ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

SOLID WASTE DISPOSAL FACILITY *PERMIT*

PERMITTEE:	**Escambia County Environmental Corporation**
FACILITY NAME:	**Timberlands Sanitary Landfill**
FACILITY LOCATION:	**Sections 5 and 6, Township 3 North, Range 9 East, and located in Escambia County, Alabama. The total permitted area is approximately 246.23 acres with 134.33 acres approved for disposal.**
PERMIT NUMBER:	**27-08**
PERMIT TYPE:	**Municipal Solid Waste Landfill**
WASTE APPROVED FOR DISPOSAL:	**Non-hazardous, non-infectious, putrescible and non-putrescible wastes including but not limited to household garbage, industrial waste, construction and demolition debris, commercial waste, appliances, tires, trees, limbs, stumps, sludge, paper and other similar type materials. Special waste approved by ADEM may also be accepted.**
APPROVED WASTE VOLUME:	**Maximum Average Daily Volume of waste is 2500 tons per day**
APPROVED SERVICE AREA:	**Autauga, Baldwin, Butler, Choctaw, Clarke, Coffee, Conecuh, Covington, Crenshaw, Dale, Dallas, Elmore, Escambia, Geneva, Henry, Houston, Lowndes, Marengo, Mobile, Monroe, Montgomery, Perry, Pike, Washington, and Wilcox Counties in the State of Alabama; Bay, Escambia, Okaloosa, Santa Rosa, and Walton Counties in the State of Florida; George, Hancock, Harrison, Jackson, and Stone Counties in the State of Mississippi**

In accordance with and subject to the provisions of the Alabama Solid Wastes & Recyclable Materials Management Act, as amended, Code of Alabama 1975, §§ 22-27-1 to 22-27-27 ("SWRMMA"), the Alabama Environmental Management Act, as amended, Code of Alabama 1975, §§ 22-22A-1 to 22-22A-15, and rules and regulations adopted thereunder, and subject further to the conditions set forth in this permit, the Permittee is hereby authorized to dispose of the above-described solid wastes at the above-described facility location.

ISSUANCE DATE:	?????????????????
EFFECTIVE DATE:	?????????????????
EXPIRATION DATE:	?????????????????

Alabama Department of Environmental Management

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
SOLID WASTE PERMIT

Permittee:	Escambia County Environmental Corporation P. O. Box 899 Greenville, Alabama 36037
Landfill Name:	Timberlands Sanitary Landfill
Landfill Location:	Sections 5 and 6, Township 3 North, Range 9 East on Highway 41 in Escambia County, Alabama
Permit Number:	27-08
Landfill Type:	Municipal Solid Waste

Pursuant to the Alabama Solid Wastes and Recyclable Materials Management Act, Code of Alabama 1975, §§ 22-27-1, *et seq*., as amended, and attendant regulations promulgated thereunder by the Alabama Department of Environmental Management (ADEM), this permit is issued to Escambia County Environmental Corporation (hereinafter called the Permittee), to operate a solid waste disposal facility, known as the Timberlands Sanitary Landfill.

The Permittee must comply with all terms and conditions of this permit. This permit consists of the conditions set forth herein (including those in any attachments), and the applicable regulations contained in Chapters 335-13-1 through 335-13-16 of the ADEM Administrative Code (hereinafter referred to as the "ADEM Admin. Code"). Rules cited are set forth in this document for the purpose of Permittee reference. Any Rule that is cited incorrectly in this document does not constitute grounds for noncompliance on the part of the Permittee. Applicable ADEM Administrative Codes are those that are in effect on the date of issuance of this permit or any revisions approved after permit issuance.

This permit is based on the information submitted to the Department on March 19, 2019, for permit renewal and modification and known as the Permit Application, and as amended, (hereby incorporated by reference and hereinafter referred to as the Application). Any inaccuracies found in this information could lead to the termination or modification of this permit and potential enforcement action. The Permittee must inform the Department of any deviation from or changes in the information in the Application that would affect the Permittee's ability to comply with the applicable ADEM Admin. Code or permit conditions.

This permit is effective as of ??????????????????, and shall remain in effect until ????????????????, unless suspended or revoked.

____
Alabama Department of Environmental Management

____
Date Signed

SECTION I. STANDARD CONDITIONS.

A. Effect of Permit

The Permittee is allowed to dispose of nonhazardous solid waste in accordance with the conditions of this permit and ADEM Admin. Code Div. 13. Issuance of this permit does not convey property rights of any sort or an exclusive privilege, nor does it authorize the injury to persons or property, the invasion of other private rights, or the infringement of state or local laws or regulations. Except for actions brought under Code of Alabama 1975, §§22-27-1, *et seq*., as amended, compliance with the conditions of this permit shall be deemed to be compliance with applicable requirements in effect as of the date of issuance of this permit and future revisions.

B. Permit Actions

This permit may be suspended, revoked or modified for cause. The filing of a request for a permit modification or the notification of planned changes or anticipated noncompliance on the part of the Permittee, and the suspension or revocation does not stay the applicability or enforceability of permit condition.

C. Severability

The provisions of this permit are severable, and if a provision of this permit, or the application of a provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

D. Definitions

For the purpose of this permit, terms used herein shall have the same meaning as those in ADEM Admin. Code Div. 13, unless this permit specifically provides otherwise; where terms are not otherwise defined, the meaning associated with such terms shall be as defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

1. "EPA" means the United States Environmental Protection Agency.

2. "Permit Application" means all permit application forms, design plans, operational plans, closure plans, technical data, reports, specifications, plats, geological and hydrological reports, and other materials which are submitted to the Department in pursuit of a solid waste disposal permit.

E. Duties and Requirements

1. Duty to Comply

The Permittee must comply with all conditions of this permit except to the extent and for the duration such noncompliance is authorized by a variance granted by the Department. A permit noncompliance, other than noncompliance authorized by a variance, constitutes a violation of Code of Alabama 1975, §§22-27-1 et seq., as amended, and is grounds for enforcement action, permit suspension, revocation, modification, and/or denial of a permit renewal application.

2. Duty to Reapply

If the Permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the Permittee must apply for and obtain a new permit. The renewal application must be submitted to the Department at least 180 days before this permit expires.

3. Permit Expiration

This permit and all conditions therein will remain in effect beyond the permit's expiration date if the Permittee has submitted a timely, complete application as required by Section I.E.2., and, through no fault of the Permittee, the Department has not made a final decision regarding the renewal application.

4. Need to Halt or Reduce Activity Not A Defense

It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity to maintain compliance with the conditions of this permit.

5. Duty to Mitigate

In the event of noncompliance with this permit, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment.

6. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of control (and related appurtenances) that are installed or used by the Permittee to achieve compliance with the conditions of this permit.

7. Duty to Provide Information

If requested, the Permittee shall furnish to the Department, within a reasonable time, the information that the Department may reasonably need to determine whether cause exists for denying, suspending, revoking, or modifying this permit, or to determine compliance with this permit. If requested, the Permittee shall also furnish the Department with copies of records kept as a requirement of this permit.

8. Inspection and Entry

Upon presentation of credentials and other documents as may be required by law, the Permittee shall allow the employees of the Department or their authorized representative to:

a. Enter at reasonable times the Permittee's premises where the regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit.

b. Have access to and copy, at reasonable times, the records that must be kept under the conditions of this permit.

c. Inspect, at reasonable times, the facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit.

d. Sample or monitor, at reasonable times, the substances or parameters at a location for the purposes of assuring permit compliance or as otherwise authorized by Code of Alabama 1975, §§22-27-1 *et seq*.

9. Monitoring, Corrective Actions, and Records

a. Samples and measurements taken for the purpose of monitoring or corrective action shall be representative of the monitored activity. The methods used to obtain representative samples to be analyzed must be the appropriate method from Chapter 335-13-4 or the methods as specified in the Application attached hereto and incorporated by reference. Laboratory methods must be those specified in Standard Methods for the Examination of Water and Wastewater (American Public Health Association, latest edition), Methods for Chemical Analysis of Water and Wastes

(EPA-600/4-79-020), Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA Publication SW-846, latest edition), other appropriate EPA methods, or as specified in the Application. All field tests must be conducted using approved EPA test kits and procedures.

b. The Permittee shall retain records, at the location specified in Section I.I., of all monitoring, or corrective action information, including all calibration and maintenance records, copies of all reports and records required by this permit, and records of all data used to complete the application for this permit for a period of at least three years from the date of the sample, measurement, report or record or for periods elsewhere specified in this permit. These periods may be extended by the request of the Department at any time and are automatically extended during the course of an unresolved enforcement action regarding this facility.

c. Records of monitoring and corrective action information shall include.

    i. The exact place, date, and time of sampling or measurement.

    ii. The individual(s) and company who performed the sampling or measurements.

    iii. The date(s) analyses were performed.

    iv. The individual(s) and company who performed the analyses.

    v. The analytical techniques or methods used.

    vi. The results of such analyses.

d. The Permittee shall submit all monitoring and corrective action results at the interval specified elsewhere in this permit.

10. Reporting Planned Changes

The Permittee shall notify the Department, in the form of a request for permit modification, at least 90 days prior to a change in the permitted service area, increase in the waste received, or change in the design or operating procedure as described in this permit, including planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

11. Transfer of Permit

This permit may be transferred to a new owner or operator. All requests for transfer of permits shall be in writing and shall be submitted on forms provided by the Department. Before transferring ownership or operation of the facility during its operating life, the Permittee shall notify the new owner or operator in writing of the requirements of this permit.

12. Certification of Construction

The Permittee may not commence disposal of waste in a new cell or phase until the Permittee has submitted to the Department, by certified mail or hand delivery, a letter signed by both the Permittee and a professional engineer certifying that the facility has been constructed in compliance with the permit. The Department must inspect the constructed cells or phases before the owner or operator can commence waste disposal unless the Permittee is notified that the Department will waive the inspection.

13. Compliance Schedules

Reports of compliance or noncompliance with or progress reports on interim and final requirements contained in a compliance schedule required and approved by the Department shall be submitted no later than 14 days following each schedule date.

