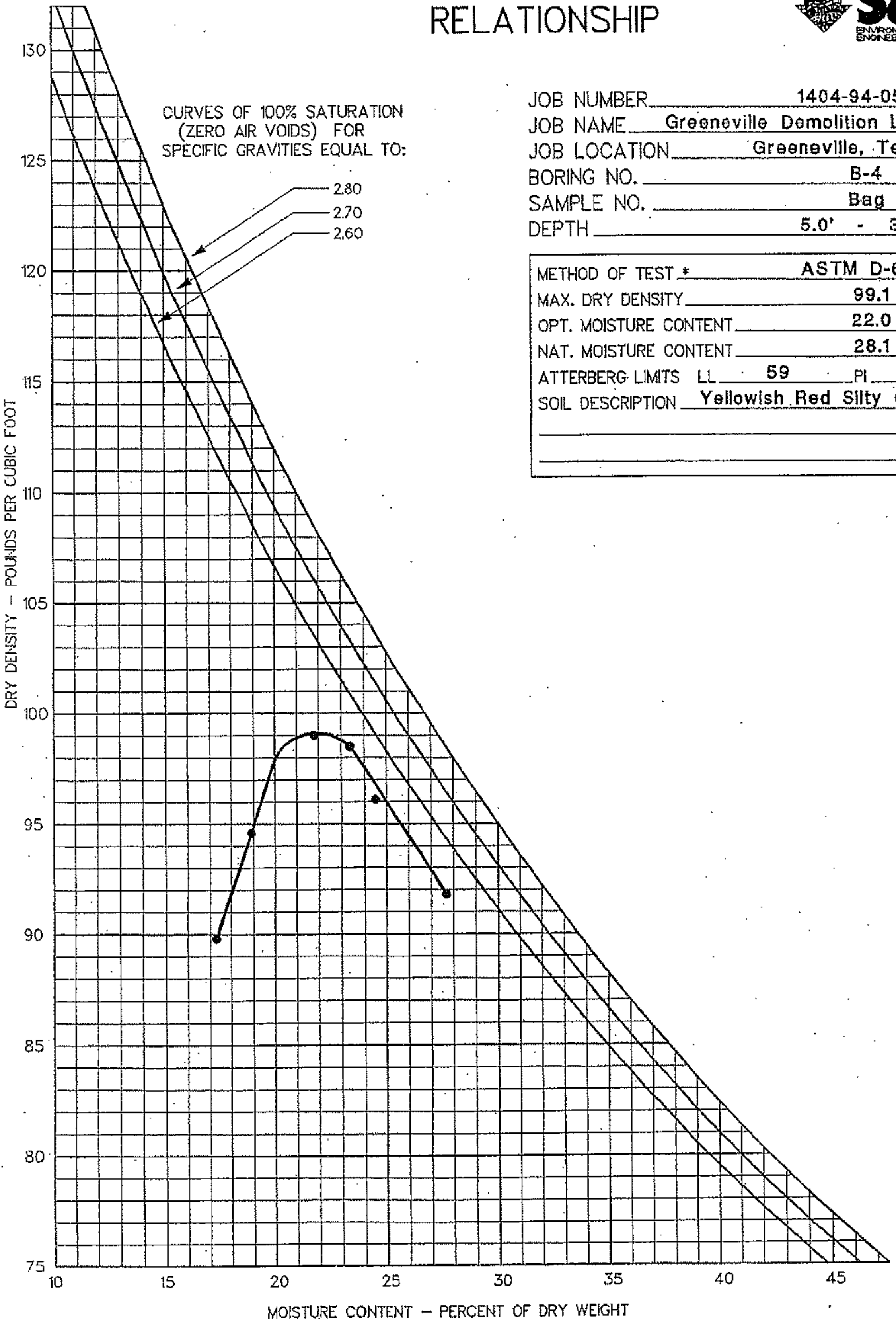
ENGINEERING TESTING

MOISTURE – DENSITY RELATIONSHIP

JOB NUMBER 1404-94-051-A
JOB NAME Greeneville Demolition Landfill Site
JOB LOCATION Greeneville, Tennessee
BORING NO. B-4
SAMPLE NO. Bag
DEPTH 5.0' - 30.0'

METHOD OF TEST * ASTM D-698A
MAX. DRY DENSITY 99.1 PCF
OPT. MOISTURE CONTENT 22.0 %
NAT. MOISTURE CONTENT 28.1 %
ATTERBERG LIMITS LL 59 PI 33
SOIL DESCRIPTION Yellowish Red Silty CLAY (CH)



* ASTM D698 = Standard Proctor / ASTM D1557 = Modified Proctor

MOISTURE – DENSITY RELATIONSHIP

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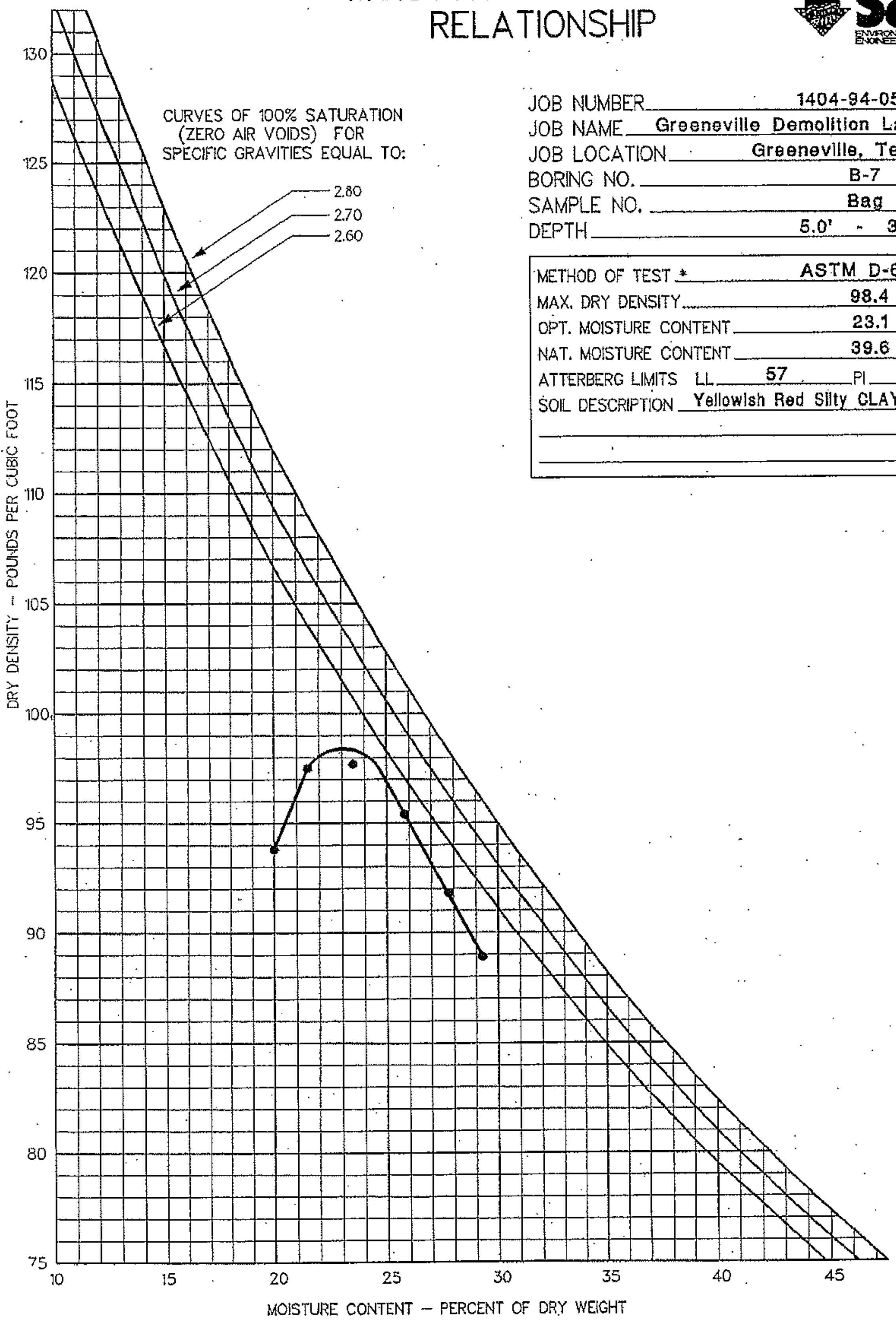
ENGINEERING TESTING

JOB NUMBER 1404-94-051-A
JOB NAME Greeneville Demolition Landfill Site
JOB LOCATION Greeneville, Tennessee
BORING NO. B-7
SAMPLE NO. Bag
DEPTH 5.0' - 30.0'

METHOD OF TEST * ASTM D-698A
MAX. DRY DENSITY 98.4 PCF
OPT. MOISTURE CONTENT 23.1 %
NAT. MOISTURE CONTENT 39.6 %
ATTERBERG LIMITS LL 57 PI 28
SOIL DESCRIPTION Yellowish Red Silty CLAY (CL or CH)



* ASTM D698 = Standard Proctor / ASTM D1557 = Modified Proctor

MOISTURE – DENSITY RELATIONSHIP

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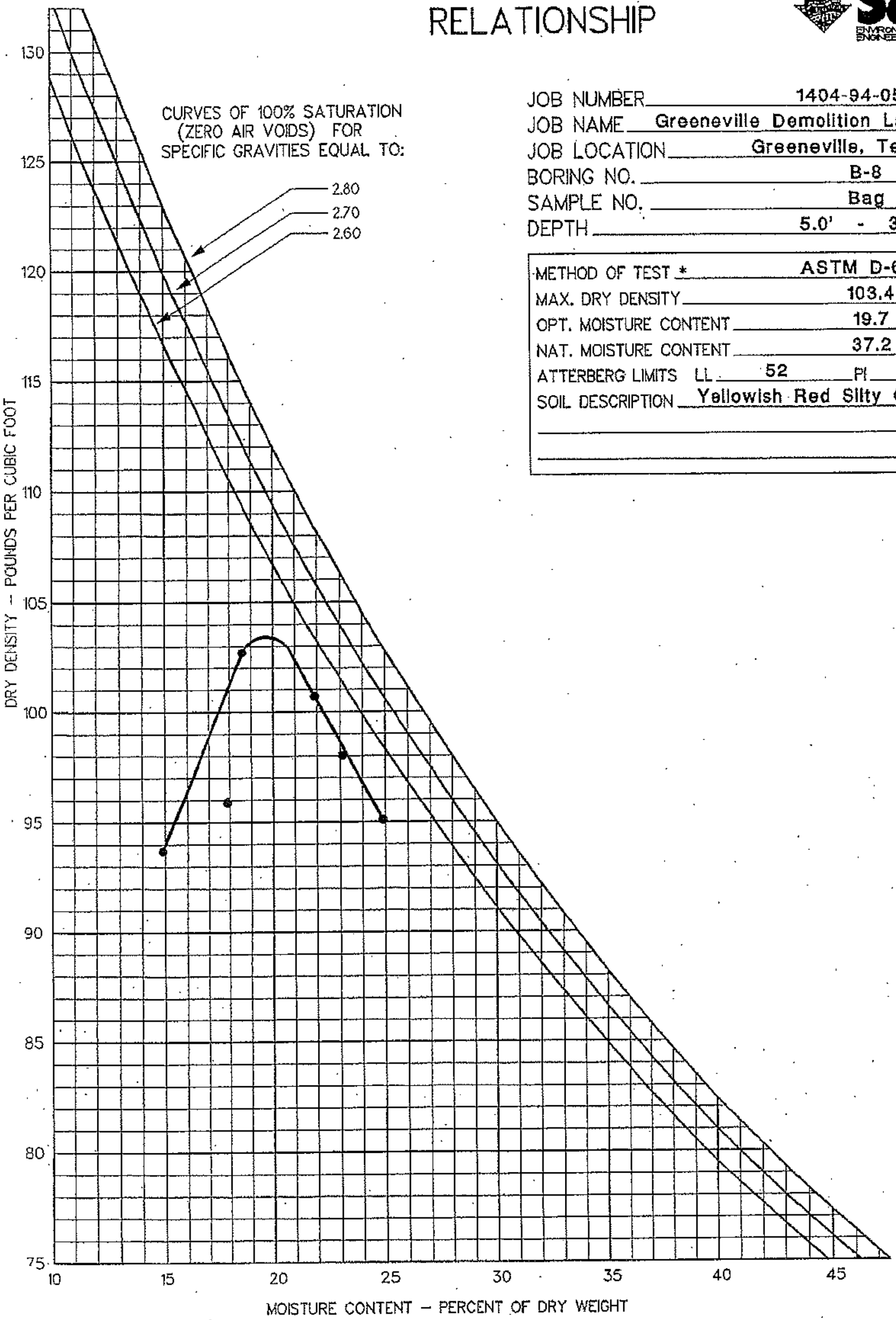
JOB NUMBER 1404-94-051-A
JOB NAME Greeneville Demolition Landfill Site
JOB LOCATION Greeneville, Tennessee
BORING NO. B-8
SAMPLE NO. Bag
DEPTH 5.0' - 30.0'

METHOD OF TEST * ASTM D-698A
MAX. DRY DENSITY 103.4 PCF
OPT. MOISTURE CONTENT 19.7 %
NAT. MOISTURE CONTENT 37.2 %
ATTERBERG LIMITS LL 52 PI 29
SOIL DESCRIPTION Yellowish Red Silty CLAY (CH)



* ASTM D698 = Standard Proctor / ASTM D1557 = Modified Proctor

HYDROLOGIC COLUMBIA
Sample Data Report
NC Certification No. 400
SC Certification No. 40101

Date : 8/23/94
Client : S & ME, Inc.
Project Name/No.: 1404-94-051A Greaneville Demolition Landfill Site
Date Collected : 6/27-28/94
Date Received : 8/1/94
Date Analyzed : 8/22/94
Date Reported : 8/23/94

Sample ID	Client ID	Cation Exchange Capacity
94-3331	B-1	11.4
94-3332	B-3	14.8
94-3333	B-6	14.6

Cation Echange Capacity = mEq/100g Soil by M9081

Data Approved for Release:

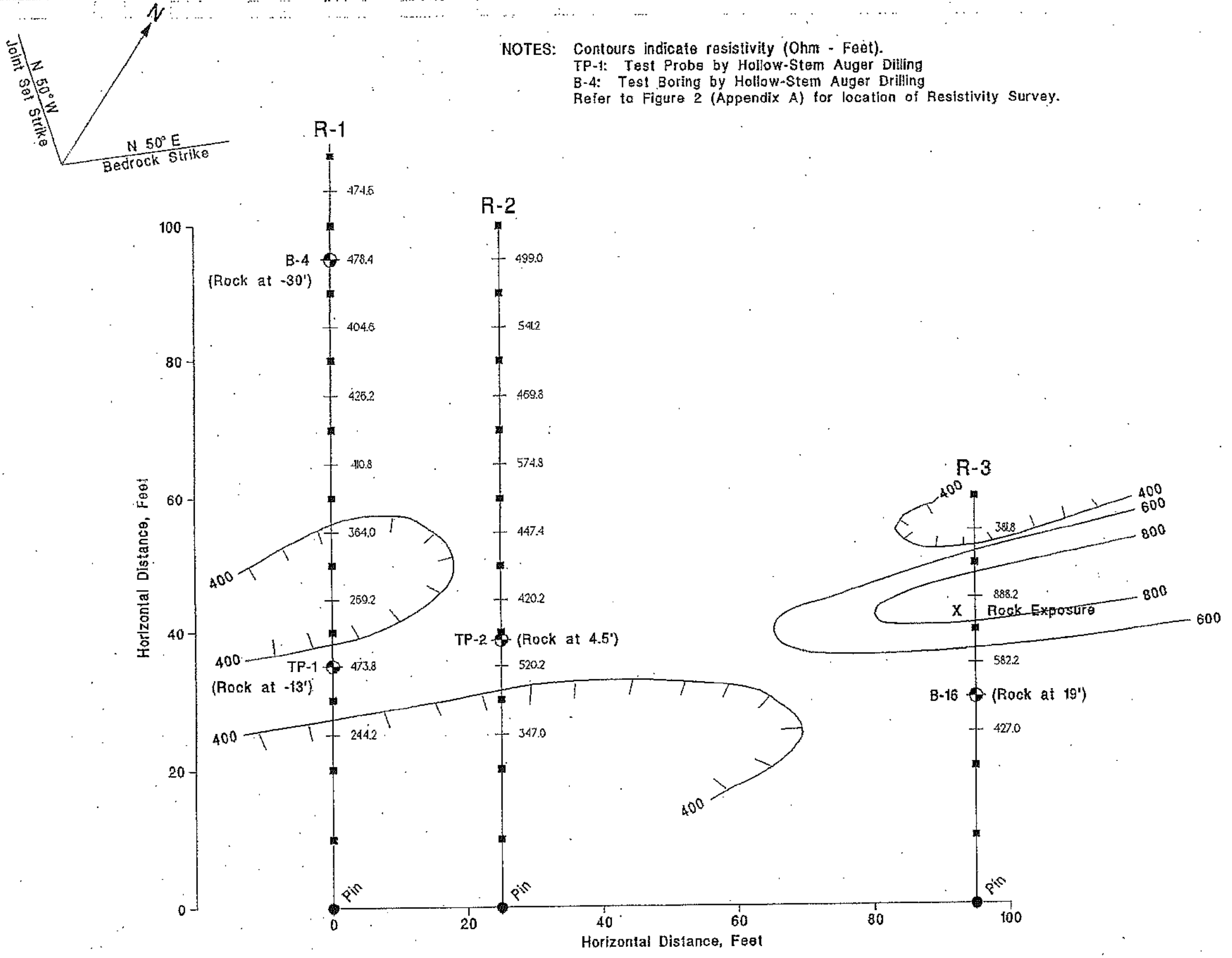
Tom Smith
Laboratory Manager

TABLE I: ELECTRICAL RESISTIVITY FIELD DATA

PROFILE LINE NO.	LOCATION	READING	MULTIPLIER	RESISTANCE (ohms)	RESISTIVITY (ohm-ft)
R-1	0+00	244.2	0.1	24.42	244.2
	0+10	473.8	0.1	47.38	473.8
	0+20	269.2	0.1	26.92	269.2
	0+30	364.0	0.1	36.40	364.0
	0+40	410.8	0.1	41.08	410.8
	0+50	426.2	0.1	42.62	426.2
	0+60	404.6	0.1	40.46	404.6
	0+70	478.4	0.1	47.84	478.4
	0+80	474.6	0.1	47.46	474.6
R-2	0+00	347.0	0.1	34.70	347.0
	0+10	520.2	0.1	52.02	520.2
	0+20	420.2	0.1	42.02	420.2
	0+30	447.4	0.1	44.74	447.4
	0+40	574.8	0.1	57.48	574.8
	0+50	469.8	0.1	46.98	469.8
	0+60	541.2	0.1	54.12	541.2
	0+70	499.0	0.1	49.90	499.0
R-3	0+00	427.0	0.1	42.70	427.0
	0+10	582.2	0.1	58.22	582.2
	0+20	888.2	0.1	88.82	888.2
	0+30	381.8	0.1	38.18	381.8
	0+40	708.2	0.1	70.82	708.2

Note: The electrode spacing for all surveys was maintained consistant at 10 feet.

NOTES: Contours indicate resistivity (Ohm - Feet).
TP-1: Test Probe by Hollow-Stem Auger Dilling
B-4: Test Boring by Hollow-Stem Auger Drilling
Refer to Figure 2 (Appendix A) for location of Resistivity Survey.



PROJECT:

ELECTRICAL RESISTIVITY CONTOUR MAP
GREENEVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE

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ENGINEERING TESTING

SCALE:	1" = 20'
JOB NO.:	1404-94-051-A
FIG. NO.:	Figure A

DIVISION OF WATER SUPPLY
401 Church Street
6th Floor, L&C Tower
Nashville, TN 37243-1549

APPLICATION FOR AUTHORIZATION FOR CLASS V UNDERGROUND INJECTION WELL

In accordance with the provisions of Tennessee Code Annotated Section 69-3-105 and Regulations of the Tennessee Water Quality Control Board, application is hereby made to operate a Class V Underground Injection Well in the State of Tennessee.

Part A - General Information

1. Describe the activities conducted by the applicant which require it to obtain Class V UIC permit authorization: Mr. Randy Curtis, TDEC Division of Solid Waste Management, has requested a dye tracing study to determine the direction of groundwater flow and to determine a groundwater monitoring strategy.

2. Name and location of the facility at which these activities (will) occur:

   Site or Facility Name Greeneville Demolition Landfill Site.

   Street or Highway Address 1550 Old Stage Road

   City Greeneville Zip Code ____

   County Greene Tel. (615)-639-4416

3. USGS topographic coordinates of the injection well or facility location:

   Quadrangle Name: Greeneville
   Latitude 36°11′50″N; Longitude 82°45′15″W
   Ground elevation at injection location: approximately 1566.2 feet above MSL

4. Name and address of owner of injection well or facility:

   Individual or Firm Name Greene County
   Street Town Hall
   City Greeneville State Tennessee
   Zip Code 37743 Tel.

5. Type of business: ___ Federal ___ State
_X_ Public ___ Private
___ Other

6. Nature of business: Landfill site for demolition waste material

7. List up to four standard industrial (SIC) codes which best reflect the principal products or services provided by the facility:

4953-03 - Sanitary Landfill

8. Name and address of legal contact or person responsible for the operation of the Class V injection well or facility:

Name Mr. Bob Bird

Street Town Hall

City Greeneville State TN

Zip 37743 Tel.

9. Is the facility located on Indian Lands? ___ Yes _X_ No

10. Permit Status: _X_ (a) new well or facility
___ (b) modification of existing well or facility
___ (c) reapplication for previously permitted well or facility

11. List all other permits or construction approvals received or applied for under any of the following programs:

a. Hazardous Waste Management program under federal or state law.
b. UIC program under federal or state law.
c. NPDES program under federal or state law.
d. Prevention of Significant Deterioration (PSD) program under federal or state law.
e. Nonattainment program under federal or state law.
f. National Emission Standards for Hazardous Pollutants (NESHAPS) preconstruction approval under federal or state law.
g. Ocean dumping permits under the Marine Protection Research and Sanctuaries Act.
h. Dredge and fill permits under section 404 of the Clean Water Act, 33 U.S.C. Section 1344.
i. Comprehensive Environmental Response, compensation and liability Act (Federal Superfund) or Tennessee Hazardous Waste management Act (Tennessee Superfund).

j. UST program under federal or state law.
k. Other relevant environmental permits.

Permit No.	Type	Date

None related to this injection facility.

Part B - Facility Description

1. Nature, type or purpose or injection well:

   Dye injection into a monitoring well located at the landfill site will provide information necessary to determine the direction of ground water flow in order to develop a groundwater monitoring strategy for the site.

2. Description of injection well or facility, including monitoring wells and other associated structures:

   The injection area is a new monitoring well located on the site.

3. Depth of injection zone: At ground level into monitoring well
   Approximately 1566.2 feet above MSL

4. Operating status of well or facility:

   ____ proposed
   _X_ active
   ____ inactive
   ____ abandoned

5. Dates of operation: from September 29, 1995, only to ____________

6. For previously active facilities, give history of injection or operation:

   There have been no previous injections at the site.

7. Mode of operation: _____ continuous _____ intermittent

   One event only: September 29, 1995

8. Volume of injected fluid in gallons _5_ or cubic yards ___ (specify):

_X_ per day (one event) ___ per month ___ per year

9. Nature of injected fluid, including physical, chemical, biological and/or radiological properties:

Uranine Liquid tracing dye is in the dipotassium fluorescein chemical family and is referred to as Acid Yellow 73. It decomposes to carbon monoxide, carbon dioxide, and oxides of nitrogen. The dye is an odorless, brown aqueous liquid with a pH of 9.

10. Origin of injected fluid:

Chemcentral Dyes and Pigments

11. Description of treatment of fluid prior to injection:

Liquid dye is injected, then flushed with water.

12. Type of injection: ___ pump _X_ gravity ___ other
Description of pump, if applicable:

13. Operating parameters of injection well:

a. fluid flow: ___________ gpm

b. fluid pressure: ___________ psig

c. fluid temperature: ≈50 °F

d. other significant operating information:

The injection is by gravity and therefore at atmospheric conditions.

Part C - Description of Area of Review

The area of review (AOR) for each individually permitted Class V injection well shall, unless otherwise specified by the Department, consist of the area lying within and below a one mile radius of the injection well or facility, and shall include, but not be limited to surface geographic features, subsurface geology, and demographic and cultural features within the area. Attach to this Part of the application a complete characterization of the AOR, including the following:

1. Describe all past and present uses of ground water within the area of review, as documented by public record.

   The past and present use of ground water within the area of review is for a domestic drinking water source. A public water supply currently serves some residences and businesses.

2. Describe the ground water hydrology within the area of review, including characteristics of all subsurface aquifers, presence or absence of solutional development features, general direction of ground water movement, and chemical characteristics of the ground waters in the area of review.

   Groundwater flow at the site is interpreted to occur under gravity-induced head at atmospheric pressure. That is to say, groundwater flow occurs under typical water-table conditions. Because the ground water occurs within limestone, it is understood that ground water flows primarily along bedding planes and fractures enlarged by solution, that is, in zones of secondary porosity. Flow gradients have been interpreted from water level measurements in an adjacent landfill to be toward the northeast. However, dye tracing studies at the adjacent landfill indicated there may be more than one flow gradient direction. The pH of the groundwater typically ranges from 6.2 to 8.2.

3. Describe the population and cultural development within the area of review, including the number of persons living within one mile of the injection well or facility, land uses within the area of review, and the existence of any State, Regional or National Parks, Wildlife refuges, natural or wilderness areas, parks, recreational or other public-use areas, or any other environmentally sensitive features within the area of review.

   The population is industrial/residential (approximately 75 residences within one mile of the injection well location). There are no known nearby public-use areas.

4. Identify all sources of publicly-supplied drinking water for persons living or working within the area of review.

   The source of publicly-supplied drinking water from Greeneville is not located within the area of review.

5. Identify any single or multi-family residences, churches, schools, businesses or other inhabited structures within the area of review which do not have access to a public drinking water supply system.

   None. Some residences and industries use groundwater from wells; however, a public drinking water supply is accessible.

6. If ground water is used for drinking water within the area of review, identify and locate on Attachment 1 all ground water withdrawal points within the AOR which supply public or private drinking water systems.

   Attachment 1 includes all ground water withdrawal points within the AOR which supply public or private drinking water systems.

7. Identify any surface water bodies or features within the area of review which may be impacted by ground water discharge to surface waters.

   Moon Creek and Frank Creek.

8. Identify any surface water intake which supplies a public water distribution system and is located within the area of review or within three miles topographically downgradient from the injection well or facility. If any such intake(s) exist, locate on Attachment 1.

   None.

Attachments

1. USGS topographic quadrangle map showing the location of the Class V injection well or facility and a one-mile radius area surrounding the well or facility.

   Attachment 1.

2. USGS geologic quadrangle or regional geologic map showing the subsurface structure in the area of the well or facility, from the surface to the injection zone.

   Attachment 1.

3. Schematic diagram of the injection well showing construction details and materials of the injection well.

   Injection will be into the new on-site monitoring well installed in test boring B-18, detailed on Attachment 2.

4. Chemical analysis data of injection fluid, if required.

   The MSDS provided by the manufacturer is attached.

5. Process description of the treatment or other process which is the source of the injection fluid, if required.

   Not applicable.

6. Procedures for operation and maintenance of the injection well or facility, if required.

   Not applicable.

7. Geologic/hydrogeologic information collected during the planning, construction and design phases of the facility and injection well.

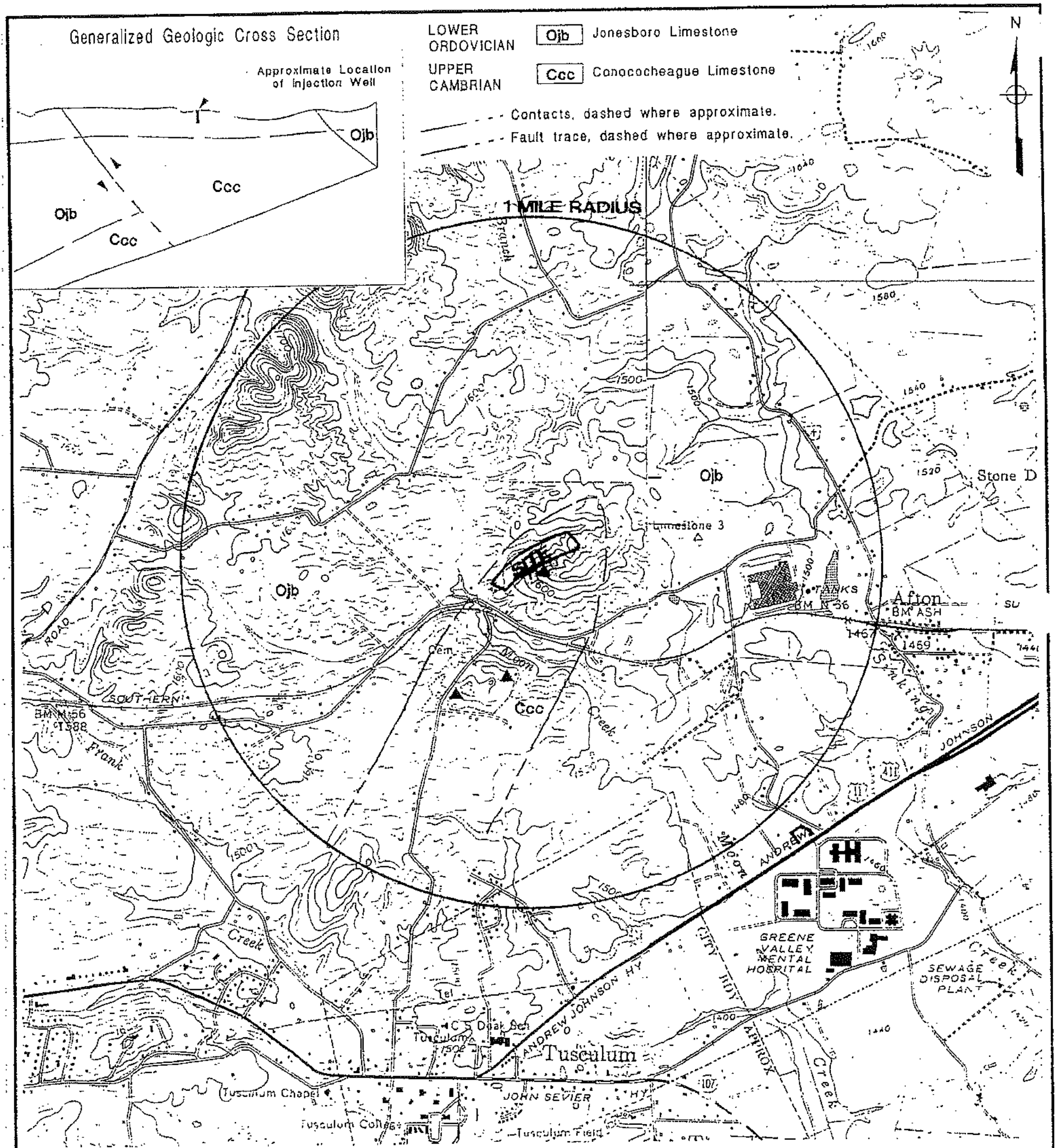
   Summarized on Attachment 1.

8. Blueprints from the facility showing the injection well and portions of the facility that will or may contribute injectate to the injection well, including storm runoff waters.

   Not applicable.

9. Construction diagrams depicting erosion and sediment controls.

   Not applicable.



▲ - Indicates Approximate Location of Private Drinking Water Supplies.

NOTE: Developed from Greeneville, TN & Chucky, TN Quadrangles U.S.G.S. Topographic Maps.

PROJECT:

AREA OF REVIEW
GREENEVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING TESTING

SCALE: 1" = 2000'
JOB NO 1404-94-051-A
FIG. NO Attachment 1

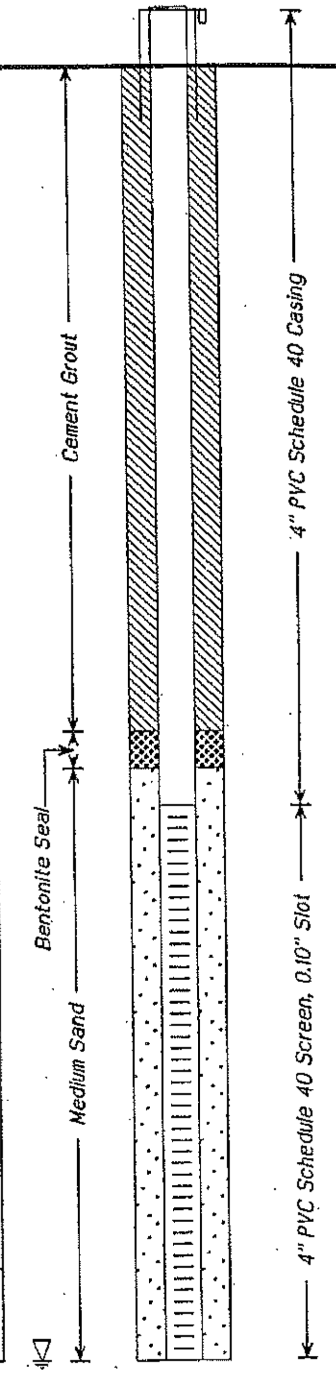
ATTACHMENT 2

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**GEOLOGIST LOG**	**B-18**

PROJECT NO.: *1404-94-051-A*	**ELEVATION:** *1566.2__FEET_MSLD*	**NOTES:**
LOGGED BY: *PCH*	**BORING DEPTH:** *150.0__FEET*	
DATE DRILLED: *5-07-95*	**WATER LEVEL:** *70.0*	Used 10" Air Rotary Drill to 40 Feet
DRILLING METHOD: *8" Air Rotary*	**DRILL RIG:** *Mobile B-57*	

DEPTH (ft)	Description & Remarks	SAMPLE NUMBER	SAMPLE	OVM (ppm)	SPR	ELEV.
	Topsoil					
	Brown Sandy Silty **CLAY** (Drillers Description)					
5						1561
10						1556
15						1551
20						1546
25						1541
30						1536
35						1531
40	Weathered **LIMESTONE** and Soil Seams					1526
45						1521
50						1516
55						1511
60						1506
	LIMESTONE					
65						1501
70						1496

WELL DIAGRAM



∇ WATER LEVEL (T.O.B.)

▼ WATER LEVEL (24 HR.)

Ⅲ HOLE CAVE

S&ME

Tri-Cities Branch
2153 Highway 75
P.O. Box 1118 TCAS
Blountville, T.N.
37617
(615) 323-2101

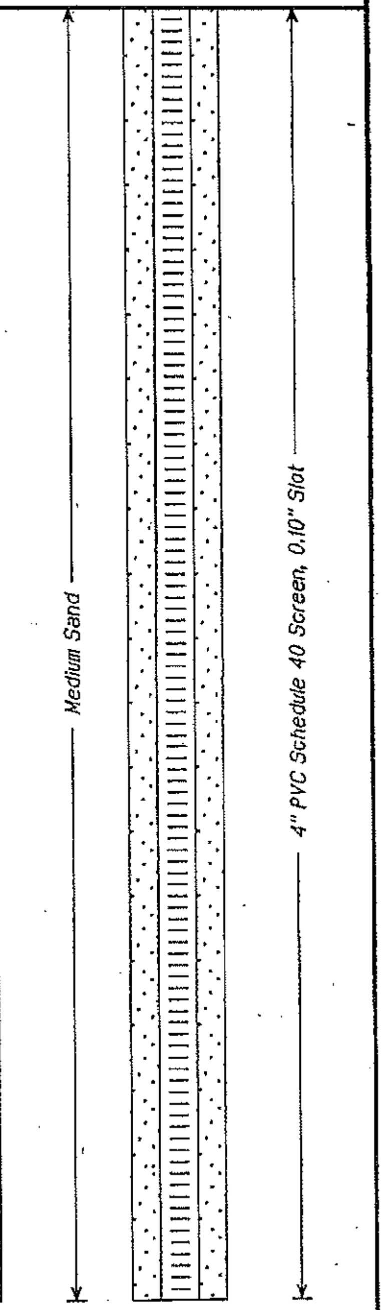
ATTACHMENT 2 CONT.

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**GEOLOGIST LOG**	**B-18**

PROJECT NO. : *1404-94-051-A*	**ELEVATION:**	*1566.2__FEET_MSLD*	**NOTES:**	
LOGGED BY: *PCH*	**BORING DEPTH:**	*150.0___FEET*		
DATE DRILLED: *5-07-95*	**WATER LEVEL:**	*70.0*	Used 10" Air Rotary Drill to 40 Feet	
DRILLING METHOD: *8" Air Rotary*	**DRILL RIG:**	*Mobile B-57*		

DEPTH (ft)	GRAPHIC LOG	Description & Remarks	SAMPLE NUMBER	SAMPLE	OVM (ppm)	SPR	ELEV.
		LIMESTONE					
75		Fracture from 75.0 to 75.5 Feet					1491
80							1486
85		Fracture from 85.0 to 85.5 Feet					1481
90							1478
95							1471
		Fracture from 98.0 to 98.5 Feet					
100							1466
105							1461
110							1456
115							1451
120							1446
125							1441
		Fracture from 128.0 to 128.5 Feet					
130							1436
135							1431
140							1426

WELL DIAGRAM



∇ WATER LEVEL (T.O.B.)

▼ WATER LEVEL (24 HR.)

HC HOLE CAVE

S&ME

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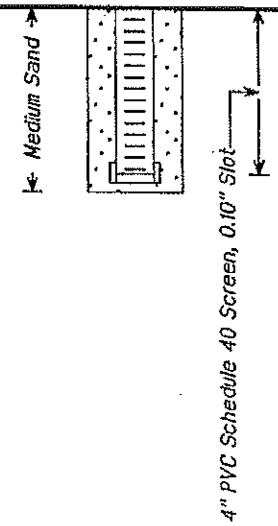
ATTACHMENT 2 CONT.

PROJECT:	**Greeneville Demolition Landfill Site** **Greeneville, Tennessee**	**GEOLOGIST LOG** **B-18**

PROJECT NO.: *1404-94-051-A*	**ELEVATION:** *1566.2__FEET_MSLD*	**NOTES:**
LOGGED BY: *PCH*	**BORING DEPTH:** *150.0__FEET*	
DATE DRILLED: *5-07-95*	**WATER LEVEL:** *70.0*	Used 10" Air Rotary Drill to 40 Feet
DRILLING METHOD: *8" Air Rotary*	**DRILL RIG:** *Mobile B-57*	

DEPTH (ft)	GRAPHIC LOG	Description & Remarks	SAMPLE NUMBER	SAMPLE	OVM (ppm)	SPR	ELEV.	WELL DIAGRAM
		LIMESTONE						
145							1421	
150		*Boring Terminated at 150.0 Feet*					1416	
155							1411	
160							1406	
165							1401	
170							1396	
175							1391	
180							1386	
185							1381	
190							1376	
195							1371	
200							1366	
205							1361	
210							1356	



∇ WATER LEVEL (T.O.B.)
▼ WATER LEVEL (24 HR.)
⫼ HOLE CAVE

S&ME

Tri-Cities Branch
2153 Highway 75
P.O. Box 1118 TCAS
Blountville, T.N.
37617
(615) 323-2101

MATERIAL SAFETY DATA SHEET

17053 Uranine Liquid

SECTION I - IDENTIFICATION

ANUFACTURER/DISTRIBUTOR. CHEMCENTRAL/Dyes & Pigments Division
13395 Huron River Drive
Romulus, Michigan 48174
MERGENCY PHONE NUMBER... (313) 941-4800
EFFECTIVE DATE........... 09/26/1995
EVISED DATE............. 09/26/1995
HEMICAL NAME............ Acid Yellow 73 (mixture containing) (Color Index name)

TRADE NAME............... 17053 Uranine Liquid

HEMICAL FAMILY.......... Dipotassium Fluorescein, aqueous solution
CHEMICAL FORMULA......... 45350 (mixture containing) (Color Index formula)

SECTION II - HAZARDOUS INGREDIENTS

AZARDOUS COMPONENTS	HAZARDOUS %	TLV (Units)	PROD. CAS #
Potassium Hydroxide	15-20	Not established	1310-58-3

his product supplied is
n compliance with TSCA
Reporting Requirements,
ARA Title III. Not
isted.

SECTION III - PHYSICAL DATA

BOILING Point(F)......... Not evaluated
REEZING POINT (F)....... Not evaluated
OLATILITY/VOL(%)........ N/A
MELTING POINT............ N/A
VAPOR PRESSURE (mm Hg)... Not evaluated
APOR DENSITY (Air=1).... N/A
SOLUBILITY IN H20........ Completely miscible
APPEARANCE/ODOR.......... Brown aqueous liquid
PECIFIC GRAVITY (H20=1). 10.8 pounds per gallon
APORATION RATE......... N/A
PH....................... 9.0

SECTION IV FIRE & EXPLOSION HAZARD DATA

LASH POINT.............. N/A
OWER FLAME LIMIT........ N/A
HIGHER FLAME LIMIT....... N/A
EXTINGUISH MEDIA......... Water fog, CO2, or Dry chemical.

MATERIAL SAFETY DATA SHEET

17053 Uranine Liquid

FOR FIRE.................. Fire fighters should be equipped with self contained breathing apparatus and turnout gear.

UNUSUAL FIRE HAZARD...... Adequate ventilation and clean up must be maintained to minimize fume accumulation.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE.... Not established

OVER EXPOSURE EFFECTS.... Contact with eyes may result in severe irritation. Contact with skin may result in irritation. Ingestion may result in gastric disturbances. Inhalation of fumes may irritate respiratory tract.

FIRST AID PROCEDURES..... Flush eyes with flowing water at least 15 minutes. If irritation develops, consult a physician. Wash affected skin areas thoroughly with soap and water. If irritation develops, consult a physician. Remove and launder contaminated clothing before reuse. If swallowed, dilute with water and induce vomiting. Get immediate medical attention. If inhaled, move to fresh air. Aid in breathing, if necessary, and get medical attention.
NEVER GIVE FLUIDS OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAS CONVULSIONS.

SECTION VI - REACTIVITY DATA

CHEMICAL STABILITY....... Stable

CONDITIONS TO AVOID...... N/A

INCOMPATIBLE MATERIALS... Unknown

DECOMPOSITION PRODUCTS... Carbon monoxide,Carbon dioxide,and oxides of Nitrogen.

HAZARDOUS POLYMERIZATION. Does not occur

POLYMERIZATION AVOID..... N/A

SECTION VII - SPILL OR LEAK PROCEDURE

FOR SPILL .... Spills should be contained and placed in suitable containers.

WASTE DISPOSAL METHOD.... Do not discharge into sewers or waterways. Dispose of in accordance with local regulations.

SECTION VIII - SPECIAL PROTECTION

RESPIRATORY PROTECTION... NIOSH/OSHA approved respirator as necessary.

VENTILATION.............. Local exhaust to control fumes.

PROTECTIVE GLOVES........ To prevent skin contact.

EYE PROTECTION........... Goggles.

MATERIAL SAFETY DATA SHEET

17053 Uranine Liquid

PROTECTIVE EQUIPMENT..... Eye wash fountains should be easily accessible.
HANDLING AND STORAGE..... Keep away from excessive heat and moisture. Keep containers closed.

SECTION IX - SPECIAL PRECAUTIONS

HAZARD CLASS............. N/A
DOT SHIPPING NAME........ Ink Material
NMFC Item #101720
REPORTABLE QUANTITY (RQ). N/A
UN NUMBER................ N/A
NA #..................... N/A
DOT LABELS REQUIRED...... Mfg. Label Only
SPECIAL SHIPPING INSTRUCTIONS:
PROTECT FROM FREEZING
PACKAGING SIZE........... Various

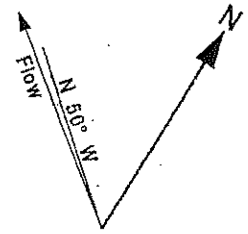
FOOT NOTES
This information is furnished without warranty, representation, or license of any kind, except that it is accurate to the best of CHEMCENTRAL Corporation's knowledge or obtained from sources believed by CHEMCENTRAL Corporation to be accurate. The CHEMCENTRAL Corporation does not assume any legal responsibility for use or reliance upon same. Customers are encouraged to conduct their own tests. Before using any product, read its label.

N/A = Not Applicable

REFERENCES

TABLE II: HYDRAULIC GRADIENT CALCULATIONS FOR GREENEVILLE DEMOLITION LANDFILL

3-POINT SOLUTION METHOD TO DETERMINE THE DIRECTION OF HYDRAULIC GRADIENT:



$$\frac{(h_h - h_i)}{x} = \frac{(h_h - h_l)}{L}$$

h_h = highest hydraulic head elevation

h_i = intermediate hydraulic head elevation

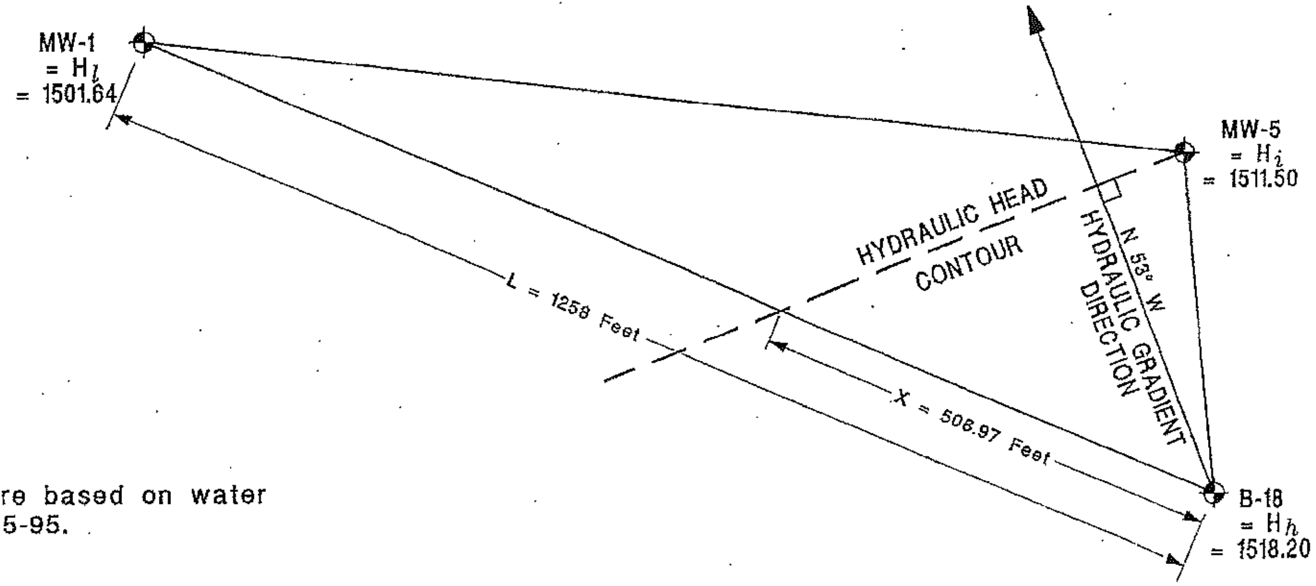
h_l = lowest hydraulic head elevation

L = distance between well with h_h and well with h_l

x = distance from well with h_h and well with h_l where the hydraulic head elevation equals that of h_i

$$\frac{1518.20' - 1511.50'}{x} = \frac{1518.20' - 1501.64'}{1258'}$$

x = 508.97'



NOTE: Gradient calculations are based on water elevations obtained 10-5-95.

SCALE: 1" = 200'

TABLE III

GROUNDWATER ELEVATIONS AND WELL COORDINATES

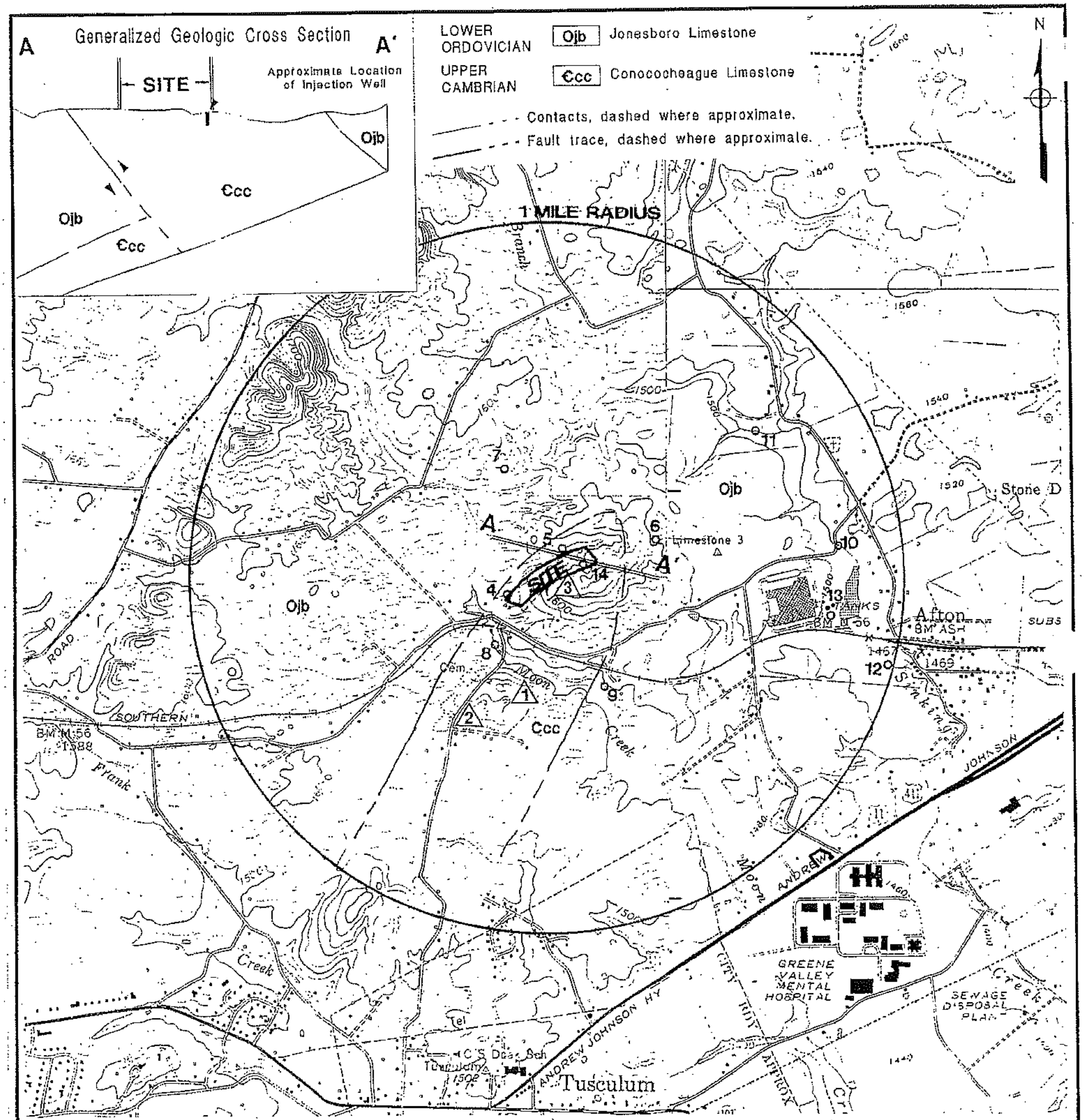
WELL NUMBER	DATE MEASURED	DEPTH OF WELL (FEET)	TOP OF CASING ELEVATION (MSL)	DEPTH FROM TOP OF CASING TO WATER (FEET)	POTENTIOMETRIC SURFACE ELEVATION (MSL)
MW-1 Northing: 4092.2581 Easting: 6859.5262	10/5/95	30.0	1522.90	21.26	1501.64
MW-5 Northing: 4627.3802 Easting: 7859.7118	10/5/95	75.0	1567.00	55.50	1511.50
MW @ B-18 Northing: 4333.0246 Easting: 8092.1797	10/5/95	150.0	1613.97	95.77	1518.20

TABLE IV

LOCATIONS OF DYE MONITORING POINTS AND RESULTS OF DYE TRACING STUDY

MONITORING POINT NUMBER	MONITORING LOCATION	BACKGROUND TEST RESULTS (9/6-11/95)	DYE INJECTION TEST RESULTS (9/29/95)	DYE INJECTION TEST RESULTS (9/29/95 - 10/5/95)
1	DOMESTIC WELL	-	NS	-
2	DOMESTIC WELL	-	NS	-
3	DOMESTIC WELL	ACID BLUE #9	NS	ACID BLUE #9
4	MW-1	-	-	-
5	MW-5	-	ACID YELLOW 73	ACID YELLOW 73
6	MW-3	-	NS	-
7	MW-2	-	-	-
8	PICKETT SPRING	-	NS	ACID YELLOW 73
9	MOON CREEK (DOWNSTREAM)	-	NS	ACID YELLOW 73
10	SINKING CREEK (DOWNSTREAM)	-	NS	-
11	SINKING CREEK (DOWNSTREAM)	-	NS	-
12	PROETT SPRING	-	NS	LOST PACKET
13	ALLTRISTA PROCESS WELL	-	NS	-
14	INJECTION WELL (B-18)	-	-	ACID YELLOW 73

LEGEND:	-	NOTHING DETECTED
	NS	NOT SAMPLED



12 ○ - Indicates Approximate Location of Dye Monitoring Points. Location 14 was the dye injection well.

⚠ - Indicates Approximate Location of Private Drinking Water Supplies.

NOTE: Developed from Greeneville, TN & Chucky, TN Quadrangles U.S.G.S. Topographic Maps.

PROJECT:
LOCATION MAP OF DYE
MONITORING POINTS
GREENVILLE DEMOLITION LANDFILL SITE
GREENEVILLE, TENNESSEE

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING TESTING

SCALE:	1" = 2000'
JOB NO.:	1404-94-051-A
FIG. NO.:	Figure B

APPENDIX 2

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN
GREENEVILLE/GREENE COUNTY
CLASS III (FORMERLY CLASS IV) LANDFILL

TABLE OF CONTENTS

TABLES:

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN
GREENEVILLE/GREENE COUNTY
DEMOLITION LANDFILL

A2-1.0 INTRODUCTION, SCOPE, AND PURPOSE

Certain construction activities at this facility require quality assurance to provide documentation that the protection of the environment is being provided in accordance with the applicable regulations and this operational plan. In particular, the following items of work will be subject to this plan:

1. Construction of compacted fill over encountered rock outcrops.

2. Installation of geosynthetic clay liners on slopes of the existing Class I Landfill and in the stormwater ponds.

3. Final cap construction to meet final grades.

A2-2.0 ORGANIZATION AND DEFINITIONS

OPERATOR – Although the Operator of the facility is the Waste Industries, the Owners, the Town of Greeneville and Greene County, are responsible for the overall management, control, and operation of the facility during operating closure and throughout the post-closure care period.

DESIGNER - The designer of the original CQA Plan was Vaughn and Melton of Greeneville, Tennessee. The current CQA Plan incorporates modifications made by Minor Permit Modifications in 2007 by S&ME of Johnson City, Tennessee. The designer of the revised Final Closure is Draper Aden Associates of Blacksburg, Virginia. The Designer is responsible for overall review of the construction, operation, and remedial activities, providing assistance to the Owner in the letting of contracts for construction and documentation requirements of this Plan.

SOILS TESTING FIRM - The Soils Testing Firm shall report to the Designer and shall be an independent consulting engineering firm specializing in the inspection and testing of soils. The firm shall be licensed to practice engineering in the State of Tennessee.

QUALITY ASSURANCE ENGINEER – The Quality Assurance Engineer (QAE) shall be an engineer registered in the State of Tennessee with responsibility for overall Construction Quality Assurance. Duties will consist of oversight of the CQA for applicable activities, supervision of Engineering Technicians and final certification of the construction as being in conformance with the regulations, specifications, and this CQA Plan.

ENGINEERING TECHNICIANS – Engineering Technicians are responsible for field observations, testing and inspection. Technicians will be assigned to the project as determined necessary by the QAE and Project Superintendent. Engineering Technicians will have a minimum of two years of progressive experience in the applicable aspects of the testing and inspection required by this plan.

QUALITY ASSURANCE - Quality Assurance is a planned system of activities whose purpose is to provide assurance that the overall quality control program is being effectively implemented. The system involves a continuing evaluation of the adequacy and effectiveness of the quality program with a view to having corrective measures initiated where necessary. For a specific material or service, this involves verifications, audits, and the evaluation of the quality factors that affect the specification, production, inspection, and use of the material or service.

QUALITY CONTROL -Quality Control is a planned system of activities whose purpose is to provide a level of quality that meets the permit requirements. The objective of quality control is to provide stable quality that is safe, adequate, dependable, and economic. The overall system involves integrating the quality factors of several related steps including: the proper specification of what is wanted, production to meet the full intent of the specification, inspection to determine whether the resulting material, product, service, etc. is in accordance with the specifications, and review of usage to determine necessary revisions of specifications.

WRITTEN COMMUNICATIONS -To the extent consistent with the orderly progression of the project, all communications shall be in written format or verbal format confirmed in writing. The general forms of communication shall be as follows:

A. Daily Reports - These shall be written reports filed on a daily basis to document significant activities and developments at the site. Also used as a cover document for QC testing reports in a given day.

B. Non-Conformance Reports (NCRs) - These reports shall be intermittent reports filed on an as-required basis by the Registered Engineer to document serious issues of non-conformance to the specifications. The effect of an NCR shall be the immediate suspension of all work except as permitted by the Registered Engineer until the non-conformance issues are resolved. The NCR may be rescinded only in writing and only by the Registered Engineer with documentation of the corrective steps taken.

MEETINGS

A. Pre-Construction Meeting to be attended by all parties to the construction prior to any operations at the site.

B. Progress Meetings are to be held as directed by the Registered Engineer. These are to provide a forum for exchange of observations and recommendations as well as a summary of the daily meetings.

C. Problem Resolution Meetings will be held when directed by the Registered Engineer to address a specific problem or immediately after the issuance of Non- conformance Reports.

A2-3.0 METHODS AND STANDARDS

The following methods and standards may be applied to the work:

1) Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass, ASTM D2216-10.

2) Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil by Direct Heating Method, ASTM D4959-07.

3) Standard Test Method for Particle-Size Analysis of Soils, ASTM D-422-63(2007).

4) Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils, ASTM D4318-10.

5) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort, ASTM D698-07e1.

6) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth), ASTM D6938-10.

7) Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method, ASTM D2937-10.

8) Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, ASTM D5084-10.

9) Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes, ASTM D1587-08.

10) Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve, ASTM D1140-00(2006)

11) Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating, ASTM D4643-08.

12) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method, ASTM D1559-07.

A2-4.0 CQA, QC AND CONSTRUCTION

A. Construction of the clay buffer, final cover, and embankments for the facility shall consist of a series of steps which, at certain milestones, will be reviewed, tested and documented. Construction will conform to the Plans, Specifications, and Contract Documents referenced in the permit documents. The CQA/QC milestones are described in the following paragraphs.

B. Pre-Qualification Testing (Low-Permeability Layers) - Prior to excavation or transportation of any borrow material to be used in the low-permeability layers of any buffer (over rock outcrops, etc) or closure cap, a series of pre-qualification tests shall be conducted. The tests shall be conducted in the laboratory of the soils testing firm or in an equivalent laboratory meeting the approval of the Registered Engineer. Table 2-1 presents the tests and testing frequencies for suitability of borrow soils.

Soil for the low permeability layers shall have a permeability of no greater than $1x10^{-5}$ cm/sec.

C. Maintaining Quality Control during Construction - The ground surface, or the surface of any embankment layer in place, shall not be in a frozen condition and shall be free of snow, ice and mud when a subsequent layer is placed thereon. Frozen, muddy, or desiccated materials shall be removed. The top of the natural buffer should be free of deleterious material including roots, vegetation and rocks over 2" in diameter.

Construction of lifts should continue to completion of the low permeability layer. However, if, due to weather, unavoidable operational conflicts, equipment problems, etc., the subsequent lifts are delayed, the existing surface must be prepared. This may involve removal of dried soils, wetted soils or disturbed soils to competent undisturbed material. The surface shall be scarified to prevent horizontal joints within the layer.

Maximum density and optimum moisture shall be monitored as described elsewhere. Compaction of the low permeability layer shall meet a density of 98% standard proctor (ASTM D698) maximum dry density. For purposes of evaluating field data, an average value of 98% standard proctor maximum dry density must be achieved on each lift with no single test in a given lift falling below 95% standard proctor maximum dry density. Adjustments to the soil moisture content may be made by aeration of the material to dry or the uniform incorporation of water, as necessary, to add moisture. These methods may be used within the fill area after spreading of the lift and before compaction. Reduction to the lift thickness may be necessary to ensure fill depth adjustment.

Unacceptable material, frozen, wet or desiccated soils shall be removed. These materials shall not be re-used for construction of low permeability layers. They may be used in construction of roads, berms, channels, etc.

D. Lines, Grades and Control Grid - The lines and grades shall be established by the Designer using control points defined in the Contract Documents. In addition to the lines and grades, a control grid in each separate area of the site to receive low permeability buffer layers or caps. The control grid shall consist of square segments. Each area of the site to be graded shall be divided into a grid. The grid shall be numbered in the field by a method which will enable rapid determination of actual field location. The control grid shall be surveyed for elevation prior to commencement of grading at the subgrade elevation for the low permeability layer; at the top of the layer; and at the completion of the protective soil layer of the cover. Depth of the low-permeability soil layer and the protective soil layer of the final cover shall be verified by test holes (hand dug for minimal disturbance of the soil). Elevations shall be documented, and all results, calculations and field documentation shall be submitted to the Quality Assurance Engineer within 72 hours after completion of the survey.

The control grid, along with the test holes, shall be used to document the thickness of each component (i.e. subgrade, the low-permeability layers and the vegetative support layers) of the final cover. The thickness shall be determined at each point of the control grid by subtracting the starting elevation from the ending elevation, as well as by direct measurement in the test hole.

E. Testing of Soil Properties - At the intervals defined in Tables 2-1 and 2-2, a relatively-undisturbed sample of the soil shall be taken. This sample shall be subjected to testing as defined in Table 2-1. Locations of the testing samples will be determined by the soils testing firm. A random selection by survey grid points will be used.

The relatively undisturbed samples shall be obtained by pushing a thin-walled sampling tube a measured distance into the soil and extracting the tube and encased soil to run the tests. The methods used shall conform to the technical requirements of ASTM D1587.

In each lift of the low-permeability layers, field density tests shall be conducted to document that placement conditions are within the "acceptance band" for the soils with respect to moisture and density. Test locations shall be selected at representative locations uniformly spaced across each lift in the areas as defined in Tables 2-1 and 2-2.

Deleterious material (roots, sticks, vegetation, and debris) and stones larger than 2 inches shall not be acceptable in the low permeability layers. Stone and chert less than 2 inches are acceptable if they are less than 10% of the material. Unacceptable materials are to be removed from the fill after spreading the lift. Borrow areas that have excessive amounts of unacceptable material will not be used or the material will be pre-screened prior to hauling to the fill area.

TABLE 2-1
Borrow Source Testing Frequency

Parameter	Test Method	Testing Frequency
Percent Fines (Note 1)	ASTM D1140	1 per soil type
Percent Gravel (Note 2)	ASTM D422	1 per soil type
Liquid/Plastic Limits	ASTM D4318	1 per soil type
Water Content	ASTM D4643 (Note 3A)	1 per soil type (Note 3B)
Water Content (Note 4)	ASTM D2216	1 per day
Moisture/Density	ASTM D698	1 per soil type
Permeability (Remolded)	ASTM D5084 (Note 5)	2 per soil type over range of water contents

Note 1: Percent fines is defined as percent passing the Number 200 sieve.
Note 2: Percent gravel is defined as percent retained on the Number 4 sieve.
Note 3A: This is a microwave oven drying procedure. Other methods may be used, if more appropriate.
Note 3B: Water adjustments to be made as required during field placement in lieu of more frequent tests.
Note 4: Microwave oven drying, and other speedy methods, may involve systematic errors. Conventional oven drying (ASTM D2216) is recommended, but not mandatory, on every fifth sample taken for rapid measurement. The intent is to document any systematic error in rapid water content measurements.
Note 5: ASTM D5084 is a laboratory procedure for determining hydraulic conductivity of soil materials.

TABLE 2-2
Construction Testing Frequency

Parameter	Test Method	Minimum Testing Frequency
Water Content	ASTM D6938 (Nuclear Method) or ASTM D4643 (Microwave)	5 per acre per lift (Note 1)
Water Content (Note 2)	ASTM D2216 (Oven Dry)	1 per acre per lift (Note 2)
Density (Notes 3 and 4)	ASTM D6938 (Nuclear Method)	5 per acre per lift
Permeability (Notes 5 and 7)	ASTM D5084	1 per acre with entire layer sampled by Shelby tube
Permeability (Note 6)	Sealed Double Ring Infiltrometer	1 per test pad
Number of Passes	Visual Observation	1 per acre per lift(Note 1)
Construction Oversight	Visual Observation	Continuous

Notes:

1. In addition, at least one test should be performed each day soil is compacted and additional tests should be performed in areas for which CQA Personnel have reason to suspect inadequate compaction.
2. Every fifth sample tested with ASTM D6938 or D4643 should also be tested by direct oven drying (ASTM D2216) to aid in identifying any significant, systematic calibration errors with D6938 or D4643.
3. ASTM D6938 is a nuclear method.
4. The sand cone (ASTM D1556) is required in the event that construction involves soils having more than 20% retained on the No. 4 sieve.
5. ASTM D5084 is a laboratory permeability test that is to be performed on Shelby tube samples taken from the constructed liner. However, this test is not acceptable for soils with more than 20% retained on the No. 4 sieve.
6. The Sealed Double Ring Infiltrometer test is a field test which is to be performed prior to construction where soils have more than 20% retained on the No. 4 sieve.
7. Permit Modification approved by TDEC on May 21, 2007 stated that the frequency of testing should be 3 per 3 acres. However, that requirement was directly related to an upcoming partial closure that consisted of three acres. The requirement of 1 test per acre is a generalization of that requirement.

F. Repair of Perforations or Penetrations- Any penetrations into or through the low-permeability layers shall be repaired by replacing the removed soil with powdered or pelletized bentonite prior to placement of the next lift of soil over the tested lift. The bentonite shall be adequately hydrated to swell and fill the void created by sampling.

G. Acceptance - Acceptance of each lift of the low-permeability layer shall be conditioned on the review of the previously described tests. Acceptance or a description of any deficiencies shall be provided at the completion of testing of each lift. Any deficiencies noted shall be corrected. Areas that do not meet the moisture/density requirements shall be excavated and replaced. A geotechnical engineer shall be consulted to review this work and recommend construction practices to prevent joint seams in the low permeability soils.

H. Preservation of Work - Until acceptance and subsequent covering by the next lift, each lift shall be maintained by moistening, rolling and other preservation techniques such as over-building or covering with temporary geomembrane.

I. Vegetative Support Layer - Testing of the vegetative support layer shall consist of verification that overall soil thickness meets the minimum requirements. No compaction shall be required beyond that sufficient for support of the vegetation. Fertilization, seeding and other surface applications shall be visually inspected and documented by the contractor by means of shipping tickets, weigh tickets, receipts, and other documentation given to the Quality Assurance Engineer, within 24 hours of placing the seed and stabilization measures.

A2-5.0 CERTIFICATION

A. The Quality Assurance Engineer shall prepare a Certification Report at the completion of the construction and the CQA effort. The report shall document all data, findings, adjustments and conclusions of the CQA program and, providing conformance was attained, certify that the elements of the CQA Plan were all constructed in accordance with the Plans, Specifications and Contract Documents as well as the requirements of this CQA Plan. The certification shall include, as a minimum, the deliverable items shown in Item B.

B. The Certification Report shall include deliverable items as follows:

1. As-Built Drawing showing final conditions and any locations where the final construction deviated from the Plans in any material fashion.
2. Documentation Package containing all Pre-Qualification and Quality Control test results.
3. Communications Package containing all communications (i.e. Daily Reports, Weekly Reports, NCRs and resolution of all NCRs) and any communications pertaining to this Plan not specifically described herein.

C. The Certification Report shall contain the signed, dated seal of the Quality Assurance Engineer and the following statement:

"To the best of my knowledge and belief, I _______________, a duly registered engineer in the State of Tennessee, do hereby affirm that all information herein is true, complete, and accurate."

A2-6.0 GEOSYNTHETIC CLAY LINER (GCL) QUALITY ASSURANCE PROCEDURES

6.1 GENERAL

1) Lines and grades shall be established using control points provided by the Engineer.

2) Each area, upon acceptance of the subgrade, shall immediately be covered with the GCL. Only areas for which adequate GCL is on-site shall be accepted.

3) GCL on the bottom of ponds shall be covered with eight inches of non- limestone gravel (well-graded, size ranging between 1/8 inch and 1 inch), as shown in the engineering drawings. Installation of stone shall be in accordance with the GCL manufacturer's instructions. Side slopes of the GCL shall be covered with 12" of clay soil (soil that classifies as ML or CL) and seeded.

4) Construction Inspection Procedures:

   a. All delivered GCL rolls shall be visually inspected and approved by the Project Superintendent or the Installer’s Project Inspector prior to installation. Defects or damage from shipping and handling shall be grounds for rejection at the discretion of the Engineering Inspector.

   b. As each GCL panel is being deployed, the Installer and Engineering Technician shall provide observation of the installation. Observation shall consist of:

      1. Recording of each roll number and lot number as panels are deployed along with a general description of the location of each panel.

      2. Inspection of overlap.

      3. Visual inspection of geotextile quality, bentonite uniformity and the degree of hydration, if any, on the GCL. Marking of any areas as appropriate for repair.

      4. Inspection of anchoring and sealing around penetrations and structures.

6.2 GCL DELIVERY AND STORAGE

A. Packing and Shipping

1. GCL shall be supplied in rolls wrapped individually in relatively impermeable and opaque protective covers.

2. GCL rolls shall be marked or tagged with the following information:
    a. Manufacturer's name
    b. Product identification
    c. Roll number
    d. Roll dimensions
    e. Roll weight

B. Storage and Protection

1. Provide on-site storage area for GCL rolls from time of delivery until installed.

2. Preserve integrity and readability of GCL roll labels.

6.3 SUBGRADE PREPARATION

A. The subgrade shall be prepared in a manner consistent with proper subgrade preparation techniques for the installation of geosynthetic materials.

B. The subgrade shall be properly compacted so as not to settle and cause excessive strains in the GCL or other synthetic liner materials.

C. Ensure that rutting or ravelling is not caused by installation equipment.

D. Ensure a surface free of debris, roots, or angular stones larger than 1-1/2 inch.

E. Prior to installation, ensure that the subgrade has been rolled to provide smooth surface.

6.4 INSTALLATION

A. GCL Deployment: Handle GCL in a manner to ensure it is not damaged. At a minimum, comply with the following:

1. On slopes, anchor the GCL securely and deploy it down the slope in a controlled manner.

2. Weight the GCL with sandbags or equivalent in the presence of wind.

3. Cut GCL with a geotextile cutter (hook blade), scissors, or other approved device. Protect adjacent materials from potential damage due to cutting of GCL.

4. Prevent damage to underlying layers during placement of GCL.

5. During GCL deployment, do not entrap in or beneath GCL, stones, trash, or moisture that could damage GCL.

6. Visually examine entire GCL surface. Ensure no potentially harmful foreign objects, such as needles, are present.

7. Do not place GCL in the rain or at times of impending rain.

8. Do not place GCL in areas of ponded water.

9. Replace GCL that is hydrated before placement of overlying geomembrane or a minimum of 12-inches of approved cover soil (on stone layer in ponds).

10. In general, only deploy GCL that can be covered during that day by geomembrane or approved cover soil.

11. On side slopes, run to the bottom of the slope as indicated.

B. Overlaps:

1. On slopes, overlap GCL to the manufacturer's match line.

2. In general, no horizontal seams are allowed on side slopes.

3. Overlap GCL onto low-permeability soil at least 5-feet.

C. Defects and Repairs:

Repair all flaws or damaged areas by placing a patch of the same material extending at least 1 foot beyond the flaw or damaged area.

CETCO
COLLOID ENVIRONMENTAL TECHNOLOGIES COMPANY

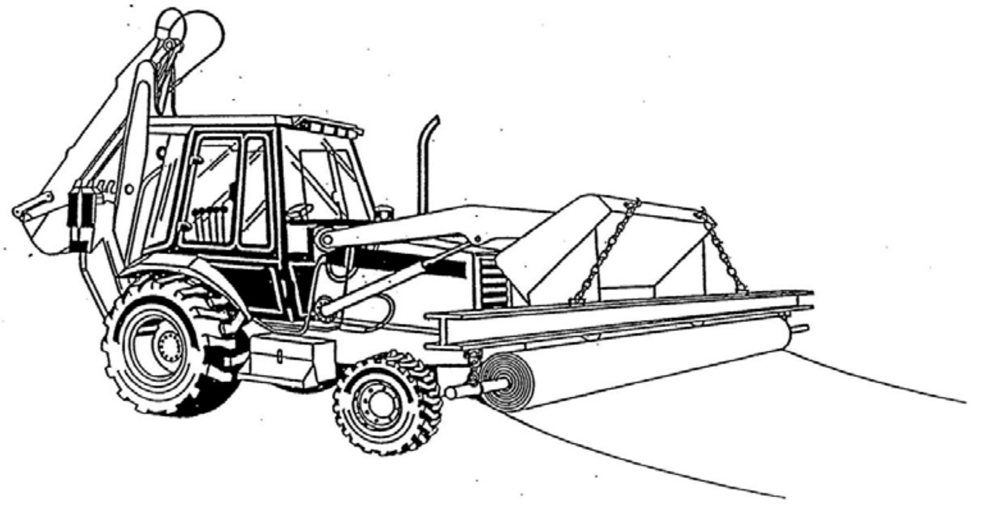
TR-405
October 1995

TECHNICAL DATA SHEET

BENTOMAT®

CLAYMAX®

GEOSYNTHETIC CLAY LINERS INSTALLATION GUIDELINES



This document is intended for use as a GENERAL GUIDELINE for the installation of CETCO's GCLs. Exceptions to this guideline may be required to address site-specific and/or product-specific conditions.

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APPENDIX 3

DRAINAGE AND STORM WATER CONTROL CALCULATIONS

A. Original Calculations-1996 Permit

B. Calculations for Modified Closure Grade

A. ORIGINAL DESIGN CALCULATIONS

GREENEVILLE DEMOLITION LANDFILL

SEDIMENT POND No. 2

DESIGN CALCULATIONS

May 27, 1996

VAUGHN & MELTON
219 West Depot Street
Greeneville, Tennessee 37743
(800)723-0271

V&M Project No. 29201-07

TABLE OF CONTENTS

SUMMARY

Pond No.	25-Year Runoff Volume (ac-ft)	Pond Volume at Top of Embankment (ac-ft)	25-Year Storm			100-Year Storm		
			Peak Inflow (cfs)	Peak Outflow (cfs)	Surge Elev. (ft)	Peak Inflow (cfs)	Peak Outflow (cfs)	Surge Elev. (ft)
2	7.97	7.98	128.6	9.8	1528.58	191.3	169.0	1531.25

Note that it was assumed that the diversion ditch would fail during a 100-year storm event, i.e., the watershed boundary during a 100-year event for Pond No. 2 will include the watershed boundary for the ditch as well as the pond watershed for a 25-year storm.

The ditch was designed to safely carry the peak discharge from a 25-year storm, i.e., 22 cfs. Vegetation will be sufficient for resisting excessive erosion on most of the ditch, portions which are less than 10 percent grade. The allowable velocity for the soil conditions and the type of vegetation selected is 6 fps; 3.45 fps was determined for grades of 9 percent. Riprap will be needed on portions in excess of 10 percent. A maximum of 14 percent grade is recommended. Riprap will not stay in place on slopes greater than 14 percent during a 25-year storm.

SEDIMENT POND No. 2 CALCULATIONS

```
5/25/96                                                    Page 1
                          UNIT HYDROGRAPH REPORT

   RECORD NUMBER   : 5
   TYPE            : TRIANGULAR UH
   DESCRIPTION     : POND No. 2 UH

[UNIT HYDROGRAPH INFORMATION]

   Peak Discharge............................  =       134.55 (cfs)
   Shape Factor..............................  =       484.00

[BASIN DESCRIPTION]

   Watershed Area............................  =         24.91 (ac)
   Curve Number..............................  =         87

[TIME CONCENTRATION -- SCS LAG]

   Channel Slope (S).........................  =       0.07200
   Flow Length (L)...........................  =       1450.00 (ft)
   Time of Concentration.....................  =         12.60 (min)
```

```
                        HYDROGRAPH REPORT

   RECORD NUMBER   : 13
   TYPE            : COMPUTED FLOOD
   DESCRIPTION     : POND No. 2 - INFLOW, 25Q24

[HYDROGRAPH INFORMATION]

   Peak Discharge...........................  =       128.62 (cfs)
   Volume...................................  =         7.97 (acft)
   Multiplication factor....................  =         1.00

[UNIT HYDROGRAPH INFORMATION]

   Unit hydrograph #........................  =         5
   Unit hydrograph type.....................  =      TRIANGULAR UH
   Peak Discharge...........................  =       134.55 (cfs)
   Shape Factor.............................  =       484.00

[BASIN DESCRIPTION]

   Watershed Area...........................  =         24.91 (ac)
   Curve Number.............................  =         87


[TIME CONCENTRATION -- SCS LAG]

   Channel Slope (S)........................  =      0.07200
   Flow Length (L)..........................  =      1450.00 (ft)
   Time of Concentration....................  =        12.60 (min)

[RAINFALL DESCRIPTION]

   Distribution Type........................  =          SCS II
   Total Precipitation......................  =          5.30 (in)
   Return Period............................  =         25    (yr)
   Storm Duration...........................  =         24.00 (hr)
```

```
5/27/96                                                 Page 1

                        HYDROGRAPH REPORT

   RECORD NUMBER    : 15
   TYPE             : RESER STOR. IND
   DESCRIPTION      : POND No. 2 -OUTFLOW, 25Q24

[HYDROGRAPH INFORMATION]

   Peak Discharge.............................  =          9.76 (cfs)
   Volume.....................................  =          4.44 (acft)
   Peak Elevation.............................  =       1528.58 (ft)

[INFLOW HYDROGRAPH INFORMATION]

    Hydrograph #...............................  =        13
    Hydrograph Description.....................  = POND No. 2 - INFLOW,
25Q24
```

```
                         UNIT HYDROGRAPH REPORT

    RECORD NUMBER    : 6
    TYPE             : TRIANGULAR UH
    DESCRIPTION      : POND No. 2 UH - 100YR

[UNIT HYDROGRAPH INFORMATION]

    Peak Discharge.........................  =          163.51 (cfs)
    Shape Factor...........................  =          484.00

[BASIN DESCRIPTION]

                    [WEIGHTED WATERSHED AREA]
   --------------------------------------------------------
    DESCRIPTION                                AREA     CN#
   --------------------------------------------------------
    DISTURBED                                  24.91    87
    WOODED, GOOD CONDITION                     12.27    70
   --------------------------------------------------------
    Overall Approximation                      37.18    81

[TIME CONCENTRATION -- SCS LAG]

    Channel Slope (S)......................  =         0.07200
    Flow Length (L)........................  =         1450.00 (ft)
    Time of Concentration..................  =           15.48 (min)
```

```
                              HYDROGRAPH REPORT

    RECORD NUMBER   : 14
    TYPE            : COMPUTED FLOOD
    DESCRIPTION     : POND No. 2 - INFLOW, 100Q24

[HYDROGRAPH INFORMATION]

    Peak Discharge...........................  =         191.33 (cfs)
    Volume...................................  =          12.87 (acft)
    Multiplication factor....................  =           1.00

[UNIT HYDROGRAPH INFORMATION]

    Unit hydrograph #........................  =           6
    Unit hydrograph type.....................  =        TRIANGULAR UH
    Peak Discharge...........................  =         163.51 (cfs)
    Shape Factor.............................  =         484.00

[BASIN DESCRIPTION]

                          [WEIGHTED WATERSHED AREA]
    ----------------------------------------------------------
    DESCRIPTION                                    AREA    CN#
    ----------------------------------------------------------
    DISTURBED                                     24.91    87
    WOODED, GOOD CONDITION                        12.27    70
    ----------------------------------------------------------
    Overall Approximation                         37.18    81


[TIME CONCENTRATION -- SCS LAG]

    Channel Slope (S)........................  =         0.07200
    Flow Length (L)..........................  =        1450.00 (ft)
    Time of Concentration....................  =          15.48 (min)

[RAINFALL DESCRIPTION]

    Distribution Type........................  =            SCS II
    Total Precipitation......................  =           6.30 (in)
    Return Period............................  =         100    (yr)
    Storm Duration...........................  =          24.00 (hr)
```

```
5/27/96                                                      Page 1

                           HYDROGRAPH REPORT

   RECORD NUMBER   : 16
   TYPE            : RESER STOR. IND
   DESCRIPTION     : POND No. 2 - OUTFLOW, 100Q24

[HYDROGRAPH INFORMATION]

   Peak Discharge...........................  =        168.98 (cfs)
   Volume...................................  =         12.03 (acft)
   Peak Elevation...........................  =       1531.25 (ft)

[RESERVOIR STRUCTURE INFORMATION]

    Reservoir #.............................  =           4
    Description.............................  = POND No. 2, SEDIMENT AT
60%
    Storage type............................  = MAN STAGE/AREA
    Max storage.............................  =      141678.00 Cuft
    Discharge type..........................  = COMP STAGE/DISC
    Max discharge...........................  =         306.17 cfs

[RESERVOIR INFORMATION]

    Reservoir #.............................  =           4
    Reservoir Description...................  = POND No. 2, SEDIMENT AT
60%

[INFLOW HYDROGRAPH INFORMATION]

    Hydrograph #............................  =          14
    Hydrograph Description..................  = POND No. 2 - INFLOW,
100Q24
```

```
                                RESERVOIR REPORT

     RECORD NUMBER    : 3
     STORAGE TYPE     : MAN STAGE/AREA
     DISCHARGE TYPE   : COMP STAGE/DISC
     DESCRIPTION      : POND No. 2

 [RATING CURVE LIMIT]

     Minimum Elevation.........................   =          1520.00 (ft)
     Maximum Elevation.........................   =          1532.00 (ft)
     Elevation Increment.......................   =             0.20 (ft)

 [STAGE STORAGE INFORMATION]

     Input file = NULL
     Output file = NULL

         [Manual Contour Area vs. Elevation]

 -----------------------------------------------
     ELEVATION                      CONTOUR AREA
       (ft)                            (sqft)
 -----------------------------------------------
     1520.00                        13569.00
     1522.00                        18470.00
     1524.00                        23406.00
     1526.00                        28606.00
     1528.00                        34041.00
     1530.00                        39706.00
     1532.00                        45600.00

 [STAGE DISCHARGE INFORMATION]

     OUTLET STRUCTURE:
     STR #          :    6
     TYPE           :  STAND PIPE WEIR
     DESCRIPTION    :  PRIMARY SPILLWAY - POND No. 2


                     [Reservoir Discharge vs. Stage]
                     (the elevation increment is 0.20)

 -----------------------------------------------------------------------
        STAGE      ELEVATION    CONTOUR AREA    STORAGE     DISCHARGE
        (ft)         (ft)         (sqft)        (cuft)        (cfs)
 -----------------------------------------------------------------------
        0.00       1520.00      13569.00          0.00         0.00
        0.20       1520.20      14058.98       2762.80         0.00
        0.40       1520.40      14549.26       5623.62         0.00
        0.60       1520.60      15039.24       8582.47         0.23
        0.80       1520.80      15529.52      11639.35         0.27
        1.00       1521.00      16019.50      14794.25         0.31
        1.20       1521.20      16509.48      18047.15         0.34
        1.40       1521.40      16999.76      21398.07         0.37
        1.60       1521.60      17489.74      24847.02         0.39
```

```
                        RESERVOIR REPORT

     RECORD NUMBER  : 3
     STORAGE TYPE   : MAN STAGE/AREA

     DISCHARGE TYPE : COMP STAGE/DISC
     DESCRIPTION    : POND No. 2

                     [Reservoir Discharge vs. Stage]
                    (the elevation increment is 0.20)

---------------------------------------------------------------------
        STAGE     ELEVATION    CONTOUR AREA    STORAGE     DISCHARGE
        (ft)        (ft)          (sqft)        (cuft)       (cfs)
---------------------------------------------------------------------

        1.80      1521.80      17980.02      28394.00        0.42
        2.00      1522.00      18470.00      32039.00        0.44
        2.20      1522.20      18963.48      35782.35        0.61
        2.40      1522.40      19457.26      39624.42        0.73
        2.60      1522.60      19950.74      43565.22        0.81
        2.80      1522.80      20444.52      47604.75        0.89
        3.00      1523.00      20938.00      51743.00        0.96
        3.20      1523.20      21431.48      55979.95        1.02
        3.40      1523.40      21925.26      60315.62        1.07
        3.60      1523.60      22418.74      64750.02        1.13
        3.80      1523.80      22912.52      69283.15        1.18
        4.00      1524.00      23406.00      73915.00        1.22
        4.20      1524.20      23925.87      78648.19        1.42
        4.40      1524.40      24446.06      83485.38        1.55
        4.60      1524.60      24965.94      88426.59        1.66
        4.80      1524.80      25486.13      93471.79        1.76
        5.00      1525.00      26006.00      98621.00        1.85
        5.20      1525.20      26525.87     103874.19        1.93
        5.40      1525.40      27046.06     109231.38        2.00
        5.60      1525.60      27565.94     114692.59        2.08
        5.80      1525.80      28086.13     120257.79        2.15
        6.00      1526.00      28606.00     125927.00        2.21
        6.20      1526.20      29149.37     131702.53        2.42
        6.40      1526.40      29693.07     137586.78        2.58
        6.60      1526.60      30236.43     143579.73        2.71
        6.80      1526.80      30780.13     149681.39        2.82
        7.00      1527.00      31323.50     155891.75        2.93
        7.20      1527.20      31866.87     162210.78        3.02
        7.40      1527.40      32410.57     168638.53        3.12
        7.60      1527.60      32953.93     175174.98        3.21
        7.80      1527.80      33497.63     181820.14        3.29
        8.00      1528.00      34041.00     188574.00        3.37
        8.20      1528.20      34607.36     195438.84        4.84
        8.40      1528.40      35174.07     202416.98        7.47
        8.60      1528.60      35740.43     209508.44        9.97
        8.80      1528.80      36307.14     216713.19       11.41
        9.00      1529.00      36873.50     224031.25       12.39
        9.20      1529.20      37439.86     231462.59       13.29
        9.40      1529.40      38006.57     239007.23       14.12
        9.60      1529.60      38572.93     246665.19       14.89
        9.80      1529.80      39139.64     254436.44       15.62
       10.00      1530.00      39706.00     262321.00       16.32
       10.20      1530.20      40295.26     270321.12       16.83
```

```
                              RESERVOIR REPORT

        RECORD NUMBER  : 3
        STORAGE TYPE   : MAN STAGE/AREA

        DISCHARGE TYPE : COMP STAGE/DISC
        DESCRIPTION    : POND No. 2

                       [Reservoir Discharge vs. Stage]
                      (the elevation increment is 0.20)

----------------------------------------------------------------------------
         STAGE      ELEVATION     CONTOUR AREA     STORAGE      DISCHARGE
          (ft)         (ft)          (sqft)         (cuft)        (cfs)
----------------------------------------------------------------------------
         10.40       1530.40       40884.87       278439.12       17.01
         10.60       1530.60       41474.13       286675.03       17.18
         10.80       1530.80       42063.74       295028.81       17.35
         11.00       1531.00       42653.00       303500.50       17.52
         11.20       1531.20       43242.26       312090.03       17.69
         11.40       1531.40       43831.87       320797.44       17.85
         11.60       1531.60       44421.13       329622.75       18.02
         11.80       1531.80       45010.74       338565.94       18.18
         12.00       1532.00       45600.00       347627.00       18.34
```