14. Other Noncompliance

The Permittee shall report all instances of noncompliance with the permit at the time monitoring reports are submitted.

15. Other Information

If the Permittee becomes aware that information required by the Application was not submitted or was incorrect in the Application or in a report to the Department, the Permittee shall promptly submit such facts or information. In addition, upon request, the Permittee shall furnish to the Department, within a reasonable time, information related to compliance with the permit.

F. Design and Operation of Facility

The Permittee shall maintain and operate the facility to minimize the possibility of a fire, explosion, or an unplanned sudden or nonsudden release of contaminants (including leachate and explosive gases) to air, soil, groundwater, or surface water, which could threaten human health or the environment.

G. Inspection Requirements

1. The Permittee shall comply with all requirements set forth under ADEM Admin. Code Div. 13.

2. The Permittee shall conduct random inspections of incoming loads.

3. Records of all inspections shall be included in the operating record.

H. Recordkeeping and Reporting

1. The Permittee shall maintain a written operating record at the location specified in Section I.I. The operating record shall include:

    a. Documentation of inspection and maintenance activities.

    b. Daily Volume reports.

    c. Personnel training documents and records.

    d. Solid/Hazardous Waste Determination Forms for Industrial Wastes, and the associated Department disposal approval correspondence for special wastes, industrial wastes, etc.

    e. Groundwater monitoring records.

    f. Explosive gas monitoring records.

    g. Surface water and leachate monitoring records. Monitoring is subject to applicable conditions of Section VII. of the permit.

    h. Copies of this Permit and the Application.

i. Copies of all variances granted by the Department, including copies of all approvals of special operating conditions (such as approvals for open burning,).

2. Quarterly Volume Report

Beginning with the effective date of this permit, the Permittee shall submit, within thirty (30) days after the end of each calendar quarter, a report summarizing the daily waste receipts for the previous (just ended) quarter. Copies of the quarterly reports shall be maintained in the operating record.

3. Monitoring and Corrective Action Reports

The Permittee shall submit reports on all monitoring and corrective activities conducted pursuant to the requirements of this permit, including, but not limited to, groundwater, surface water, explosive gas and leachate monitoring. The groundwater monitoring shall be conducted in March and September of each year and the reports shall be submitted at least semi-annually. The reports should contain all monitoring results and conclusions from samples and measurements conducted during the sampling period. Explosive gas monitoring must be submitted on a quarterly basis, and the reports should be submitted to the Department and placed in the operating record within 30 days of the monitoring event. Copies of the semi-annual groundwater and quarterly explosive gas monitoring reports shall be maintained in the operating record.

4. Availability, Retention, and Disposition of Records

a. All records, including plans, required under this permit or ADEM Admin. Code Div. 13 must be furnished upon request, and made available at reasonable times for inspection by an officer, employee, or representative of the Department.

b. All records, including plans, required under this permit or ADEM Admin. Code Div. 13 shall be retained by the Permittee for a period of at least three years. The retention period for all records is extended automatically during the course of an unresolved enforcement action regarding the facility, or as requested by the Department.

c. A copy of records of waste disposal locations and quantities must be submitted to the Department and local land authority upon closure of the facility.

I. Documents to be Maintained by the Permittee

The Permittee shall maintain, at the landfill, the following documents and amendments, revisions and modifications to these documents until an engineer certifies closure.

1. Operating record.

2. Closure Plan.

J. Mailing Location

All reports, notifications, or other submissions which are required by this permit should be sent via signed mail (i.e. certified mail, express mail delivery service, etc.) or hand delivered to:

1. Mailing Address

Chief, Solid Waste Branch
Alabama Department of Environmental Management
P.O. Box 301463
Montgomery, AL 36130-1463

2. Physical Address

Chief, Solid Waste Branch
Alabama Department of Environmental Management
1400 Coliseum Blvd.
Montgomery, Alabama 36110-2400

K. Signatory Requirement

All applications, reports or information required by this permit, or otherwise submitted to the Department, shall be signed and certified by the owner as follows:

1. If an individual, by the applicant.

2. If a city, county, or other municipality or governmental entity, by the ranking elected official, or by a duly authorized representative of that person.

3. If a corporation, organization, or other legal entity, by a principal executive officer, of at least the level of Vice President, or by a duly authorized representative of that person.

L. Confidential Information

The Permittee may claim information submitted as confidential if the information is protected as per Rule 335-1-1-.06(2).

M. State Laws and Regulations

Nothing in this permit shall be construed to preclude the initiation of a legal action or to relieve the Permittee from the responsibilities, liabilities, or penalties established pursuant to an applicable state law or regulation.

SECTION II. GENERAL OPERATING CONDITIONS.

A. Operation of Facility

The Permittee shall operate and maintain the disposal facility consistent with the Application, this permit, and ADEM Admin. Code Div. 13.

B. Open Burning

The Permittee shall not allow open burning without prior written approval from the Department and other appropriate agencies. A burn request should be submitted in writing to the Department outlining why that burn request should be granted. This request should include, but not be limited to, specifically what areas will be utilized, types of waste to be burned, the projected starting and completion dates for the project, and the projected days and hours of operation. The approval, if granted, shall be included in the operating record.

C. Prevention of Unauthorized Disposal

The Permittee shall follow the approved procedures for the detecting and preventing the disposal of free liquids, regulated hazardous waste, PCB's, and medical waste at the facility.

D. Unauthorized Discharge

The Permittee shall operate the disposal facility in such a manner that there will be no water pollution or unauthorized discharge. A discharge from the disposal facility or practice thereof may require a National Pollutant Discharge Elimination System permit under the Alabama Water Pollution Control Act.

E. Industrial and Medical Waste Disposal

The Permittee shall dispose of industrial process waste as required by ADEM Admin. Code Div. 13. The Permittee, prior to disposal of industrial waste and/or medical waste, shall obtain from each generator a written certification that the material to be disposed does not contain free liquids, regulated hazardous wastes, regulated medical waste, or regulated PCB wastes and as per Rule 335-13-4-.21 (c). All the additional requirements listed in the Rule should also need to be addressed by the permittee.

F. Boundary Markers

The Permittee shall ensure that the facility is identified with a sufficient number of permanent boundary markers that are at least visible from one marker to the next.

G. Certified Operator

The Permittee shall be required to have an operator certified by the Department on-site during hours of operation, in accordance with the requirements of ADEM Admin. Code 335-13-12.

SECTION III. SPECIFIC MSW LANDFILL REQUIREMENTS.

A. Waste Identification and Management

1. Subject to the terms of this permit, the Permittee may dispose of the nonhazardous solid wastes listed in Section III.B. Disposal of other waste streams is prohibited, except waste that is granted a temporary or one-time waiver by the Director.

2. The permitted facility boundary for the Timberlands Sanitary Landfill is approximately 246.23 acres, with a solid waste boundary for the municipal solid waste disposal area of 134.33 acres.

3. The maximum average daily volume of waste disposed at the facility, as contained in the permit application and approved by the Escambia County Commission, shall not exceed 2500 tons per day. Should the average daily volume exceed for two or more consecutive reporting quarters this value by 20% or 100 tons/day, whichever is less, the permittee shall be required to modify the permit in accordance with Rule 335-13-5-.06(2)(a)5. An increase in maximum average daily volume shall not be approved by the Department unless the permittee has received local approval for the increased maximum average daily volume. The average daily volume shall be computed as specified by Rule 335-13-5-.06(2)(a)5.(i).

B. Waste Streams

The Permittee may accept for disposal nonhazardous solid wastes, noninfectious putrescible and nonputrescible wastes including but not limited to household garbage, industrial waste, construction and demolition debris, commercial waste, appliances, tires, trees, limbs, stumps, sludge, paper and other similar type materials. Special waste approved by the Department may also be accepted.

C. Service Area

The service area for this landfill, as contained in the permit application and approved by the Escambia County Commission, is Autauga, Baldwin, Butler, Choctaw, Clarke, Coffee, Conecuh, Covington, Crenshaw, Dale, Dallas, Elmore, Escambia, Geneva, Henry, Houston, Lowndes, Marengo, Mobile, Monroe, Montgomery, Perry, Pike, Washington and Wilcox Counties in the State of Alabama; Bay, Escambia, Okaloosa, Santa Rosa, and Walton Counties in the State of Florida; Jackson, George, Harrison, Stone and Hancock Counties in the State of Mississippi.

D. Special Waste

The Permittee may dispose of special wastes in accordance with ADEM Admin. Code Div. 13.

1. Asbestos Waste. The Permittee shall dispose of asbestos waste in accordance with Rule 335-13-4-.26.

2. Foundry Sand. The Permittee shall dispose of foundry waste in accordance with Rule 335-13-4-.26.

3. Petroleum Contaminated Waste. The Permittee shall dispose of petroleum contaminated waste in accordance with Rule 335-13-4-.26.

4. Municipal Solid Waste Ash. The Permittee shall dispose of municipal solid waste ash in accordance with Rule 335-13-4-.26.

E. Liner Requirements

The Permittee shall install a composite liner system for the municipal solid waste disposal area as described in the Application. The Permittee shall be required to construct either option 1 liner section or option 2 liner sections. Option 1 liner section shall consist of a two foot compacted clay liner with a permeability of $1x10^{-7}$ cm/sec overlain with a 60 mil HDPE geomembrane liner. Option 2 liner sections shall consist of 1 foot of compacted clay with a permeability of $1x10^{-5}$ cm/sec overlain with geosynthetic clay liner overlain with a 60 mil HDPE geomembrane liner. The Permittee shall be required to construct either option 1 drainage/protective soil layer or option 2 drainage/protective soil layers. Option 1 drainage/protective layer shall consist of one foot drainage layer with a permeability of $2x10^{-2}$ cm/sec overlain with a protective soil cover with a permeability of $1x10^{-4}$. Option 2 drainage/protective soil layer consists of a geocomposite drainage layer overlain with 1 foot drainage/protective soil layer with a permeability of $1x10^{-4}$ cm/sec. The Permittee shall be required to notify the department in writing which options will be utilized during construction. The base of the composite liner system shall be a minimum of five (5) feet above the temporal fluctuation of the groundwater table.