POND VOLUME

Pond No. 2

ELEVATION (ft)	AREA (sq.ft.)	INCREMENTAL VOLUME (ac-ft)	CUMULATIVE VOLUME (ac-ft)
1520	13,569		0.000
		0.736	
1522	18,470		0.736
		0.961	
1524	23,406		1.697
		1.194	
1526	28,606		2.891
		1.438	
1528	34,041		4.329
		1.693	
1530	39,706		6.022
		1.958	
1532	45,600		7.980

60% Cleanout Volume	4.788 ac-ft
60% Cleanout Elevat	1528.54 ft

```
                         RESERVOIR REPORT

     RECORD NUMBER  : 4
     STORAGE TYPE   : MAN STAGE/AREA
     DISCHARGE TYPE : COMP STAGE/DISC
     DESCRIPTION    : POND No. 2, SEDIMENT AT 60%

 [RATING CURVE LIMIT]

     Minimum Elevation..........................  =        1528.50 (ft)
     Maximum Elevation..........................  =        1532.00 (ft)
     Elevation Increment........................  =           0.10 (ft)

 [STAGE STORAGE INFORMATION]

     Input file = NULL
     Output file = NULL

        [Manual Contour Area vs. Elevation]

 ----------------------------------------------
     ELEVATION                    CONTOUR AREA
       (ft)                          (sqft)
 ----------------------------------------------
     1528.50                      35457.00
     1530.00                      39706.00
     1532.00                      45600.00

 [STAGE DISCHARGE INFORMATION]

     OUTLET STRUCTURE:
     STR #       :   7
     TYPE        : TRAPEZOIDAL WEIR
     DESCRIPTION : EMERGENCY SPILLWAY - POND No. 2


                    [Reservoir Discharge vs. Stage]
                   (the elevation increment is 0.10)

 --------------------------------------------------------------------
        STAGE     ELEVATION    CONTOUR AREA    STORAGE    DISCHARGE
        (ft)        (ft)          (sqft)        (cuft)      (cfs)
 --------------------------------------------------------------------
         0.00     1528.50      35457.00          0.00       0.00
         0.10     1528.60      35740.20       3559.86       0.00
         0.20     1528.70      36023.39       7148.04       0.00
         0.30     1528.80      36306.94      10764.56       0.00
         0.40     1528.90      36590.14      14409.41       0.00
         0.50     1529.00      36873.33      18082.58       0.00
         0.60     1529.10      37156.53      21784.08       0.00
         0.70     1529.20      37439.73      25513.89       0.00
         0.80     1529.30      37723.27      29272.04       0.00
         0.90     1529.40      38006.47      33058.53       0.00
         1.00     1529.50      38289.67      36873.34       0.00
         1.10     1529.60      38572.86      40716.46       1.97
         1.20     1529.70      38856.06      44587.91       5.64
```

RESERVOIR REPORT

RECORD NUMBER : 4
STORAGE TYPE : MAN STAGE/AREA

DISCHARGE TYPE : COMP STAGE/DISC
DESCRIPTION : POND No. 2, SEDIMENT AT 60%

[Reservoir Discharge vs. Stage]
(the elevation increment is 0.10)

STAGE (ft)	ELEVATION (ft)	CONTOUR AREA (sqft)	STORAGE (cuft)	DISCHARGE (cfs)
1.30	1529.80	39139.61	48487.69	10.48
1.40	1529.90	39422.80	52415.81	16.29
1.50	1530.00	39706.00	56372.25	22.99
1.60	1530.10	40000.63	60357.59	30.51
1.70	1530.20	40295.26	64372.38	38.82
1.80	1530.30	40590.24	68416.66	47.87
1.90	1530.40	40884.87	72490.41	57.65
2.00	1530.50	41179.50	76593.63	68.15
2.10	1530.60	41474.13	80726.31	79.34
2.20	1530.70	41768.76	84888.45	91.22
2.30	1530.80	42063.74	89080.08	103.77
2.40	1530.90	42358.37	93301.19	117.00
2.50	1531.00	42653.00	97551.76	130.90
2.60	1531.10	42947.63	101831.79	145.46
2.70	1531.20	43242.26	106141.28	160.69
2.80	1531.30	43537.24	110480.26	176.57
2.90	1531.40	43831.87	114848.71	193.11
3.00	1531.50	44126.50	119246.63	210.31
3.10	1531.60	44421.13	123674.02	228.17
3.20	1531.70	44715.76	128130.86	246.68
3.30	1531.80	45010.74	132617.19	265.85
3.40	1531.90	45305.37	137133.00	285.68
3.50	1532.00	45600.00	141678.27	306.17

```
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                         OUTLET STRUCTURE REPORT

   RECORD NUMBER    : 6
   TYPE             : STAND PIPE WEIR
   DESCRIPTION      : PRIMARY SPILLWAY - POND No. 2

[RATING CURVE LIMIT]

   Minimum Elevation........................  =          1520.00 (ft)
   Maximum Elevation........................  =          1532.00 (ft)
   Elevation Increment......................  =             0.20 (ft)

                         [STANDPIPE INFORMATION]

   DESCRIPTION : CIRCULAR STAND PIPE

[OUTLET STRUCTURE INFORMATION]

   Radius...................................  =          0.75000 (ft)
   Crest Length.............................  =             4.71 (ft)
   Crest Elevation..........................  =          1528.00 (ft)
   Fraction Open Area.......................  =          1.00000

[RECTANGULAR STAND PIPE EQUATION]

   ORIFICE EQ:  Q = Co*A(2gh)^0.5
   WEIR    EQ:  Q = Cw*L*H^exp
   Coefficient Co ..........................  =          0.61000
   Coefficient Cw ..........................  =          3.33000
   Exponential..............................  =          1.50000

[DEFINITIONS]

   H    = Headwater depth, (ft)
   A    = Wetted area, (sqft)
   L    = Crest length, (ft)

                         [ORIFICE INFORMATION]

   SUBRECORD    : 1
   DESCRIPTION  : CIRCULAR ORIFICE

[OUTLET STRUCTURE INFORMATION]

   Radius...................................  =          0.08330 (ft)
   Invert Elevation.........................  =       1520.00000 (ft)
   Coefficient Co...........................  =          0.61000
   # of Openings............................  =             3

[CIRCULAR ORIFICE EQUATION]

   Q = N*Co*A*[2gh]/k]^0.5
   A = Wetted area, (sqft)
   h = Centroid of Wetted area, (ft)
   N = number of openings
   K = 1
```

```
                         OUTLET STRUCTURE REPORT

    RECORD_NUMBER   : 6
    TYPE            : STAND PIPE WEIR
    DESCRIPTION     : PRIMARY SPILLWAY - POND No. 2

                          [ORIFICE INFORMATION]

    SUBRECORD    : 2
    DESCRIPTION : CIRCULAR ORIFICE

[OUTLET STRUCTURE INFORMATION]

    Radius................................   =          0.08330 (ft)
    Invert Elevation......................   =       1522.00000 (ft)
    Coefficient Co........................   =          0.61000
    # of Openings.........................   =             4

[CIRCULAR ORIFICE EQUATION]

    Q = N*Co*A*[2gh]/k]^0.5
    A = Wetted area, (sqft)
    h = Centroid of Wetted area, (ft)
    N = number of openings
    K = 1

                          [ORIFICE INFORMATION]

    SUBRECORD    : 3
    DESCRIPTION : CIRCULAR ORIFICE

[OUTLET STRUCTURE INFORMATION]

    Radius................................   =          0.08330 (ft)
    Invert Elevation......................   =       1524.00000 (ft)
    Coefficient Co........................   =          0.61000
    # of Openings.........................   =             4

[CIRCULAR ORIFICE EQUATION]

    Q = N*Co*A*[2gh]/k]^0.5
    A = Wetted area, (sqft)
    h = Centroid of Wetted area, (ft)
    N = number of openings
    K = 1
```

```
                    OUTLET STRUCTURE REPORT

    RECORD NUMBER   : 6
    TYPE            : STAND PIPE WEIR
    DESCRIPTION     : PRIMARY SPILLWAY - POND No. 2

                        [ORIFICE INFORMATION]
    SUBRECORD    : 4
    DESCRIPTION  : CIRCULAR ORIFICE

[OUTLET STRUCTURE INFORMATION]

    Radius................................   =        0.08330 (ft)
    Invert Elevation......................   =     1526.00000 (ft)
    Coefficient Co........................   =        0.61000
    # of Openings.........................   =        4

[CIRCULAR ORIFICE EQUATION]

    Q = N*Co*A*[2gh]/k]^0.5
    A = Wetted area, (sqft)
    h = Centroid of Wetted area, (ft)
    N = number of openings
    K = 1

                        [CULVERT INFORMATION]
    DESCRIPTION : CIRCULAR CMP/headwall

[OUTLET STRUCTURE INFORMATION]

    Circular Radius.......................   =        0.75000 (ft)
    Culvert Length........................   =       80.00000 (ft)
    Culvert Invert Elevation..............   =     1520.00000 (ft)
    Slope.................................   =        0.00400 (ft/ft)
    Manning's n-value.....................   =        0.02400
    Entrance Loss Coefficient.............   =        0.90000
    Tailwater Elevation...................   =     1520.57996 (ft)
    Number of barrels.....................   =        1

[UNSUBMERGED EQUATION]

    H/Diam = Hc/Diam + K *(Q/A*Diam^0.5))^M - 0.5*S^2
    Coefficient K.........................   =         0.07800
    coefficient M.........................   =         2.00000

[SUBMERGED EQUATION]

    H/Diam = c*(Q/(A*Diam^0.5))^Z + Y - 0.5*S^2
    Coefficient c.........................   =         0.03790
    Coefficient Y.........................   =         0.69000

[DEFINITIONS]

    H    = Headwater depth, (ft)
    Diam = Interior height of culvert barrel, (ft)
    Hc   = Specific head at critical depth (dc + Vc^2/2g), (ft)
    Q    = Discharge, (cfs)
    A    = Full cross sectional area of culvert barrel, (sqft)
    S    = Culvert barrel slope, (ft/ft)
```

OUTLET STRUCTURE REPORT

RECORD NUMBER : 6
TYPE : STAND PIPE WEIR
DESCRIPTION : PRIMARY SPILLWAY - POND No. 2

[Stand Pipe Discharge vs. Stage]
(the elevation increment is 0.20)

STAGE	ELEVATION (ft)	ORIFICE (cfs)	WEIR (cfs)	STAND PIPE (cfs)	CULVERT (cfs)	TOTAL FLOW (cfs)
0.00	1520.00	0.00	0.00	0.00	0.00	0.00
0.20	1520.20	0.11	0.00	0.00	0.00	0.00
0.40	1520.40	0.18	0.00	0.00	0.00	0.00
0.60	1520.60	0.23	0.00	0.00	0.99	0.23
0.80	1520.80	0.27	0.00	0.00	1.63	0.27
1.00	1521.00	0.31	0.00	0.00	2.29	0.31
1.20	1521.20	0.34	0.00	0.00	2.94	0.34
1.40	1521.40	0.37	0.00	0.00	3.56	0.37
1.60	1521.60	0.39	0.00	0.00	4.15	0.39
1.80	1521.80	0.42	0.00	0.00	4.70	0.42
2.00	1522.00	0.44	0.00	0.00	5.24	0.44
2.20	1522.20	0.61	0.00	0.00	5.74	0.61
2.40	1522.40	0.73	0.00	0.00	6.22	0.73
2.60	1522.60	0.81	0.00	0.00	6.68	0.81
2.80	1522.80	0.89	0.00	0.00	7.12	0.89
3.00	1523.00	0.96	0.00	0.00	7.47	0.96
3.20	1523.20	1.02	0.00	0.00	7.81	1.02
3.40	1523.40	1.07	0.00	0.00	8.15	1.07
3.60	1523.60	1.13	0.00	0.00	8.49	1.13
3.80	1523.80	1.18	0.00	0.00	8.83	1.18
4.00	1524.00	1.22	0.00	0.00	9.18	1.22
4.20	1524.20	1.42	0.00	0.00	9.52	1.42
4.40	1524.40	1.55	0.00	0.00	9.86	1.55
4.60	1524.60	1.66	0.00	0.00	10.20	1.66
4.80	1524.80	1.76	0.00	0.00	10.54	1.76
5.00	1525.00	1.85	0.00	0.00	10.88	1.85
5.20	1525.20	1.93	0.00	0.00	11.23	1.93
5.40	1525.40	2.00	0.00	0.00	11.57	2.00
5.60	1525.60	2.08	0.00	0.00	11.91	2.08
5.80	1525.80	2.15	0.00	0.00	12.25	2.15
6.00	1526.00	2.21	0.00	0.00	12.59	2.21
6.20	1526.20	2.42	0.00	0.00	12.87	2.42
6.40	1526.40	2.58	0.00	0.00	13.09	2.58
6.60	1526.60	2.71	0.00	0.00	13.32	2.71
6.80	1526.80	2.82	0.00	0.00	13.53	2.82
7.00	1527.00	2.93	0.00	0.00	13.75	2.93
7.20	1527.20	3.02	0.00	0.00	13.97	3.02
7.40	1527.40	3.12	0.00	0.00	14.17	3.12
7.60	1527.60	3.21	0.00	0.00	14.38	3.21
7.80	1527.80	3.29	0.00	0.00	14.58	3.29
8.00	1528.00	3.37	0.00	0.00	14.78	3.37
8.20	1528.20	3.45	0.00	1.38	14.98	4.84
8.40	1528.40	3.53	0.00	3.94	15.18	7.47
8.60	1528.60	3.61	0.00	6.36	15.37	9.97
8.80	1528.80	3.68	0.00	7.73	15.56	11.41

OUTLET STRUCTURE REPORT

RECORD NUMBER : 6
TYPE : STAND PIPE WEIR
DESCRIPTION : PRIMARY SPILLWAY - POND No. 2

[Stand Pipe Discharge vs. Stage]
(the elevation increment is 0.20)

STAGE	ELEVATION (ft)	ORIFICE (cfs)	WEIR (cfs)	STAND PIPE (cfs)	CULVERT (cfs)	TOTAL FLOW (cfs)
9.00	1529.00	3.75	0.00	8.64	15.75	12.39
9.20	1529.20	3.82	0.00	9.47	15.93	13.29
9.40	1529.40	3.89	0.00	10.23	16.12	14.12
9.60	1529.60	3.96	0.00	10.93	16.30	14.89
9.80	1529.80	4.03	0.00	11.60	16.48	15.62
10.00	1530.00	4.09	0.00	12.23	16.66	16.32
10.20	1530.20	4.16	0.00	12.82	16.83	16.83
10.40	1530.40	4.22	0.00	13.39	17.01	17.01
10.60	1530.60	4.28	0.00	13.94	17.18	17.18
10.80	1530.80	4.34	0.00	14.47	17.35	17.35
11.00	1531.00	4.40	0.00	14.98	17.52	17.52
11.20	1531.20	4.46	0.00	15.47	17.69	17.69
11.40	1531.40	4.52	0.00	15.94	17.85	17.85
11.60	1531.60	4.58	0.00	16.41	18.02	18.02
11.80	1531.80	4.63	0.00	16.86	18.18	18.18
12.00	1532.00	4.69	0.00	17.29	18.34	18.34

OUTLET STRUCTURE REPORT

RECORD NUMBER : 6
TYPE : STAND PIPE WEIR
DESCRIPTION : PRIMARY SPILLWAY - POND No. 2

[Orifices Discharge vs. Stage]
(the elevation increment is 0.20)

STAGE	ELEVATION (ft)	ORIF1 (cfs)	ORIF2 (cfs)	ORIF3 (cfs)	ORIF4 (cfs)	TOTAL (cfs)
0.00	1520.00	0.00	0.00	0.00	0.00	0.00
0.20	1520.20	0.11	0.00	0.00	0.00	0.11
0.40	1520.40	0.18	0.00	0.00	0.00	0.18
0.60	1520.60	0.23	0.00	0.00	0.00	0.23
0.80	1520.80	0.27	0.00	0.00	0.00	0.27
1.00	1521.00	0.31	0.00	0.00	0.00	0.31
1.20	1521.20	0.34	0.00	0.00	0.00	0.34
1.40	1521.40	0.37	0.00	0.00	0.00	0.37
1.60	1521.60	0.39	0.00	0.00	0.00	0.39
1.80	1521.80	0.42	0.00	0.00	0.00	0.42
2.00	1522.00	0.44	0.00	0.00	0.00	0.44
2.20	1522.20	0.47	0.15	0.00	0.00	0.61
2.40	1522.40	0.49	0.24	0.00	0.00	0.73
2.60	1522.60	0.51	0.31	0.00	0.00	0.81
2.80	1522.80	0.53	0.36	0.00	0.00	0.89
3.00	1523.00	0.55	0.41	0.00	0.00	0.96
3.20	1523.20	0.57	0.45	0.00	0.00	1.02
3.40	1523.40	0.58	0.49	0.00	0.00	1.07
3.60	1523.60	0.60	0.53	0.00	0.00	1.13
3.80	1523.80	0.62	0.56	0.00	0.00	1.18
4.00	1524.00	0.63	0.59	0.00	0.00	1.22
4.20	1524.20	0.65	0.62	0.15	0.00	1.42
4.40	1524.40	0.67	0.65	0.24	0.00	1.55
4.60	1524.60	0.68	0.68	0.31	0.00	1.66
4.80	1524.80	0.70	0.70	0.36	0.00	1.76
5.00	1525.00	0.71	0.73	0.41	0.00	1.85
5.20	1525.20	0.72	0.75	0.45	0.00	1.93
5.40	1525.40	0.74	0.78	0.49	0.00	2.00
5.60	1525.60	0.75	0.80	0.53	0.00	2.08
5.80	1525.80	0.77	0.82	0.56	0.00	2.15
6.00	1526.00	0.78	0.84	0.59	0.00	2.21
6.20	1526.20	0.79	0.87	0.62	0.14	2.42
6.40	1526.40	0.80	0.89	0.65	0.24	2.58
6.60	1526.60	0.82	0.91	0.68	0.31	2.71
6.80	1526.80	0.83	0.93	0.70	0.36	2.82
7.00	1527.00	0.84	0.95	0.73	0.41	2.93
7.20	1527.20	0.85	0.97	0.75	0.45	3.02
7.40	1527.40	0.87	0.98	0.78	0.49	3.12
7.60	1527.60	0.88	1.00	0.80	0.53	3.21
7.80	1527.80	0.89	1.02	0.82	0.56	3.29
8.00	1528.00	0.90	1.04	0.84	0.59	3.37
8.20	1528.20	0.91	1.06	0.87	0.62	3.45
8.40	1528.40	0.92	1.07	0.89	0.65	3.53
8.60	1528.60	0.93	1.09	0.91	0.68	3.61

OUTLET STRUCTURE REPORT

RECORD NUMBER : 6
TYPE : STAND PIPE WEIR
DESCRIPTION : PRIMARY SPILLWAY - POND No. 2

[Orifices Discharge vs. Stage]
(the elevation increment is 0.20)

STAGE	ELEVATION (ft)	ORIF1 (cfs)	ORIF2 (cfs)	ORIF3 (cfs)	ORIF4 (cfs)	TOTAL (cfs)
8.80	1528.80	0.95	1.11	0.93	0.70	3.68
9.00	1529.00	0.96	1.12	0.95	0.73	3.75
9.20	1529.20	0.97	1.14	0.97	0.75	3.82
9.40	1529.40	0.98	1.15	0.98	0.78	3.89
9.60	1529.60	0.99	1.17	1.00	0.80	3.96
9.80	1529.80	1.00	1.19	1.02	0.82	4.03
10.00	1530.00	1.01	1.20	1.04	0.84	4.09
10.20	1530.20	1.02	1.22	1.06	0.87	4.16
10.40	1530.40	1.03	1.23	1.07	0.89	4.22
10.60	1530.60	1.04	1.25	1.09	0.91	4.28
10.80	1530.80	1.05	1.26	1.11	0.93	4.34
11.00	1531.00	1.06	1.27	1.12	0.95	4.40
11.20	1531.20	1.07	1.29	1.14	0.97	4.46
11.40	1531.40	1.08	1.30	1.15	0.98	4.52
11.60	1531.60	1.09	1.32	1.17	1.00	4.58
11.80	1531.80	1.10	1.33	1.19	1.02	4.63
12.00	1532.00	1.10	1.34	1.20	1.04	4.69

```
                         OUTLET STRUCTURE REPORT

    RECORD NUMBER    : 7
    TYPE             : TRAPEZOIDAL WEIR
    DESCRIPTION      : EMERGENCY SPILLWAY - POND No. 2

[RATING CURVE LIMIT]

    Minimum Elevation.........................   =          1529.50 (ft)
    Maximum Elevation.........................   =          1532.00 (ft)
    Elevation Increment.......................   =             0.10 (ft)

[OUTLET STRUCTURE INFORMATION]

    Weir Angle................................   =           136.40 (deg)
    Crest Elevation...........................   =          1529.50 (ft)
    Crest Length..............................   =            20.00 (ft)

    Coefficient Cw............................   =          3.10000
    Exponential...............................   =          1.50000

[TRAPEZOIDAL WEIR EQUATION]

    Q = Cw(L+0.8Htan(ang/2))H^exp
    H   = Headwater depth, (ft)
    ang = Weir Angle, (deg)


                        [Discharge vs. Stage]
                  (the elevation increment is 0.10)
----------------------------------------------------------
      STAGE              ELEVATION           FLOW
                           (ft)              (cfs)
----------------------------------------------------------
       0.00              1529.50              0.00
       0.10              1529.60              1.98
       0.20              1529.70              5.65
       0.30              1529.80             10.49
       0.40              1529.90             16.31
       0.50              1530.00             23.01
       0.60              1530.10             30.53
       0.70              1530.20             38.84
       0.80              1530.30             47.89
       0.90              1530.40             57.68
       1.00              1530.50             68.17
       1.10              1530.60             79.37
       1.20              1530.70             91.25
       1.30              1530.80            103.80
       1.40              1530.90            117.04
       1.50              1531.00            130.94
       1.60              1531.10            145.50
       1.70              1531.20            160.72
       1.80              1531.30            176.61
       1.90              1531.40            193.15
       2.00              1531.50            210.35
       2.10              1531.60            228.21
       2.20              1531.70            246.72
       2.30              1531.80            265.90
       2.40              1531.90            285.73
       2.50              1532.00            306.22
```

DIVERSION DITCH CALCULATIONS

```
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                           UNIT HYDROGRAPH REPORT

   RECORD NUMBER  : 3
   TYPE           : TRIANGULAR UH
   DESCRIPTION    : DITCH UH

[UNIT HYDROGRAPH INFORMATION]

   Peak Discharge............................  =           27.47 (cfs)
   Shape Factor..............................  =          484.00


[BASIN DESCRIPTION]

   Watershed Area............................  =           12.27 (ac)
   Curve Number..............................  =           70

[TIME CONCENTRATION -- SCS LAG]

   Channel Slope (S).........................  =         0.06400
   Flow Length (L)...........................  =         2100.00 (ft)
   Time of Concentration.....................  =           30.41 (min)
```

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                          HYDROGRAPH REPORT

   RECORD NUMBER    : 3
   TYPE             : COMPUTED FLOOD
   DESCRIPTION      : DIVERSION DITCH - 25Q24

[HYDROGRAPH INFORMATION]

   Peak Discharge...........................  =        22.22 (cfs)
   Volume...................................  =         2.31 (acft)
   Multiplication factor....................  =         1.00

[UNIT HYDROGRAPH INFORMATION]

   Unit hydrograph #........................  =        3
   Unit hydrograph type.....................  =      TRIANGULAR UH
   Peak Discharge...........................  =        27.47 (cfs)
   Shape Factor.............................  =       484.00

[BASIN DESCRIPTION]

   Watershed Area...........................  =         12.27 (ac)
   Curve Number.............................  =         70


[TIME CONCENTRATION -- SCS LAG]

   Channel Slope (S)........................  =      0.06400
   Flow Length (L)..........................  =      2100.00 (ft)
   Time of Concentration....................  =        30.41 (min)

[RAINFALL DESCRIPTION]

   Distribution Type........................  =          SCS II
   Total Precipitation......................  =         5.30 (in)
   Return Period............................  =        25    (yr)
   Storm Duration...........................  =        24.00 (hr)
```

```
                    TRIANGULAR OPEN CHANNEL
                       DESIGN DATA SHEET


PROJECT INFORMATION SUMMARY
===========================
Name of Project:  Greeneville Demolition Landfill
Name of Ditch:  Diversion Ditch


CHANNEL CHARACTERISTICS
=======================
Side slope no.1 is    5.33 horizontal to 1 vertical
Side slope no.2 is    2.00 horizontal to 1 vertical
Channel grade is   9.00 percent
Channel lining is Tall Fescue
Manning's number is 0.095


CHANNEL FLOW SUMMARY
====================
Cross-sectional area is    6.373 sq.ft.
Wetted perimeter is  10.100 ft.
Hydraulic radius is  0.631 ft.
Hydraulic depth is   0.659 ft.
Reynolds number is    201,696
Froude number is   0.749


DISCHARGE DATA SUMMARY
======================
Peak discharge is    22.00 cfs
Velocity is  3.45 fps
Depth of flow is  1.319 ft.
Flow is turbulent and subcritical


ALLOWABLE VELOCITY
==================
Vegetation type is   Tall Fescue
Retardance classification is  B
Soil type is   Clay Loam and Silty Clay Loam
Estimated K value is   0.32
Soil classification is  Erosion Resistant
Allowable velocity is   6 fps
```

DESIGN DATA SHEET
FOR
RIPRAP LINED CHANNEL

PROJECT INFORMATION

Client: City of Greeneville
Project: Greeneville Landfill
Channel: Demolition Landfill Diversion Ditch
Station: 0+00 to 1+00

CHANNEL CHARACTERISTICS

Slope = 14.00 percent
Side Slopes = 2.5 v : 1h, left 2.5 v : 1h, right
Bottom Width = 8 feet, b/d = 22.5
Depth of Flow = 0.355 feet, supercritical
Velocity = 6.98 fps @ Discharge = 22.0 cfs
Req'd Freeboard = 0.30 feet, Actual FB = 0.6 feet
Total Depth = 1 feet
Total Length = 100 feet, Outside Bend Radius = NA feet

RIPRAP PROPERTIES

Median Size: 8.3 inches
Manning's Number: 0.037
Rock Type: limestone
Specific Gravity: 2.8
Rock Shape: very angular
Angle of Repose: 42 degrees
Unit Weight of Dumped Riprap: 125 lbs./cu.ft.

RIPRAP SIZING

D-100 = 17 inches @ 242 lbs. each stone
D-85 = 15 inches @ 162 lbs. each stone
D-50 = 8 inches @ 30 lbs. each stone
D-15 = 4 inches @ 3.8 lbs. each stone
Thickness of riprap blanket = 25 inches
Total amount needed = 174 tons minimum
(Rounded up to nearest 1 tons)

MINIMUM SAFETY FACTORS AGAINST LINING FAILURE

Channel Bed: 1.00
Channel Side Slopes: 1.03

DESIGN DATA SHEET
FOR
RIPRAP LINED CHANNEL
SHEET 2 OF 2
Demolition Landfill Diversion Ditch
0+00 to 1+00

BEDDING SOIL CHARACTERISTICS

D-85 = 1.5 mm
D-50 = 0.5 mm
D-15 = 0.17 mm

GRANULAR FILTER DESIGN

	Grain Size	Seive Size
D-85 =	1.5 inches	1-1/2 inch
D-50 =	0.75 inches	3/4 inch
D-15 =	0.25 inches	No. 3

Thickness of filter blanket = 12.5 inches
Unit Weight of gravel = 115 lbs./cu.ft.
Total amount needed = 80 tons minimum
(Rounded up to nearest 1 tons)

FILTER FABRIC DESIGN

A geotextile may used in lieu of a gravel filter. An acceptable filter fabric is Typar 3401

Width of one roll of fabric: 16.4 feet
Length of one roll of fabric: 300 feet
Amount of overlap of each roll: 3.0 feet
Total number of rolls needed: < 1

RIPRAP AND FILTER DESIGN
SUPPORTING CALCULATIONS SHEET

Reference: BJ Barfield, RC Warner, and CT Haan, "Applied Hydrology and Sedimentology for Disturbed Areas", Oklahoma Technical Press, 1981

FORMULAS USED TO DETERMINE RIPRAP SIZE FOR DITCH

```
*********************************************
n = ( .0395*(D50^.16667))            Z = (Z1+Zr)/2
[TAU] = Xb*(62.4*d*S)                Xb is obtained from Fig. 3.16b
[ETA]b = (21*TAU)/(62.4*(SG-1)*D50)
[PHI] = FROM FIG. 3.14
[THETA] = CHANNEL SLOPE IN RADIANS
SFbed = (COS[THETA]*TAN[PHI])/((SIN[THETA])+(ETAb*TAN[PHI]))
[TAU]max = Xs*(62.4*d*S)             Xs is obtained from Fig. 3.16a
[ETA] = (21*Tmax)/(62.4*(SG-1)*D50)
[ALPHA] = ATAN(1/Z)
[LAMBDA] = [THETA]
[BETA] =ATAN(COS[LAMBDA])/(((2*SIN[ALPHA])/([ETA]*TAN[PHI]))+SIN[LAMBDA
[ETA]'=([ETA]*((1+(SIN([LAMBDA]+[BETA])))/2)
SFside =(COS[ALPHA]*TAN[PHI])/(([ETA]'*TAN[PHI])+(SIN[ALPHA]*COS[BETA]
===========================================================
D50   =        0.69 feet              Xs =          0.8
n   =        0.0371                   [TAU]max=     2.480 lbs./ft^2
S   =        0.140 ft./ft.            [ETA]s=       0.670
Z =            2.5                    [ALPHA]=      0.381 radians
Xb =             1                    [LAMBDA]=     0.139 radians
[TAU]   =    3.100 lbs./ft^2          [BETA]  =     0.626 radians
[ETA]b =     0.838                    [ETA]' =      0.567
[PHI]=       0.733 radians            SFside=        1.03
[THETA]=     0.139 radians            SFbed=         1.00
```

RIPRAP SIZING

```
D15 of riprap:                 4 inches        = D50 * 0.5
D50 of riprap:                 8 inches        = D50 * 1.0
D85 of riprap:                15 inches        = D50 * 1.75
D100 of riprap:               17 inches        = D50 * 2.0
Riprap thickness:             25 inches        = D100 * 1.5
```

GRANULAR FILTER

```
D15 of filter material:      0.25 inches   =    No. 3
D50 of filter material:      0.75 inches   =    3/4 inch
D85 of filter material:       1.5 inches   =    1-1/2 inch
Filter thickness:            12.5 inch = 0.5 * riprap thickness
```

FILTER DESIGN ANALYSIS

```
d50f/d50b =            38.10 OK, ratio within required limits.
d50r/d50f =            11.07 OK, ratio within required limits.
d15f/d15b =            37.35 OK, ratio within required limits.
d15r/d15f =            16.60 OK, ratio within required limits.
d15f/d85b =             4.23 OK, ratio within required limits.
d15r/d85f =             2.77 OK, ratio within required limits.
```

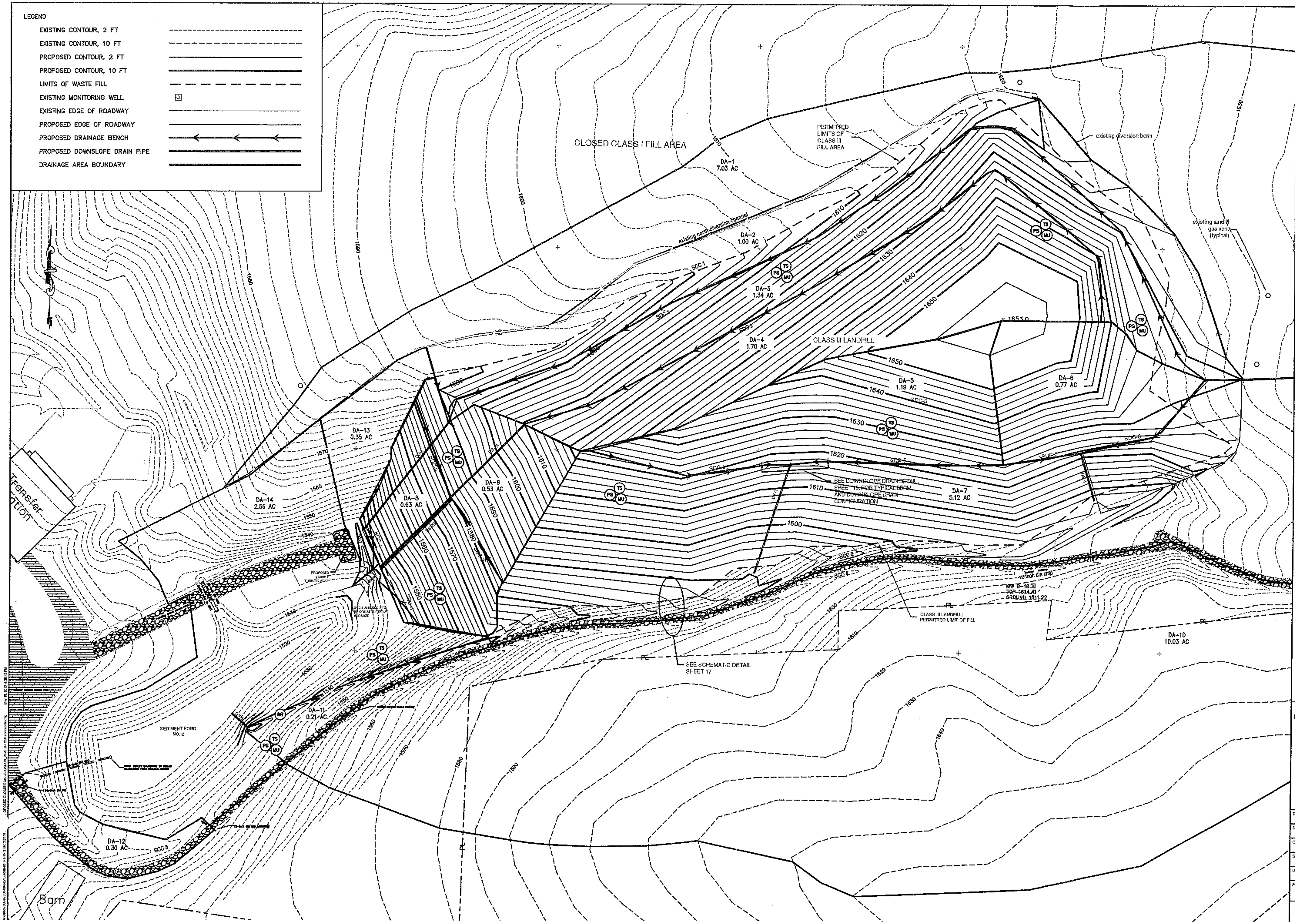
FILTER FABRIC DESIGN

```
O-95 < [2 or 3]D-85(base) <          3     to       4.5 mm
An acceptable fabric is:    Typar 3401
```

B. CALCULATIONS FOR MODIFIED CLOSURE GRADE

Greeneville Class III Landfill
Table 3.B.1
Permit Modification
Drainage Area Flow Summary Table
April, 2013

Drainage Area	Drainage Area (acres)	Time of Concentration (min)	SCS Curve Number	25 Year, 24 Hour Storm		100 Year, 24 Hour Storm	
				Peak Flow (cfs)	Volume (cuft)	Peak Flow (cfs)	Volume (cuft)
DA-1	7.03	37.8	76	11.21	54,962	15.95	77,519
DA-2	1.00	5	83	4.58	9,366	6.12	12,665
DA-3	1.34	5	87	6.85	14,259	8.92	18,859
DA-4	1.70	5	87	8.68	18,090	11.31	23,925
DA-5	1.19	5	87	6.08	12,663	11.93	16,747
DA-6	0.77	5	87	3.93	8,194	5.12	10,837
DA-7	5.12	24.7	83	13.72	50,353	18.47	68,090
DA-8	0.63	5	87	3.22	6,704	4.19	8,866
DA-9	0.53	5	87	2.71	5,640	3.53	7,459
DA-10	10.03	25.3	74	19.16	71,517	27.73	102,198
DA-11	0.21	5	79	0.85	1,716	1.17	2,376
DA-12	0.30	5	79	1.21	2,452	1.67	3,394
DA-13	0.35	5	79	1.41	2,861	1.94	3,960
DA-14	2.56	5	79	10.34	20,923	14.21	28,964



DRAINAGE AREAS
PERMIT MODIFICATION

GREENEVILLE CLASS III LANDFILL

GREENEVILLE, TENNESSEE

Draper Aden Associates

Engineering • Surveying • Environmental Services

Blacksburg, VA
2206 South Main Street
Blacksburg, VA 24060
540-552-0444 Fax: 540-552-0291
www.daa.com

Richmond, VA
Charlottesville, VA
Hampton Roads, VA

REVISIONS

Rev. 1; 4-25-2013
Revisions to drainage areas per TDEC comments

DESIGNED BY:	MAC
DRAWN BY:	DLD
CHECKED BY:	LPK
SCALE:	1" = 40'
DATE:	May 15, 2012
PROJECT NUMBER:	7686-09

FIG 3.B.1

Greeneville Class III Landfill
Table 3.B.2
Permit Modification
Downslope Drain Summary Table
April, 2013

Downslope Drain No.	Contributing Drainage Areas	Flow, 25-Year Storm (cfs)	Velocity (fps)	Flow Depth (ft)
DS-1	DA-2, DA-3	11.4	19.2	0.55
DS-2A	DA-4	8.7	16.1	0.52
DS-2B	DA-9	2.7	12.7	0.27
DS-3	DA-5	6.1	14.6	0.43
DS-4	DA-6	3.9	12.9	0.34
DS-5	DA-11, SCC-3	24.58	22.9	0.88

Greeneville Class III Landfill
Table 3.B.3
Outlet Protection Summary
Permit Modification
April 26, 2014 (Revision)

	Diameter or Equivalent Diameter (in)	Q-Peak (cfs) Calculated	Q (cfs) - See note below	L-a (ft)	W-a (ft)	D-50 (in)
Downslope drain 1	18	11.4	15.0	14	15.5	6
Downslope drains 2A, 2B	2-18 pipes	11.4	56.0	20	23	7
Downslope drain 3	18	6.1	10.0	9	10.5	6 (See note 2)
Downslope drain 4	18	3.9	10.0	9	10.5	6 (See note 2)
Downslope drain 5	24	24.6	35.0	20	22	9

NOTES:

Note 1. TDEC guide dated March 2002. Flow available from table rounded up. Table attached.

Note 2: Table indicates rip rap size of 3.5". Have chosen Tennessee recommended minimum of 6".

Riprap Outlet Protection Specifications

This table is intended to select two parameters for the design of riprap outlet protection, based upon outlet velocities that correspond with circular culverts flowing full. Flow values less than the lowest value for the culvert size usually indicate a full-flow velocity less than 5 feet per second, for which riprap is usually not necessary. Flow values more than the highest value for the culvert size usually indicates that a concrete stilling basin or energy dissipater structure is necessary.

Adjust values upward if the circular culvert is not flowing full based upon outlet conditions. For noncircular pipe, convert into an equivalent cross-sectional area of circular culvert to continue design.

Riprap Aprons for Low Tailwater
(downstream flow depth < 0.5 x pipe diameter)

Culvert Diameter	Lowest value			Intermediate values to interpolate from									Highest value		
	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}
	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In
12"	4	7	2.5	6	10	3.5	9	131	6	12	16	7	14	17	8.5
15"	6.5	8	3	10	12	5	15	16	7	20	18	10	25	20	12
18"	10	9	3.5	15	14	5.5	20	17	7	30	22	11	40	25	14
21"	15	11	4	25	18	7	35	22	10	45	26	13	60	29	18
24"	21	13	5	35	20	8.5	50	26	12	65	30	16	80	33	19
27"	27	14	5.5	50	24	9.5	70	29	14	90	34	18	110	37	22
30"	36	16	6	60	25	9.5	90	33	15.5	120	38	20	140	41	24
36"	56	20	7	100	32	13	140	40	18	180	45	23	220	50	28
42"	82	22	8.5	120	32	12	160	39	17	200	45	20	260	52	26
48"	120	26	10	170	37	14	220	46	19	270	54	23	320	64	37

Riprap Aprons for High Tailwater
(downstream flow depth > 0.5 x pipe diameter)

Culvert Diameter	Lowest value			Intermediate values to interpolate from									Highest value		
	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}	Q	L_A	D_{50}
	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In	Cfs	Ft	In
12"	4	8	2	6	18	2.5	9	28	4.5	12	36	7	14	40	8
15"	7	8	2	10	20	2.5	15	34	5	20	42	7.5	25	50	10
18"	10	8	2	15	22	3	20	34	5	30	50	9	40	60	11
21"	15	8	2	25	32	4.5	35	48	7	45	58	11	60	72	14
24"	20	8	2	35	36	5	50	55	8.5	65	63	12	80	80	15
27"	27	10	2	50	41	6	70	58	10	90	70	14	110	82	17
30"	36	11	2	60	42	6	90	64	11	120	80	15	140	90	18
36"	56	13	2.5	100	60	7	140	85	13	180	104	18	220	120	23
42"	82	15	2.5	120	50	6	160	75	10	200	96	14	260	120	19
48"	120	20	2.5	170	58	7	220	85	12	270	105	16	320	120	20

Table 1

Source: Knoxville Engineering Department

Greeneville Class IV Landfill
Table 3.B.4
Permit Modification
Channel Summary Table
April, 2013

Channel	Tributary Flows	Q-Peak (cfs)	Channel Shape	Channel Depth (ft)	Flow Depth (ft)	Flow Velocity (fps)	Channel Lining
North Diversion-Upper Section (existing)	DA-1	11.21	Vee	1.5	0.66	4.29	Grass
North Diversion-Lower Section (existing)	DA-1	11.21	Vee	1.5	0.7	3.83	Riprap, TDOT Class A-1
SCC-1	DA-2	4.58	Trapezoidal	1.5	0.3	3.1	Riprap, TDOT Class A-1
SCC-2	DA-5,-6,-7	23.73	Trapezoidal	1.5	1.2	4.5	Riprap, TDOT Class A-1
SCC-3	DA-11, SCC-2	24.58	Trapezoidal	1.5	1.3	5.6	Riprap, TDOT Class B
SCC-4	DA-10	19.16	Trapezoidal	1.5	1.1	4.2	Riprap, TDOT Class A-1
SCC-5	DA-12	1.21	Trapezoidal	1.5	0.1	3.0	Grass
SCC-6	DA-4, -8, -9	14.62	Trapezoidal	1.5	0.3	4.9	Riprap, TDOT Class A-1
SCC-7	DA-2,-3, -13	12.84	Trapezoidal	1.5	0.8	3.6	Riprap, TDOT Class A-1

Notes:

1. Depths and velocities based on 25-year, 24-hour storm
2. Channel lining sizes based on material properties in Flowmaster software, by Bentley Systems.

Existing North Diversion Channel-upper portion

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030
Channel Slope	0.03400 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	10.00 ft/ft (H:V)
Discharge	11.20 ft^3/s

Results

Normal Depth	0.66 ft
Flow Area	2.61 ft^2
Wetted Perimeter	8.10 ft
Hydraulic Radius	0.32 ft
Top Width	7.91 ft
Critical Depth	0.74 ft
Critical Slope	0.01888ft/ft
Velocity	4.29 ft/s
Velocity Head	0.29 ft
Specific Energy	0.95 ft
Froude Number	1.32
Flow Type	Supercritical

Existing North Diversion Channel-Lower Portion

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069
Channel Slope	0.13300 ft/ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	10.00 ft/ft (H:V)
Discharge	11.21 ft^3/s

Results

Normal Depth	0.70 ft
Flow Area	2.92 ft^2
Wetted Perimeter	8.58 ft
Hydraulic Radius	0.34 ft
Top Width	8.38 ft
Critical Depth	0.74 ft
Critical Slope	0.09987 ft/ft
Velocity	3.83 ft/s
Velocity Head	0.23 ft
Specific Energy	0.93 ft
Froude Number	1.14
Flow Type	Supercritical

SCC-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.03600	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	4.58	ft^3/s

Results

Normal Depth	0.29	ft
Flow Area	1.50	ft^2
Wetted Perimeter	6.39	ft
Hydraulic Radius	0.23	ft
Top Width	6.32	ft
Critical Depth	0.31	ft
Critical Slope	0.02879	ft/ft
Velocity	3.06	ft/s
Velocity Head	0.15	ft
Specific Energy	0.44	ft
Froude Number	1.11	
Flow Type	Supercritical	

SCC-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.06600	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	23.73	ft³/s

Results

Normal Depth	1.21	ft
Flow Area	5.34	ft²
Wetted Perimeter	7.40	ft
Hydraulic Radius	0.72	ft
Top Width	6.83	ft
Critical Depth	1.14	ft
Critical Slope	0.08512	ft/ft
Velocity	4.45	ft/s
Velocity Head	0.31	ft
Specific Energy	1.52	ft
Froude Number	0.89	
Flow Type	Subcritical	

(Revised per TDEC comments, April 2013)

SCC-3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.13000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	0.50	ft
Discharge	24.58	ft³/s

Results

Normal Depth	1.23	ft
Flow Area	4.38	ft²
Wetted Perimeter	7.13	ft
Hydraulic Radius	0.61	ft
Top Width	6.64	ft
Critical Depth	1.34	ft
Critical Slope	0.08537	ft/ft
Velocity	5.61	ft/s
Velocity Head	0.49	ft
Specific Energy	1.72	ft
Froude Number	1.22	
Flow Type	Supercritical	

(Revised per TDEC comments, April 2013)

SCC-4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.06300	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	19.16	ft³/s

Results

Normal Depth	1.10	ft
Flow Area	4.63	ft²
Wetted Perimeter	6.93	ft
Hydraulic Radius	0.67	ft
Top Width	6.41	ft
Critical Depth	1.02	ft
Critical Slope	0.08748	ft/ft
Velocity	4.13	ft/s
Velocity Head	0.27	ft
Specific Energy	1.37	ft
Froude Number	0.86	
Flow Type	Subcritical	

(Revised per TDEC comments, April 2013)

SCC-5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.033	
Channel Slope	0.07600	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	3.00	ft
Discharge	1.21	ft³/s

Results

Normal Depth	0.12	ft
Flow Area	0.42	ft²
Wetted Perimeter	3.79	ft
Hydraulic Radius	0.11	ft
Top Width	3.75	ft
Critical Depth	0.16	ft
Critical Slope	0.03093	ft/ft
Velocity	2.87	ft/s
Velocity Head	0.13	ft
Specific Energy	0.25	ft
Froude Number	1.51	
Flow Type	Supercritical	

(Revised per TDEC comments, April 2013)

SCC-6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.32000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	14.62	ft^3/s

Results

Normal Depth	0.28	ft
Flow Area	2.99	ft^2
Wetted Perimeter	11.75	ft
Hydraulic Radius	0.25	ft
Top Width	11.66	ft
Critical Depth	0.39	ft
Critical Slope	0.09958	ft/ft
Velocity	4.89	ft/s
Velocity Head	0.37	ft
Specific Energy	0.65	ft
Froude Number	1.70	
Flow Type	Supercritical	

(Revised per TDEC comments, April 2013)

SCC-7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.069	
Channel Slope	0.07100	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	12.84	ft³/s

Results

Normal Depth	0.80	ft
Flow Area	3.55	ft²
Wetted Perimeter	7.09	ft
Hydraulic Radius	0.50	ft
Top Width	6.82	ft
Critical Depth	0.76	ft
Critical Slope	0.09222	ft/ft
Velocity	3.62	ft/s
Velocity Head	0.20	ft
Specific Energy	1.01	ft
Froude Number	0.89	
Flow Type	Subcritical	

(Revised per TDEC comments, April 2013)

Slope Diversion Channel Capacity

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.033
Channel Slope	0.03000 ft/ft
Normal Depth	1.00 ft
Left Side Slope	2.00 ft/ft (H:V)
Right Side Slope	4.00 ft/ft (H:V)

Results

Discharge	14.18 ft^3/s
Flow Area	3.00 ft^2
Wetted Perimeter	6.36 ft
Hydraulic Radius	0.47 ft
Top Width	6.00 ft
Critical Depth	1.07 ft
Critical Slope	0.02114 ft/ft
Velocity	4.73 ft/s
Velocity Head	0.35 ft
Specific Energy	1.35 ft
Froude Number	1.18
Flow Type	Supercritical

Note:

Maximum predicted flow in a Slope Diversion Channel is 11.34 cfs, for a 100-year storm, in Slope Diversion Channel SDC-2. Factor of Safety = 14.18 / 11.31 = 1.25.

(Revised per TDEC comments, April 2013)

Downslope Drain Capacity (18-inch)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.028	
Channel Slope	0.27500	ft/ft
Normal Depth	1.40	ft
Diameter	1.50	ft

Results

Discharge	27.51	ft^3/s
Flow Area	1.72	ft^2
Wetted Perimeter	3.93	ft
Hydraulic Radius	0.44	ft
Top Width	0.75	ft
Critical Depth	1.49	ft
Percent Full	93.3	%
Critical Slope	0.29808	ft/ft
Velocity	16.02	ft/s
Velocity Head	3.99	ft
Specific Energy	5.39	ft
Froude Number	1.87	
Maximum Discharge	27.51	ft^3/s
Discharge Full	25.57	ft^3/s
Slope Full	0.31811	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	93.33	%
Downstream Velocity	Infinity	ft/s

Downslope Drain Capacity (18-inch)

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.40	ft
Critical Depth	1.49	ft
Channel Slope	0.27500	ft/ft
Critical Slope	0.29808	ft/ft

Downslope Drain Capacity (24-inch)

Project Description

Friction Method	Manning Formula	
Solve For	Discharge	

Input Data

Roughness Coefficient	0.028	
Channel Slope	0.27500	ft/ft
Normal Depth	1.90	ft
Diameter	2.00	ft

Results

Discharge	59.18	ft^3/s
Flow Area	3.08	ft^2
Wetted Perimeter	5.38	ft
Hydraulic Radius	0.57	ft
Top Width	0.87	ft
Critical Depth	1.99	ft
Percent Full	95.0	%
Critical Slope	0.29905	ft/ft
Velocity	19.20	ft/s
Velocity Head	5.73	ft
Specific Energy	7.63	ft
Froude Number	1.80	
Maximum Discharge	59.25	ft^3/s
Discharge Full	55.08	ft^3/s
Slope Full	0.31751	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	95.00	%
Downstream Velocity	Infinity	ft/s

Downslope Drain Capacity (24-inch)

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.90	ft
Critical Depth	1.99	ft
Channel Slope	0.27500	ft/ft
Critical Slope	0.29905	ft/ft

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

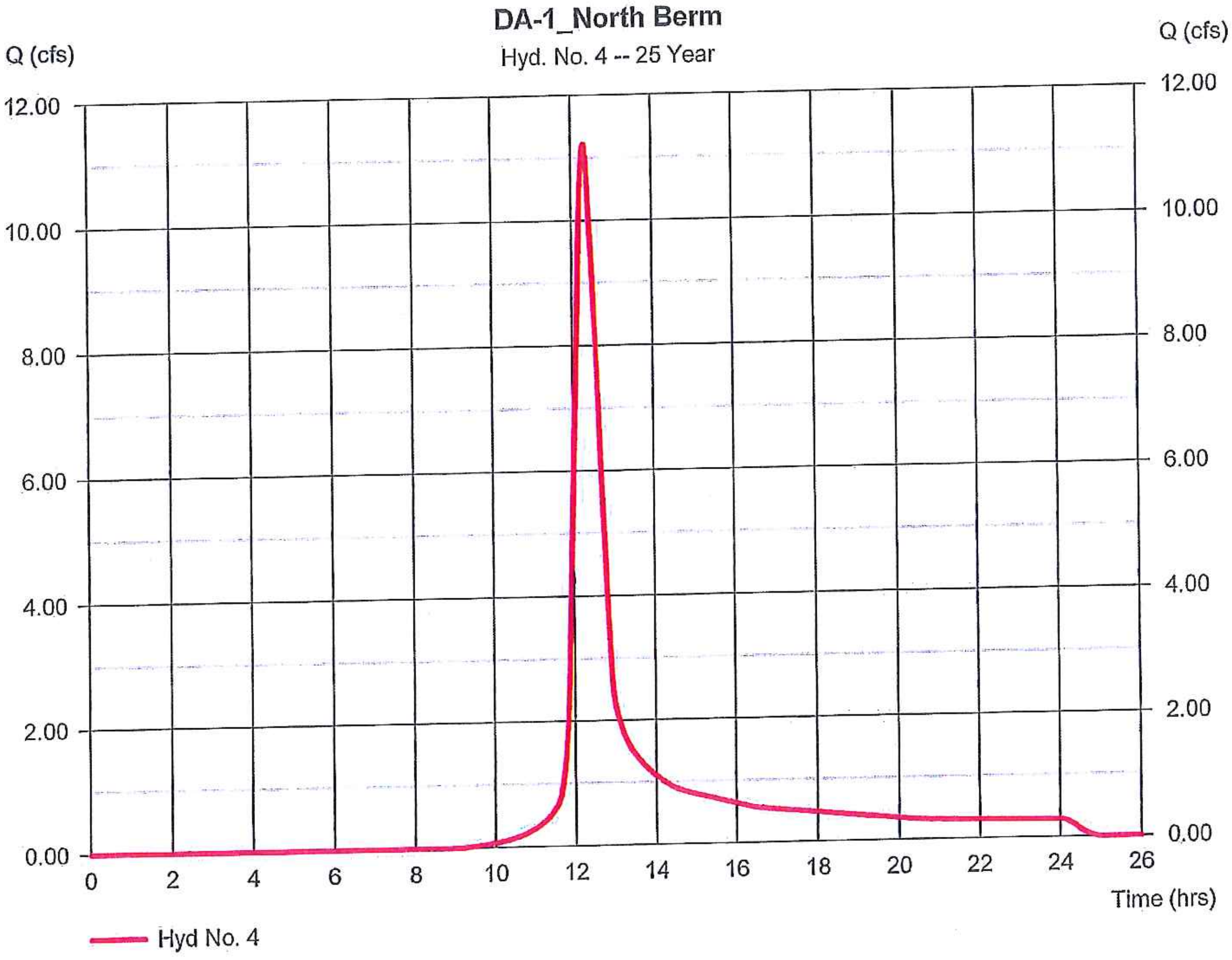
Thursday, 00 27, 2012

Hyd. No. 4

DA-1_North Berm

Hydrograph type	= SCS Runoff	Peak discharge	= 11.21 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 54,962 cuft
Drainage area	= 7.030 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.80 min
Total precip.	= 4.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.030 x 74)] / 7.030



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 4

DA-1_North Berm

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 7.030 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 11.21 cfs
Time to peak = 12.30 hrs
Hyd. volume = 54,962 cuft
Curve number = 76*
Hydraulic length = 0 ft
Time of conc. (Tc) = 37.8 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = [(7.030 x 74)] / 7.030

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.80	0.228	11.93	4.028	13.07	2.080	14.20	1.014
10.87	0.249	12.00	5.801	13.13	1.935	14.27	0.985
10.93	0.272	12.07	7.543	13.20	1.810	14.33	0.958
11.00	0.297	12.13	9.134	13.27	1.704	14.40	0.934
11.07	0.324	12.20	10.44	13.33	1.614	14.47	0.913
11.13	0.354	12.27	11.17	13.40	1.538	14.53	0.894
11.20	0.388	12.33	11.03	13.47	1.474	14.60	0.877
11.27	0.426	12.40	10.28	13.53	1.417	14.67	0.862
11.33	0.470	12.47	9.415	13.60	1.365	14.73	0.849
11.40	0.519	12.53	8.471	13.67	1.316	14.80	0.836
11.47	0.576	12.60	7.461	13.73	1.270	14.87	0.824
11.53	0.642	12.67	6.408	13.80	1.226	14.93	0.813
11.60	0.740	12.73	5.348	13.87	1.186	15.00	0.803
11.67	0.913	12.80	4.323	13.93	1.148	15.07	0.792
11.73	1.211	12.87	3.391	14.00	1.112	15.13	0.782
11.80	1.713	12.93	2.665	14.07	1.078	15.20	0.771
11.87	2.590	13.00	2.265	14.13	1.045	15.27	0.761

Continues on next page...

DA-1_North Berm

Hydrograph Discharge Table

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
15.33	0.750	17.07	0.531	18.80	0.430	20.53	0.331
15.40	0.740	17.13	0.528	18.87	0.426	20.60	0.329
15.47	0.729	17.20	0.524	18.93	0.422	20.67	0.328
15.53	0.718	17.27	0.520	19.00	0.418	20.73	0.326
15.60	0.708	17.33	0.516	19.07	0.414	20.80	0.325
15.67	0.697	17.40	0.512	19.13	0.410	20.87	0.324
15.73	0.686	17.47	0.508	19.20	0.406	20.93	0.323
15.80	0.675	17.53	0.505	19.27	0.402	21.00	0.323
15.87	0.664	17.60	0.501	19.33	0.398	21.07	0.322
15.93	0.654	17.67	0.497	19.40	0.394	21.13	0.321
16.00	0.643	17.73	0.493	19.47	0.390	21.20	0.320
16.07	0.632	17.80	0.489	19.53	0.386	21.27	0.320
16.13	0.621	17.87	0.485	19.60	0.382	21.33	0.319
16.20	0.611	17.93	0.481	19.67	0.378	21.40	0.318
16.27	0.601	18.00	0.477	19.73	0.374	21.47	0.317
16.33	0.592	18.07	0.473	19.80	0.370	21.53	0.317
16.40	0.583	18.13	0.470	19.87	0.366	21.60	0.316
16.47	0.575	18.20	0.466	19.93	0.361	21.67	0.315
16.53	0.569	18.27	0.462	20.00	0.357	21.73	0.314
16.60	0.562	18.33	0.458	20.07	0.353	21.80	0.314
16.67	0.557	18.40	0.454	20.13	0.349	21.87	0.313
16.73	0.552	18.47	0.450	20.20	0.346	21.93	0.312
16.80	0.547	18.53	0.446	20.27	0.342	22.00	0.311
16.87	0.543	18.60	0.442	20.33	0.339	22.07	0.310
16.93	0.539	18.67	0.438	20.40	0.336	22.13	0.310
17.00	0.535	18.73	0.434	20.47	0.333	22.20	0.309

Continues on next page...

DA-1_North Berm

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
22.27	0.308
22.33	0.307
22.40	0.307
22.47	0.306
22.53	0.305
22.60	0.304
22.67	0.304
22.73	0.303
22.80	0.302
22.87	0.301
22.93	0.301
23.00	0.300
23.07	0.299
23.13	0.298
23.20	0.297
23.27	0.297
23.33	0.296
23.40	0.295
23.47	0.294
23.53	0.294
23.60	0.293
23.67	0.292
23.73	0.291
23.80	0.290
23.87	0.290
23.93	0.289
24.00	0.288
24.07	0.283
24.13	0.272
24.20	0.255
24.27	0.232

...End

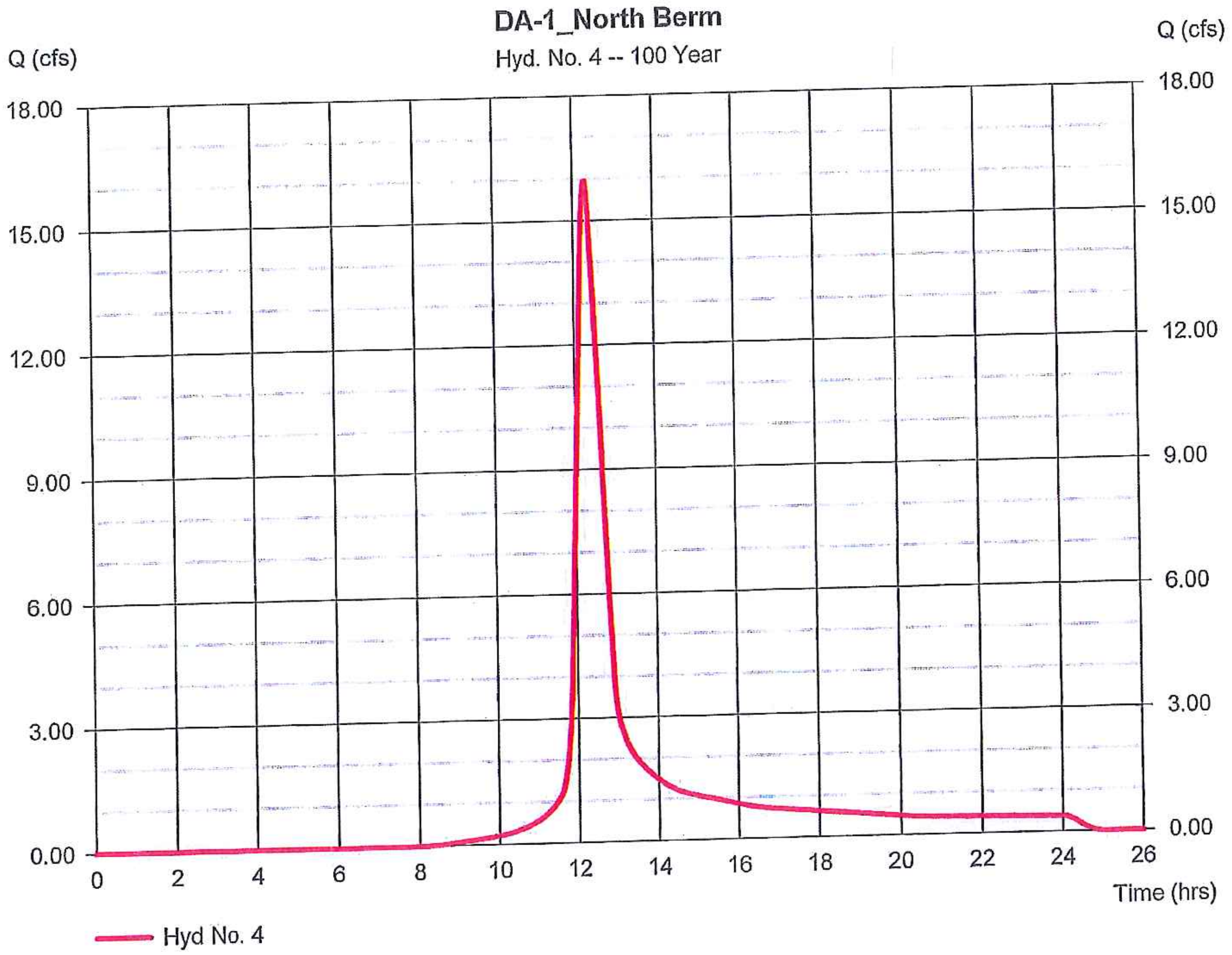
Hydrograph Report

Hyd. No. 4

DA-1_North Berm

Hydrograph type	= SCS Runoff	Peak discharge	= 15.95 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 77,519 cuft
Drainage area	= 7.030 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.80 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.030 x 74)] / 7.030



Hydrograph Report

Hyd. No. 4

DA-1_North Berm

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Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 77,519 cuft
Drainage area	= 7.030 ac	Curve number	= 76*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 37.8 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(7.030 x 74)] / 7.030

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.43	0.322	11.57	1.176	12.70	8.130	13.83	1.615
10.50	0.344	11.63	1.377	12.77	6.639	13.90	1.562
10.57	0.368	11.70	1.726	12.83	5.245	13.97	1.512
10.63	0.393	11.77	2.308	12.90	4.065	14.03	1.464
10.70	0.421	11.83	3.293	12.97	3.276	14.10	1.419
10.77	0.450	11.90	4.956	13.03	2.918	14.17	1.376
10.83	0.483	11.97	7.328	13.10	2.704	14.23	1.335
10.90	0.518	12.03	9.836	13.17	2.520	14.30	1.298
10.97	0.556	12.10	12.17	13.23	2.362	14.37	1.263
11.03	0.597	12.17	14.19	13.30	2.229	14.43	1.233
11.10	0.642	12.23	15.60	13.37	2.117	14.50	1.206
11.17	0.692	12.30	15.95 <<	13.43	2.022	14.57	1.182
11.23	0.748	12.37	15.13	13.50	1.940	14.63	1.160
11.30	0.811	12.43	13.91	13.57	1.866	14.70	1.140
11.37	0.883	12.50	12.58	13.63	1.797	14.77	1.123
11.43	0.965	12.57	11.15	13.70	1.732	14.83	1.106
11.50	1.057	12.63	9.652	13.77	1.672	14.90	1.091

Continues on next page...

Hydrograph Discharge Table

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
14.97	1.076	16.70	0.735	18.43	0.597	20.17	0.458
15.03	1.062	16.77	0.728	18.50	0.592	20.23	0.453
15.10	1.048	16.83	0.722	18.57	0.586	20.30	0.448
15.17	1.034	16.90	0.717	18.63	0.581	20.37	0.444
15.23	1.019	16.97	0.711	18.70	0.576	20.43	0.441
15.30	1.005	17.03	0.706	18.77	0.570	20.50	0.437
15.37	0.991	17.10	0.701	18.83	0.565	20.57	0.435
15.43	0.977	17.17	0.696	18.90	0.560	20.63	0.433
15.50	0.962	17.23	0.691	18.97	0.554	20.70	0.431
15.57	0.948	17.30	0.686	19.03	0.549	20.77	0.429
15.63	0.933	17.37	0.681	19.10	0.544	20.83	0.428
15.70	0.919	17.43	0.675	19.17	0.538	20.90	0.426
15.77	0.904	17.50	0.670	19.23	0.533	20.97	0.425
15.83	0.890	17.57	0.665	19.30	0.528	21.03	0.424
15.90	0.875	17.63	0.660	19.37	0.522	21.10	0.423
15.97	0.861	17.70	0.655	19.43	0.517	21.17	0.422
16.03	0.846	17.77	0.649	19.50	0.512	21.23	0.421
16.10	0.832	17.83	0.644	19.57	0.506	21.30	0.420