The Permittee was granted approval for the revised base grade plan, for cells 7, 8, 9 and 10 of the landfill. The revised base grade plan is depicted on sheet M-4 of the application for the major modification submitted on April 28, 2006. As part of the modification the permittee is required to install a new groundwater monitoring well at due south of former boring B-5.

The Permittee is allowed to use on-site protective cover soils in the place of sand on the base liner side slopes only. The on-site protective cover soil will be placed directly over the geocomposite.

F Septic Tank Pumpings and Sewage Sludge

The Permittee shall not dispose of septic tank pumpings and/or sewage sludge unless specifically approved in writing by the Department.

G. Large Dead Animals and Highly Putrescible Wastes

The Permittee shall handle the disposal of large dead animals and/or highly putrescible waste as required by Rule 335-13-4-.22(1)(j). Disposal is allowed only in the municipal solid waste disposal area.

H. Cover Requirements

The Permittee shall cover all wastes as required by ADEM Admin. Code Div. 13. Alternate Daily Cover (ADC) consisting of shredder fluff and contaminated soils is approved for use. The ADC shall pass the paint filter test, be non-hazardous and receive the Department's approval for disposal prior to acceptance. If an ADC is being used, the Permittee shall be required to cover each Friday with a minimum of six inches of compacted soil.

I. Waste Compaction

All waste shall be thoroughly compacted with adequate landfill equipment before the daily or weekly cover is applied. A completed daily cell shall not exceed eight feet in vertical thickness measured perpendicular to the slope of the preceding cell. A completed daily cell is allowed to be 15 feet in vertical thickness. (See Section X.2.)

J. Daily Cells

All waste shall be confined to an area as small as possible and spread to a depth not exceeding two feet prior to compaction, and such compaction shall be accomplished on a face slope not to exceed 4 to 1or as otherwise approved by the Department.

K. Security

The Permittee shall provide artificial and/or natural barriers, which prevent entry of unauthorized vehicular traffic to the facility.

L. All Weather Access Roads

The Permittee shall provide an all-weather access road to the dumping face that is wide enough to allow passage of collection vehicles.

M. Adverse Weather Disposal

The Permittee shall provide for disposal activities in adverse weather conditions.

N. Personnel

The Permittee shall maintain adequate personnel to ensure continued and smooth operation of the facility.

O. Equipment

The Permittee shall provide the landfill equipment as required by Rule 335-13-4-.22(1)(f).

P. Environmental Monitoring and Treatment Structures

The Permittee shall provide protection and proper maintenance of environmental monitoring and treatment structures.

Q. Vector Control

The Permittee shall provide for vector control as required by ADEM Admin. Code Div. 13.

R. Bulk or Noncontainerized Liquid Waste

The Permittee shall not dispose of bulk or noncontainerized liquid waste, or containers capable of holding liquids, unless the conditions of Rule 335-13-4-.22(1)(k) are met.

S. Empty Containers

The Permittee shall render empty containers larger than normally found in household waste unsuitable for holding liquids prior to delivery to the landfill unit unless otherwise approved by the Department.

T. Other Requirements

The Department may enhance or reduce the requirements for operating and maintaining the landfill as deemed necessary by the Land Division.

U. Other Permits

The Permittee shall operate the landfill according to this and other applicable permits.

V. Scavenging and Salvaging Operations

The Permittee shall prevent scavenging and salvaging operations, except as part of a controlled recycling effort.

W. Signs

The Permittee shall provide a sign outlining instructions for use of the site. The sign shall be posted and have the information required by Rule 335-13-4-.22(1)(i).

X. Litter Control

The Permittee shall control litter.

Y. Fire Control

The Permittee shall provide fire control measures.

SECTION IV. GROUNDWATER MONITORING REQUIREMENTS.

A. The Permittee shall install and/or maintain a groundwater monitoring system, as specified below.

1. The permittee shall maintain the groundwater monitoring wells and piezometers identified in Table 1 at the locations specified in the Application, and any other groundwater monitoring wells which are added during the active life and the post closure care period.

2. The Permittee shall maintain groundwater monitoring well UGW-1 as the background groundwater monitoring well for the entire facility.

3. The Permittee shall install and maintain additional groundwater monitoring wells as necessary to assess changes in the rate and extent of a plume of contamination or as otherwise deemed necessary to maintain compliance with the ADEM Admin. Code Div. 13.

4. Prior to installing additional groundwater monitoring wells, the Permittee shall submit a report to the Department with a permit modification request specifying the design, location and installation of additional monitoring wells. This report shall be submitted within ninety (90) days prior to the installation which, at a minimum, shall include.

    a. Well construction techniques including proposed casing depths, proposed total depth, and proposed screened interval of well(s);

    b. Well development method(s);

    c. A complete analysis of well construction materials;

    d. A schedule of implementation for construction; and

e. Provisions for determining the lithologic characteristics, hydraulic conductivity and grain-size distribution for the applicable aquifer unit(s) at the location of the new well(s).

5. The Permittee is approved for inter-well method for statistical analysis.

B. Groundwater Monitoring Requirements

1. The Permittee shall determine the groundwater surface elevation at each monitoring well and piezometer identified in Table 1 each time the well or piezometer is sampled and at least semi-annually throughout the active life and post-closure care period.

2. The Permittee shall determine the groundwater flow rate and direction in the first zone of saturation at least annually or each time groundwater is sampled and submit as required by ADEM Admin. Code Div. 13.

3. Prior to the initial receipt of waste at the facility, the Permittee shall sample, and analyze for the parameters listed in Appendix I of Chapter 335-13-4-.27, in all monitoring wells identified in Section IV.A.2. to establish background water quality and/or as directed by Rules 335-13-4-.27(2)(j) and 335-13-4-.27(2)(a)(1). The records and results of this sampling and analysis activity shall be submitted to the Department, within sixty (60) days of the date of sampling.

4. The Permittee shall sample, and analyze all monitoring wells identified in Table 1 for the parameters listed in Appendix I of Chapter 335-13-4-.27(3), on a semi-annual basis throughout the active life of the facility and the post-closure care period in accordance with Chapter 335-13-4-.27(3). Sampling shall be conducted during March and September of each year, beginning with the effective date of this permit. The records and results of this sampling and analysis activity shall be submitted to the Department, within ninety (90) days of the date of sampling. **Groundwater monitoring shall be conducted according to the groundwater monitoring plan submitted June 17, 2020.**

5. In addition to the requirements of Sections IV., B.1., B.2., B.3. and B.4., the Permittee shall record water levels, mean sea level elevation measuring point, depth to water, and the results of field tests for pH and specific conductance at the time of sampling for each well.

C. Sampling and Analysis Procedures

The Permittee shall use the following techniques and procedures when obtaining and analyzing samples from the groundwater monitoring wells described in Section IV.A. to provide a reliable indication of the quality of the groundwater.

1. Samples shall be collected, preserved, and shipped (when shipped off-site for analysis) in accordance with the procedures specified in the Application. Monitoring wells shall be bailed, pumped or micro-purged in accordance with the approved GWSAP to remove an adequate quantity of well water to allow sampling. Slow recharge wells shall be bailed until dry. Wells shall be allowed to recharge prior to sampling.

2. Samples shall be analyzed according to the procedures specified of the Application, Standard Methods for the Examination of Water and Wastewater (American Public Health Association, latest edition), Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA Publication SW-846, latest edition), or other appropriate methods approved by this Department. All field tests must be conducted using approved EPA test kits and procedures.

3. Samples shall be tracked and controlled using the chain-of-custody and QA/QC procedures specified of the Application.

D. Recordkeeping and Reporting Requirements

1. Recording of Results

For each sample and/or measurement taken pursuant to the requirements of this permit, the Permittee shall record the information required by Section I.E.9.c.

2. Recordkeeping

Records and results of all groundwater monitoring, sampling, and analysis activities conducted pursuant to the requirements of this permit shall be included in the operating record required by Section I.I.1.

E. Permit Modification

If the Permittee or the Department determines that the groundwater monitoring system no longer satisfies the requirements of Rule 335-13-4-.14 or Section IV.A. of this permit, the Permittee must, within 90 days, submit an application for a permit modification to make necessary and/or appropriate changes to the system.

TABLE 1
GROUNDWATER MONITORING WELLS.

Monitoring Well Number	Top of Casing (feet msl)	Part Monitoring
UGW-1	234.38	Cells 1 thru 10
GW-4	232.52	Cells 1 thru 6
GW-5	217.21	Cells 1 thru 6
GW-6	222.00	Cells 1 thru 6
GW-7	214.60	Cells 1 thru 6
GW-8	215.76	Cells 1 thru 6
GW-1	224.47	Cells 7 thru 10B
GW-2	291.91	Cells 7 thru 10B
GW-3	313.06	Cells 7 thru 10B
GW-9	234.85	Cells 7 thru 10B
GW-10	232.33	Cells 7 thru 10B

SECTION V. GAS MONITORING REQUIREMENTS.

A. The permittee shall design, construct, and operate the facility so as to control and monitor the generation and emission of explosive gases (such as methane), and so as to prevent said gases from collecting in, or around structures at concentrations exceeding the limits imposed by this permit.

B. Systems and Equipment

The Permittee shall provide, install, and maintain gas monitoring and/or recovery systems and equipment.

C. Concentration Limits

The Permittee shall prevent explosive gases from exceeding:

1. The lower explosive limit at the facility boundary.

2. Twenty-five percent (25%) of the lower explosive limit in a facility structure other than those which are components of the gas control and/or recovery system.

D. Explosive Gas Monitoring

1. The Permittee shall monitor explosive gases at the facility. The gas monitoring program shall monitor explosive gas concentrations in the atmosphere, in the soil, and inside all structures at the facility, including but not limited to buildings, under bridges, and at other locations which are conducive to gas accumulation. Gas monitoring data shall be included in the operating record and be made available to the Department during inspections and at other times upon request.