16.17	0.817	17.90	0.639	19.63	0.501	21.37	0.419
16.23	0.804	17.97	0.634	19.70	0.495	21.43	0.418
16.30	0.791	18.03	0.628	19.77	0.490	21.50	0.417
16.37	0.779	18.10	0.623	19.83	0.485	21.57	0.416
16.43	0.768	18.17	0.618	19.90	0.479	21.63	0.415
16.50	0.758	18.23	0.613	19.97	0.474	21.70	0.414
16.57	0.750	18.30	0.607	20.03	0.468	21.77	0.413
16.63	0.742	18.37	0.602	20.10	0.463	21.83	0.412

Continues on next page...

DA-1_North Berm

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
21.90	0.411
21.97	0.410
22.03	0.409
22.10	0.408
22.17	0.407
22.23	0.406
22.30	0.405
22.37	0.404
22.43	0.403
22.50	0.402
22.57	0.401
22.63	0.400
22.70	0.399
22.77	0.398
22.83	0.396
22.90	0.395
22.97	0.394
23.03	0.393
23.10	0.392
23.17	0.391
23.23	0.390
23.30	0.389
23.37	0.388
23.43	0.387
23.50	0.386
23.57	0.385
23.63	0.384
23.70	0.383
23.77	0.382
23.83	0.381
23.90	0.380
23.97	0.379
24.03	0.376
24.10	0.365
24.17	0.347
24.23	0.321

...End

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Hyd. No. 4

DA-1_North Berm

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.240	0.011	0.011	
Flow length (ft)	= 200.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 2.20	0.00	0.00	
Land slope (%)	= 1.50	0.00	0.00	
Travel Time (min)	**= 33.62**	**+ 0.00**	**+ 0.00**	**= 33.62**
Shallow Concentrated Flow				
Flow length (ft)	= 300.00	0.00	0.00	
Watercourse slope (%)	= 4.30	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=3.35	0.00	0.00	
Travel Time (min)	**= 1.49**	**+ 0.00**	**+ 0.00**	**= 1.49**
Channel Flow				
X sectional flow area (sqft)	= 4.00	0.00	0.00	
Wetted perimeter (ft)	= 6.00	0.00	0.00	
Channel slope (%)	= 4.70	0.00	0.00	
Manning's n-value	= 0.025	0.015	0.015	
Velocity (ft/s)	=9.85	0.00	0.00	
Flow length (ft)	({0})1560.0	0.0	0.0	
Travel Time (min)	**= 2.64**	**+ 0.00**	**+ 0.00**	**= 2.64**
Total Travel Time, Tc				**37.75 min**

Hydrograph Report

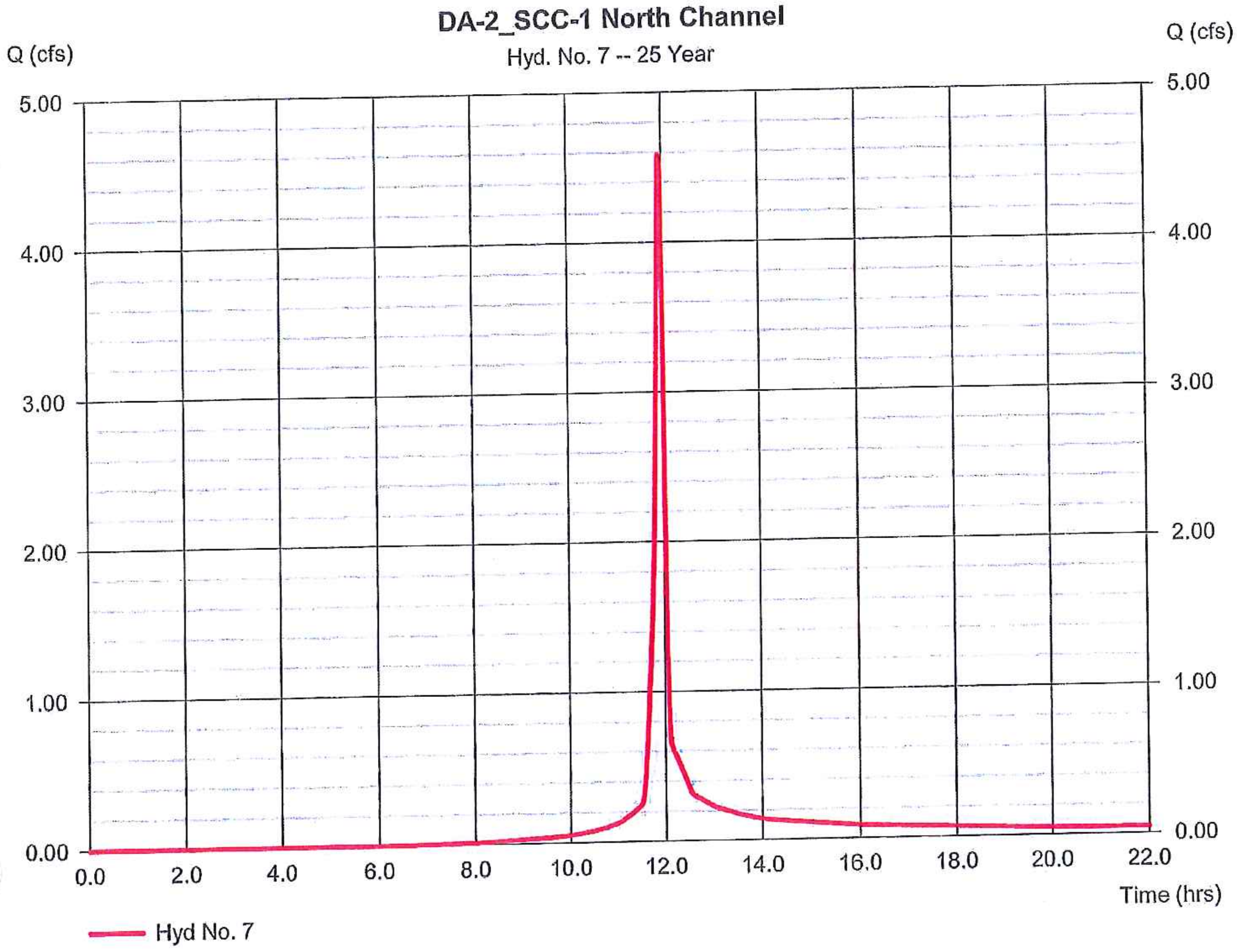
Hyd. No. 7

DA-2_SCC-1 North Channel

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 1.000 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 4.583 cfs
Time to peak = 11.93 hrs
Hyd. volume = 9,366 cuft
Curve number = 83*
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = [(0.500 x 74) + (0.500 x 91)] / 1.000



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 7

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Storm duration = 24 hrs

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* Composite (Area/CN) = [(0.500 x 74) + (0.500 x 91)] / 1.000

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- Outflow		Time -- Outflow		Time -- Outflow		Time -- Outflow	
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.70	0.093	11.83	2.485	12.97	0.237	14.10	0.134
10.77	0.100	11.90	3.967	13.03	0.225	14.17	0.133
10.83	0.106	11.97	4.497	13.10	0.216	14.23	0.131
10.90	0.113	12.03	2.259	13.17	0.209	14.30	0.129
10.97	0.121	12.10	0.779	13.23	0.203	14.37	0.128
11.03	0.128	12.17	0.616	13.30	0.196	14.43	0.126
11.10	0.140	12.23	0.565	13.37	0.190	14.50	0.125
11.17	0.155	12.30	0.515	13.43	0.183	14.57	0.123
11.23	0.171	12.37	0.463	13.50	0.177	14.63	0.121
11.30	0.188	12.43	0.411	13.57	0.171	14.70	0.120
11.37	0.206	12.50	0.358	13.63	0.166	14.77	0.118
11.43	0.224	12.57	0.315	13.70	0.161	14.83	0.116
11.50	0.243	12.63	0.297	13.77	0.156	14.90	0.115
11.57	0.348	12.70	0.285	13.83	0.152	14.97	0.113
11.63	0.667	12.77	0.273	13.90	0.147	15.03	0.111
11.70	1.091	12.83	0.261	13.97	0.142	15.10	0.110
11.77	1.588	12.90	0.249	14.03	0.137	15.17	0.108

Continues on next page...

DA-2_SCC-1 North Channel

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.23	0.106
15.30	0.105
15.37	0.103
15.43	0.101
15.50	0.100
15.57	0.098
15.63	0.096
15.70	0.095
15.77	0.093

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

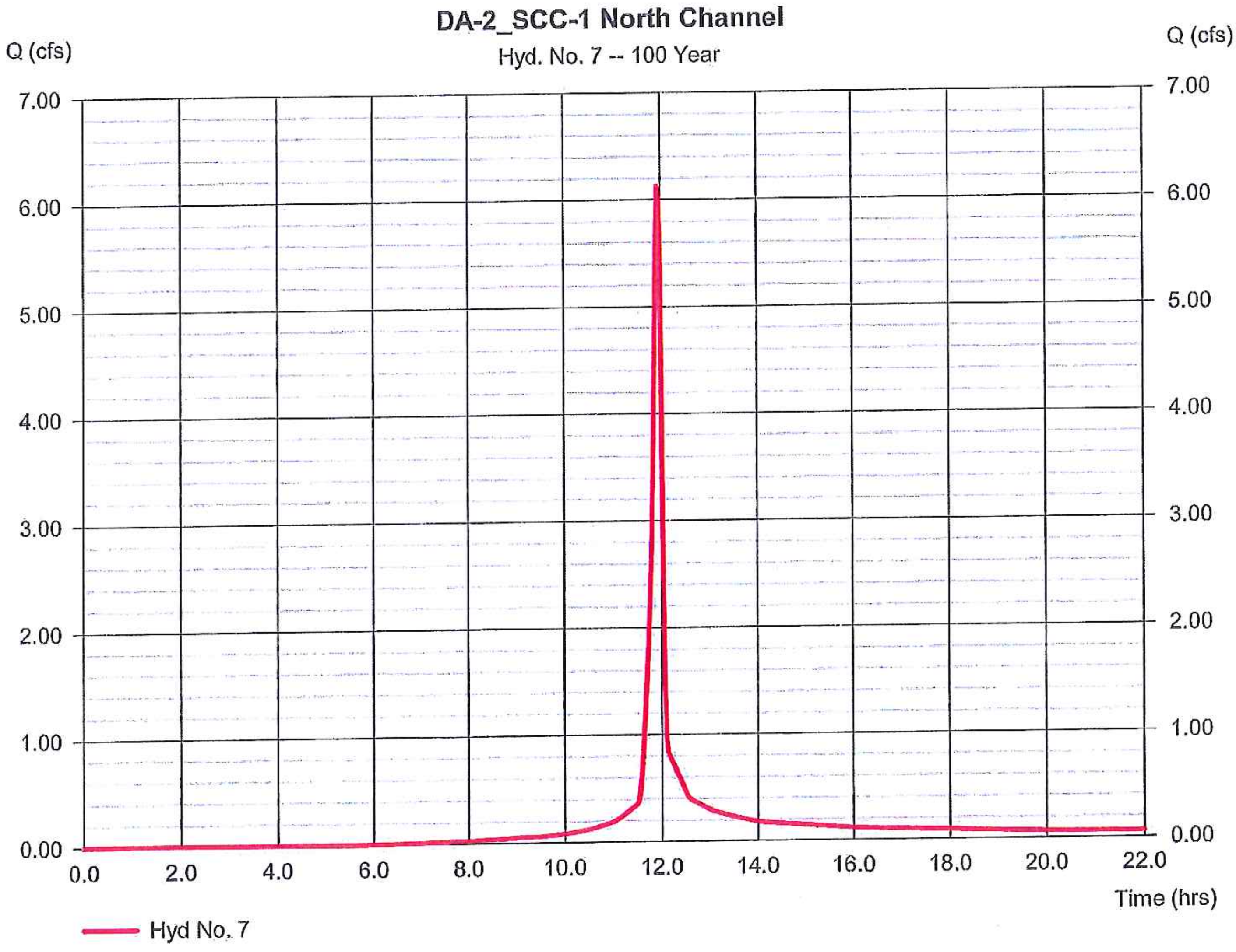
Thursday, 00 27, 2012

Hyd. No. 7

DA-2_SCC-1 North Channel

Hydrograph type	= SCS Runoff	Peak discharge	= 6.122 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 12,665 cuft
Drainage area	= 1.000 ac	Curve number	= 83*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.500 x 74) + (0.500 x 91)] / 1.000



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

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Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.53	0.124	11.67	1.242	12.80	0.347	13.93	0.187
10.60	0.131	11.73	1.866	12.87	0.331	14.00	0.180
10.67	0.140	11.80	2.696	12.93	0.315	14.07	0.175
10.73	0.149	11.87	4.309	13.00	0.299	14.13	0.172
10.80	0.158	11.93	6.122 <<	13.07	0.285	14.20	0.170
10.87	0.168	12.00	4.710	13.13	0.276	14.27	0.168
10.93	0.178	12.07	1.640	13.20	0.267	14.33	0.166
11.00	0.188	12.13	0.840	13.27	0.259	14.40	0.164
11.07	0.202	12.20	0.772	13.33	0.250	14.47	0.162
11.13	0.221	12.27	0.705	13.40	0.242	14.53	0.160
11.20	0.243	12.33	0.637	13.47	0.233	14.60	0.158
11.27	0.267	12.40	0.569	13.53	0.225	14.67	0.155
11.33	0.290	12.47	0.500	13.60	0.217	14.73	0.153
11.40	0.315	12.53	0.434	13.67	0.211	14.80	0.151
11.47	0.341	12.60	0.395	13.73	0.205	14.87	0.149
11.53	0.392	12.67	0.378	13.80	0.199	14.93	0.147
11.60	0.701	12.73	0.362	13.87	0.193	15.00	0.145

Continues on next page...

DA-2_SCC-1 North Channel

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.07	0.142
15.13	0.140
15.20	0.138
15.27	0.136
15.33	0.134
15.40	0.132
15.47	0.129
15.53	0.127
15.60	0.125
15.67	0.123

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

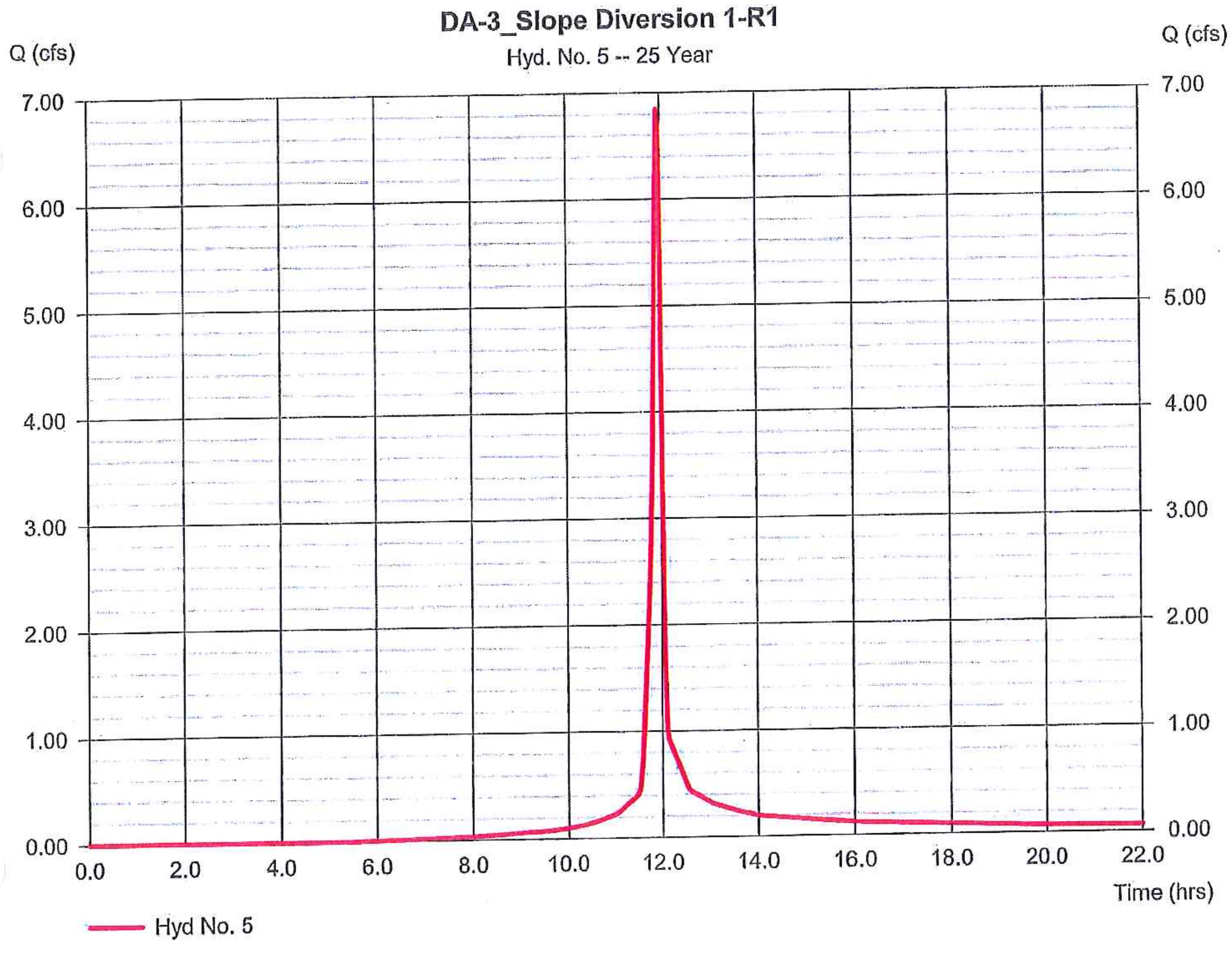
Thursday, 00 27, 2012

Hyd. No. 5

DA-3_Slope Diversion 1-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 1.340 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 6.845 cfs
Time to peak = 11.93 hrs
Hyd. volume = 14,259 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

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Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print Interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.43	0.137	11.63	1.101	12.83	0.374	14.03	0.196
10.50	0.144	11.70	1.770	12.90	0.357	14.10	0.191
10.57	0.151	11.77	2.522	12.97	0.339	14.17	0.189
10.63	0.161	11.83	3.851	13.03	0.322	14.23	0.187
10.70	0.171	11.90	5.994	13.10	0.309	14.30	0.184
10.77	0.182	11.97	6.655	13.17	0.300	14.37	0.182
10.83	0.193	12.03	3.303	13.23	0.290	14.43	0.180
10.90	0.204	12.10	1.131	13.30	0.281	14.50	0.177
10.97	0.216	12.17	0.892	13.37	0.271	14.57	0.175
11.03	0.228	12.23	0.818	13.43	0.262	14.63	0.172
11.10	0.247	12.30	0.743	13.50	0.252	14.70	0.170
11.17	0.272	12.37	0.668	13.57	0.244	14.77	0.168
11.23	0.298	12.43	0.592	13.63	0.236	14.83	0.165
11.30	0.325	12.50	0.515	13.70	0.230	14.90	0.163
11.37	0.352	12.57	0.453	13.77	0.223	14.97	0.161
11.43	0.381	12.63	0.426	13.83	0.216	15.03	0.158
11.50	0.410	12.70	0.409	13.90	0.209	15.10	0.156
11.57	0.582	12.77	0.392	13.97	0.202	15.17	0.153

Continues on next page...

DA-3_Slope Diversion 1-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.23	0.151
15.30	0.149
15.37	0.146
15.43	0.144
15.50	0.141
15.57	0.139

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

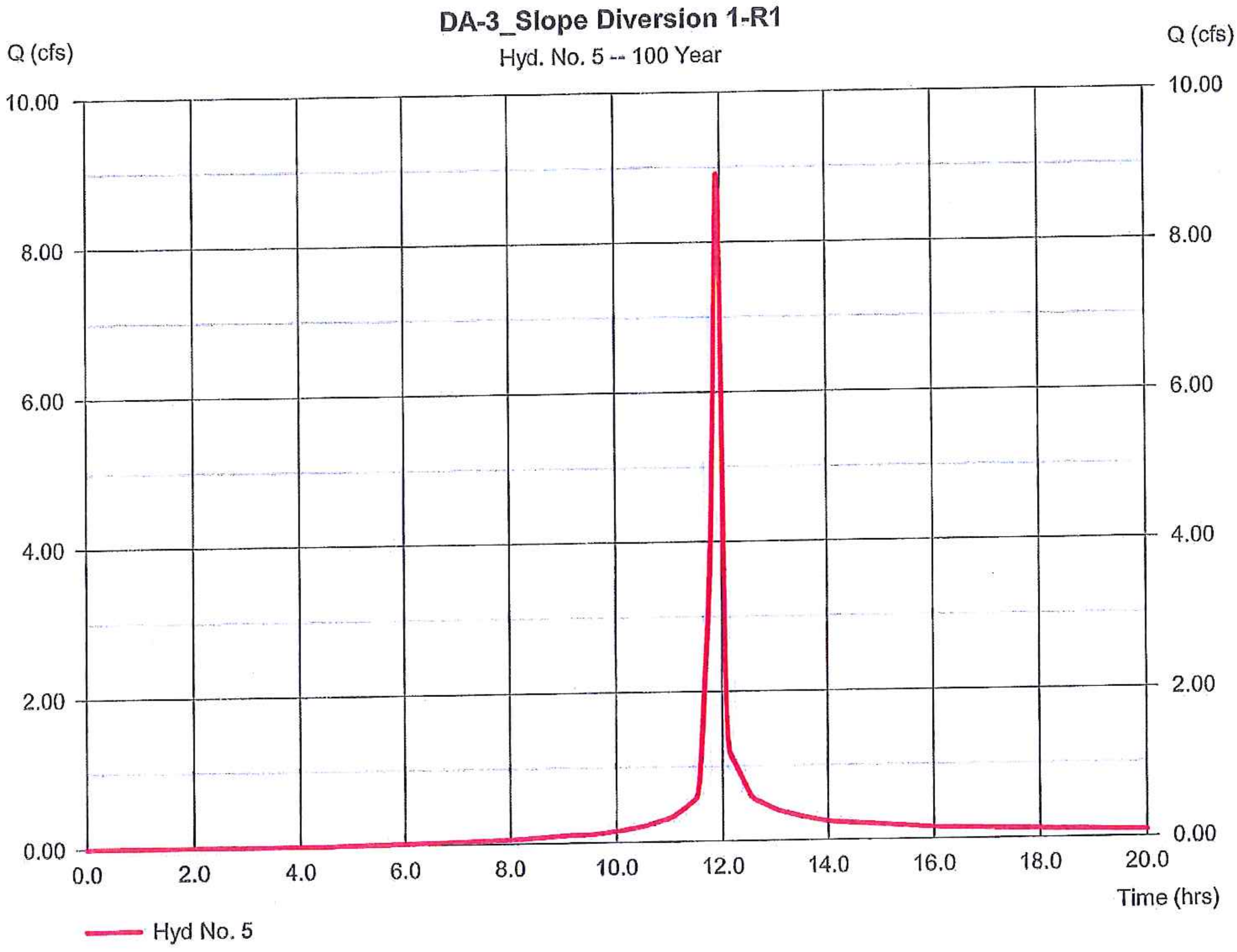
Thursday, 00 27, 2012

Hyd. No. 5

DA-3_Slope Diversion 1-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 1.340 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 8.915 cfs
Time to peak = 11.93 hrs
Hyd. volume = 18,859 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 5

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Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.27	0.179	11.47	0.549	12.60	0.558	13.80	0.279
10.33	0.188	11.53	0.627	12.67	0.533	13.87	0.270
10.40	0.196	11.60	1.113	12.73	0.511	13.93	0.262
10.47	0.205	11.67	1.948	12.80	0.489	14.00	0.253
10.53	0.215	11.73	2.880	12.87	0.466	14.07	0.246
10.60	0.226	11.80	4.086	12.93	0.444	14.13	0.242
10.67	0.240	11.87	6.399	13.00	0.422	14.20	0.239
10.73	0.255	11.93	8.915 <<	13.07	0.402	14.27	0.236
10.80	0.269	12.00	6.770	13.13	0.388	14.33	0.233
10.87	0.284	12.07	2.340	13.20	0.376	14.40	0.230
10.93	0.300	12.13	1.194	13.27	0.364	14.47	0.227
11.00	0.315	12.20	1.096	13.33	0.352	14.53	0.224
11.07	0.336	12.27	1.000	13.40	0.340	14.60	0.221
11.13	0.367	12.33	0.903	13.47	0.327	14.67	0.218
11.20	0.401	12.40	0.806	13.53	0.315	14.73	0.214
11.27	0.437	12.47	0.708	13.60	0.305	14.80	0.211
11.33	0.473	12.53	0.613	13.67	0.297	14.87	0.208
11.40	0.511			13.73	0.288	14.93	0.205

Continues on next page...

DA-3_Slope Diversion 1-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.00	0.202
15.07	0.199
15.13	0.196
15.20	0.193
15.27	0.190
15.33	0.187
15.40	0.184
15.47	0.181

...End

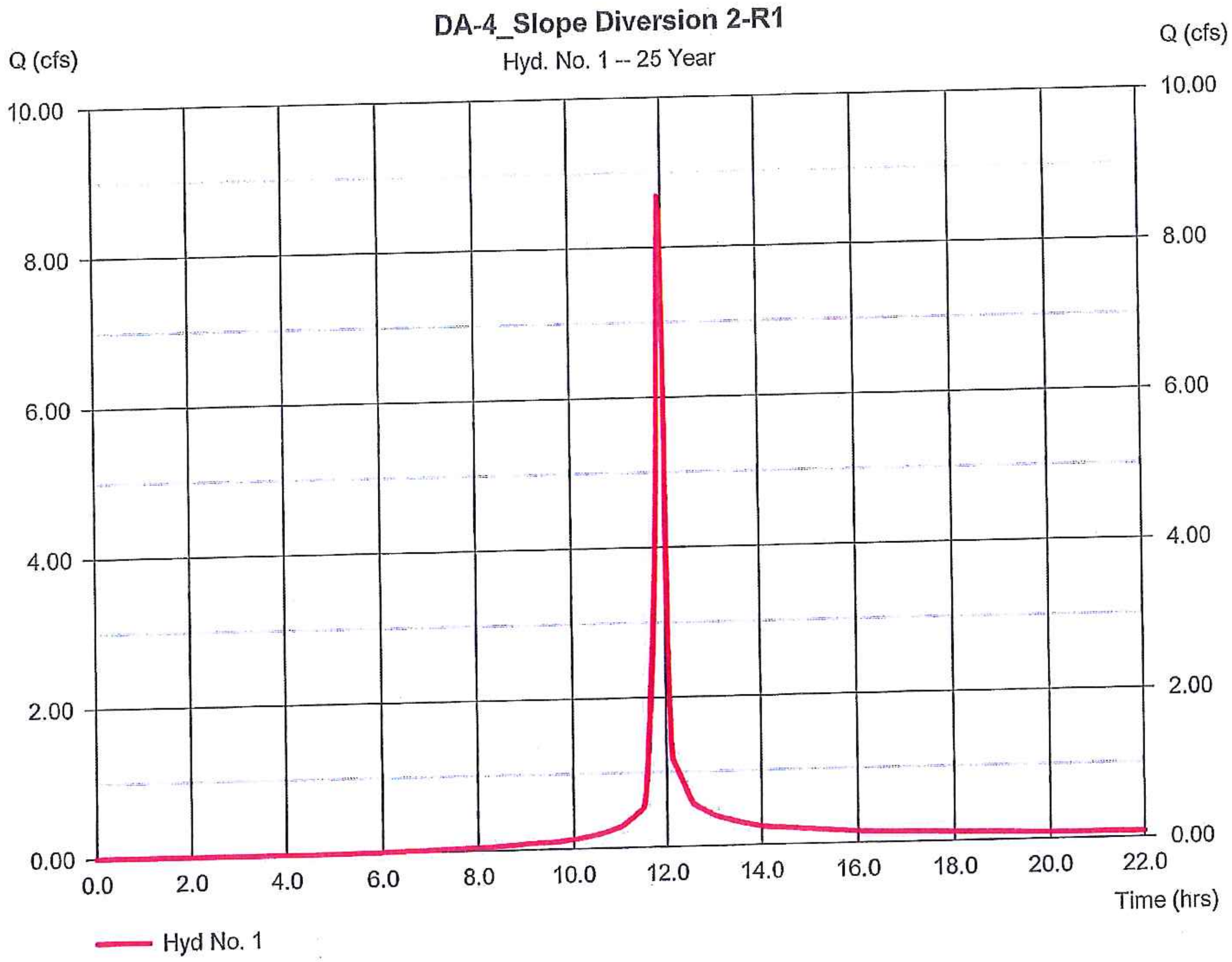
Hydrograph Report

Hyd. No. 1

DA-4_Slope Diversion 2-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 1.700 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 8.684 cfs
Time to peak = 11.93 hrs
Hyd. volume = 18,090 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Tuesday, 05 / 7 / 2013

Hyd. No. 1

DA-4_Slope Diversion 2-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 1.700 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 8.684 cfs
Time to peak = 11.93 hrs
Hyd. volume = 18,090 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.43	0.174	11.63	1.397	12.83	0.475	14.03	0.248
10.50	0.183	11.70	2.245	12.90	0.453	14.10	0.243
10.57	0.192	11.77	3.200	12.97	0.431	14.17	0.240
10.63	0.204	11.83	4.886	13.03	0.409	14.23	0.237
10.70	0.217	11.90	7.605	13.10	0.392	14.30	0.234
10.77	0.231	11.97	8.443	13.17	0.380	14.37	0.231
10.83	0.245	12.03	4.190	13.23	0.368	14.43	0.228
10.90	0.259	12.10	1.435	13.30	0.356	14.50	0.225
10.97	0.274	12.17	1.132	13.37	0.344	14.57	0.222
11.03	0.289	12.23	1.038	13.43	0.332	14.63	0.219
11.10	0.314	12.30	0.943	13.50	0.320	14.70	0.216
11.17	0.345	12.37	0.847	13.57	0.309	14.77	0.213
11.23	0.378	12.43	0.751	13.63	0.300	14.83	0.210
11.30	0.412	12.50	0.654	13.70	0.291	14.90	0.207
11.37	0.447	12.57	0.575	13.77	0.283	14.97	0.204
11.43	0.483	12.63	0.541	13.83	0.274	15.03	0.201
11.50	0.521	12.70	0.519	13.90	0.265	15.10	0.198
11.57	0.738	12.77	0.497	13.97	0.257	15.17	0.195

Continues on next page...

DA-4_Slope Diversion 2-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.23	0.192
15.30	0.188
15.37	0.185
15.43	0.182
15.50	0.179
15.57	0.176

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

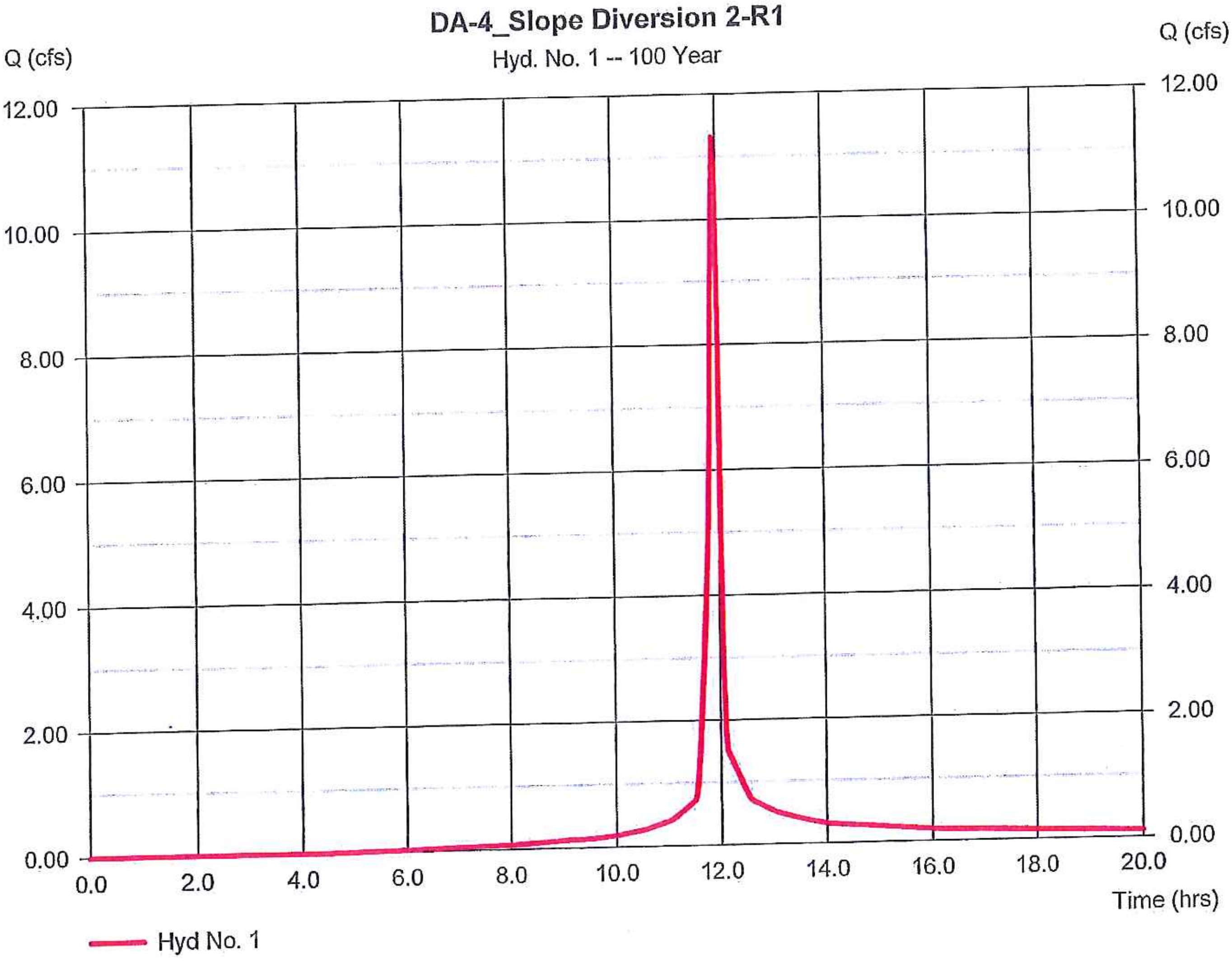
Tuesday, 05 / 7 / 2013

Hyd. No. 1

DA-4_Slope Diversion 2-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 1.700 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 11.31 cfs
Time to peak = 11.93 hrs
Hyd. volume = 23,925 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

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Tuesday, 05 / 7 / 2013

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Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.27	0.227	11.47	0.697	12.60	0.708	13.80	0.354
10.33	0.238	11.53	0.796	12.67	0.677	13.87	0.343
10.40	0.249	11.60	1.412	12.73	0.648	13.93	0.332
10.47	0.260	11.67	2.472	12.80	0.620	14.00	0.321
10.53	0.272	11.73	3.653	12.87	0.592	14.07	0.312
10.60	0.287	11.80	5.184	12.93	0.563	14.13	0.307
10.67	0.305	11.87	8.118	13.00	0.535	14.20	0.303
10.73	0.323	11.93	11.31	13.07	0.510	14.27	0.299
10.80	0.342	12.00	8.589	13.13	0.492	14.33	0.295
10.87	0.361	12.07	2.969	13.20	0.477	14.40	0.291
10.93	0.380	12.13	1.515	13.27	0.462	14.47	0.287
11.00	0.400	12.20	1.390	13.33	0.446	14.53	0.284
11.07	0.426	12.27	1.269	13.40	0.431	14.60	0.280
11.13	0.465	12.33	1.146	13.47	0.415	14.67	0.276
11.20	0.509	12.40	1.022	13.53	0.400	14.73	0.272
11.27	0.554	12.47	0.898	13.60	0.387	14.80	0.268
11.33	0.601	12.53	0.778	13.67	0.376	14.87	0.264
11.40	0.648			13.73	0.365	14.93	0.261

Continues on next page

DA-4_Slope Diversion 2-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.00	0.257
15.07	0.253
15.13	0.249
15.20	0.245
15.27	0.241
15.33	0.237
15.40	0.233
15.47	0.229

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

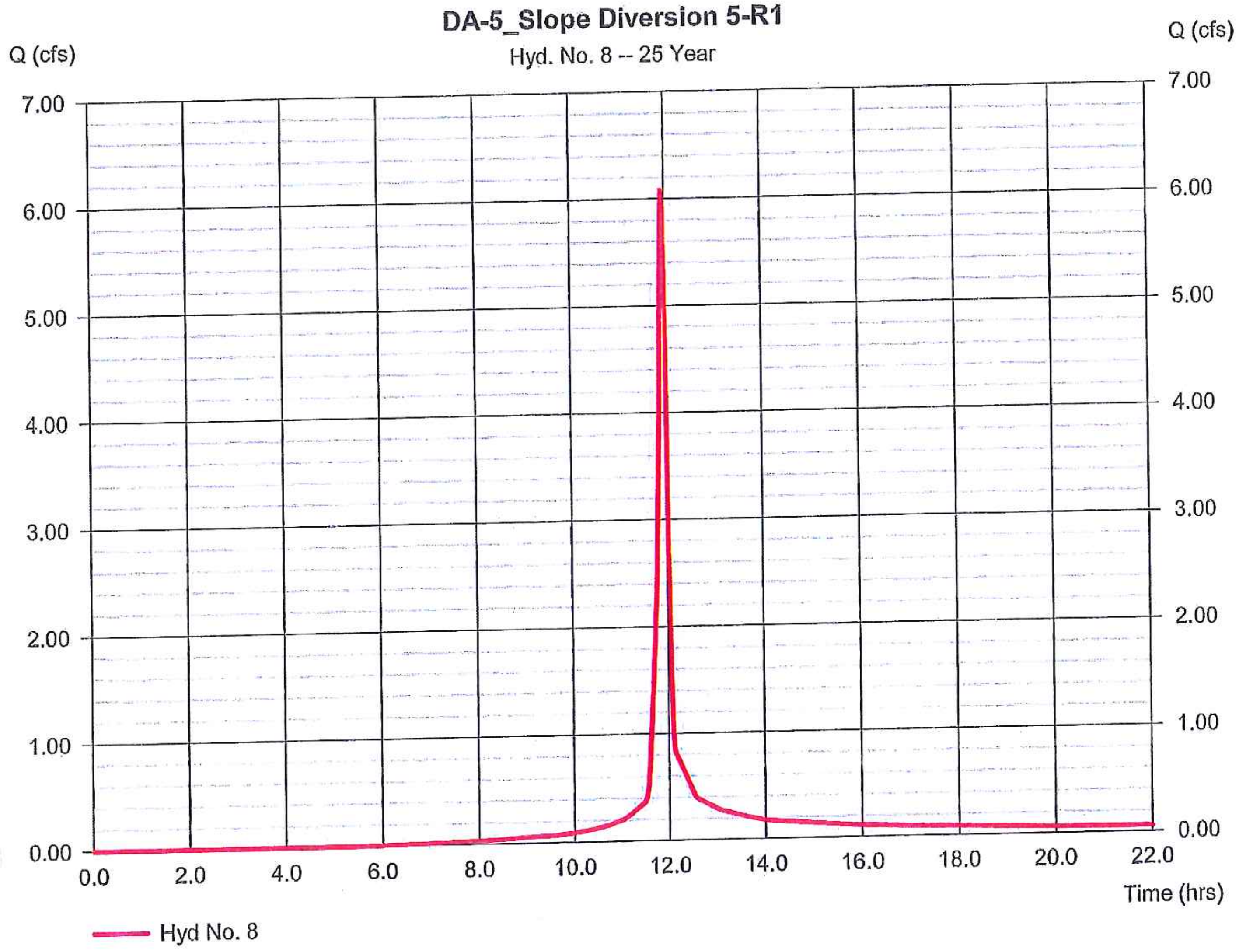
Thursday, 00 27, 2012

Hyd. No. 8

DA-5_Slope Diversion 5-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 1.190 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 6.079 cfs
Time to peak = 11.93 hrs
Hyd. volume = 12,663 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 8

DA-5_Slope Diversion 5-R1

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Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- Outflow (hrs	cfs)	Time -- Outflow (hrs	cfs)	Time -- Outflow (hrs	cfs)	Time -- Outflow (hrs	cfs)
10.43	0.122	11.63	0.978	12.83	0.332	14.03	0.174
10.50	0.128	11.70	1.572	12.90	0.317	14.10	0.170
10.57	0.134	11.77	2.240	12.97	0.301	14.17	0.168
10.63	0.143	11.83	3.420	13.03	0.286	14.23	0.166
10.70	0.152	11.90	5.323	13.10	0.275	14.30	0.164
10.77	0.162	11.97	5.910	13.17	0.266	14.37	0.162
10.83	0.171	12.03	2.933	13.23	0.258	14.43	0.159
10.90	0.181	12.10	1.005	13.30	0.249	14.50	0.157
10.97	0.192	12.17	0.792	13.37	0.241	14.57	0.155
11.03	0.203	12.23	0.726	13.43	0.233	14.63	0.153
11.10	0.220	12.30	0.660	13.50	0.224	14.70	0.151
11.17	0.241	12.37	0.593	13.57	0.216	14.77	0.149
11.23	0.265	12.43	0.526	13.63	0.210	14.83	0.147
11.30	0.288	12.50	0.458	13.70	0.204	14.90	0.145
11.37	0.313	12.57	0.403	13.77	0.198	14.97	0.143
11.43	0.338	12.63	0.378	13.83	0.192	15.03	0.140
11.50	0.364	12.70	0.363	13.90	0.186	15.10	0.138
11.57	0.517	12.77	0.348	13.97	0.180	15.17	0.136

Continues on next page...

DA-5_Slope Diversion 5-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.23	0.134
15.30	0.132
15.37	0.130
15.43	0.128
15.50	0.126
15.57	0.123

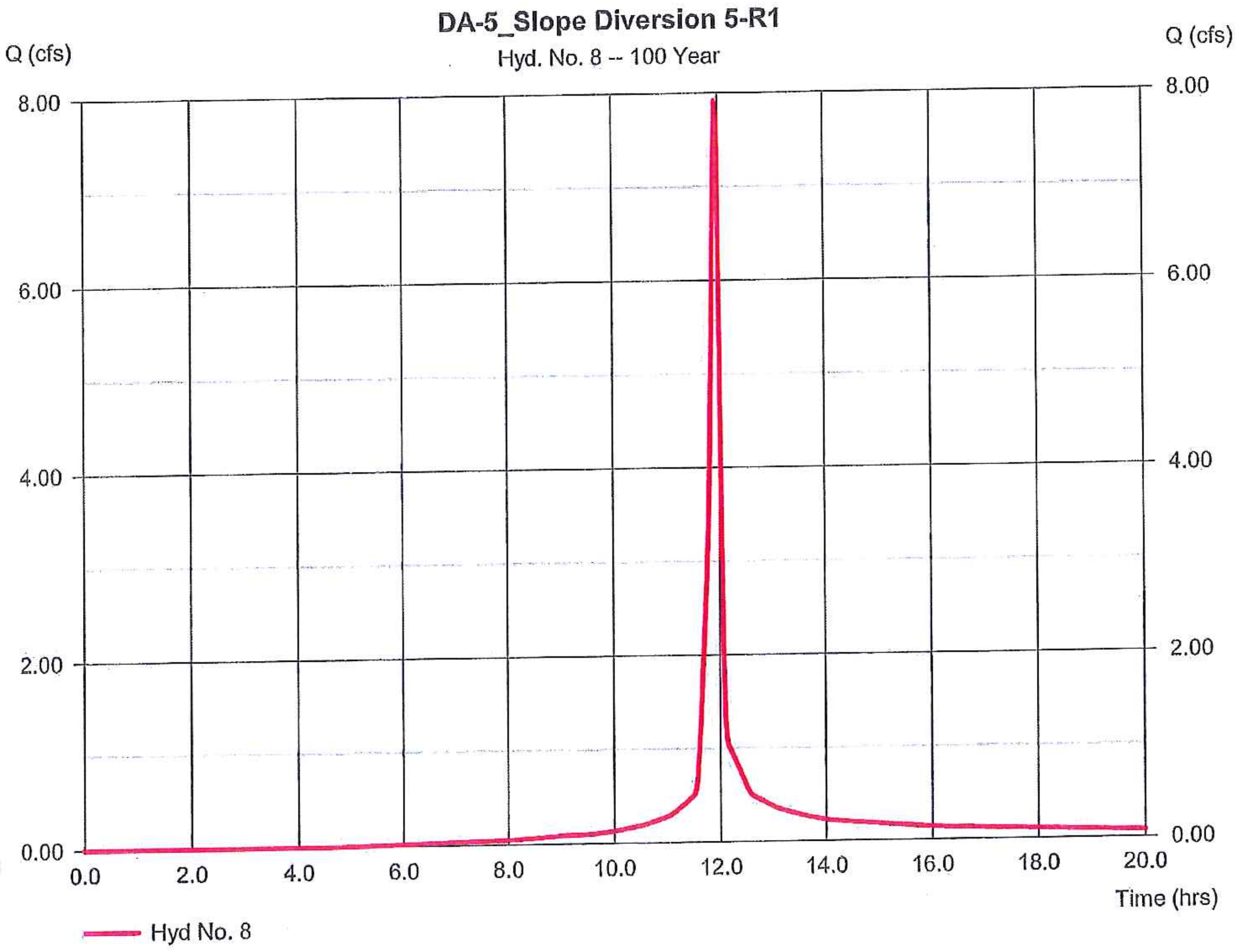
...End

Hydrograph Report

Hyd. No. 8

DA-5_Slope Diversion 5-R1

Hydrograph type	= SCS Runoff	Peak discharge	= 7.917 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 16,748 cuft
Drainage area	= 1.190 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hyd. No. 8

DA-5_Slope Diversion 5-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 1.190 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 7.917 cfs
Time to peak = 11.93 hrs
Hyd. volume = 16,748 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

<<

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.27	0.159	11.47	0.488	12.60	0.496	13.80	0.248
10.33	0.167	11.53	0.557	12.67	0.474	13.87	0.240
10.40	0.174	11.60	0.988	12.73	0.454	13.93	0.232
10.47	0.182	11.67	1.730	12.80	0.434	14.00	0.225
10.53	0.191	11.73	2.557	12.87	0.414	14.07	0.218
10.60	0.201	11.80	3.629	12.93	0.394	14.13	0.215
10.67	0.213	11.87	5.683	13.00	0.374	14.20	0.212
10.73	0.226	11.93	7.917	13.07	0.357	14.27	0.209
10.80	0.239	12.00	6.012	13.13	0.345	14.33	0.207
10.87	0.253	12.07	2.078	13.20	0.334	14.40	0.204
10.93	0.266	12.13	1.061	13.27	0.323	14.47	0.201
11.00	0.280	12.20	0.973	13.33	0.312	14.53	0.199
11.07	0.298	12.27	0.888	13.40	0.302	14.60	0.196
11.13	0.326	12.33	0.802	13.47	0.291	14.67	0.193
11.20	0.356	12.40	0.716	13.53	0.280	14.73	0.190
11.27	0.388	12.47	0.628	13.60	0.271	14.80	0.188
11.33	0.420	12.53	0.545	13.67	0.263	14.87	0.185
11.40	0.454			13.73	0.256	14.93	0.182

Continues on next page...

DA-5_Slope Diversion 5-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.00	0.180
15.07	0.177
15.13	0.174
15.20	0.172
15.27	0.169
15.33	0.166
15.40	0.163
15.47	0.161

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

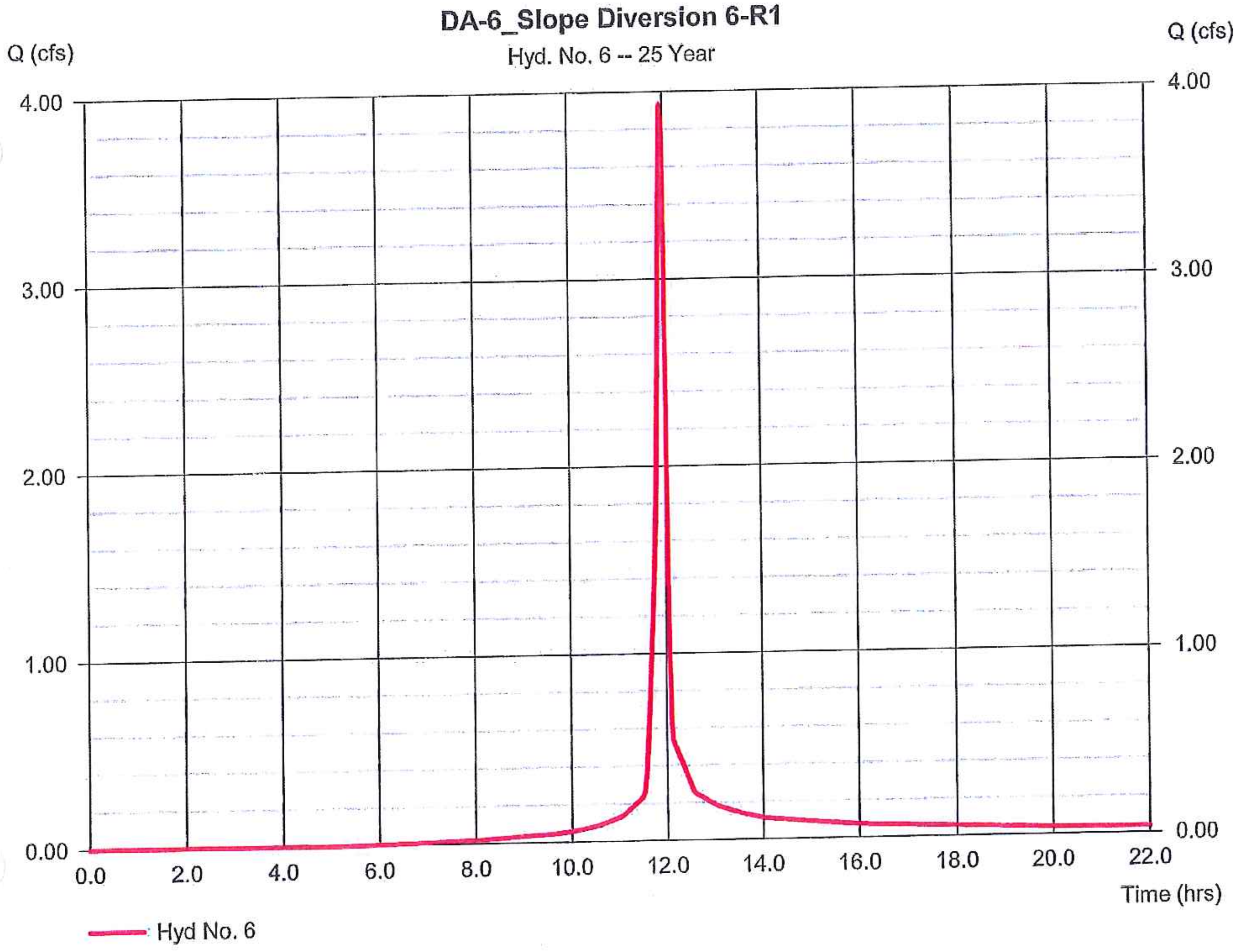
Thursday, 00 27, 2012

Hyd. No. 6

DA-6_Slope Diversion 6-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.770 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 3.934 cfs
Time to peak = 11.93 hrs
Hyd. volume = 8,194 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 6

DA-6_Slope Diversion 6-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.770 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 3.934 cfs
Time to peak = 11.93 hrs
Hyd. volume = 8,194 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.43	0.079	11.63	0.633	12.83	0.215	14.03	0.112
10.50	0.083	11.70	1.017	12.90	0.205	14.10	0.110
10.57	0.087	11.77	1.449	12.97	0.195	14.17	0.109
10.63	0.093	11.83	2.213	13.03	0.185	14.23	0.107
10.70	0.098	11.90	3.444	13.10	0.178	14.30	0.106
10.77	0.105	11.97	3.824	13.17	0.172	14.37	0.105
10.83	0.111	12.03	1.898	13.23	0.167	14.43	0.103
10.90	0.117	12.10	0.650	13.30	0.161	14.50	0.102
10.97	0.124	12.17	0.513	13.37	0.156	14.57	0.100
11.03	0.131	12.23	0.470	13.43	0.151	14.63	0.099
11.10	0.142	12.30	0.427	13.50	0.145	14.70	0.098
11.17	0.156	12.37	0.384	13.57	0.140	14.77	0.096
11.23	0.171	12.43	0.340	13.63	0.136	14.83	0.095
11.30	0.187	12.50	0.296	13.70	0.132	14.90	0.094
11.37	0.202	12.57	0.261	13.77	0.128	14.97	0.092
11.43	0.219	12.63	0.245	13.83	0.124	15.03	0.091
11.50	0.236	12.70	0.235	13.90	0.120	15.10	0.089
11.57	0.334	12.77	0.225	13.97	0.116	15.17	0.088

Continues on next page...

DA-6_Slope Diversion 6-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.23	0.087
15.30	0.085
15.37	0.084
15.43	0.083
15.50	0.081
15.57	0.080

...End

Hydrograph Report

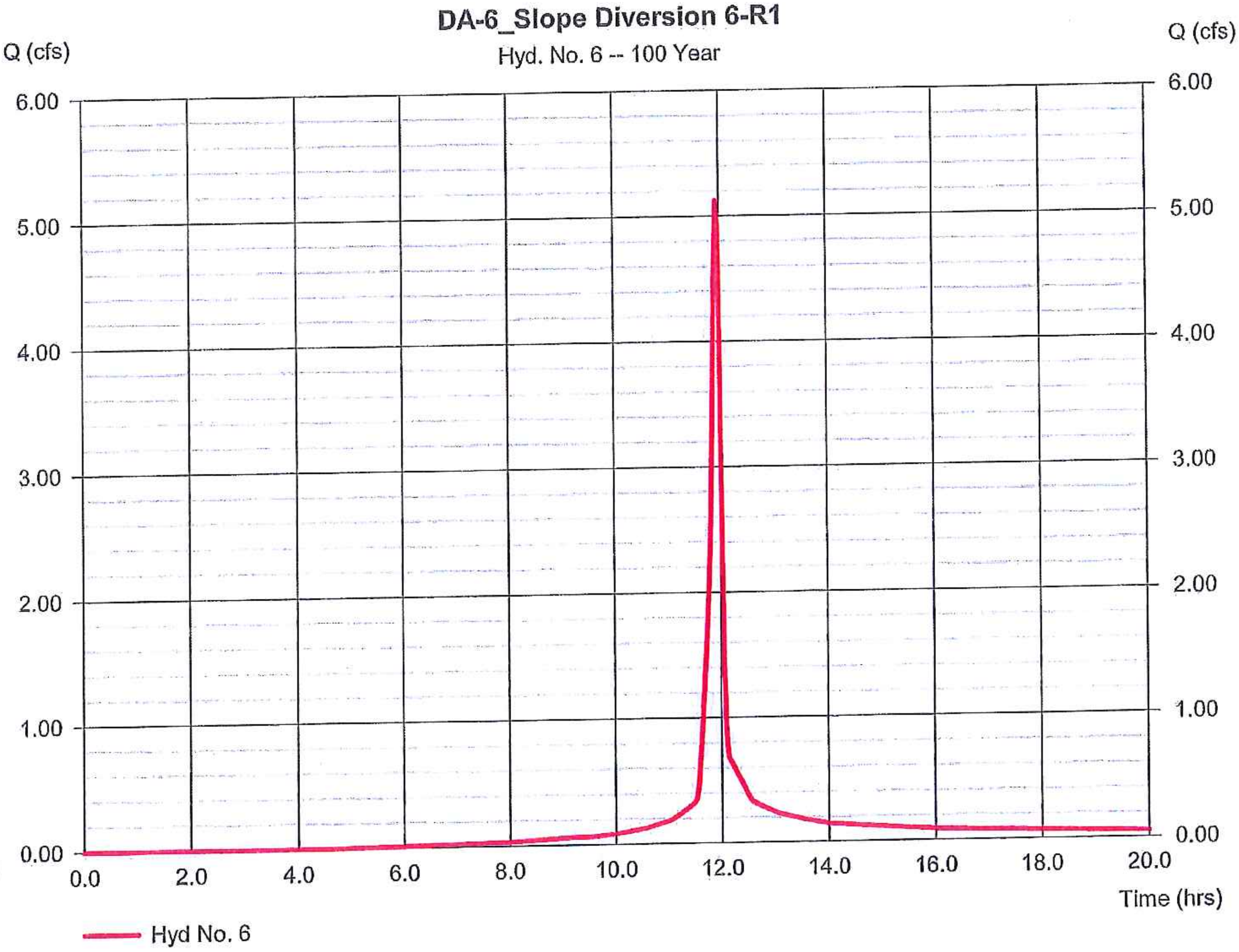
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 6

DA-6_Slope Diversion 6-R1

Hydrograph type	= SCS Runoff	Peak discharge	= 5.123 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 10,837 cuft
Drainage area	= 0.770 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 6

DA-6_Slope Diversion 6-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.770 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 5.123 cfs
Time to peak = 11.93 hrs
Hyd. volume = 10,837 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)
10.27	0.103
10.33	0.108
10.40	0.113
10.47	0.118
10.53	0.123
10.60	0.130
10.67	0.138
10.73	0.146
10.80	0.155
10.87	0.163
10.93	0.172
11.00	0.181
11.07	0.193
11.13	0.211
11.20	0.231
11.27	0.251
11.33	0.272
11.40	0.294
11.47	0.316
11.53	0.361
11.60	0.639
11.67	1.120
11.73	1.655
11.80	2.348
11.87	3.677
11.93	5.123
12.00	3.890
12.07	1.345
12.13	0.686
12.20	0.630
12.27	0.575
12.33	0.519
12.40	0.463
12.47	0.407
12.53	0.352
12.60	0.321
12.67	0.306
12.73	0.294
12.80	0.281
12.87	0.268
12.93	0.255
13.00	0.242
13.07	0.231
13.13	0.223
13.20	0.216
13.27	0.209
13.33	0.202
13.40	0.195
13.47	0.188
13.53	0.181
13.60	0.175
13.67	0.170
13.73	0.165
13.80	0.160
13.87	0.155
13.93	0.150
14.00	0.145
14.07	0.141
14.13	0.139
14.20	0.137
14.27	0.135
14.33	0.134
14.40	0.132
14.47	0.130
14.53	0.128
14.60	0.127
14.67	0.125
14.73	0.123
14.80	0.121
14.87	0.120
14.93	0.118

Continues on next page...

DA-6_Slope Diversion 6-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.00	0.116
15.07	0.114
15.13	0.113
15.20	0.111
15.27	0.109
15.33	0.107
15.40	0.106
15.47	0.104

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

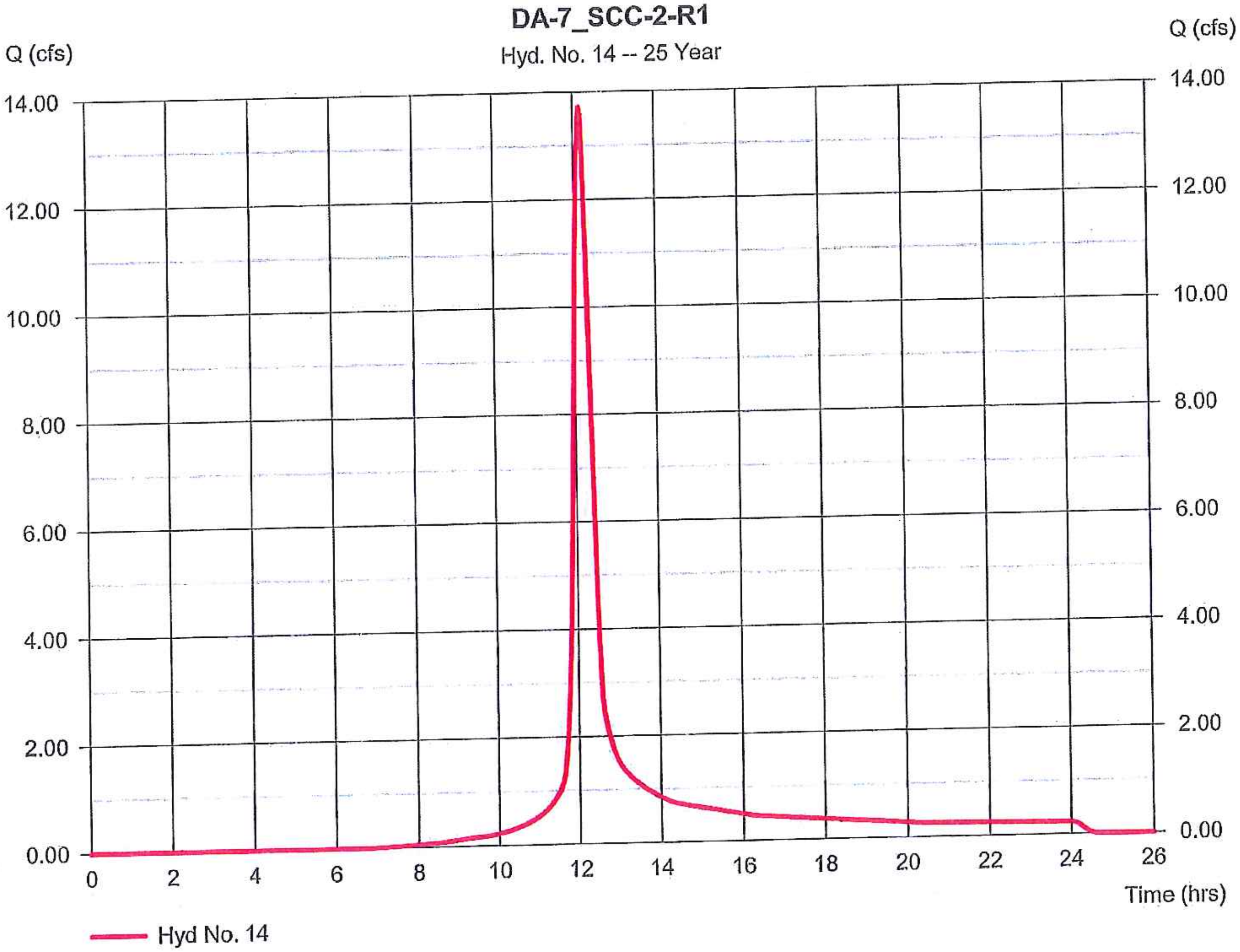
Hyd. No. 14

DA-7_SCC-2-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 5.120 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 13.72 cfs
Time to peak = 12.13 hrs
Hyd. volume = 50,353 cuft
Curve number = 83*
Hydraulic length = 0 ft
Time of conc. (Tc) = 24.70 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = [(1.990 x 87) + (2.520 x 79)] / 5.120



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 14

DA-7_SCC-2-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 5.120 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 13.72 cfs
Time to peak = 12.13 hrs
Hyd. volume = 50,353 cuft
Curve number = 83*
Hydraulic length = 0 ft
Time of conc. (Tc) = 24.7 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = [(1.990 x 87) + (2.520 x 79)] / 5.120

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.27	0.277	11.40	0.842	12.53	3.725	13.67	0.993
10.33	0.293	11.47	0.921	12.60	2.703	13.73	0.960
10.40	0.310	11.53	1.012	12.67	2.286	13.80	0.929
10.47	0.328	11.60	1.176	12.73	2.060	13.87	0.900
10.53	0.347	11.67	1.510	12.80	1.872	13.93	0.872
10.60	0.368	11.73	2.126	12.87	1.720	14.00	0.845
10.67	0.390	11.80	3.179	12.93	1.598	14.07	0.819
10.73	0.414	11.87	4.908	13.00	1.499	14.13	0.795
10.80	0.440	11.93	7.508	13.07	1.419	14.20	0.772
10.87	0.469	12.00	10.38	13.13	1.352	14.27	0.752
10.93	0.500	12.07	12.66	13.20	1.292	14.33	0.735
11.00	0.534	12.13	13.72 <<	13.27	1.237	14.40	0.721
11.07	0.570	12.20	12.98	13.33	1.188	14.47	0.709
11.13	0.610	12.27	11.11	13.40	1.143	14.53	0.698
11.20	0.655	12.33	9.112	13.47	1.102	14.60	0.689
11.27	0.709	12.40	7.142	13.53	1.063	14.67	0.680
11.33	0.771	12.47	5.292	13.60	1.027	14.73	0.671

Continues on next page...

DA-7_SCC-2-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
14.80	0.662
14.87	0.653
14.93	0.645
15.00	0.636
15.07	0.627
15.13	0.618
15.20	0.609
15.27	0.600
15.33	0.591
15.40	0.582
15.47	0.573
15.53	0.564
15.60	0.555
15.67	0.546
15.73	0.537
15.80	0.528
15.87	0.519
15.93	0.510
16.00	0.501
16.07	0.492
16.13	0.483
16.20	0.475
16.27	0.468
16.33	0.462
16.40	0.457
16.47	0.453
16.53	0.449
16.60	0.445
16.67	0.442
16.73	0.439
16.80	0.436
16.87	0.433
16.93	0.429
17.00	0.426
17.07	0.423
17.13	0.420
17.20	0.417
17.27	0.413
17.33	0.410
17.40	0.407
17.47	0.404
17.53	0.400
17.60	0.397
17.67	0.394
17.73	0.391
17.80	0.388
17.87	0.384
17.93	0.381
18.00	0.378
18.07	0.375
18.13	0.371
18.20	0.368
18.27	0.365
18.33	0.362
18.40	0.358
18.47	0.355
18.53	0.352
18.60	0.348
18.67	0.345
18.73	0.342
18.80	0.339
18.87	0.335
18.93	0.332
19.00	0.329
19.07	0.325
19.13	0.322
19.20	0.319
19.27	0.316
19.33	0.312
19.40	0.309
19.47	0.306
19.53	0.302
19.60	0.299
19.67	0.296
19.73	0.292
19.80	0.289
19.87	0.286
19.93	0.282
20.00	0.279
20.07	0.276

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

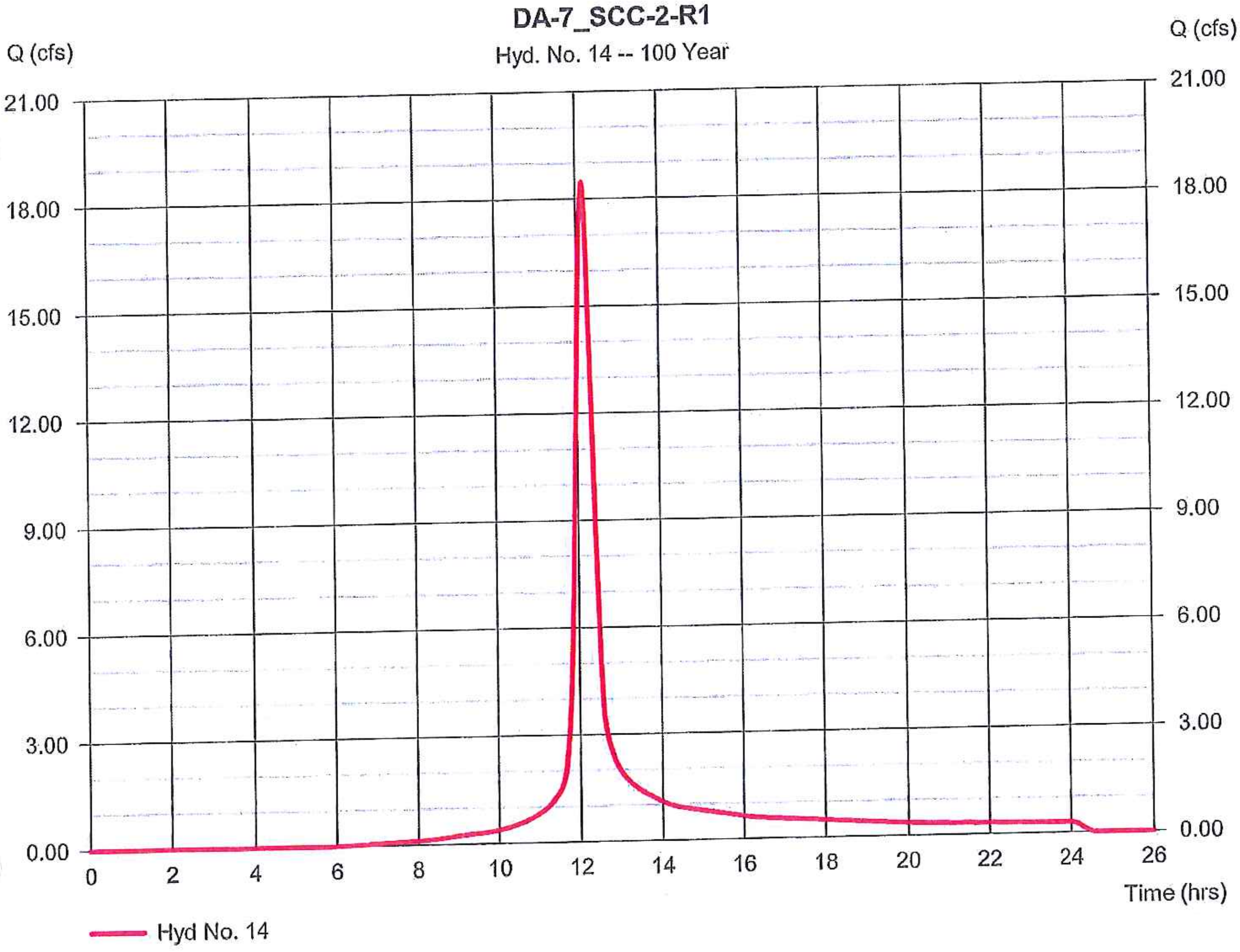
Hyd. No. 14

DA-7_SCC-2-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 5.120 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 18.47 cfs
Time to peak = 12.13 hrs
Hyd. volume = 68,090 cuft
Curve number = 83*
Hydraulic length = 0 ft
Time of conc. (Tc) = 24.70 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = [(1.990 x 87) + (2.520 x 79)] / 5.120



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Thursday, 00 27, 2012

Hyd. No. 14

DA-7_SCC-2-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 5.120 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 18.47 cfs
Time to peak = 12.13 hrs
Hyd. volume = 68,090 cuft
Curve number = 83*
Hydraulic length = 0 ft
Time of conc. (Tc) = 24.7 min
Distribution = Type II
Shape factor = 484

* Composite (Area/CN) = [(1.990 x 87) + (2.520 x 79)] / 5.120

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.00	0.375	11.13	0.930	12.27	14.83	13.40	1.481
10.07	0.393	11.20	0.995	12.33	12.11	13.47	1.428
10.13	0.411	11.27	1.070	12.40	9.450	13.53	1.377
10.20	0.431	11.33	1.158	12.47	6.966	13.60	1.330
10.27	0.453	11.40	1.258	12.53	4.878	13.67	1.286
10.33	0.476	11.47	1.369	12.60	3.527	13.73	1.243
10.40	0.501	11.53	1.496	12.67	2.979	13.80	1.202
10.47	0.527	11.60	1.727	12.73	2.683	13.87	1.164
10.53	0.555	11.67	2.198	12.80	2.436	13.93	1.128
10.60	0.585	11.73	3.062	12.87	2.236	14.00	1.093
10.67	0.616	11.80	4.522	12.93	2.076	14.07	1.059
10.73	0.651	11.87	6.886	13.00	1.948	14.13	1.027
10.80	0.689	11.93	10.38	13.07	1.842	14.20	0.998
10.87	0.730	12.00	14.18	13.13	1.754	14.27	0.972
10.93	0.775	12.07	17.15	13.20	1.676	14.33	0.950
11.00	0.822	12.13	18.47	13.27	1.605	14.40	0.931
<< 11.07	0.873	12.20	17.40	13.33	1.540	14.47	0.915

Continues on next page...

DA-7_SCC-2-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
14.53	0.901	16.27	0.602	18.00	0.485	19.73	0.375
14.60	0.889	16.33	0.595	18.07	0.481	19.80	0.370
14.67	0.877	16.40	0.588	18.13	0.477		
14.73	0.866	16.47	0.582	18.20	0.472		
14.80	0.854	16.53	0.577	18.27	0.468		
14.87	0.843	16.60	0.573	18.33	0.464		
14.93	0.831	16.67	0.569	18.40	0.460		
15.00	0.820	16.73	0.564	18.47	0.456		
15.07	0.808	16.80	0.560	18.53	0.451		
15.13	0.797	16.87	0.556	18.60	0.447		
15.20	0.785	16.93	0.552	18.67	0.443		
15.27	0.774	17.00	0.548	18.73	0.439		
15.33	0.762	17.07	0.544	18.80	0.434		
15.40	0.750	17.13	0.539	18.87	0.430		
15.47	0.739	17.20	0.535	18.93	0.426		
15.53	0.727	17.27	0.531	19.00	0.422		
15.60	0.715	17.33	0.527	19.07	0.417		
15.67	0.704	17.40	0.523	19.13	0.413		
15.73	0.692	17.47	0.519	19.20	0.409		
15.80	0.680	17.53	0.514	19.27	0.405		
15.87	0.668	17.60	0.510	19.33	0.400		
15.93	0.657	17.67	0.506	19.40	0.396		
16.00	0.645	17.73	0.502	19.47	0.392		
16.07	0.633	17.80	0.498	19.53	0.388		
16.13	0.622	17.87	0.493	19.60	0.383		
16.20	0.612	17.93	0.489	19.67	0.379		

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

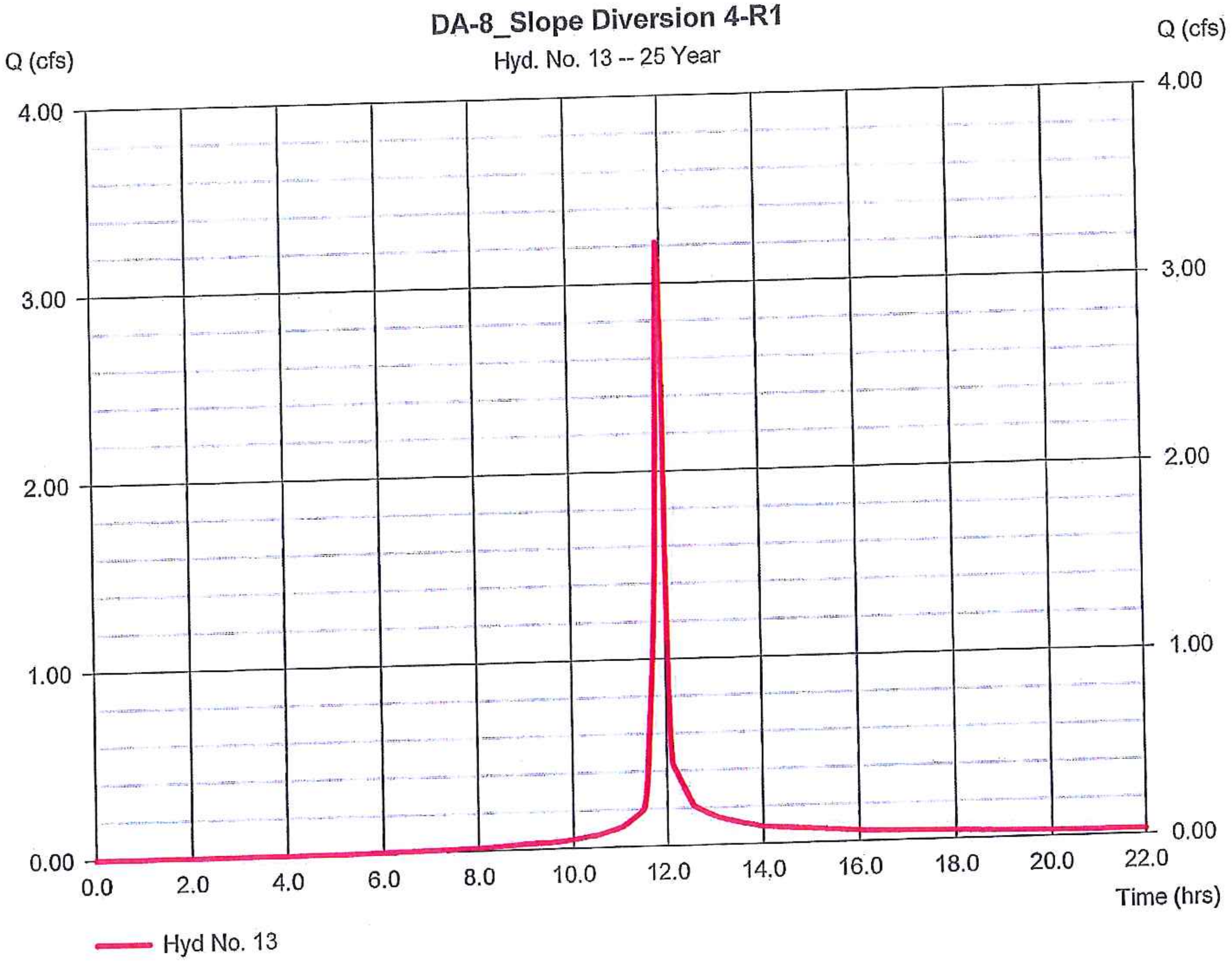
Friday, 00 11, 2013

Hyd. No. 13

DA-8_Slope Diversion 4-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.630 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 3.218 cfs
Time to peak = 11.93 hrs
Hyd. volume = 6,704 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 13

DA-8_Slope Diversion 4-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.630 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 3.218 cfs
Time to peak = 11.93 hrs
Hyd. volume = 6,704 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
9.27	0.032	10.47	0.066	11.67	0.671	12.80	0.180
9.33	0.033	10.53	0.069	11.73	1.002	12.87	0.172
9.40	0.034	10.60	0.073	11.80	1.438	12.93	0.164
9.47	0.034	10.67	0.078	11.87	2.281	13.00	0.155
9.53	0.035	10.73	0.083	11.93	3.218	13.07	0.148
9.60	0.036	10.80	0.088			13.13	0.143
9.67	0.037	10.87	0.093	12.00	2.464	13.20	0.139
9.73	0.039	10.93	0.099	12.07	0.856	13.27	0.134
9.80	0.041	11.00	0.104	12.13	0.438	13.33	0.130
9.87	0.043	11.07	0.111	12.20	0.402	13.40	0.125
9.93	0.045	11.13	0.122	12.27	0.367	13.47	0.121
10.00	0.047	11.20	0.134	12.33	0.332	13.53	0.117
10.07	0.049	11.27	0.146	12.40	0.296	13.60	0.113
10.13	0.052	11.33	0.159	12.47	0.260	13.67	0.110
10.20	0.054	11.40	0.172	12.53	0.226	13.73	0.106
10.27	0.057	11.47	0.186	12.60	0.205	13.80	0.103
10.33	0.060	11.53	0.213	12.67	0.196	13.87	0.100
10.40	0.063	11.60	0.380	12.73	0.188	13.93	0.097

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Continues on next page...

DA-8_Slope Diversion 4-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
14.00	0.094
14.07	0.091
14.13	0.089
14.20	0.088
14.27	0.087
14.33	0.086
14.40	0.085
14.47	0.084
14.53	0.083
14.60	0.082
14.67	0.081
14.73	0.079
14.80	0.078
14.87	0.077
14.93	0.076
15.00	0.075
15.07	0.074
15.13	0.073
15.20	0.072
15.27	0.070
15.33	0.069
15.40	0.068
15.47	0.067
15.53	0.066
15.60	0.065
15.67	0.064
15.73	0.062
15.80	0.061
15.87	0.060
15.93	0.059
16.00	0.058
16.07	0.057
16.13	0.056
16.20	0.056
16.27	0.056
16.33	0.055
16.40	0.055
16.47	0.054
16.53	0.054
16.60	0.054
16.67	0.053
16.73	0.053
16.80	0.052
16.87	0.052
16.93	0.052
17.00	0.051
17.07	0.051
17.13	0.050
17.20	0.050
17.27	0.050
17.33	0.049
17.40	0.049
17.47	0.048
17.53	0.048
17.60	0.048
17.67	0.047
17.73	0.047
17.80	0.046
17.87	0.046
17.93	0.046
18.00	0.045
18.07	0.045
18.13	0.044
18.20	0.044
18.27	0.044
18.33	0.043
18.40	0.043
18.47	0.042
18.53	0.042
18.60	0.041
18.67	0.041
18.73	0.041
18.80	0.040
18.87	0.040
18.93	0.039
19.00	0.039
19.07	0.039
19.13	0.038
19.20	0.038
19.27	0.037
19.33	0.037
19.40	0.037
19.47	0.036
19.53	0.036
19.60	0.035
19.67	0.035
19.73	0.035
19.80	0.034
19.87	0.034
19.93	0.033
20.00	0.033
20.07	0.033
20.13	0.032
20.20	0.032
20.27	0.032

...End

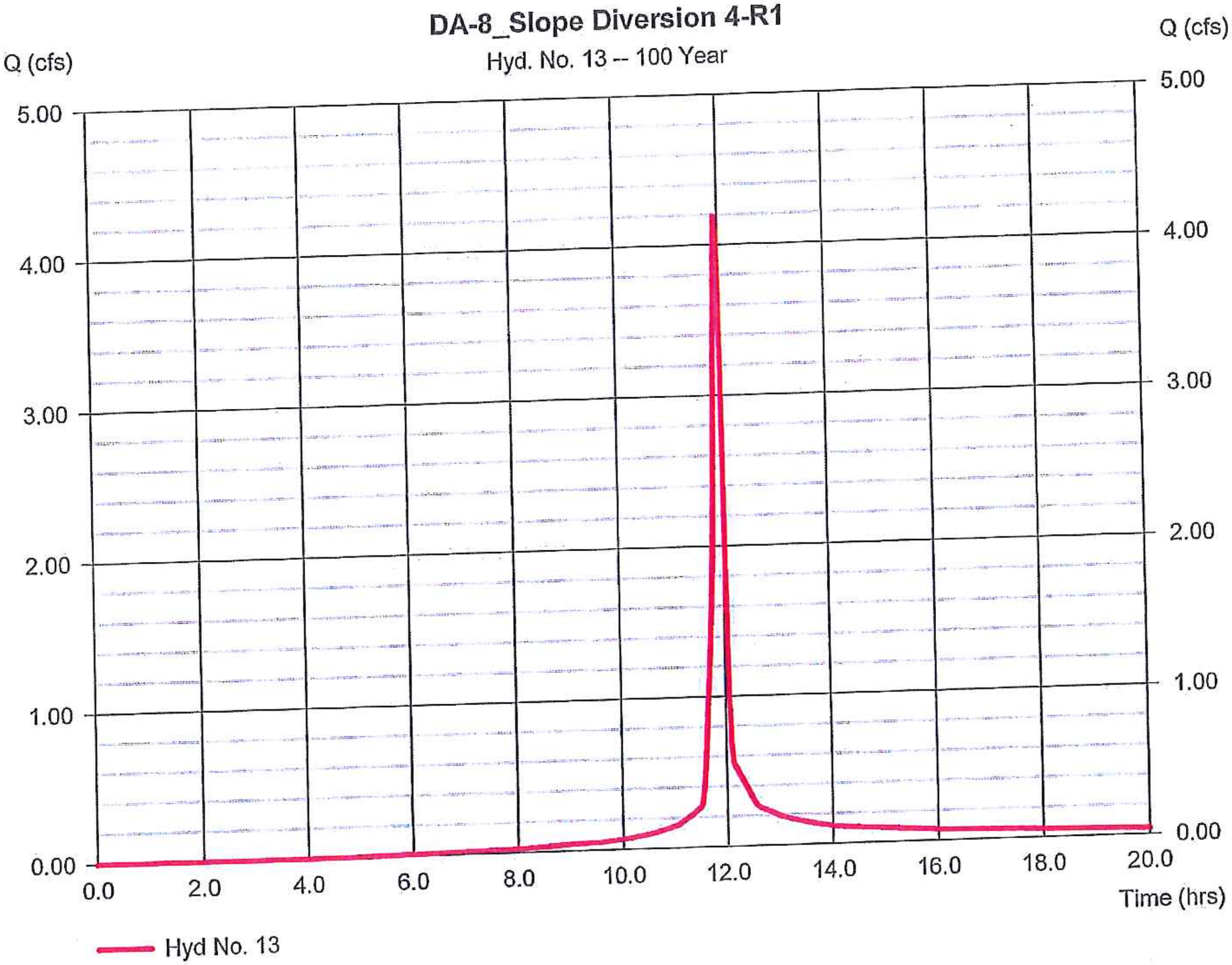
Hydrograph Report

Hyd. No. 13

DA-8_Slope Diversion 4-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.630 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 4.191 cfs
Time to peak = 11.93 hrs
Hyd. volume = 8,866 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 13

DA-8_Slope Diversion 4-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.630 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 4.191 cfs
Time to peak = 11.93 hrs
Hyd. volume = 8,866 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
8.83	0.043	10.03	0.071	11.23	0.197	12.43	0.356
8.90	0.044	10.10	0.075	11.30	0.214	12.50	0.310
8.97	0.046	10.17	0.078	11.37	0.231	12.57	0.272
9.03	0.047	10.23	0.082	11.43	0.249	12.63	0.256
9.10	0.049	10.30	0.086	11.50	0.267	12.70	0.246
9.17	0.049	10.37	0.090	11.57	0.378	12.77	0.235
9.23	0.050	10.43	0.094	11.63	0.710	12.83	0.225
9.30	0.051	10.50	0.099	11.70	1.130	12.90	0.214
9.37	0.051	10.57	0.103	11.77	1.594	12.97	0.204
9.43	0.052	10.63	0.110	11.83	2.403	13.03	0.193
9.50	0.053	10.70	0.116	11.90	3.692	13.10	0.185
9.57	0.054	10.77	0.123	11.97	4.055	13.17	0.180
9.63	0.056	10.83	0.130	12.03	2.000	13.23	0.174
9.70	0.058	10.90	0.137	12.10	0.683	13.30	0.168
9.77	0.061	10.97	0.145	12.17	0.538	13.37	0.163
9.83	0.063	11.03	0.152	12.23	0.493	13.43	0.157
9.90	0.066	11.10	0.165	12.30	0.447	13.50	0.151
9.97	0.069	11.17	0.180	12.37	0.402	13.57	0.146

Continues on next page...

DA-8_Slope Diversion 4-R1

Hydrograph Discharge Table

Time --	Outflow
(hrs	cfs)
13.63	0.141
13.70	0.137
13.77	0.133
13.83	0.129
13.90	0.125
13.97	0.121
14.03	0.117
14.10	0.114
14.17	0.113
14.23	0.112
14.30	0.110
14.37	0.109
14.43	0.107
14.50	0.106
14.57	0.104
14.63	0.103
14.70	0.102
14.77	0.100
14.83	0.099
14.90	0.097
14.97	0.096
15.03	0.094
15.10	0.093
15.17	0.092
15.23	0.090
15.30	0.089
15.37	0.087
15.43	0.086
15.50	0.084
15.57	0.083
15.63	0.081
15.70	0.080
15.77	0.079
15.83	0.077
15.90	0.076
15.97	0.074
16.03	0.073
16.10	0.072
16.17	0.071
16.23	0.071
16.30	0.070
16.37	0.070
16.43	0.069
16.50	0.069
16.57	0.068
16.63	0.068
16.70	0.067
16.77	0.067
16.83	0.066
16.90	0.066
16.97	0.065
17.03	0.065
17.10	0.064
17.17	0.064
17.23	0.063
17.30	0.063
17.37	0.062
17.43	0.062
17.50	0.061
17.57	0.061
17.63	0.060
17.70	0.060
17.77	0.059
17.83	0.058
17.90	0.058
17.97	0.057
18.03	0.057
18.10	0.056
18.17	0.056
18.23	0.055
18.30	0.055
18.37	0.054
18.43	0.054
18.50	0.053
18.57	0.053
18.63	0.052
18.70	0.052
18.77	0.051
18.83	0.051
18.90	0.050
18.97	0.050
19.03	0.049
19.10	0.049
19.17	0.048
19.23	0.048
19.30	0.047
19.37	0.047
19.43	0.046
19.50	0.045
19.57	0.045
19.63	0.044
19.70	0.044
19.77	0.043
19.83	0.043
19.90	0.042

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

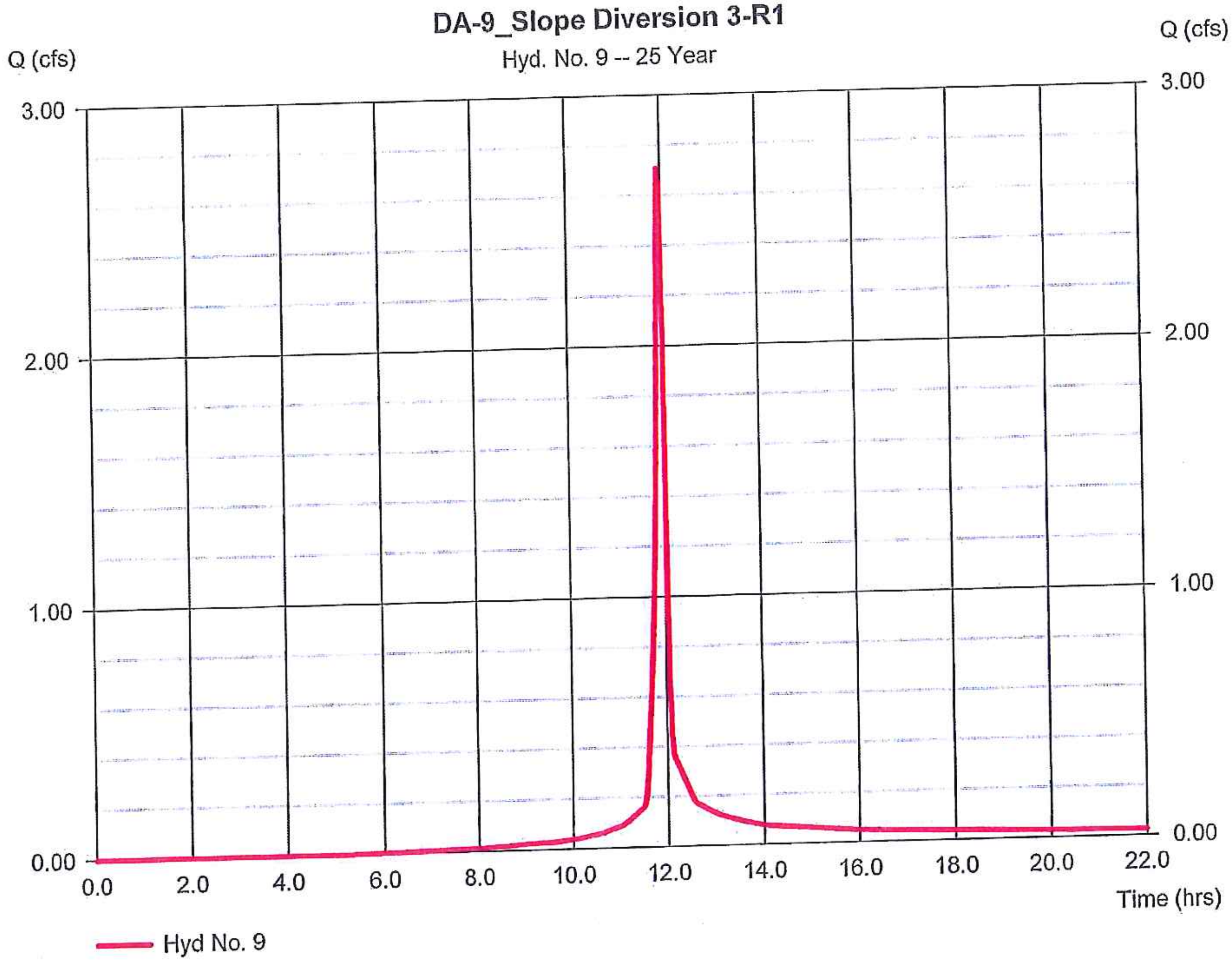
Friday, 00 11, 2013

Hyd. No. 9

DA-9_Slope Diversion 3-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.530 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 2.708 cfs
Time to peak = 11.93 hrs
Hyd. volume = 5,640 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 9

DA-9_Slope Diversion 3-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.530 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 2.708 cfs
Time to peak = 11.93 hrs
Hyd. volume = 5,640 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
9.27	0.027	10.47	0.056	11.67	0.564	12.80	0.151
9.33	0.028	10.53	0.058	11.73	0.843	12.87	0.145
9.40	0.028	10.60	0.062	11.80	1.210	12.93	0.138
9.47	0.029	10.67	0.066	11.87	1.919	13.00	0.131
9.53	0.029	10.73	0.070	11.93	2.708	13.07	0.125
9.60	0.030	10.80	0.074			13.13	0.120
9.67	0.032	10.87	0.079	12.00	2.073	13.20	0.117
9.73	0.033	10.93	0.083	12.07	0.720	13.27	0.113
9.80	0.035	11.00	0.088	12.13	0.368	13.33	0.109
9.87	0.036	11.07	0.094	12.20	0.338	13.40	0.105
9.93	0.038	11.13	0.103	12.27	0.309	13.47	0.102
10.00	0.039	11.20	0.113	12.33	0.279	13.53	0.098
10.07	0.041	11.27	0.123	12.40	0.249	13.60	0.095
10.13	0.043	11.33	0.134	12.47	0.219	13.67	0.092
10.20	0.046	11.40	0.145	12.53	0.190	13.73	0.089
10.27	0.048	11.47	0.156	12.60	0.173	13.80	0.087
10.33	0.051	11.53	0.179	12.67	0.165	13.87	0.084
10.40	0.053	11.60	0.320	12.73	0.158	13.93	0.081

Continues on next page...

DA-9_Slope Diversion 3-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
14.00	0.079
14.07	0.076
14.13	0.075
14.20	0.074
14.27	0.073
14.33	0.072
14.40	0.071
14.47	0.071
14.53	0.070
14.60	0.069
14.67	0.068
14.73	0.067
14.80	0.066
14.87	0.065
14.93	0.064
15.00	0.063
15.07	0.062
15.13	0.061
15.20	0.060
15.27	0.059
15.33	0.058
15.40	0.057
15.47	0.056
15.53	0.055
15.60	0.054
15.67	0.054
15.73	0.053
15.80	0.052
15.87	0.051
15.93	0.050
16.00	0.049
16.07	0.048
16.13	0.047
16.20	0.047
16.27	0.047
16.33	0.046
16.40	0.046
16.47	0.046
16.53	0.045
16.60	0.045
16.67	0.045
16.73	0.044
16.80	0.044
16.87	0.044
16.93	0.043
17.00	0.043
17.07	0.043
17.13	0.042
17.20	0.042
17.27	0.042
17.33	0.041
17.40	0.041
17.47	0.041
17.53	0.040
17.60	0.040
17.67	0.040
17.73	0.039
17.80	0.039
17.87	0.039
17.93	0.038
18.00	0.038
18.07	0.038
18.13	0.037
18.20	0.037
18.27	0.037
18.33	0.036
18.40	0.036
18.47	0.036
18.53	0.035
18.60	0.035
18.67	0.035
18.73	0.034
18.80	0.034
18.87	0.034
18.93	0.033
19.00	0.033
19.07	0.033
19.13	0.032
19.20	0.032
19.27	0.031
19.33	0.031
19.40	0.031
19.47	0.030
19.53	0.030
19.60	0.030
19.67	0.029
19.73	0.029
19.80	0.029
19.87	0.028
19.93	0.028
20.00	0.028
20.07	0.027
20.13	0.027
20.20	0.027
20.27	0.027

...End

Hydrograph Report

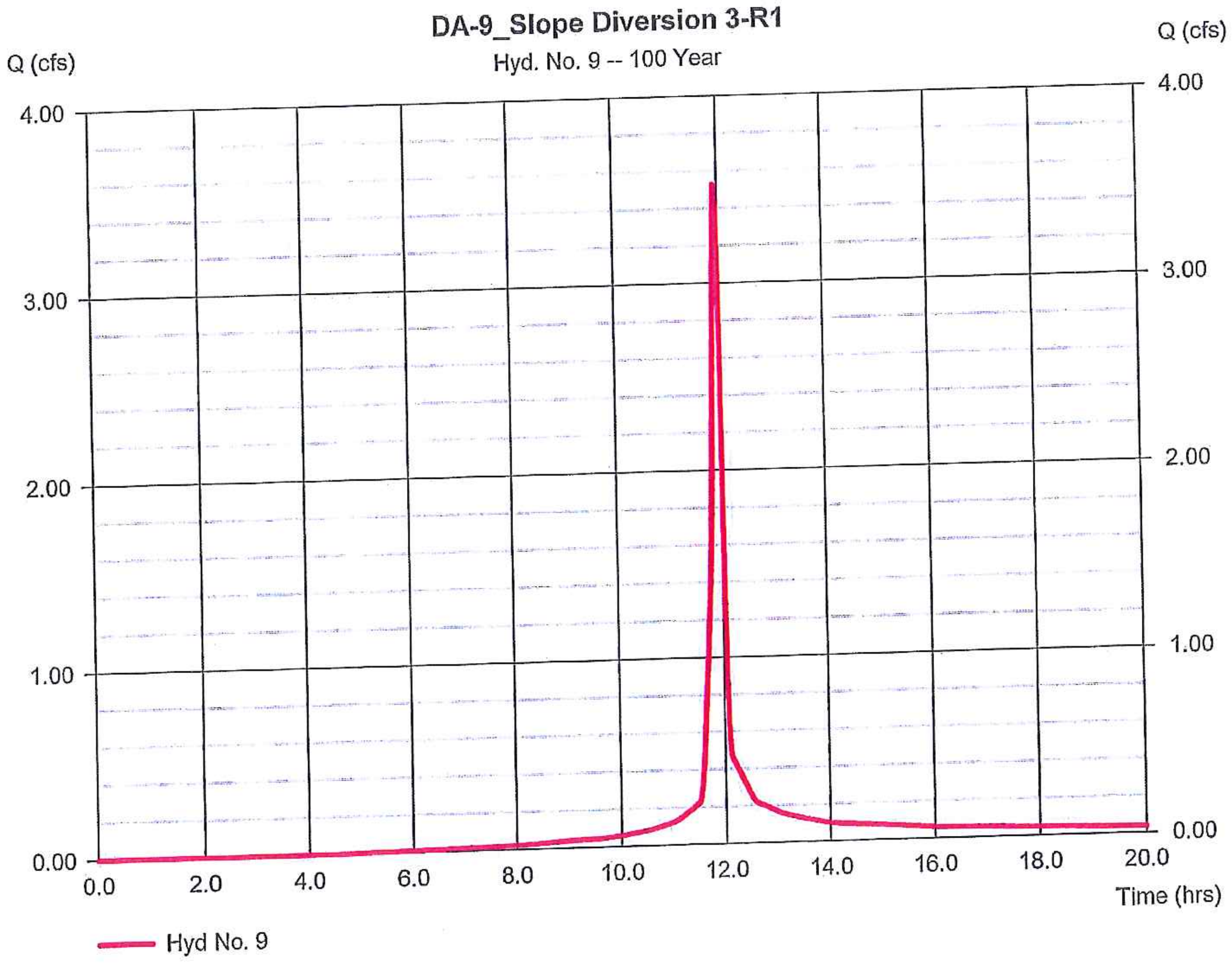
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 9

DA-9_Slope Diversion 3-R1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.526 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 7,459 cuft
Drainage area	= 0.530 ac	Curve number	= 87
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hyd. No. 9

DA-9_Slope Diversion 3-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.530 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 3.526 cfs
Time to peak = 11.93 hrs
Hyd. volume = 7,459 cuft
Curve number = 87
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
8.83	0.036	10.03	0.060	11.23	0.166	12.43	0.299
8.90	0.037	10.10	0.063	11.30	0.180	12.50	0.260
8.97	0.039	10.17	0.066	11.37	0.195	12.57	0.229
9.03	0.040	10.23	0.069	11.43	0.210	12.63	0.215
9.10	0.041	10.30	0.073	11.50	0.225	12.70	0.207
9.17	0.041	10.37	0.076	11.57	0.318	12.77	0.198
9.23	0.042	10.43	0.079	11.63	0.597	12.83	0.189
9.30	0.043	10.50	0.083	11.70	0.951	12.90	0.180
9.37	0.043	10.57	0.087	11.77	1.341	12.97	0.171
9.43	0.044	10.63	0.092	11.83	2.022	13.03	0.163
9.50	0.044	10.70	0.098	11.90	3.106	13.10	0.156
9.57	0.045	10.77	0.104	11.97	3.412	13.17	0.151
9.63	0.047	10.83	0.109	12.03	1.683	13.23	0.146
9.70	0.049	10.90	0.115	12.10	0.575	13.30	0.142
9.77	0.051	10.97	0.122	12.17	0.452	13.37	0.137
9.83	0.053	11.03	0.128	12.23	0.415	13.43	0.132
9.90	0.055	11.10	0.138	12.30	0.376	13.50	0.127
9.97	0.058	11.17	0.152	12.37	0.338	13.57	0.123

Continues on next page...

DA-9_Slope Diversion 3-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
13.63	0.119
13.70	0.116
13.77	0.112
13.83	0.109
13.90	0.105
13.97	0.102
14.03	0.098
14.10	0.096
14.17	0.095
14.23	0.094
14.30	0.093
14.37	0.091
14.43	0.090
14.50	0.089
14.57	0.088
14.63	0.087
14.70	0.085
14.77	0.084
14.83	0.083
14.90	0.082
14.97	0.081
15.03	0.079
15.10	0.078
15.17	0.077
15.23	0.076
15.30	0.075
15.37	0.073
15.43	0.072
15.50	0.071
15.57	0.070
15.63	0.069
15.70	0.067
15.77	0.066
15.83	0.065
15.90	0.064
15.97	0.062
16.03	0.061
16.10	0.060
16.17	0.060
16.23	0.060
16.30	0.059
16.37	0.059
16.43	0.058
16.50	0.058
16.57	0.057
16.63	0.057
16.70	0.057
16.77	0.056
16.83	0.056
16.90	0.055
16.97	0.055
17.03	0.054
17.10	0.054
17.17	0.054
17.23	0.053
17.30	0.053
17.37	0.052
17.43	0.052
17.50	0.051
17.57	0.051
17.63	0.051
17.70	0.050
17.77	0.050
17.83	0.049
17.90	0.049
17.97	0.048
18.03	0.048
18.10	0.047
18.17	0.047
18.23	0.047
18.30	0.046
18.37	0.046
18.43	0.045
18.50	0.045
18.57	0.044
18.63	0.044
18.70	0.044
18.77	0.043
18.83	0.043
18.90	0.042
18.97	0.042
19.03	0.041
19.10	0.041
19.17	0.040
19.23	0.040
19.30	0.040
19.37	0.039
19.43	0.039
19.50	0.038
19.57	0.038
19.63	0.037
19.70	0.037
19.77	0.037
19.83	0.036
19.90	0.036

...End

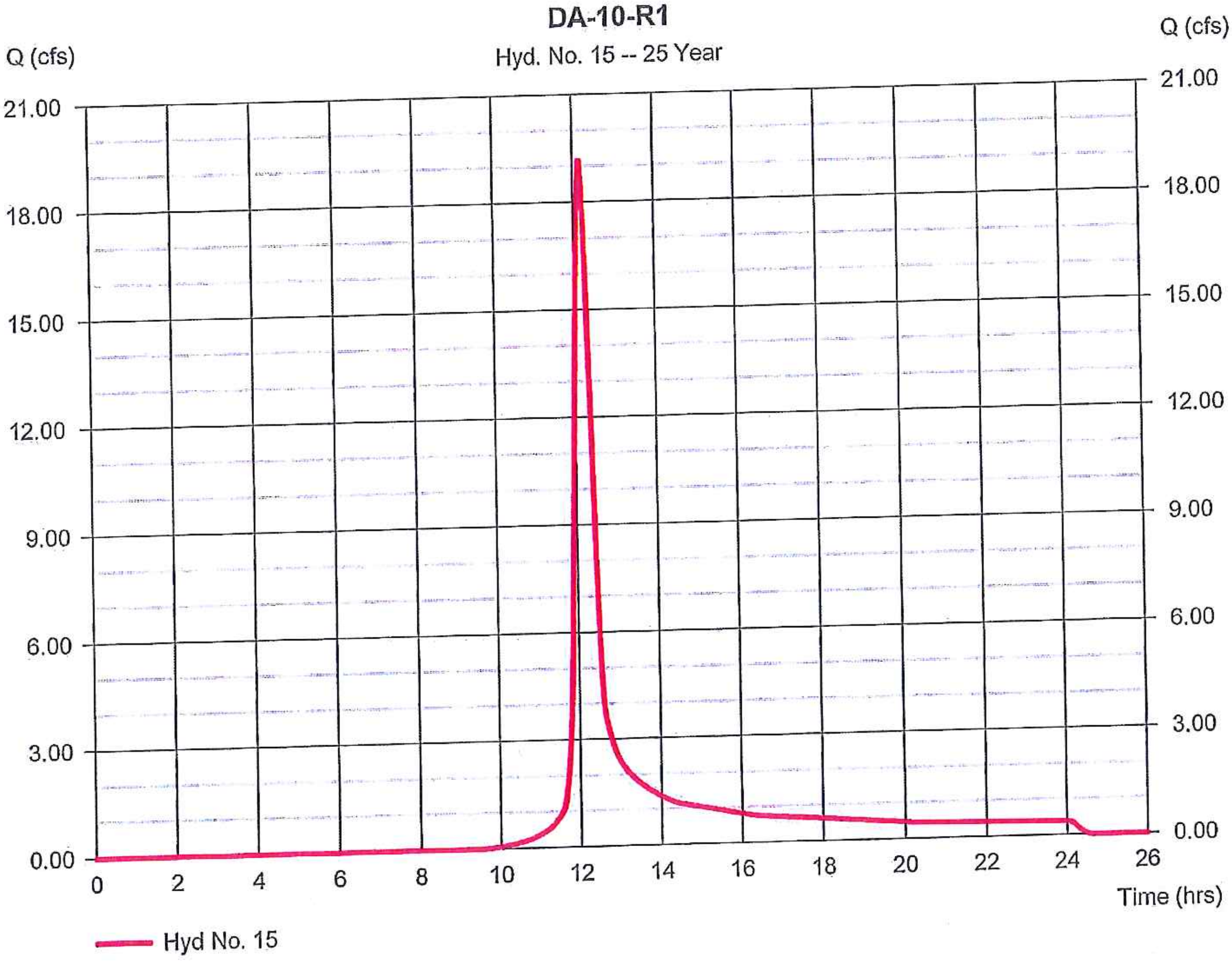
Hydrograph Report

Hyd. No. 15

DA-10-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 10.030 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 19.16 cfs
Time to peak = 12.13 hrs
Hyd. volume = 71,517 cuft
Curve number = 74
Hydraulic length = 0 ft
Time of conc. (Tc) = 25.30 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 15

DA-10-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 10.030 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 19.16 cfs
Time to peak = 12.13 hrs
Hyd. volume = 71,517 cuft
Curve number = 74
Hydraulic length = 0 ft
Time of conc. (Tc) = 25.3 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print interval = 2)

Time -- Outflow (hrs	cfs)	Time -- Outflow (hrs	cfs)	Time -- Outflow (hrs	cfs)	Time -- Outflow (hrs	cfs)
10.60	0.200	11.80	3.534	12.93	2.543	14.13	1.292
10.67	0.223	11.87	5.808	13.00	2.391	14.20	1.257
10.73	0.249	11.93	9.461	13.07	2.267	14.27	1.225
10.80	0.277	12.00	13.70	13.13	2.163	14.33	1.199
10.87	0.308	12.07	17.24	13.20	2.070	14.40	1.176
10.93	0.342	12.13	19.16	13.27	1.986	14.47	1.157
<< 11.00	0.378			13.33	1.909	14.53	1.140
11.07	0.419	12.20	18.46	13.40	1.839	14.60	1.126
11.13	0.464	12.27	16.03	13.47	1.775	14.67	1.112
11.20	0.516	12.33	13.35	13.53	1.715	14.73	1.098
11.27	0.577	12.40	10.64	13.60	1.659	14.80	1.084
11.33	0.647	12.47	8.035	13.67	1.605	14.87	1.071
11.40	0.729	12.53	5.763	13.73	1.554	14.93	1.057
11.47	0.821	12.60	4.237	13.80	1.505	15.00	1.043
11.53	0.929	12.67	3.601	13.87	1.459	15.07	1.029
11.60	1.119	12.73	3.255	13.93	1.415	15.13	1.015
11.67	1.503	12.80	2.966	14.00	1.372	15.20	1.001
11.73	2.234	12.87	2.731	14.07	1.331	15.27	0.986

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DA-10-R1

Hydrograph Discharge Table

Time -- Outflow		Time -- Outflow		Time -- Outflow		Time -- Outflow	
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
15.33	0.972	17.07	0.703	18.80	0.567	20.53	0.441
15.40	0.958	17.13	0.698	18.87	0.561	20.60	0.439
15.47	0.944	17.20	0.693	18.93	0.556	20.67	0.438
15.53	0.929	17.27	0.687	19.00	0.551	20.73	0.437
15.60	0.915	17.33	0.682	19.07	0.545	20.80	0.436
15.67	0.901	17.40	0.677	19.13	0.540	20.87	0.435
15.73	0.886	17.47	0.672	19.20	0.534	20.93	0.434
15.80	0.872	17.53	0.667	19.27	0.529	21.00	0.433
15.87	0.857	17.60	0.662	19.33	0.524	21.07	0.432
15.93	0.842	17.67	0.657	19.40	0.518	21.13	0.431