2. The Permittee shall conduct the gas monitoring at least once in each quarter. The Permittee shall submit a report to the Department within thirty (30) days after each monitoring event documenting the levels of explosive gases measured at the facility.

3. In the event that explosive gas levels exceed the limits specified in this permit, the Permittee shall:

   a. Immediately take all necessary steps to ensure immediate protection of human health and property.

   b. Immediately notify the Department of the explosive gas levels detected and the immediate steps taken to protect human health and property.

   c. Within twenty (20) days, submit to the Department for approval a remedial plan for the explosive gas releases. This plan shall describe the nature and extent of the problem and the proposed remedy. The plan shall be implemented upon approval by the Department, but within sixty (60) days of detection. Within the sixty (60) days the plan shall be placed in the operating record of the facility and the Department notified that the plan has been implemented.

4. Monitoring points for the measurement of explosive gas concentrations in the soil and/or atmosphere shall be located along the landfill boundaries and shall be spaced no more than 300 feet apart. In areas where the landfill boundary is within 1000 feet of a structure, the monitoring points shall be not more than 100 feet apart.

SECTION VI. MUNICIPAL SOLID WASTE LANDFILL AIR EMISSIONS.

This landfill may be subject to ADEM Admin. Code Division 3 and the Federal Clean Air Act. Contact the ADEM Air Division for applicable requirements and permits.

SECTION VII. LEACHATE AND SURFACE WATER MANAGEMENT REQUIREMENTS.

The Permittee must collect and dispose of the leachate that is generated at the facility, and the leachate must be recirculated into the landfill through injection or onto the working face and intermediate cover of the landfill surface so as not to run-off, or managed at a facility permitted to treat leachate. The Permittee shall install a leachate collection system designed to maintain less than 12 inches (30 cm) depth of leachate over the liner.

Timberland Landfill is permitted to construct and operate an on-site biological leachate treatment system. The on-site leachate treatment system is consisting of a series of constructed wetlands. The constructed wetlands will utilize both a horizontal surface flow wetland system and two parallel vertical flow wetland biofilter system (WBS) units, all of which will be double-lined with a 30 mil PVC primary liner underlain with geo composite and 60 mil HDPE geomembrane or with geo composite between two 60 mil HDPE geomembranes.

The treated leachate will be either: (i) discharged to a nearby stream; or (ii) returned to an existing on-site leachate storage tanks if the effluent does not meet discharge standards. The discharge of the treated leachate from the constructed wetland is monitored through the NPDES permit issued by ADEM’s Industrial Water Section.

Timberland Landfill is also permitted to simplify the piping layout in Cell No. 9 to maximize the volume of leachate that can be treated using the constructed wetlands. The leachate collecting pipes in Cell 10 and other future cells, the leachate collection stone shall be sized such that no more than 5% of the stones are smaller than 3/8 of an inch and no more than 5% of the stones are larger than 2 inches in the longest direction with 0% larger than 3 inches. Further, gravel for this work shall consist of hard, strong, durable, non-carbonate particles which are free of any metals, roots, trees, stumps, concrete, construction debris, other organic matter, deleterious materials or coatings. The stone shall be rounded and shall exhibit less than 15% carbonate content by weight when tested according to ASTM D 3042 (or later revision thereof). In the event that crushed or angular stone is utilized, an additional layer of geotextile shall cushion the stone if a geocomposite is not present immediately under the leachate collection corridor.

If Timberland Landfill is required to transport leachate to offsite prior to initial disposal, the permittee shall provide the Department with a letter from the receiving publicly or privately owned treatment works, approving the acceptance of the leachate. Discharges to publicly or privately owned treatment works may be subject to the requirements of the ADEM Water Division's State Indirect Discharge (SID) Program. The permittee shall construct and maintain run-on and run-off control structures. Surface water discharges from drainage control structures shall be permitted through the ADEM Water Division's National Pollutant Discharge Elimination System (NPDES) Program.

The Permittee has reconfigured Pond 3B to facilitate the construction of the pond without relocating the existing landfill gas flare station. The reconfigured design will discharge to the same tributary as did the previous design. The Permittee has redesigned Pond 5 to size the outlet structure to eliminate the need for re-routing the tributary into which the pond discharges. The reconfigured design will discharge into the same tributary as did the previous design, and avoids disturbance of 380 linear feet of the tributary that is currently permitted.

The Permittee revised the Leachate Collection Plan to dedicate an area onsite for 2 additional leachate storage tanks to be constructed in the future. The location of the additional leachate storage tanks will be in the currently permitted leachate tank storage area.

SECTION VIII. CLOSURE AND POST- CLOSURE REQUIREMENTS.

The Permittee shall close the landfill and perform post-closure care of the landfill in accordance with ADEM Admin. Code Div. 13.

A. Final Cover

The landfill shall be closed in accordance with the approved application and ADEM Admin. Code Div. 13. The final cover shall consist of 18 inch thick layer of cohesive clay soil with a hydraulic conductivity of 1×10^{-5} cm/sec or less, 40 mil LLDPE textured geomembrane, geotextile filter fabric, 12 inch sand layer and 6 inches of top soil. The permittee is approved for two alternate final covers. The first alternate final cover shall consist of an 18 inch soil infiltration layer with a hydraulic conductivity of $1\times10_{-5}$ cm/sec or less, 40 mil LLDPE textured geomembrane, geocomposite drainage layer, and 18 inch layer of protective soil. The second alternate final cover shall consist of an12 inch infiltration layer with a hydraulic conductivity of 1×10^{-5} cm/sec or less, 50 mil HDPE drainage structured geomembrane, and 18 in layer of protective soil. The final cover grading plan has been revised to show 2-foot contour interval and tack-on stormwater diversion berms.

B. Vegetative Cover

The Permittee shall establish a vegetative or other appropriate cover within 90 days after completion of final grading requirements in the Application. Preparation of a vegetative cover shall include, but not be limited to, the placement of seed, fertilizer, mulch, and water.

C. Notice of Intent

The Permittee shall place in the operating record and notify the Department of their intent to close the landfill prior to beginning closure.

D. Completion of Closure Activities

The Permittee must complete closure activities of each landfill unit in accordance with the Closure Plan within 180 days of the last known receipt of waste.

E. Certification of Closure

Following closure of each unit, the Permittee must submit to the Department a certification, signed by an engineer, verifying the closure has been completed according to the Closure Plan.

F. Post-Closure Care Period

Post-closure care activities shall be conducted after closure of each unit throughout the life of this permit and continuing for a period of thirty (30) years following closure of the facility. The Department may shorten or extend the post-closure care period applicable to the solid waste disposal facility. The Permittee shall reapply in order to fulfill the post-closure care requirements of this permit.

G. Post-Closure Maintenance

The Permittee shall provide post closure maintenance of the facility to include regularly scheduled inspections. This shall include maintenance of the cover, vegetation, monitoring devices and pollution control equipment and correction of other deficiencies that may be observed by the Department. Monitoring requirements shall continue throughout the post closure period as determined by the Department unless all waste is removed and no unpermitted discharge to waters of the State have occurred.

H. Post-Closure Use of Property

The Permittee shall ensure that post closure use of the property never be allowed to disturb the integrity of the final cover, liner, or other components of the containment system. This shall preclude the growing of deep-rooted vegetation on the closed area.

I. Certification of Post-Closure

Following post-closure of each unit, the Permittee must submit to the Department a certification, signed by an engineer, verifying the post-closure has been completed according to the Post-Closure Plan.

J. Notice in Deed to Property

The Permittee shall record a notation onto the land deed containing the property utilized for disposal within 90 days after permit expiration, revocation or when closure requirements are achieved as determined by the Department as stated in the Application. This notation shall state that the land has been used as a solid waste disposal facility, the name of the Permittee, type of disposal activity, location of the disposal facility and beginning and closure dates of the disposal activity.

K. Recording Instrument

The Permittee shall submit a certified copy of the recording instrument to the Department within 120 days after permit expiration, revocation, or as directed by the Department as described in the Application.

L. Removal of Waste

If the Permittee or other person(s) wishes to remove waste, waste residues, the liner, or any contaminated soils, the owner must request and receive prior approval from the Department.

SECTION IX. FINANCIAL ASSURANCE

A. The Permittee shall maintain detailed written cost estimates, in current dollars, at the landfill office and on file with the Department in accordance with ADEM Admin. Code 335-13-4-.28.

B. All cost estimates must be updated annually as required by ADEM Admin Code 335-13-4-.28.

C. The Permittee must place a copy of the financial assurance mechanism along with other items required by ADEM Admin. Code 335-13-4-28. into the landfill operating record and submitted to the Department before the initial receipt of waste in the case of closure, post-closure care, or no later than 120 days after corrective action remedy has been selected.

D. The financial assurance mechanisms must ensure that funds will be available in a timely fashion when needed.

E. The financial assurance mechanisms must be legally valid, binding, and enforceable under state and federal law.

F. The Permittee shall demonstrate continuous compliance with ADEM Admin. Code 335-13-4-28. by providing documentation of financial assurance in at least the amount that equals or exceeds the cost estimate. Changes in the financial assurance mechanism must be approved by the Department.

G. The Permittee shall increase the closure, post-closure or corrective action cost estimates and the amount of financial assurance if changes in the closure, post-closure or correction action plans or landfill conditions increase the maximum cost.

H. The Permittee may reduce the amount of financial assurance by submitting justification and a revised estimate to the Department for approval.

SECTION X. VARIANCES.

1. The Permittee is granted a variance to Rule 335-13-4-.20(2)(c)2. requiring the maximum final grade of the final cover system shall not exceed 4 to 1. The maximum final slope of 3.5 to 1 shall be allowed along the toe of the slope in cell 1 and cell 3-B. The final slope above the 243-foot elevation shall be 4 to 1 in cell 1 and cell 3-B. The final slopes in the remaining cells shall not exceed 4 to 1.

2. The Permittee is granted a variance to Rule 335-13-4-.22(1)(c) requiring a daily completed cell shall not exceed 8 feet in vertical thickness measured perpendicular to the slope of the preceding cell. The Permittee shall be allowed a vertical thickness of 15 feet. (See Section III.I.)