16.00	0.828	17.73	0.651	19.47	0.513	21.20	0.430
16.07	0.813	17.80	0.646	19.53	0.507	21.27	0.429
16.13	0.799	17.87	0.641	19.60	0.502	21.33	0.428
16.20	0.786	17.93	0.636	19.67	0.496	21.40	0.427
16.27	0.775	18.00	0.630	19.73	0.491	21.47	0.426
16.33	0.765	18.07	0.625	19.80	0.485	21.53	0.425
16.40	0.757	18.13	0.620	19.87	0.480	21.60	0.424
16.47	0.750	18.20	0.615	19.93	0.474	21.67	0.423
16.53	0.744	18.27	0.609	20.00	0.469	21.73	0.422
16.60	0.738	18.33	0.604	20.07	0.463	21.80	0.421
16.67	0.733	18.40	0.599	20.13	0.458	21.87	0.420
16.73	0.728	18.47	0.593	20.20	0.454	21.93	0.419
16.80	0.723	18.53	0.588	20.27	0.450	22.00	0.418
16.87	0.718	18.60	0.583	20.33	0.446	22.07	0.417
16.93	0.713	18.67	0.577	20.40	0.444	22.13	0.416
17.00	0.708	18.73	0.572	20.47	0.442	22.20	0.415

Continues on next page...

DA-10-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
22.27	0.414
22.33	0.413
22.40	0.412
22.47	0.411
22.53	0.410
22.60	0.409
22.67	0.408
22.73	0.407
22.80	0.406
22.87	0.405
22.93	0.404
23.00	0.403
23.07	0.402
23.13	0.401
23.20	0.400
23.27	0.399
23.33	0.398
23.40	0.397
23.47	0.396
23.53	0.395
23.60	0.394
23.67	0.393
23.73	0.391
23.80	0.390
23.87	0.389
23.93	0.388
24.00	0.387
24.07	0.373
24.13	0.340
24.20	0.289
24.27	0.220

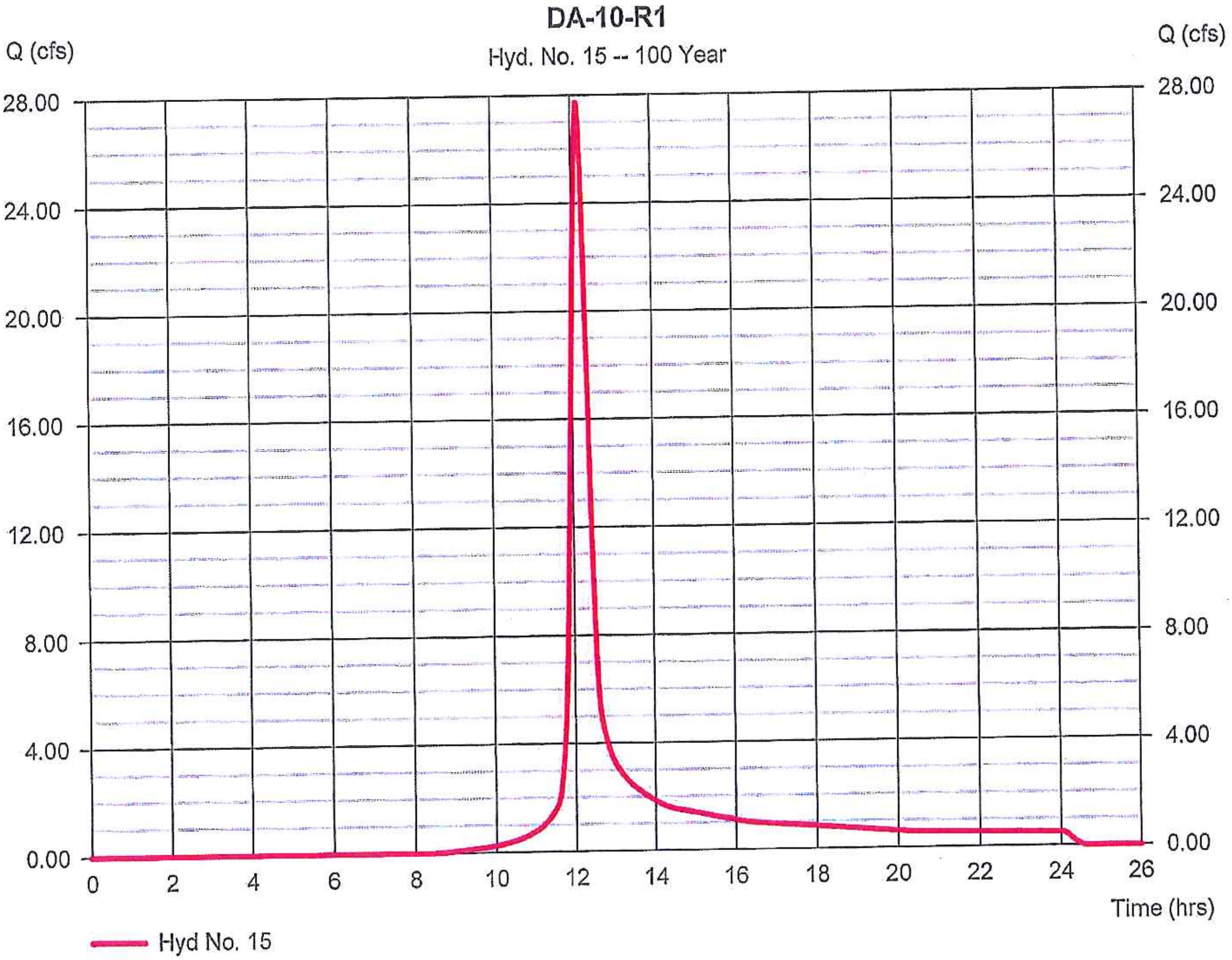
...End

Hydrograph Report

Hyd. No. 15

DA-10-R1

Hydrograph type	= SCS Runoff	Peak discharge	= 27.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 102,198 cuft
Drainage area	= 10.030 ac	Curve number	= 74
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.30 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 15

DA-10-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 10.030 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 27.73 cfs
Time to peak = 12.13 hrs
Hyd. volume = 102,198 cuft
Curve number = 74
Hydraulic length = 0 ft
Time of conc. (Tc) = 25.3 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print Interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.10	0.281	11.30	1.161	12.50	9.478	13.70	2.137
10.17	0.303	11.37	1.282	12.57	6.711	13.77	2.069
10.23	0.327	11.43	1.420	12.63	5.265	13.83	2.004
10.30	0.353	11.50	1.573	12.70	4.684	13.90	1.942
10.37	0.381	11.57	1.788	12.77	4.242	13.97	1.883
10.43	0.411	11.63	2.219	12.83	3.881	14.03	1.825
10.50	0.442	11.70	3.065	12.90	3.590	14.10	1.771
10.57	0.477	11.77	4.580	12.97	3.357	14.17	1.720
10.63	0.513	11.83	7.199	13.03	3.167	14.23	1.674
10.70	0.554	11.90	11.52	13.10	3.011	14.30	1.634
10.77	0.598	11.97	17.42	13.17	2.876	14.37	1.600
10.83	0.647	12.03	23.02	13.23	2.754	14.43	1.572
10.90	0.700	12.10	26.88	13.30	2.643	14.50	1.548
10.97	0.758	12.17	27.59	13.37	2.542	14.57	1.526
11.03	0.820	12.23	24.80	13.43	2.450	14.63	1.507
11.10	0.888	12.30	20.89	13.50	2.365	14.70	1.488
11.17	0.966	12.37	16.92	13.57	2.285	14.77	1.469
11.23	1.055	12.43	13.04	13.63	2.209	14.83	1.450

Continues on next page...

DA-10-R1

Hydrograph Discharge Table

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
14.90	1.431	16.63	0.984	18.37	0.802	20.10	0.613
14.97	1.412	16.70	0.978	18.43	0.795	20.17	0.606
15.03	1.393	16.77	0.971	18.50	0.787	20.23	0.600
15.10	1.374	16.83	0.964	18.57	0.780	20.30	0.596
15.17	1.354	16.90	0.957	18.63	0.773	20.37	0.592
15.23	1.335	16.97	0.950	18.70	0.766	20.43	0.589
15.30	1.316	17.03	0.943	18.77	0.759	20.50	0.586
15.37	1.296	17.10	0.936	18.83	0.751	20.57	0.585
15.43	1.277	17.17	0.929	18.90	0.744	20.63	0.583
15.50	1.257	17.23	0.922	18.97	0.737	20.70	0.582
15.57	1.238	17.30	0.915	19.03	0.730	20.77	0.580
15.63	1.218	17.37	0.908	19.10	0.722	20.83	0.579
15.70	1.198	17.43	0.901	19.17	0.715	20.90	0.578
15.77	1.179	17.50	0.894	19.23	0.708	20.97	0.576
15.83	1.159	17.57	0.887	19.30	0.701	21.03	0.575
15.90	1.139	17.63	0.880	19.37	0.693	21.10	0.574
15.97	1.119	17.70	0.873	19.43	0.686	21.17	0.572
16.03	1.100	17.77	0.866	19.50	0.679	21.23	0.571
16.10	1.080	17.83	0.859	19.57	0.671	21.30	0.569
16.17	1.062	17.90	0.852	19.63	0.664	21.37	0.568
16.23	1.045	17.97	0.845	19.70	0.657	21.43	0.567
16.30	1.031	18.03	0.838	19.77	0.649	21.50	0.565
16.37	1.019	18.10	0.830	19.83	0.642	21.57	0.564
16.43	1.008	18.17	0.823	19.90	0.635	21.63	0.563
16.50	0.999	18.23	0.816	19.97	0.627	21.70	0.561
16.57	0.992	18.30	0.809	20.03	0.620	21.77	0.560

Continues on next page...

DA-10-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
21.83	0.558
21.90	0.557
21.97	0.556
22.03	0.554
22.10	0.553
22.17	0.552
22.23	0.550
22.30	0.549
22.37	0.547
22.43	0.546
22.50	0.545
22.57	0.543
22.63	0.542
22.70	0.540
22.77	0.539
22.83	0.538
22.90	0.536
22.97	0.535
23.03	0.533
23.10	0.532
23.17	0.530
23.23	0.529
23.30	0.528
23.37	0.526
23.43	0.525
23.50	0.523
23.57	0.522
23.63	0.521
23.70	0.519
23.77	0.518
23.83	0.516
23.90	0.515
23.97	0.513
24.03	0.506
24.10	0.475
24.17	0.419
24.23	0.340

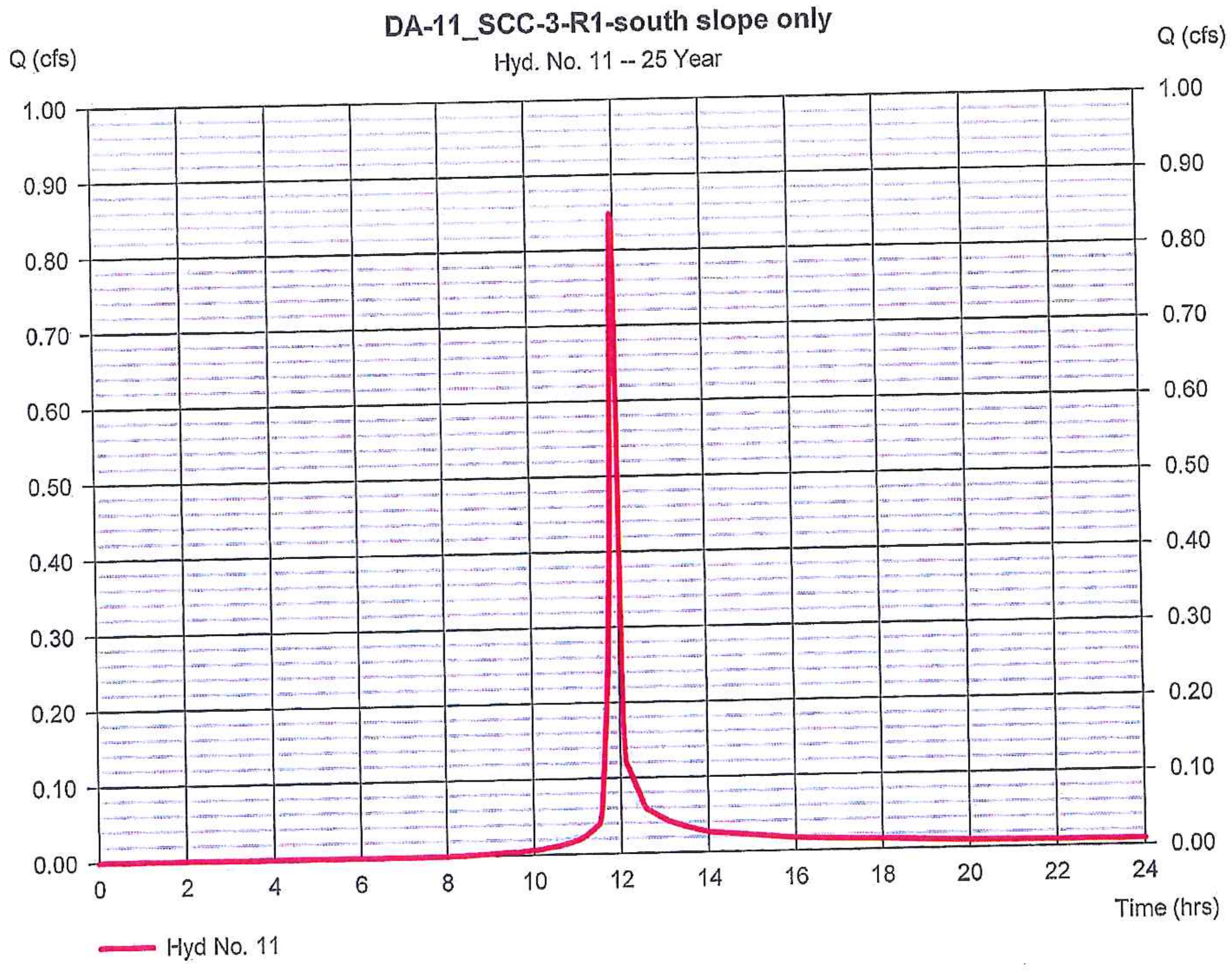
...End

Hydrograph Report

Hyd. No. 11

DA-11_SCC-3-R1-south slope only

Hydrograph type	= SCS Runoff	Peak discharge	= 0.848 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 1,716 cuft
Drainage area	= 0.210 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 4.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 11

DA-11_SCC-3-R1-south slope only

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.210 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 0.848 cfs
Time to peak = 11.93 hrs
Hyd. volume = 1,716 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp, Print interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.30	0.009	11.50	0.039	12.70	0.055	13.90	0.029
10.37	0.009	11.57	0.056	12.77	0.053	13.97	0.028
10.43	0.010	11.63	0.110	12.83	0.051	14.03	0.027
10.50	0.011	11.70	0.184	12.90	0.048	14.10	0.026
10.57	0.011	11.77	0.274	12.97	0.046	14.17	0.026
10.63	0.012	11.83	0.441	13.03	0.044	14.23	0.026
10.70	0.013	11.90	0.725	13.10	0.042	14.30	0.025
10.77	0.014	11.97	0.841	13.17	0.041	14.37	0.025
10.83	0.016	12.03	0.428	13.23	0.039	14.43	0.025
10.90	0.017	12.10	0.149	13.30	0.038	14.50	0.024
10.97	0.018	12.17	0.118	13.37	0.037	14.57	0.024
11.03	0.019	12.23	0.108	13.43	0.036	14.63	0.024
11.10	0.021	12.30	0.099	13.50	0.034	14.70	0.023
11.17	0.024	12.37	0.089	13.57	0.033	14.77	0.023
11.23	0.026	12.43	0.079	13.63	0.032	14.83	0.023
11.30	0.029	12.50	0.069	13.70	0.031	14.90	0.022
11.37	0.032	12.57	0.061	13.77	0.030	14.97	0.022
11.43	0.036	12.63	0.057	13.83	0.030	15.03	0.022

Continues on next page

DA-11_SCC-3-R1-south slope only

Hydrograph Discharge Table

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
15.10	0.021	16.83	0.015	18.57	0.012	20.30	0.010
15.17	0.021	16.90	0.015	18.63	0.012	20.37	0.010
15.23	0.021	16.97	0.015	18.70	0.012	20.43	0.010
15.30	0.021	17.03	0.015	18.77	0.012	20.50	0.010
15.37	0.020	17.10	0.015	18.83	0.012	20.57	0.010
15.43	0.020	17.17	0.015	18.90	0.012	20.63	0.010
15.50	0.020	17.23	0.015	18.97	0.012	20.70	0.009
15.57	0.019	17.30	0.015	19.03	0.012	20.77	0.009
15.63	0.019	17.37	0.015	19.10	0.011	20.83	0.009
15.70	0.019	17.43	0.014	19.17	0.011	20.90	0.009
15.77	0.018	17.50	0.014	19.23	0.011	20.97	0.009
15.83	0.018	17.57	0.014	19.30	0.011	21.03	0.009
15.90	0.018	17.63	0.014	19.37	0.011	21.10	0.009
15.97	0.017	17.70	0.014	19.43	0.011	21.17	0.009
16.03	0.017	17.77	0.014	19.50	0.011	21.23	0.009
16.10	0.017	17.83	0.014	19.57	0.011	21.30	0.009
16.17	0.017	17.90	0.014	19.63	0.010	21.37	0.009
16.23	0.016	17.97	0.013	19.70	0.010	21.43	0.009
16.30	0.016	18.03	0.013	19.77	0.010	21.50	0.009
16.37	0.016	18.10	0.013	19.83	0.010	21.57	0.009
16.43	0.016	18.17	0.013	19.90	0.010	21.63	0.009
16.50	0.016	18.23	0.013	19.97	0.010	21.70	0.009
16.57	0.016	18.30	0.013	20.03	0.010	21.77	0.009
16.63	0.016	18.37	0.013	20.10	0.010	21.83	0.009
16.70	0.016	18.43	0.013	20.17	0.010	21.90	0.009
16.77	0.016	18.50	0.013	20.23	0.010	21.97	0.009

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DA-11_SCC-3-R1-south slope only

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
22.03	0.009
22.10	0.009
22.17	0.009
22.23	0.009
22.30	0.009
22.37	0.009
22.43	0.009
22.50	0.009
22.57	0.009
22.63	0.009
22.70	0.009
22.77	0.009
22.83	0.009
22.90	0.009
22.97	0.009
23.03	0.009
23.10	0.009
23.17	0.009
23.23	0.009
23.30	0.009
23.37	0.009
23.43	0.009
23.50	0.009
23.57	0.008

...End

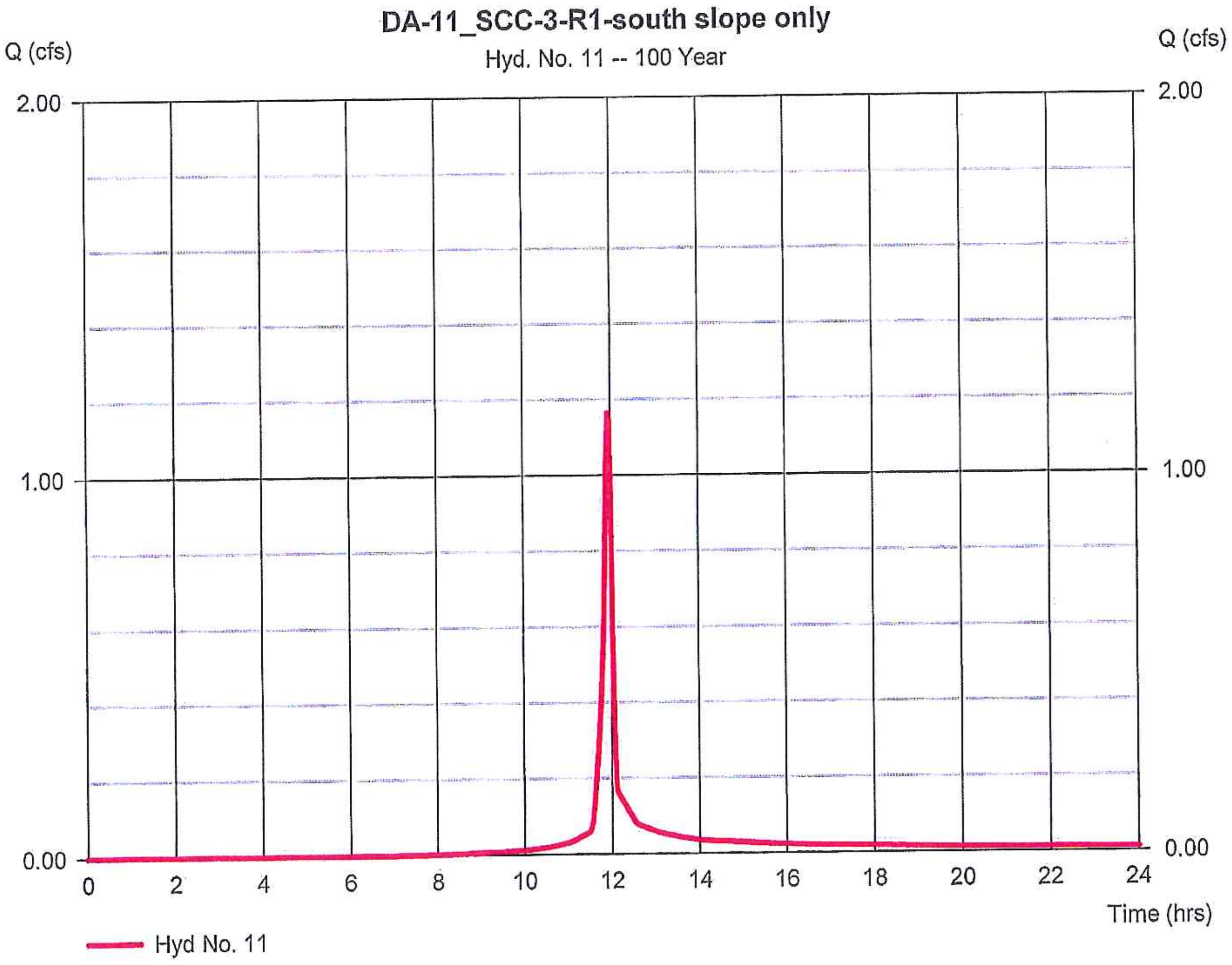
Hydrograph Report

Hyd. No. 11

DA-11_SCC-3-R1-south slope only

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.210 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 1.165 cfs
Time to peak = 11.93 hrs
Hyd. volume = 2,376 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Friday, 00 11, 2013

Hyd. No. 11

DA-11_SCC-3-R1-south slope only

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.210 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 1.165 cfs
Time to peak = 11.93 hrs
Hyd. volume = 2,376 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp. Print Interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
9.97	0.012	11.17	0.038	12.37	0.118	13.57	0.044
10.03	0.012	11.23	0.042	12.43	0.105	13.63	0.042
10.10	0.013	11.30	0.047	12.50	0.092	13.70	0.041
10.17	0.014	11.37	0.051	12.57	0.081	13.77	0.040
10.23	0.015	11.43	0.056	12.63	0.076	13.83	0.039
10.30	0.016	11.50	0.060	12.70	0.073	13.90	0.038
10.37	0.017	11.57	0.087	12.77	0.070	13.97	0.036
10.43	0.018	11.63	0.166	12.83	0.067	14.03	0.035
10.50	0.019	11.70	0.273	12.90	0.064	14.10	0.034
10.57	0.020	11.77	0.399	12.97	0.061	14.17	0.034
10.63	0.021	11.83	0.627	13.03	0.058	14.23	0.034
10.70	0.023	11.90	1.007	13.10	0.055	14.30	0.033
10.77	0.024	11.97	1.146	13.17	0.054	14.37	0.033
10.83	0.026	12.03	0.577	13.23	0.052	14.43	0.032
10.90	0.028	12.10	0.199	13.30	0.050	14.50	0.032
10.97	0.030	12.17	0.157	13.37	0.049	14.57	0.032
11.03	0.032	12.23	0.145	13.43	0.047	14.63	0.031
11.10	0.035	12.30	0.132	13.50	0.045	14.70	0.031

Continues on next page...

DA-11_SCC-3-R1-south slope only

Hydrograph Discharge Table

Time --	Outflow
(hrs	cfs)
14.77	0.030
14.83	0.030
14.90	0.029
14.97	0.029
15.03	0.029
15.10	0.028
15.17	0.028
15.23	0.027
15.30	0.027
15.37	0.026
15.43	0.026
15.50	0.026
15.57	0.025
15.63	0.025
15.70	0.024
15.77	0.024
15.83	0.023
15.90	0.023
15.97	0.023
16.03	0.022
16.10	0.022
16.17	0.022
16.23	0.022
16.30	0.021
16.37	0.021
16.43	0.021
16.50	0.021
16.57	0.021
16.63	0.021
16.70	0.020
16.77	0.020
16.83	0.020
16.90	0.020
16.97	0.020
17.03	0.020
17.10	0.020
17.17	0.019
17.23	0.019
17.30	0.019
17.37	0.019
17.43	0.019
17.50	0.019
17.57	0.018
17.63	0.018
17.70	0.018
17.77	0.018
17.83	0.018
17.90	0.018
17.97	0.018
18.03	0.017
18.10	0.017
18.17	0.017
18.23	0.017
18.30	0.017
18.37	0.017
18.43	0.016
18.50	0.016
18.57	0.016
18.63	0.016
18.70	0.016
18.77	0.016
18.83	0.016
18.90	0.015
18.97	0.015
19.03	0.015
19.10	0.015
19.17	0.015
19.23	0.015
19.30	0.014
19.37	0.014
19.43	0.014
19.50	0.014
19.57	0.014
19.63	0.014
19.70	0.013
19.77	0.013
19.83	0.013
19.90	0.013
19.97	0.013
20.03	0.013
20.10	0.013
20.17	0.013
20.23	0.013
20.30	0.013
20.37	0.012
20.43	0.012
20.50	0.012
20.57	0.012
20.63	0.012
20.70	0.012
20.77	0.012
20.83	0.012
20.90	0.012
20.97	0.012
21.03	0.012
21.10	0.012
21.17	0.012
21.23	0.012
21.30	0.012
21.37	0.012
21.43	0.012
21.50	0.012
21.57	0.012
21.63	0.012

Continues on next page...

DA-11_SCC-3-R1-south slope only

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
21.70	0.012
21.77	0.012
21.83	0.012
21.90	0.012
21.97	0.012
22.03	0.012
22.10	0.012
22.17	0.012

...End

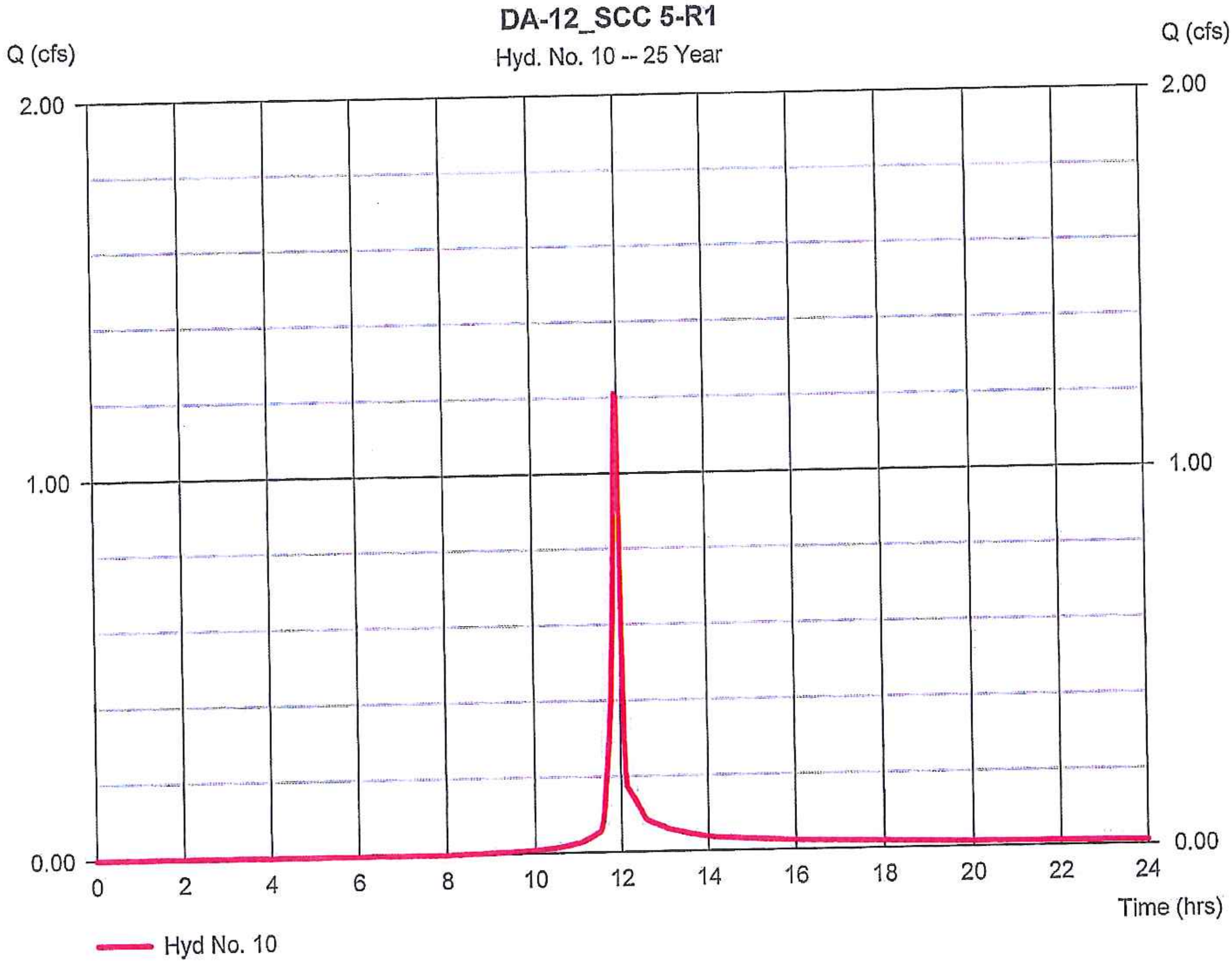
Hydrograph Report

Hyd. No. 10

DA-12_SCC 5-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.300 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 1.212 cfs
Time to peak = 11.93 hrs
Hyd. volume = 2,452 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484

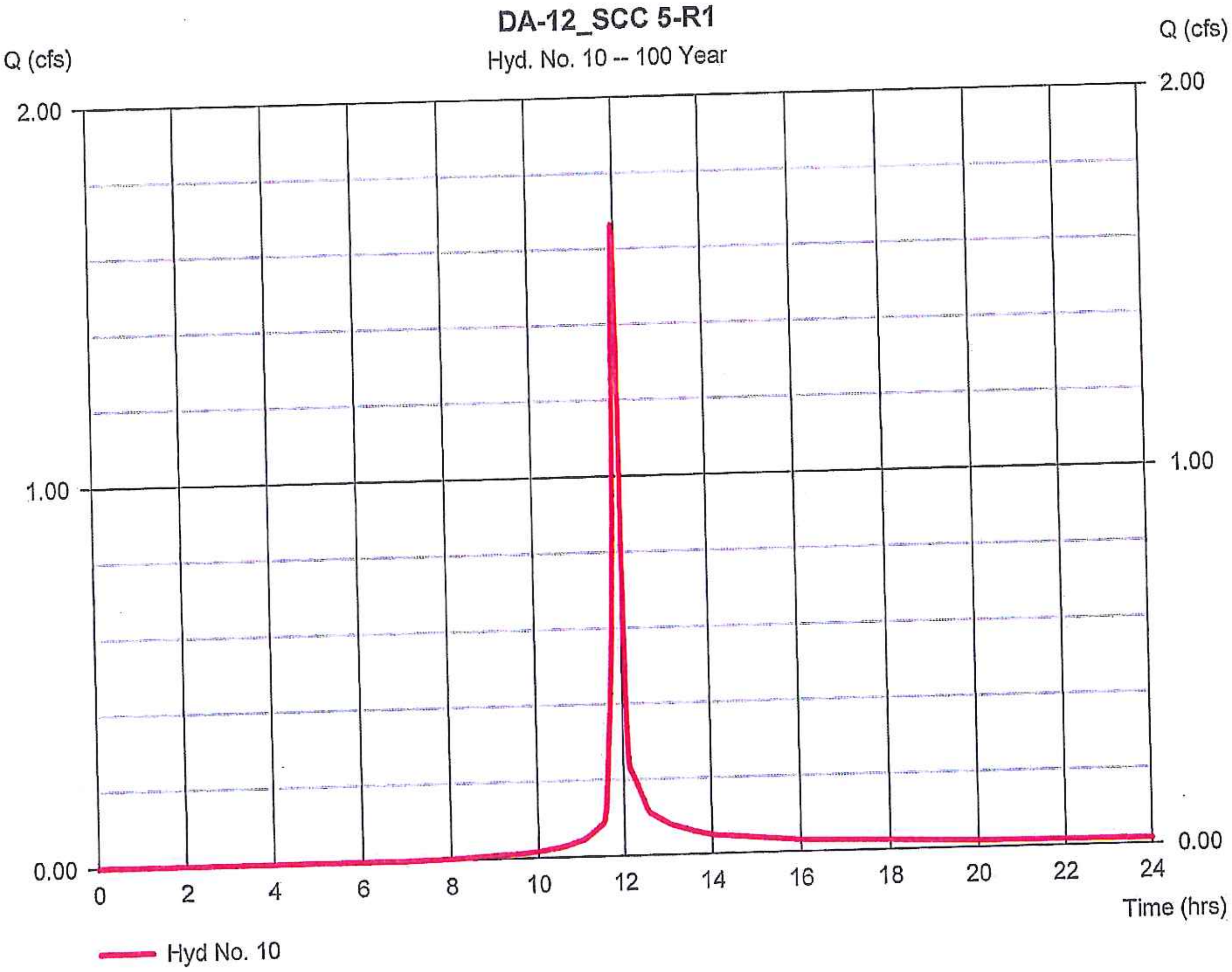


Hydrograph Report

Hyd. No. 10

DA-12_SCC 5-R1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.665 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 3,394 cuft
Drainage area	= 0.300 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hyd. No. 10

DA-12_SCC 5-R1

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.300 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 1.212 cfs
Time to peak = 11.93 hrs
Hyd. volume = 2,452 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.93	0.025	12.07	0.340	13.27	0.055	14.47	0.035
11.00	0.027	12.13	0.175	13.33	0.054	14.53	0.035
11.07	0.029	12.20	0.162	13.40	0.052	14.60	0.034
11.13	0.032	12.27	0.148	13.47	0.050	14.67	0.034
11.20	0.036	12.33	0.134	13.53	0.048	14.73	0.033
11.27	0.040	12.40	0.120	13.60	0.047	14.80	0.033
11.33	0.044	12.47	0.106	13.67	0.045	14.87	0.032
11.40	0.049	12.53	0.092	13.73	0.044	14.93	0.032
11.47	0.053	12.60	0.084	13.80	0.043	15.00	0.031
11.53	0.062	12.67	0.080	13.87	0.042	15.07	0.031
11.60	0.114	12.73	0.077	13.93	0.040	15.13	0.030
11.67	0.208	12.80	0.074	14.00	0.039	15.20	0.030
11.73	0.324	12.87	0.071	14.07	0.038	15.27	0.030
11.80	0.488	12.93	0.067	14.13	0.037	15.33	0.029
11.87	0.816	13.00	0.064	14.20	0.037	15.40	0.029
<< 11.93	1.212	13.07	0.061	14.27	0.036	15.47	0.028
12.00	0.960	13.13	0.059	14.33	0.036	15.53	0.028
		13.20	0.057	14.40	0.035	15.60	0.027

Continues on next page...

DA-12_SCC 5-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.67	0.027
15.73	0.026
15.80	0.026
15.87	0.025
15.93	0.025
16.00	0.024

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. v9

Tuesday, 00 5, 2013

Hyd. No. 10

DA-12_SCC 5-R1

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.300 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 1.665 cfs
Time to peak = 11.93 hrs
Hyd. volume = 3,394 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.73	0.034	11.93	1.665	13.07	0.081	14.27	0.048
10.80	0.036	12.00	1.300	13.13	0.078	14.33	0.047
10.87	0.038	12.07	0.456	13.20	0.076	14.40	0.047
10.93	0.041	12.13	0.234	13.27	0.073	14.47	0.046
11.00	0.044	12.20	0.216	13.33	0.071	14.53	0.045
11.07	0.047	12.27	0.197	13.40	0.068	14.60	0.045
11.13	0.052	12.33	0.179	13.47	0.066	14.67	0.044
11.20	0.058	12.40	0.160	13.53	0.064	14.73	0.044
11.27	0.063	12.47	0.141	13.60	0.062	14.80	0.043
11.33	0.070	12.53	0.122	13.67	0.060	14.87	0.042
11.40	0.076	12.60	0.111	13.73	0.058	14.93	0.042
11.47	0.083	12.67	0.106	13.80	0.056	15.00	0.041
11.53	0.096	12.73	0.102	13.87	0.055	15.07	0.041
11.60	0.173	12.80	0.098	13.93	0.053	15.13	0.040
11.67	0.311	12.87	0.093	14.00	0.051	15.20	0.039
11.73	0.476	12.93	0.089	14.07	0.050	15.27	0.039
11.80	0.701	13.00	0.084	14.13	0.049	15.33	0.038
11.87	1.147			14.20	0.048	15.40	0.037

Continues on next page

DA-12_SCC 5-R1

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.47	0.037
15.53	0.036
15.60	0.036
15.67	0.035
15.73	0.034
15.80	0.034

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

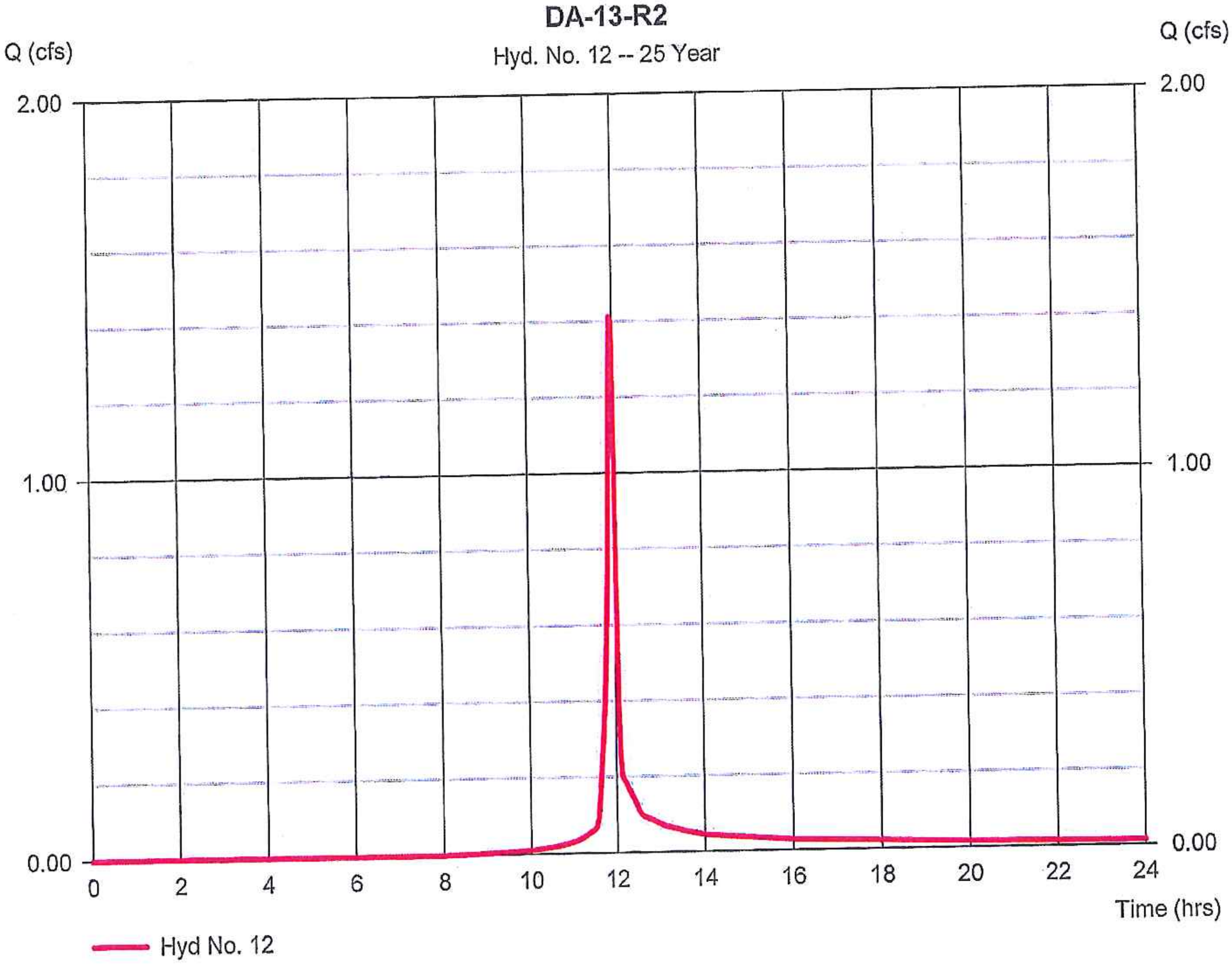
Monday, 05 / 13 / 2013

Hyd. No. 12

DA-13-R2

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.350 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 1.414 cfs
Time to peak = 11.93 hrs
Hyd. volume = 2,861 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 05 / 13 / 2013

Hyd. No. 12

DA-13-R2

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 0.350 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 1.414 cfs
Time to peak = 11.93 hrs
Hyd. volume = 2,861 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.93	0.029	12.07	0.397	13.27	0.065	14.47	0.041
11.00	0.031	12.13	0.205	13.33	0.063	14.53	0.040
11.07	0.034	12.20	0.189	13.40	0.060	14.60	0.040
11.13	0.038	12.27	0.173	13.47	0.058	14.67	0.039
11.20	0.042	12.33	0.157	13.53	0.056	14.73	0.039
11.27	0.047	12.40	0.140	13.60	0.055	14.80	0.038
11.33	0.051	12.47	0.123	13.67	0.053	14.87	0.038
11.40	0.057	12.53	0.107	13.73	0.051	14.93	0.037
11.47	0.062	12.60	0.098	13.80	0.050	15.00	0.037
11.53	0.073	12.67	0.094	13.87	0.048	15.07	0.036
11.60	0.133	12.73	0.090	13.93	0.047	15.13	0.036
11.67	0.242	12.80	0.086	14.00	0.045	15.20	0.035
11.73	0.377	12.87	0.082	14.07	0.044	15.27	0.034
11.80	0.569	12.93	0.078	14.13	0.043	15.33	0.034
11.87	0.952	13.00	0.075	14.20	0.043	15.40	0.033
<< 11.93	1.414	13.07	0.071	14.27	0.042	15.47	0.033
12.00	1.120	13.13	0.069	14.33	0.042	15.53	0.032
		13.20	0.067	14.40	0.041	15.60	0.032

Continues on next page...

DA-13-R2

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.67	0.031
15.73	0.031
15.80	0.030
15.87	0.030
15.93	0.029
16.00	0.028

...End

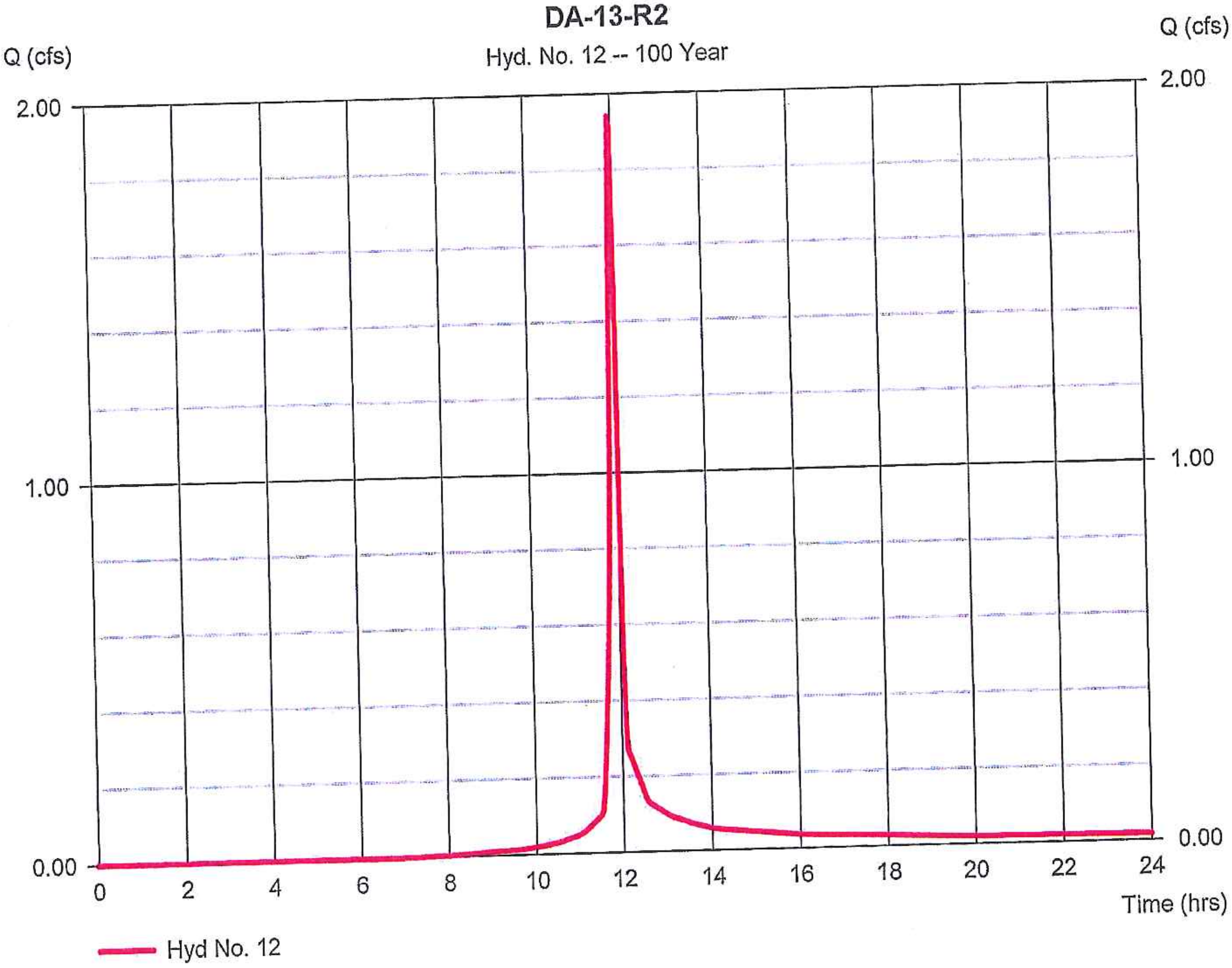
Hydrograph Report

Hyd. No. 12

DA-13-R2

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.350 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 1.942 cfs
Time to peak = 11.93 hrs
Hyd. volume = 3,960 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 05 / 13 / 2013

Hyd. No. 12

DA-13-R2

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 0.350 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 1.942 cfs
Time to peak = 11.93 hrs
Hyd. volume = 3,960 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.73	0.039	11.93	1.942	13.07	0.094	14.27	0.056
10.80	0.042	12.00	1.516	13.13	0.091	14.33	0.055
10.87	0.045	12.07	0.532	13.20	0.088	14.40	0.054
10.93	0.048	12.13	0.274	13.27	0.085	14.47	0.054
11.00	0.051	12.20	0.252	13.33	0.083	14.53	0.053
11.07	0.055	12.27	0.230	13.40	0.080	14.60	0.052
11.13	0.061	12.33	0.208	13.47	0.077	14.67	0.052
11.20	0.067	12.40	0.186	13.53	0.074	14.73	0.051
11.27	0.074	12.47	0.164	13.60	0.072	14.80	0.050
11.33	0.081	12.53	0.142	13.67	0.070	14.87	0.049
11.40	0.089	12.60	0.130	13.73	0.068	14.93	0.049
11.47	0.097	12.67	0.124	13.80	0.066	15.00	0.048
11.53	0.112	12.73	0.119	13.87	0.064	15.07	0.047
11.60	0.202	12.80	0.114	13.93	0.062	15.13	0.047
11.67	0.363	12.87	0.109	14.00	0.060	15.20	0.046
11.73	0.555	12.93	0.104	14.07	0.058	15.27	0.045
11.80	0.818	13.00	0.099	14.13	0.057	15.33	0.044
11.87	1.338			14.20	0.056	15.40	0.044

DA-13-R2

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.47	0.043
15.53	0.042
15.60	0.042
15.67	0.041
15.73	0.040
15.80	0.039

...End

Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

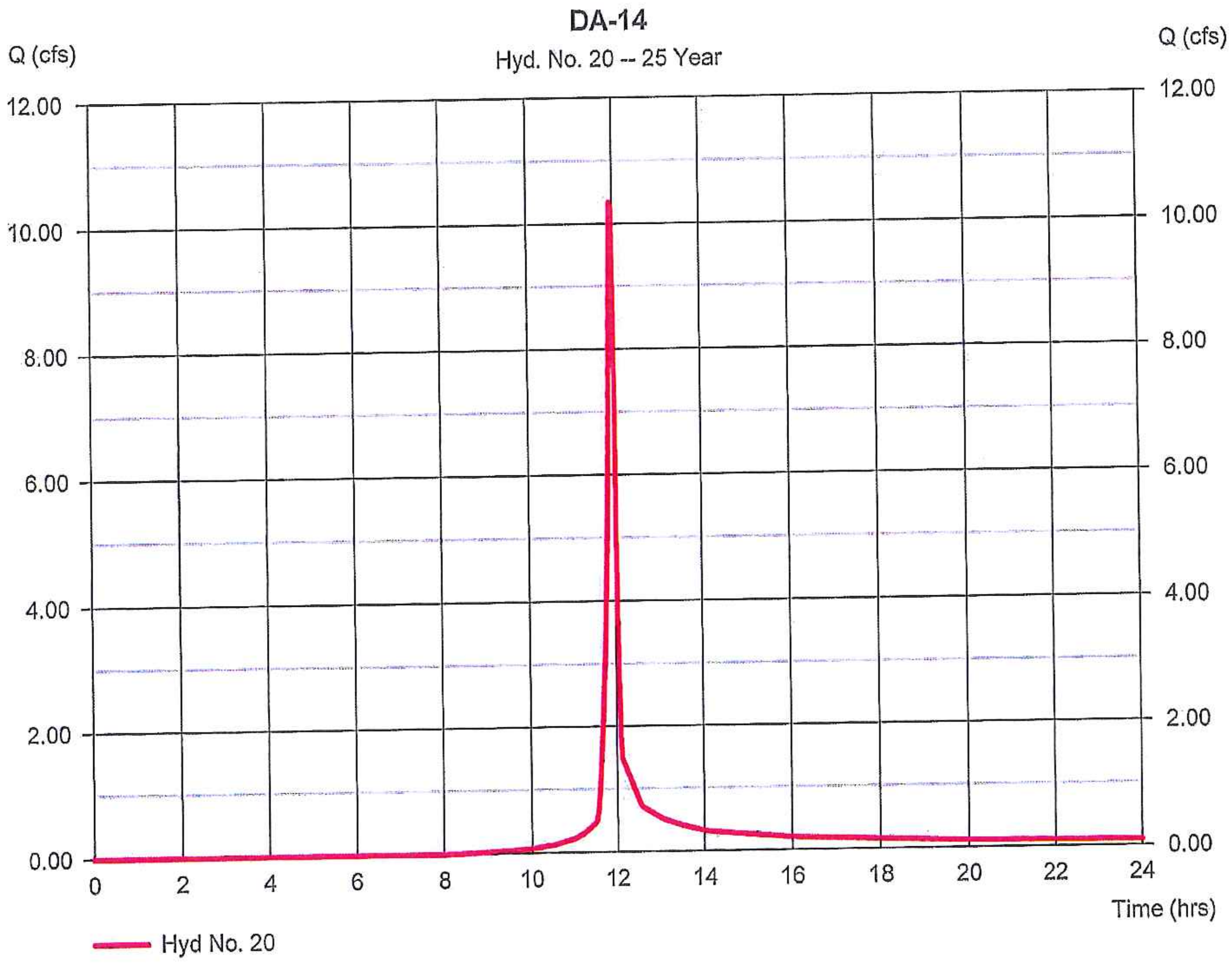
Monday, 05 / 13 / 2013

Hyd. No. 20

DA-14

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 2.560 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 4.53 in
Storm duration = 24 hrs

Peak discharge = 10.34 cfs
Time to peak = 11.93 hrs
Hyd. volume = 20,923 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.00 min
Distribution = Type II
Shape factor = 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 05 / 13 / 2013

Hyd. No. 20

DA-14

Hydrograph type	= SCS Runoff	Peak discharge	= 10.34 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 20,923 cuft
Drainage area	= 2.560 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.0 min
Total precip.	= 4.53 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)	Time -- (hrs	Outflow cfs)
10.93	0.211	12.07	2.901	13.27	0.473	14.47	0.299
11.00	0.227	12.13	1.496	13.33	0.458	14.53	0.295