Any variance granted by the Department may be terminated by the Department whenever the Department finds, after notice and opportunity for hearing, that the petitioner is in violation of any requirement, condition, schedule, limitation or any other provision of the variance, or that operation under the variance does not meet the minimum requirements established by state and federal laws and regulations or is unreasonably threatening the public health.

APPLICATION

HHNT
HODGES, HARBIN,
NEWBERRY & TRIBBLE, INC.
Consulting Engineers

March 18, 2019

Mr. C. Blake Holden
Solid Waste - Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

RECEIVED
MAR 19 2019
LAND DIVISION

Re: Timberlands Sanitary Landfill
Solid Waste Permit (#27-08) Renewal & Minor Modification
HHNT Project No. 6703-948-01

Dear Mr. Holden:

The Solid Waste Disposal Facility Permit for the subject site is set to expire on September 23, 2019. As required by ADEM regulations, a renewal application is required to be filed for permit renewal at least 180 days prior to the permit expiration (March 27, 2019). To satisfy this requirement, HHNT, on behalf of Republic Services, Inc. has enclosed the renewal application, which includes the following:

1. Permit Renewal Application (ADEM Form 439) - signed;
2. Application fee check for $18,635;
3. List of adjacent property owners with corresponding map;
4. Site plan w/ 2019 Topographic Map;
5. Copy of the current Financial Assurance mechanism;
6. Updated Permit Drawing #11, "Ground & Surface Water Monitoring Plan";
7. Copy of the approved Permit Drawing #12, "Gas Monitoring Plan";
8. Copy of Operational Plan (Jordan, Jones & Goulding, Inc, 2003);
9. Copy of the latest NPDES permit submittal (enclosed data disc);
10. Copy of Stormwater Management Master Plan (Geosyntec, 2017) (enclosed data disc);
11. Copy of the boundary survey; and
12. Letter requesting re-approval of existing permit variances.

In addition to the renewal application, we are also requesting a minor modification to the solid waste permit to allow progressive construction of landfill gas wells during waste filling operations. These wells consist of vertical gravel columns surrounding a perforated pipe which will be installed utilizing a built-in-place caisson method. The following documents have been enclosed for the minor modification.

1. Check covering the minor modification fee of $3,275;
2. New Appendix C for inclusion in the Operational Plan; and
3. New detail drawing for inclusion in the Engineering Plans;

3920 Arkwright Road, Suite 101 • Macon, Georgia 31210 • (478) 743-7175 • Fax (478) 743-1703 • www.hhnt.com
SAVANNAH • ATLANTA • **Macon** • STATESBORO • BRUNSWICK

We appreciate your assistance with this project. Please let me know if there is anything else that you need, or if you have any questions, please call.

Sincerely,

HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.

Daniel E. Cheek

Daniel E. Cheek, P.E.
Principal

DEC/cm

Enclosure

cc: Michael Guy (w/o enclosure)

SOLID WASTE DISPOSAL FACILITY

MSWLF/ILF/CCR UNIT PERMIT APPLICATION PACKAGE

January 16, 2018

MEMORANDUM

TO: Applicants Seeking a Permit for Solid Waste Facilities

FROM: Stephen A. Cobb, Chief
Land Division
Alabama Department of Environmental Management

RE: Processing Solid Waste Permits by ADEM

Any permit issued by ADEM must be in accordance with §22-27-48 and §22-27-48.1 Code of Alabama. This section indicates that ADEM may not consider an application for a new or modified permit unless such application has received approval by the affected unit of local government having an approved plan. ADEM, therefore, will require the following before it can process a new or modified permit application:

1. The local government having jurisdiction must approve the permit application in accordance with §22-27-48 and §22-27-48.1 Code of Alabama.
2. Local governments should follow the procedures outlined in §22-27-48 and §22-27-48.1 Code of Alabama and the siting standards included in the local approved plan in considering approval of a facility.

This procedure applies to applications for new or modified permits. ADEM cannot review an application unless it includes approval from the affected local government. This procedure shall not apply to exempted industrial landfills receiving waste generated on site only by the permittee.

Please contact the Solid Waste Branch of ADEM at (334) 274-4201 if there are any questions.

SAC/sss/abj

SOLID WASTE APPLICATION

PERMIT APPLICATION
SOLID WASTE DISPOSAL FACILITY
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
(Submit in Triplicate)

1. **Facility type:**
   - x____ **Municipal Solid Waste Landfill (MSWLF)**
   - _____ **Industrial Landfill (ILF)**
   - _____ **CCR Landfill (CCRLF)**
   - _____ **CCR Surface Impoundment (CCRSI)**
   - _____ **Other (explain)**______________

2. **Facility Name** Timberlands Sanitary Landfill

3. **Applicant:**

   Name: Escambia County Environmental Corporation

   Address: P.O. Box 899
   Greenville, Alabama 36037

   Telephone: (251) 867-8921

4. **Location: (include county highway map or USGS map)**

   Township 3N **Range** 9E
   Section 5&6 **County** Escambia

5. **Land Owner:**

   Name: Escambia County Environmental Corporation

   Address: P.O. Box 899
   Greenville, Alabama 36037

   Telephone: (251) 867-8921

   (Attach copy of agreement from landowner if applicable.)

6. **Contact Person:**

Name Andrew Rodgers

Position or Affiliation General Manager

Address: Timberlands Landfill, 22800 Hwy 41
Brewton Alabama 36426

Telephone: (251) 867-8921

7. **Size of Facility:** 246.23 **Acres** **Size of Disposal Area(s):** 134.33 **Acres**

8. **Identify proposed service area or specific industry that waste will be received from:**

Autanga, Baldwin, Butler, Choctaw, Clarke, Coffee, Conecuh, Covington, Crenshaw, Dale, Dallas, Elmore, Escambia, Geneva, Henry, Houston, Lowndes, Marengo, Mobile, Monroe, Montgomery, Perry, Pike, Washington, and Wilcox Counties in AL; Bay, Escambia, Okaloosa, Santa Rosa, and Walton Counties in FL; George, Hancock, Harrison, Jackson, and Stone Counties in MS.

9. **Proposed maximum average daily volume to be received at landfill (choose one):**

2,500 **Tons/Day** ________ **Cubic Yards/Day**

10. **List all waste streams to be accepted at the facility (i.e., household solid waste, wood boiler ash, tires, trees, limbs, stumps, etc.):**

Nonhazardous solid wastes; noninfectious putrescible and nonputrescible wastes including but not limited to household garbage, industrial waste, construction and demolition debris, commercial waste, appliances, tires, trees, limbs, stumps, sludge, paper, and other similar type materials. Special wastes including asbestos, foundry sand, petroleum contaminated waste, municipal solid waste ash, and other special wastes as approved by the Department.

SIGNATURE

2/28/19
DATE
2/28/19

Property Ownership Map

1,000 500 0 1,000 Feet

Timberlands Landfill
Escambia County, Alabama

Date: 11/8/2018

REPUBLIC SERVICES

REPUBLIC
SERVICES

May 11, 2018

Ms. Dee Baker
Solid Waste Branch, Land Division
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2059

Re: 2018 Financial Assurance Mechanism
Timberlands Landfill
Permit # 27-08

Dear Ms. Baker,

BFI Waste Systems of Alabama, LLC (BFI) respectfully submits the current closure and post-closure financial assurance mechanism for the above referenced facility. BFI maintains compliance by annually updating the financial assurance policy and updating estimates when necessary. The insurance policy is renewed each year, and a copy is maintained in the operating record at the facility. The attached policy has been modified from the previous submission to account for inflation.

Please contact me at (904) 591-3086 if you have questions or comments.

Sincerely,

BFI WASTE SYSTEMS OF ALABAMA, LLC

Michael Guy
Environmental Manager

cc: Mr. Darrin Hinderliter, Republic
Operating Record

2910 North Palafox Street Pensacola, FL 32501
O: 850.437.7846 mguy@republicservices.com

GLOBAL INDEMNITY ASSURANCE COMPANY
A Capital Stock Company
30 Main Street, Suite 330
Burlington, Vermont 05401

ENDORSEMENT NUMBER: 27

ATTACHING TO AND FORMING PART OF POLICY NUMBER: CPC-AL97-002

The above referenced policy has been amended as follows. Please attach this endorsement to the original policy.

POLICY CHANGE EFFECTIVE: April 9, 2018 12:01 a.m.

Named Insured: BFI Waste Systems of Alabama, LLC

Location of Insured:
Timberlands Landfill
22800 Highway 41
E. Brewton AL 36426
Permit # 27 - 08

Period of Coverage: April 9, 2018 - April 8, 2019

Limits of Liability:	**Coverage A:**	$	3,608,276
	Coverage B:	$	3,144,175
	Corrective Measures:	$	-
Renewal Premium:		$	604

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED

AUTHORIZED REPRESENTATIVE
Marie E. Davis

April 26, 2018
DATE

CERTIFICATE OF INSURANCE FOR FINAL CLOSURE, POST-CLOSURE CARE, OR CORRECTIVE MEASURES

NAME AND ADDRESS OF INSURER: (HEREIN CALLED THE "INSURER")
GLOBAL INDEMNITY ASSURANCE COMPANY
30 MAIN STREET, SUITE 330
BURLINGTON, VERMONT 05401

NAME AND ADDRESS OF INSURED:
BFI Waste Systems of Alabama, LLC
22800 Highway 41
E. Brewton AL 36426

FACILITIES OR SCRAP TIRE TRANSPORTERS COVERED:
Timberlands Landfill
22800 Highway 41
E. Brewton AL 36426
PERMIT # 27 - 08

FINAL CLOSURE:	$ 3,608,276
POST-CLOSURE:	$ 3,144,175
CORRECTIVE MEASURES:	$ -
SCRAP TIRE TRANSPORTATION:	$ -

FACE AMOUNT: $ 6,752,451

POLICY NUMBER: CPC-AL97-002

EFFECTIVE DATE: April 9, 2018

The insurer hereby certifies that it has issued to the insured the policy of insurance identified above to provide financial assurance for FINAL CLOSURE AND POST CLOSURE CARE for the facilities identified above.