11.07	0.246	12.20	1.379	13.40	0.442	14.60	0.291
11.13	0.274	12.27	1.264	13.47	0.427	14.67	0.287
11.20	0.306	12.33	1.145	13.53	0.412	14.73	0.283
11.27	0.340	12.40	1.025	13.60	0.399	14.80	0.279
11.33	0.376	12.47	0.903	13.67	0.388	14.87	0.276
11.40	0.415	12.53	0.784	13.73	0.377	14.93	0.272
11.47	0.455	12.60	0.715	13.80	0.365	15.00	0.268
11.53	0.531	12.67	0.685	13.87	0.354	15.07	0.264
11.60	0.970	12.73	0.657	13.93	0.343	15.13	0.260
11.67	1.771	12.80	0.630	14.00	0.332	15.20	0.256
11.73	2.761	12.87	0.602	14.07	0.323	15.27	0.252
11.80	4.161	12.93	0.574	14.13	0.318	15.33	0.248
11.87	6.963	13.00	0.545	14.20	0.314	15.40	0.244
<< 11.93	10.34	13.07	0.520	14.27	0.310	15.47	0.240
12.00	8.193	13.13	0.503	14.33	0.306	15.53	0.236
		13.20	0.488	14.40	0.302	15.60	0.232

Continues on next page

DA-14

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.67	0.228
15.73	0.224
15.80	0.220
15.87	0.216
15.93	0.212
16.00	0.208

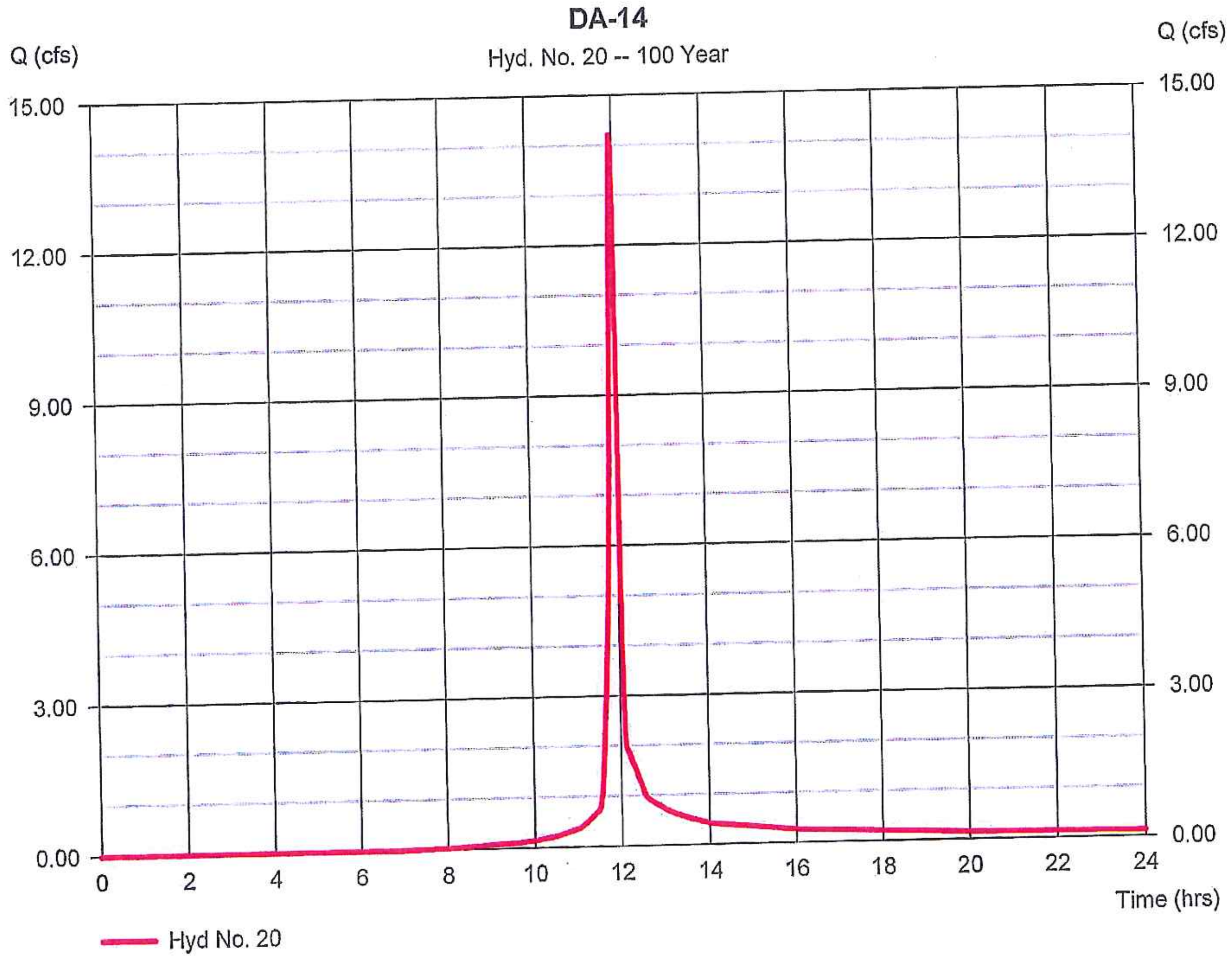
...End

Hydrograph Report

Hyd. No. 20

DA-14

Hydrograph type	= SCS Runoff	Peak discharge	= 14.21 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.93 hrs
Time interval	= 2 min	Hyd. volume	= 28,964 cuft
Drainage area	= 2.560 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 5.60 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Monday, 05 / 13 / 2013

Hyd. No. 20

DA-14

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 2.560 ac
Basin Slope = 0.0 %
Tc method = User
Total precip. = 5.60 in
Storm duration = 24 hrs

Peak discharge = 14.21 cfs
Time to peak = 11.93 hrs
Hyd. volume = 28,964 cuft
Curve number = 79
Hydraulic length = 0 ft
Time of conc. (Tc) = 5.0 min
Distribution = Type II
Shape factor = 484

Hydrograph Discharge Table

(Printed values >= 2.00% of Qp. Print interval = 2)

Time --	Outflow	Time --	Outflow	Time --	Outflow	Time --	Outflow
(hrs	cfs)	(hrs	cfs)	(hrs	cfs)	(hrs	cfs)
10.73	0.287	11.93	14.21	13.07	0.688	14.27	0.407
10.80	0.307	12.00	11.09	13.13	0.665	14.33	0.402
10.87	0.328	12.07	3.894	13.20	0.644	14.40	0.397
10.93	0.350	12.13	2.001	13.27	0.624	14.47	0.392
11.00	0.373	12.20	1.841	13.33	0.604	14.53	0.387
11.07	0.401	12.27	1.684	13.40	0.583	14.60	0.382
11.13	0.443	12.33	1.525	13.47	0.563	14.67	0.377
11.20	0.491	12.40	1.363	13.53	0.543	14.73	0.372
11.27	0.541	12.47	1.199	13.60	0.525	14.80	0.367
11.33	0.594	12.53	1.041	13.67	0.511	14.87	0.361
11.40	0.649	12.60	0.948	13.73	0.496	14.93	0.356
11.47	0.706	12.67	0.907	13.80	0.481	15.00	0.351
11.53	0.817	12.73	0.871	13.87	0.466	15.07	0.346
11.60	1.477	12.80	0.834	13.93	0.451	15.13	0.341
11.67	2.655	12.87	0.796	14.00	0.437	15.20	0.335
11.73	4.059	12.93	0.759	14.07	0.424	15.27	0.330
11.80	5.986	13.00	0.721	14.13	0.417	15.33	0.325
11.87	9.784			14.20	0.412	15.40	0.320

DA-14

Hydrograph Discharge Table

Time -- (hrs	Outflow cfs)
15.47	0.315
15.53	0.309
15.60	0.304
15.67	0.299
15.73	0.294
15.80	0.288

...End

APPPENDIX 4

CLOSURE/POST CLOSURE PLAN
GREENEVILLE/GREENE COUNTY
CLASS III LANDFILL

TABLE OF CONTENTS

TABLES:

CLOSURE/POST CLOSURE PLAN
GREENEVILLE/GREENE COUNTY
CLASS III LANDFILL

A4-1.0 GENERAL

1.1 PERFORMANCE

The operator, in accordance with Rule -0400-11-01-.04 (8), must close this facility in a manner that:

a) Minimizes the need for further maintenance;
b) Controls, minimizes, or eliminates, threats to the public health and environment.

1.2 POST CLOSURE PERIOD

In accordance with Rule -0400-11-01-.04 (8) (d), the operator must care for this facility parcel for a period of two (2) years after the date of final completion of closure.

Due to the inert nature of the waste material, threats to the environment are minimal. The two year period will ensure the final cover is stable and all vegetation is permanent. Drainage features will be stabilized in that time frame.

1.3 ADHERENCE TO PLAN

The operator must initiate and complete closure activities and conduct post-closure care activities in accordance with the approved C/PC plan.

1.4 EXPECTED YEAR OF CLOSURE

The closure date is imprecise based on the anticipated annual volume of waste. However, the best estimate is 46 years from opening. Therefore, the projected year of closing is Year 2042.

1.5 PLANNED USE

The landfill will remain in a condition of open, grass-covered space during and after the closure/post closure period. Access will remain controlled by fencing and natural barrier as it is in the present condition. No beneficial use is planned.

1.6 FACILITY CONTACT

Mayor W.T. DanielsTown of Greeneville
Telephone: 423-639-7105
Address: Greeneville Town Hall
200 North College Street
Greeneville, TN 37743

A4-2.0 FACILITY CLOSURE

2.1 PARTIAL CLOSURE

A. Notify the Division of Solid Waste Management at least sixty (60) days prior to closure of each operating area. The operator will complete closure activities including grading and establishing vegetative cover in the shortest practicable time, not to exceed 180 days after any fill areas or any portion of the fill area has achieved final grade.

B. Submit plan revisions necessary to close the landfill site or operating area. Plan revisions will address all changes necessary due to closing the site prior to the closure plans in Part B of this section. Plan revisions must be compatible with active or future active permit areas. At a minimum, such revisions shall include the following.

C. Provide any modification necessary to ensure adequate cover material on the top and sides of the active fill area. Grading necessary to provide permanent storm drainage runoff, to close or modify haul roads, and to establish long term uses or access to the property.

D. Establish permanent drainage features (channels, culverts, swales, berms) to ensure adequate erosion protection, protect fill areas and minimize off-site siltation.

E. Groundwater Sampling: Verify the construction of concrete pads around all well installations to prevent the intrusion of surface water and to provide adequate working space around each well. Also, provide for all-weather access to each monitoring well to be used for sampling.

F. Final soil cover will be placed over the covered waste prior to closure. Soils for final cover will come from the adjacent excavations, designated stockpiles, and approved on-site or off-site borrow areas.

The final cover shall be a minimum of 30-inches of compacted soil with a minimum of 12-inches which shall support vegetative cover.

G. Establish vegetative cover on closed portions of the landfill. The seeding, mulching, and fertilizing of all disturbed areas will be performed when final grade work is completed. This includes the completion of all construction outlined in Steps 2, 4, & 5.

H. All borrow areas and other disturbed areas (roads, temporary sediment control, ponds, etc.) shall be stabilized as part of the final grading. The primary road beds shall be stabilized to provide access to monitoring wells, inspection, and maintenance of the berms and covers.

Drainage features such as channels and sediment control measures shall be stabilized to permanent features. Temporary controls will be removed, permanent channels widened, cleaned, and eroded areas repaired.

I. Groundwater Monitoring System: A groundwater monitoring system will be in place at the landfill. Based on the performance of this system prior to closure, additional wells may have to be placed or existing wells removed from the monitoring program. This item will be reviewed with the Division at the time of closure. All wells shall have a concrete pad around the riser pipe and all-weather access shall be provided.

J. Certification: The landfill operator shall have a Division of Solid Waste Management representative and a Professional Engineer review all final construction for certification.

A4-3.0 FINAL CLOSURE

The Division of Solid Waste Management shall be notified at least 60 days prior to the anticipated closure date of the facility. The operator will complete closure activities including grading and establishing vegetative cover in the shortest practicable time, not to exceed 180 days after any fill areas or any portion of the fill area has achieved final grade.

A. Final Cover: The entire fill area including side slopes shall receive a final cover consisting of 18-inches of compacted low-permeability soil ($k=1.0 \times 10^{-5}$ cm/sec, maximum) with an additional minimum of 12-inches to support vegetative cover. Construction of the final cover shall be in accordance with the applicable provisions of the Construction Quality Assurance (CQA) Plan.

The first 18-inches of cover will be compacted to 98% Standard Proctor to establish a protective layer. For purposes of evaluating the field data, an average value of 98% standard proctor maximum dry density must be achieved on each lift with no single test in a given lift falling below 95% Standard Proctor maximum dry density. Compaction will be in 8-10 inch lifts using a sheepsfoot (or equivalent) roller (30,000 lb. static weight, minimum). The number of passes required will be based on field performance.

The top 12-inches shall be topsoil or soil amended by the addition of fertilizer and lime to be able to support vegetative growth. This layer shall be loosely compacted with the spreading equipment. In order to ensure a minimum of 12 inches thickness of the vegetative layer, the soil shall be placed approximately 2 inches thicker than the minimum, after loose compaction. Seeding and mulching or matting shall immediately follow soil placement.

B. Drainage System: The drainage system will be in operation the entire life of this facility. Routine inspection and maintenance should keep the channels, berms and ponds in good condition.

During closure activities, temporary structures in established areas shall be removed. These include check dams, silt fences and barriers. Pipes and rip-rap shall be inspected and replaced if necessary. If the inspections determine the necessity of corrective actions to alleviate erosion, the design changes shall be completed before completion of the work. All permanent channels shall be shaped to final section and grades. Permanent fixtures such as culverts, check dams, etc. shall be installed where indicated on the plans. This work must be coordinated with on-going active and/or future active fill operations.

C. Vegetative Cover: The vegetative cover shall be installed immediately after placement of vegetation support layer on all final cover. All disturbed areas including the drainage system shall be seeded as soon as practicable after construction. Any closed area disturbed by on-going construction must be repaired as soon as feasible.

Table A4-1 includes the seed mixture schedule for this facility. Groups 1, 2 and 3 are to be used on all completed areas depending on time of year unless noted otherwise. Group 4 shall be used on all completed slopes 4H:lV or steeper.

Groups 5, 6 and 7 shall be used for temporary seeding only. Conditions receiving temporary seeding include: winter season, temporary stockpiles, temporary berms or cut faces, temporary haul roads. Temporary shall mean a period of time not to exceed 180 days.

The operator may request changes in the seeding mixture or type of cover established as final development of the property is placed.

Fertilizers and liming will be in accordance with soil testing performed at the time of seeding. A copy of the soil test results shall be submitted to the Division of Solid Waste Management.

TABLE A4-1

SEEDING SCHEDULE

GROUP	SEEDING DATES	SEED	QUANTITY % BY WEIGHT
1	FEB. 1 – JUNE 1	KENTUCKY 31 FESCUE ENGLISH RYE KOREAN LESPEDEZA	80 5 15
2	JUNE 1 – AUG. 15	KENTUCKY 31 FESCUE ENGLISH RYE KOREAN LESPEDEZA GERMAN MILLET	55 20 15 10
3	AUG. 15 – DEC. 1	KENTUCKY 31 FESCUE ENGLISH RYE WHITE CLOVER	70 20 10
4	FEB. 1 – DEC. 1	CROWN VETCH KENTUCKY 31 FESCUE ENGLISH RYE	25 70 5
5	JAN. 1 – MAY 1	ITALIAN RYE KOREAN LESPEDEZA SUMMER OATS	33 33 34
6	MAY 1 – JULY 1	SUDAN-SORGHUM or STARR-MILLET	100
7	JULY 15 – JAN. 1	BALBOA RYE ITALIAN RYE	67 33

Notes:
1. Seed mixes in Groups 1 through 4 shall be applied at a rate of 200 lb. per acre
2. Seed mixes in Groups 5 through 7 shall be applied at a rate of 50 lb per acre when used as temporary seeding, and at a rate of 20 lb per acre when used as companion planting to Groups 1 through 4.

D. Closure Scheduling

Notify Division of Solid Waste Management 60 days prior to closure.

Review site with Division personnel and professional engineer.

Cease filling operations.	Day 1
Complete final cover .	Day 60
Complete installation of temporary sediment control.	Day 60
Complete seeding and mulching.	Day 75
Complete remedial grading and drainage work in closure plan.	Day 75
Interim inspection of closure activities.	Day 90
Notice in deed to property. Within 90 days of final closure and/or prior to sale or lease of the property, there will be recorded, a notation on the deed to the property, a notice that the land has been used as a disposal facility.	Day 90
Complete repairs of many items from interim inspection.	Day 100
Final inspection of closure activities.	Day 160
Complete final repairs, remove temporary erosion/ sediment control if stability is established.	Day180
Begin post closure care.	Day 180

A4-4.0 POST CLOSURE ACTIVITIES

4.1 GROUNDWATER MONITORING & MAINTENANCE

The compliance monitoring boundary shall be in accordance with Rule -0400-11-01-.04(7)(a)2ii. That is an imaginary boundary circumscribing the three waste management boundaries defined at this facility.

Groundwater sampling and monitoring shall continue to be performed in accordance with the Groundwater Monitoring Plan and any other documents which may be relevant.

The concrete pads around each well shall be maintained and kept repaired. Also, the access to all monitoring wells shall be maintained as all-weather access.

4.2 SURFACE WATERS

As part of the post closure activities, the operator will perform quarterly visual inspections of the facility for erosion and sedimentation for the first two (2) years. Subsequently, annual inspections will be held. The facility shall maintain the final contours, drainage system, and vegetative cover to meet the requirements of the regulations. Any degradation of these items will require immediate care to prevent siltation of the local streams or damage to the final cover. The monitoring points will be established in Moon Creek. One will be 50 feet above the spring being used as a sampling point. The second point shall be just prior to the creek going under the county road.

The surface water monitoring points shall be sampled for pH, specific conductivity, temperature, and turbidity.

The operator should also monitor off-site conditions to protect against changes to the surface run-off that could adversely affect this facility. No diversion or volume increase of off-site storm water flows should be allowed.

A4-5.0 POST CLOSURE PERIOD

The landfill has a proposed post-closure period of 2 years (minimum).

A4-6.0 POST CLOSURE CARE MAINTENANCE

The following post-closure maintenance activities must be performed at the landfill for the post-closure period. Any work to be performed will be done by the operator or an assigned contractor.

A. Perform a semi-annual assessment consisting of a site inspection, compilation of groundwater and surface water monitoring reports, and review of any complaints received.

B. Maintain approved final contours and drainage system.

Low areas will pond water thereby adding to leachate generation. All settled areas in a fill must be filled and a vegetative cover re-established.

Surface drainage must be maintained to prevent damage to slopes and to keep surface water away from fill areas. Any meandering of drainage channels should be corrected. Also, erosion of channels or silt accumulation shall be corrected.

Erosion of the berms of a landfill can expose covered waste and/or allow intrusion of surface water. Berm slopes must be kept free of erosion and a heavy vegetative cover established.

Care must be taken in performing corrective action on a fill area or the berms. The soils must be dry enough to support equipment without causing additional damage. A slope berm should be installed above corrected berm erosion. A drainage pipe (4"-6”) can temporarily be installed from the slope berm to a point below the repair work.

Closed portions of this landfill may be subject to disturbance from active and future active operations. The operator must minimize these disturbances; however, some will occur. Design of overlapping and adjacent fill areas require removal of temporary cover, channels, etc. The integrity of the in-place fills will be maintained by careful construction practices.

Ponds, channels, and other drainage/sediment control features will be maintained as part of active operations. When post closure requirements are more stringent as to testing, monitoring, and maintenance, then these requirements shall supersede normal active fill operations.

C. Maintain vegetative cover.

The primary protection of the berms and final cover is the vegetative cover. It is imperative that this cover be repaired if damaged or diseased. All previously described maintenance to the final contours and drainage system will require the re-establishment of vegetative cover.

D. Maintain groundwater monitoring system.

All test wells shall be maintained in a satisfactory manner to protect the integrity of water samples. This includes the piping and the grounds adjacent to the well. Access shall be preserved to the well sites.

E. Maintain sediment control pond

The sediment control pond will need to be cleaned of accumulated deposits in order to maintain capacity. The pond design allows for 60% of constructed capacity to be filled prior to cleaning. As shown on the pond details, a protective gravel layer is present and will be identifiable during excavation.

A4-7.0 CLOSURE AND POST-CLOSURE CARE COSTS

A. Closure Costs

The original estimate for the cost of closure construction was $78,351. That estimate has been updated annually for inflation as required by the financial assurance regulations.

The 2014 value of the original estimate is $203,362. To accommodate the anticipated extension of the life expectancy of the landfill and changes in material quantities needed for the revised closure grade, the closure construction estimate has been revised in current dollar figures).

B. Post-Closure Care Costs

Table A4-B presents the Post-Closure Care Cost estimate, based on the original estimate and inflated to the year 2014. The cost for the two-year post-closure period is $11,171.23.

INSERT COST ESTIMATE WORKSHEETS HERE