Whenever requested by the director of the Alabama Department of Environmental Management, the insurer agrees to furnish to the director a duplicate original of the policy listed above, including all endorsements thereon.

AUTHORIZED SIGNATURE FOR INSURER

Marie E. Davis
NAME OF PERSON SIGNING

Authorized Representative
TITLE OF PERSON SIGNING

Monica Klinke
SIGNATURE OF WITNESS OR NOTARY 2/10/19

April 26, 2018
DATE

MONICA KLINKE
NOTARY PUBLIC
ORLEANS COUNTY, VERMONT

ORIGIN ID:PNSA (904) 591-3086
MICHAEL GUY
ALLIED WASTE
2910 N. PALAFOX STREET

PENSACOLA, FL 32501
UNITED STATES US

SHIP DATE: 11MAY18
ACTWGT: 0.25 LB
CAD: 102025480/INET3980

BILL SENDER

TO **MS DEE BAKER**
AL DEPT. OF ENVIRONMENTAL MNGMT.
1400 COLISEUM BLVD

MONTGOMERY AL 36110
(334) 271-7700 REF 2018 FA UPDATE - REVISED
INV
PO DEPT

552J2/782B/DCA5

FedEx Express

J181118012601uv

MON - 14 MAY 3:00P
STANDARD OVERNIGHT

TRK# **7722 1690 9450**
0201

XX MGMA

36110
AL-US **BHM**

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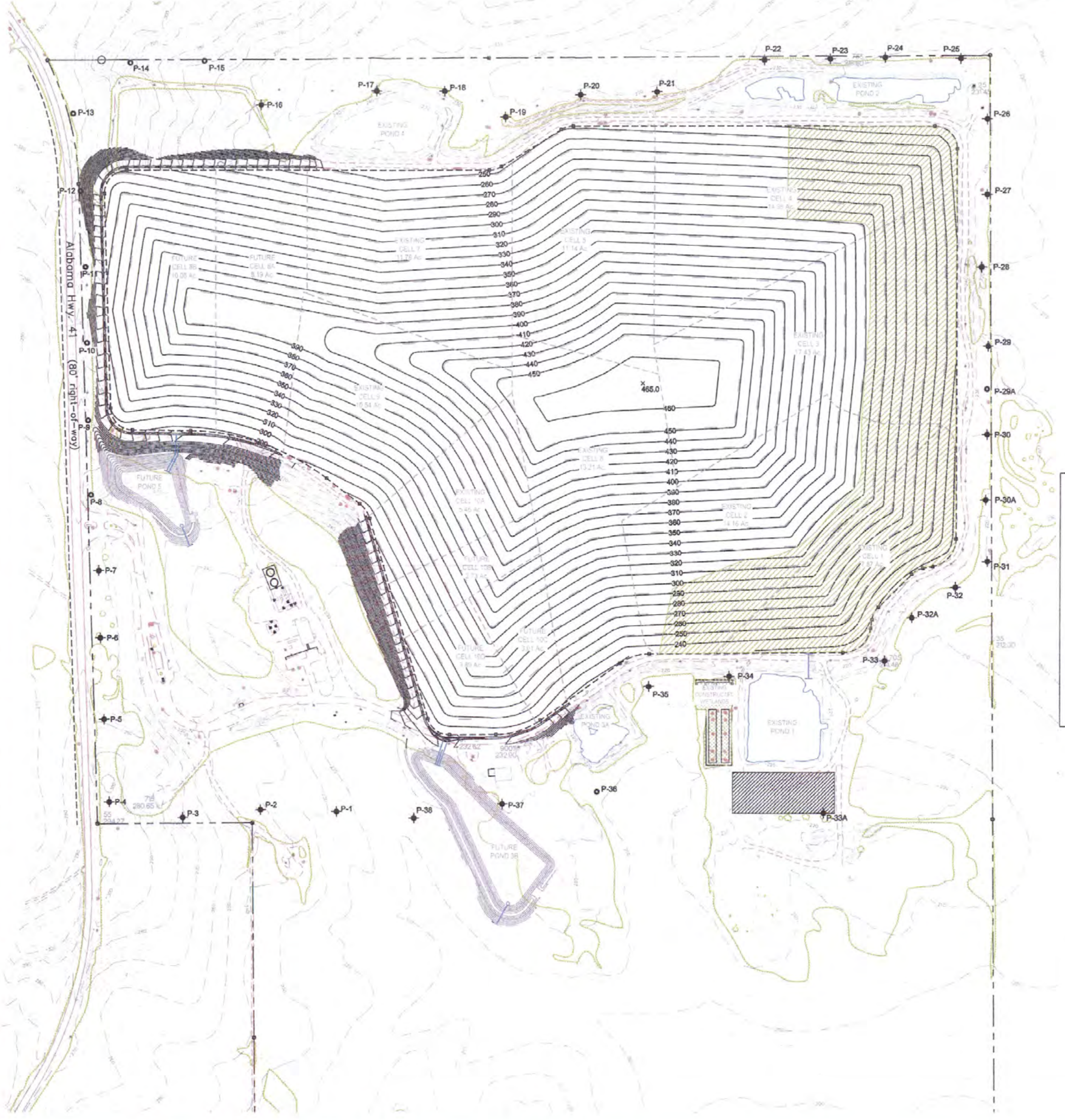
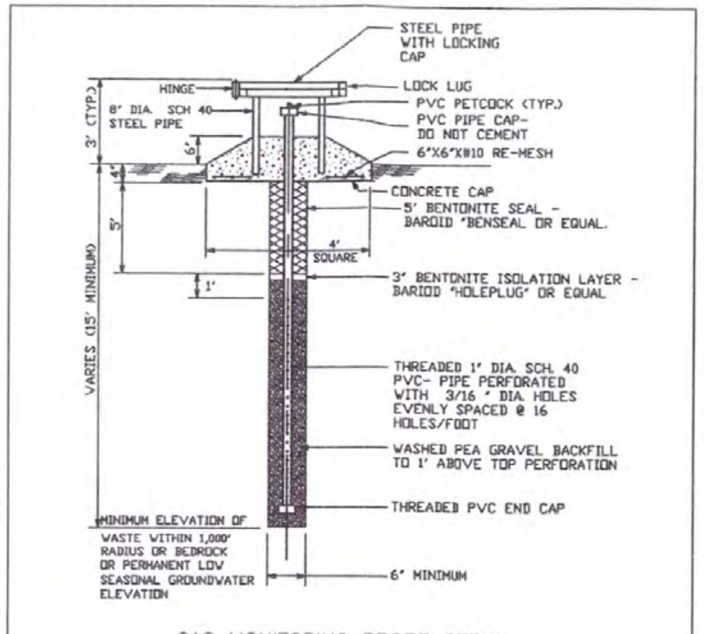
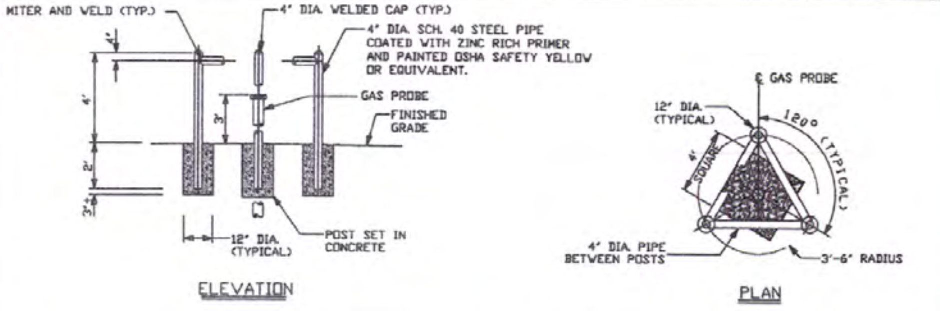




GAS MONITORING PROBE DETAIL

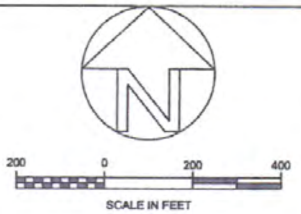
NOT TO SCALE



NOTE: PROBE PROTECTION TO BE INSTALLED AT LOCATIONS WHERE PROBES ARE VULNERABLE TO DAMAGE FROM LANDFILL ACTIVITIES.

OPTIONAL PROTECTION FOR GAS PROBES

NOT TO SCALE



NOTES:

1. GAS MONITORING PROBE LOCATIONS ARE FROM THE PREVIOUS SITE PERMIT DRAWINGS, AND ARE APPROXIMATE.
2. EXISTING TOPOGRAPHY IS FROM AN AERIAL SURVEY BY SOUTHERN RESOURCES MAPPING CORPORATION, DATED FEBRUARY, 2013.
3. ORIGINAL BOUNDARY SURVEY PERFORMED BY McCRORY AND WILLIAMS, INC., AND VERIFIED BY BARGE, WAGGONER, SUMNER, AND CANNON, INC. IN SEPTEMBER 1995.
4. BOUNDARY WAS RECONFIRMED BY C&C SURVEYING, INC., IN MARCH, 2014.
5. FOR GAS COLLECTION AND CONTROL SYSTEM COMPONENTS, PLEASE REFER TO "REPORT OF CONSTRUCTION, AUGUST 15, 2007- NOVEMBER 16, 2007 AND JANUARY 28-29, 2008", BY SCS ENGINEERS, DATED AUGUST 15 2008, OR REFER TO THE LATEST VERSION OF THE NSPS MASTER PLAN.
6. GAS PROBES #1 - 4 AND 38 WERE INSTALLED IN JUNE, 2010. INSTALLATION WAS MONITORED BY AQUATERRA ENGINEERING, LLC.

PHASE SCHEDULE OF GAS MONITORING PROBE INSTALLATION AND MONITORING:

CELL #	PROBES INSTALLED AND MONITORED
EXISTING GAS PROBES	P-1, 2, 3, 4, 5, 6, 7, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 30A, 31, 32, 32A, 33, 33A, 34, 35, 37, 38
EXISTING BAR HOLE PROBES	P-8, 9, 10, 11, 12, 13, 14, 15, 29A, 36

LEGEND:

✦ P-1	EXISTING GAS MONITORING PROBE
○ P-36	EXISTING BAR HOLE PROBE
—— 280 ——	FUTURE MAJOR CONTOUR
————	FUTURE MINOR CONTOUR
— — —	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
- - - - - -	INTER-CELL BOUNDARY
—— —— ——	LIMIT OF WASTE DISPOSAL
—— - - ——	EXTERIOR PROPERTY LINE

REV (R) SUB (S)	DATE	BY	DESCRIPTION
0	3/20/09	EJW	DRAFT REVIEW
1	5/12/09	EJW	SUBMITTAL TO A.D.E.M.
2	8/19/09	EJW	REVISED CELL LINER DETAIL
3	2/09/10	CRW	MINOR MOD w/o ALT. CAP
4	8/04/11	TSR	REMOVED FINAL COVER ALT.
5	8/19/11	TSR	SUBMITTAL TO ADEM
6	2/4/14	CNB	PERMIT RENEWAL w/ MINOR MODS
7	6/3/14	CNB	REVISIONS PER CLIENT COMMENTS

Terracon
Consulting Engineers and Scientists
4040 ROYAL DR., SUITE 100 KENNESAW, GA 30144
PH. (770) 924-9799 FAX (770) 924-7866

REPUBLIC SERVICES, INC.™
22800 HIGHWAY 41 BREWTON, AL 36426

ALABAMA LICENSED PROFESSIONAL ENGINEER No. 34105-E CLAIRE N. BACON
Cbacon 6/3/14

GAS MONITORING PLAN

PERMIT RENEWAL PLANS WITH MINOR MODS
SOLID WASTE PERMIT #27-08
TIMBERLANDS SANITARY LANDFILL
ESCAMBIA COUNTY, ALABAMA

DRAWN BY:	CNB
APPVD. BY:	CWM
JOB NO.	EJ137474

DRAWING
12

Last Saved By:CNBACON Date: 7/24/2014 11:33 AM File: N:\PROJECTS\2013\EJ137474\WORKING FILES\DIAGRAMS-DRAWINGS-FIGURES\137474-MAIN.DWG

JUL 2003
RECEIVED
LAND DIVISION

TIMBERLANDS
SANITARY LANDFILL

OPERATIONAL PLAN

JUNE 2003

PREPARED FOR:

ESCAMBIA COUNTY ENVIRONMENTAL CORPORATION

ORIGINALLY PREPARED BY:

EMCON

REVISED BY:

JORDAN, JONES & GOULDING, INC.
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TIMBERLANDS

SANITARY LANDFILL

OPERATIONAL PLAN

INDEX

APPENDIX

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OPERATIONAL PLAN

1.0 GENERAL INFORMATION

1.1 PURPOSE AND SCOPE

The purpose of this manual is to provide guidelines for properly operating and maintaining Timberlands Sanitary Landfill, referred to herein as TSL. The procedures set forth herein comprise a plan for the orderly use of the facility while protecting the environment. Attachments referenced in this permit renewal are actually contained within the original permit application, dated March 17, 1993 or as attached.

Where appropriate, descriptions of landfill features have been provided to give a clear understanding of the operational objectives. Personnel responsible for operating and maintaining the Landfill should be thoroughly familiar with this operational plan and related documents. This manual should be used in conjunction with the following documents, including any future revisions thereto:

- Facility Design and Construction Plans prepared by Emcon, dated November 1995 and any subsequent revisions (referred to herein as permit drawings).
- Alabama Department of Environmental Management Solid Waste Disposal Facility Permit for TSL, including all permit conditions and supporting documentation.
- All local, State and federal rules and regulations governing solid waste disposal.
- Alabama Department of Environmental Management NPDES permit for Timberlands Sanitary Landfill including all permit conditions.

1.2 DEFINITIONS

For the purpose of this operational plan, the following words or phrases will have the meanings ascribed to them in this section unless the context indicates differently. Words or phrases not listed herein will have the meaning ascribed to them by 40 CFR §258.2 and Alabama Department of Environmental Management regulations governing solid waste management.

ACTIVE LIFE--The period of operation beginning with the initial receipt of solid waste and ending at completion of closure.

ACTIVE PORTION--That part of the landfill that has received or is receiving waste and has not been closed in accordance with regulations.

ACCEPTABLE WASTE--Waste that is acceptable for disposal at TSL.

BUFFER ZONE--An area in which no waste will be placed. It will serve as a protective barrier between the waste disposal area and surrounding property. Roads, drainage structures, personnel and equipment facilities, and other landfill appurtenances may be located in the buffer zone.

BULK WASTE--Large items of refuse including, but not limited to, appliances, furniture, large auto parts, non-hazardous construction and demolition material, trees, branches, and stumps which cannot be handled by normal solid waste processes, collection or disposal methods.

COUNTY--Escambia County, Alabama, acting by and through its governing body, the Escambia County Commission.

COMPOSTING--The controlled biological decomposition of organic solid waste under aerobic conditions.

COMPOSITE LINER SYSTEM--All components of the composite liner system including the clay liner, synthetic liner, leachate collection system and drainage layer/protective blanket.

CONSTRUCTION AND DEMOLITION WASTE--Materials resulting from construction, remodeling, repair, or demolition of buildings, bridges, pavement and other structures. Such waste includes, but is not limited to, bricks, concrete, other masonry materials, uncontaminated soil, rocks, scrap metal, paving materials, and wood products, all being materials which constitute rubbish.

DEPARTMENT--Alabama Department of Environmental Management or any agents, boards or authorities appointed by them for the purpose of regulating the permitting, construction or operation of the solid waste disposal facility.

DIRECTOR--The director of Alabama Department of Environmental Management.

ENGINEER--Any registered professional engineer in the State of Alabama designated by ECEC to act as its representative.

ECEC--Escambia County Environmental Corporation.

HAULER--Any individual, firm, or other entity who collects solid waste for disposal at the Landfill. Hauler is not intended to include individuals who dispose of waste from their residence.

HOUSEHOLD WASTE--Any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households, including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day use recreation areas.

INDUSTRIAL WASTE--Solid waste generated by manufacturing or industrial processes that is not a hazardous waste regulated under Subtitle "C" of RCRA.

LANDFILL MANAGER--The individual(s) authorized by ECEC to be responsible for managing on-site operations of TSL.

LEACHATE--A liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste.

NPDES--National Pollutant Discharge Elimination System.

PERMIT--Solid waste disposal facility permit issued by the Department for operation of TSL.

RULE 335-13--Refers to Rule of Alabama Department of Environmental Management Administrative Code.

RUNOFF--Any rainwater, leachate, or other liquid that drains over land from any part of a facility.

RUN-ON--Any rainwater, leachate, or other liquid that drains over land onto any part of a facility.

SERVICE AREA--The geographical area which may be serviced by the landfill facility from which solid waste is generated and collected including any interim points (i.e., transfer stations) at which solid waste is repacked or reloaded onto vehicles or other methods of transport for delivery to that facility.

SPECIAL WASTE--Those wastes requiring specific processing, handling, or disposal techniques as determined necessary by facility practices or by Alabama Department of Environmental Management which are different from techniques normally utilized for handling and disposal.

SUBTITLE "D"--Refers to 40 CFR Part 258, Subtitle "D" of the Resource Conservation and Recovery Act.

TSL--The Timberlands Sanitary Landfill facility developed by Escambia County Environmental Corporation. Also may be referred to herein as the Landfill.

WHITE GOODS--Large household appliances such as refrigerators, stoves, air conditioners, etc.

WORKING FACE--That area of a landfill where active filling and compacting operations are being conducted.

YARD WASTE--Leaves, grass clippings, prunings, stumps, brush, and other natural organic matter discarded from yards and gardens.

1.3 GENERAL SITE DESCRIPTION

The site is located in the unincorporated area of Escambia County, Alabama, outside the planning jurisdiction of any local government. It is bounded on the west by Alabama Highway Number 41, approximately fifteen (15) miles north of Brewton, Alabama. The north line of the site abuts the Conecuh County line.

The site contains approximately 246 acres. It is predominately hilly pine plantation that has been clear cut within the last five years. Some older trees remain in the low areas.

1.4 CLIMATE

The climate of Escambia County is humid and mild. Rainfall is plentiful and generally well distributed throughout the year. Summers in the area are long and consistently warm. Winters are usually short and mild except for an occasional invasion of cold air that persists for about three (3) days. The average annual rainfall is approximately sixty (60) inches.

1.5 TOPOGRAPHY

The topography of the area is gently rolling with dendritic intermittent streams flowing to unnamed tributaries of Burnt Corn Creek. A ridge transects the central portion of the site and stormwater flows to low areas along both the northern and southern boundaries of the property.

Elevations on the site range from approximately 205 feet above mean sea level (MSL) to 320 feet MSL.

1.6 GEOLOGY AND HYDROLOGY

Major soil series encountered on-site can be divided into three (3) general strata. The upper stratum consists of firm to very firm sands, clayey sands or silty clayey sands with some gravel. The next stratum generally consists of stiff to very hard clay. Stratum three (3) consists of very firm to very dense sand with lesser amounts of clay, silt, coarse sand and gravel.

Groundwater flow beneath the site is to the southeast. Details of subsurface conditions can be found in the report by Southern Earth Sciences, Inc. (dated May 20, 1992) which was submitted to the Department for the hydrogeological investigation.

1.7 AREA LAND USE

Undeveloped land surrounds the entire site. There are no public or private water supply wells, residences, buildings or zoning restrictions within a fourteen hundred (1400) foot radius. Burnt Corn Creek, the closest water course, is approximately one mile east of the site. Alabama Highway Number 41 abuts the west boundary of the property with electrical power and telephone service available along this road. Electrical power is also available along a dirt road east of the site. No other utilities or paved roads are within said radius of the site. A land use map showing geological features is included in Attachment 9 of the permit application.

1.8 ACCESS ROADS

Major highways provide access to TSL from throughout the service area. The entrance of the site is from Alabama Highway Number 41, approximately one and one-half miles south of Interstate 65. Highway 41 runs north to U.S. Highway 84 (State Highway 12) and south through Brewton where it joins State Highway 84 and connects to Interstate 10 near Milton, Florida.

1.9 DESCRIPTION OF SERVICE AREA

The service area of TSL, as approved January 26, 2000 is limited to the following counties, including the municipalities located therein, in Alabama, Florida and Mississippi. ALABAMA: Autauga, Baldwin, Butler, Choctaw, Clarke, Conecuh, Covington, Crenshaw, Dallas, Elmore, Escambia, Lowndes, Marengo, Mobile, Monroe, Montgomery, Perry, Washington, Wilcox, Pike, Coffee, Dale, Henry, Geneva, and Houston. FLORIDA: Escambia, Santa Rosa, Okaloosa, Walton, and Bay. MISSISSIPPI: Jackson, George, Harrison, Stone, and Hancock.

1.10 SITE LAYOUT

The site contains approximately 246 acres with an additional 100 acre borrow area to the south of the property. The waste disposal area is comprised of approximately one hundred thirty-four and thirty-three hundredths (134.33) acres in the central portion of the property. Buffer zones, in which no waste will be placed, surround the perimeter of the site. These buffers are at least one hundred (100) feet wide and much wider in some areas. A scale and gate house are located near the entrance of the facility.

The perimeter of the waste disposal unit is encompassed by a roadway and drainage ditches. The perimeter ditches are designed to intercept stormwater run-on and runoff and convey it to sedimentation ponds. Details of the overall site layout are shown in the permit modification drawings

1.11 SEQUENCE OF OPERATIONS

The sequence of filling is shown on the permit drawings. Clearing will be performed on those areas designated to be excavated or areas used to stockpile cover material. Natural vegetation that does not interfere with construction activities will be left undisturbed. Excavation of cells will conform to the sequence of operations as set forth.

1.12 SOIL COVER

Subsurface investigation of the site indicates that on-site soils are suitable for liner construction and cover material. In the event an insufficient volume of soils suitable for liner construction is found, the QA/QC Plan sets forth specifications that will be used to acquire borrow material for this purpose.

It is estimated that approximately 3.2 million cubic yards of soil will be excavated in constructing the disposal unit. Approximately 2.6 million cubic yards of soil will be needed for cell construction, daily, intermediate and final cover leaving an excess soil balance.

1.13 DESIGN CAPACITY

In 1995, the estimated capacity of the disposal unit was over 19 million cubic yards or approximately 11.4 million tons. The average daily volume that may be received for disposal is estimated to be twenty-five hundred (2500) tons per day.

2.0 SUMMARY OF SITING STANDARDS

Siting standards addressed in this section are presented as demonstrations that the facility complies with regulatory standards in accordance with Rule 335-13-4-.01 and Subtitle "D", §258.10 through §258.16.

2.1 FLOODPLAINS

The site is located in flood zone "C", an area outside the one hundred (100) year flood boundary. Therefore the facility will not restrict the flow of the base flood, reduce the temporary water storage capacity of the floodplain or result in a washout of solid waste by waters of the base flood, so as to pose a hazard to human health, wildlife, land or water resources.

2.2 ENDANGERED OR THREATENED SPECIES OR HABITAT

The facility is not located in an area that will contribute to the taking of any endangered or threatened species or habitat. Supporting documentation from U.S. Fish and Wildlife Service is included as Attachment 5 of the permit application.

2.3 SURFACE WATER

Surface water discharge from the facility will be managed to protect water quality. Engineered structures will be used to prevent the discharge of pollutants into waters of the State or a non-point source of pollution. Surface water will be diverted to sedimentation ponds which will control the runoff and allow sediment to settle out of the water before it is released off-site. A copy of the NPDES permit application is included as Attachment 4 of the permit application. The facility will be operated in accordance with the stormwater management practices contained herein and best management practices that comply with NPDES regulations. Unpermitted discharge to waters of the State will not be allowed.

The facility is not located in an area that would degrade beaches, dunes or coastal waters and is outside the coastal area boundary.

2.4 WETLANDS

Wetlands are located in several areas of the site. No waste will be placed within one hundred (100) feet of the wetlands. The wetlands have been delineated, mapped and surveyed. The exact location is shown in the permit modification drawings. Development of the landfill was originally authorized by the U.S. Army Corps of Engineers (Corps) under Jurisdictional Number ALJ92-01015-R. The subject permit modification is based on the reclamation of 6.7 acres of low grade wetlands as approved under the Corps Jurisdictional Number ALJ95-04246-W dated September 12, 1995. This decision indicated that a Department of the Army permit pursuant Section 404 of the Clean Water Act will not be required to fill in areas of the proposed cells.

2.5 GROUNDWATER

A site specific hydrogeological evaluation was conducted by Alabama Department of Environmental Management. This investigation concluded that the site is hydrogeologically suitable for landfill development. A vertical separation of at least five (5) feet will be maintained between the high seasonal, temporal fluctuation of groundwater and the bottom of the composite liner.

Design parameters that meet or exceed minimum requirements of Rule 335-13-4-.15 through 335-13-4-.25 and Subtitle "D" criteria have been utilized to develop the TSL Operational Plan and Permit Drawings.

2.6 AIRPORTS

The facility is located more than five (5) miles from the nearest airport. Therefore waste disposal practices will not increase the likelihood of a bird hazard to aircraft. Supporting documentation from the Federal Aviation Administration is included as Attachment 8 of the permit application.

2.7 FAULTS AND SEISMIC IMPACT ZONES

The 1:250,000 scale Geologic Map of Alabama (Geologic Survey of Alabama, 1988) shows no fault that has had displacement in Holocene time exposed at the surface in the area of the proposed landfill. Likewise, no fault is shown on the State geologic map located within two hundred (200) feet of the proposed site.

The site is within an area of the central Gulf Coast that is practically free from risk of earthquakes. A map of Earthquake Risk in the United States (U.S. Department of Commerce, 1970) shows the site to be included in an area characterized as under no risk of damage from earthquakes.

2.8 UNSTABLE AREAS

The site is not located in an unstable area. The soils encountered at the site have high shear strength and low compressibility characteristics. It is not in a geologic area known for karst terrains. Preliminary settlement analysis of the site indicates settlements in the range of approximately two (2) to eight (8) inches under maximum load conditions. The design of the structural components of the Landfill incorporates accepted engineering principles and construction practices to assure stability of the containment system.

2.9 ARCHAEOLOGICAL OR HISTORICAL SIGNIFICANCE

The site has also been surveyed to determine that no historically or archaeologically sensitive areas are present. Alabama Historical Commission has reviewed the findings and concluded that development of the Landfill will have no adverse effect on cultural resources. A copy of their concurrence is included in Attachment 6 of the permit application.

3.0 DESIGN STANDARDS

3.1 LINER SYSTEM

Both the bottom and sides of the disposal area will have a composite liner consisting of a minimum of two (2) feet of clay with a hydraulic conductivity of 1×10^{-7} cm/sec or less, overlain by a 60 mil. High Density Polyethylene (HDPE) geomembrane. Textured 60 mil. HDPE will be used as necessary along the side slopes to enhance stability of the liner system. The 60 mil. HDPE along the bottom of the cells will be overlain with either an HDPE drainage net topped with a geotextile filter fabric and two (2) feet of on-site soil cover or with one (1) foot of sand with a hydraulic conductivity of 2×10^{-2} cm/sec or greater and one (1) foot of on-site material.

There is an alternate liner system approved for the facility by ADEM December 11, 2001. The alternate liner system consists of 12 inches of 1×10^{-5} cm/s compacted soil, overlain by a geosynthetic clay liner, overlain by a 60 mil HDPE geomembrane.

The liner system will provide secure containment of waste and liquids and control vertical or horizontal release from the disposal area. The system will meet the performance standards set forth by the regulations. Details of the liner system are shown on Drawing 19.

Installation of both the soil and synthetic liner will be in accordance with a specific Quality Control/Quality Assurance Plan (QA/QC) included as Attachment 12 of the permit application and updated on Drawing 19. This Plan sets forth quality control standards from the manufacturer of synthetic liner material and quality assurance measures and procedures to assure that the liners are constructed to conform with design standards. After each phase of the liner construction, a Professional Engineer, registered in the State of Alabama, will document that the liner and leachate collection system have been constructed in accordance with the project plans and specifications. Documentation will be placed in the operating record and the Department will be notified.

3.2 LEACHATE MANAGEMENT SYSTEM

3.2.1 Leachate Collection

A network of perforated HDPE pipe will be installed on top of the composite liner system to collect liquid from the landfill waste. The landfill floor will be graded to direct the flow of liquids to the piping system. Two (2) feet of soil will be placed over the bottom liner and will serve as a protective cover for the liner and as a drainage layer for the leachate collection system. The collection pipe will be laid in a gravel bed which has been wrapped in a geotextile filter fabric to preclude infiltration of sand into the gravel or pipe. The system is designed to facilitate the flow of liquid and keep hydraulic head build-up on the liner to less than thirty (30) cm or one (1) foot.

The leachate collection system will be installed throughout the floor of the landfillcells. Leachate will flow by gravity to sumps in the low point of each cell. A double layer of geomembrane will be laid in the sump area for added protection. Eighteen-inch (18") diameter sump access pipes will extend from the sump area to a sideslope riser pipe. Cleanout pipes will be connected to the leachate collection lines to provide access for cleaning. Details of the leachate collection system are shown on the permit modification drawings.

3.2.2 Leachate Removal

Stainless steel submersible pumps will be used to extract the accumulated liquid via the side slope riser. Pumps will be controlled using either pressure sensors or mercury float switches. The pump controls will be set to allow a maximum one (1) foot head on the liner system, at which time the pump will automatically activate and evacuate the sump. The individual side slope risers will discharge leachate into force mains or gravity flow lines which will convey it to a pump station. Leachate pipes laid outside of the lined area will be double walled pipes.

The pump stations will consist of dual containment wetwells with duplex submersible pumps, appropriate valving, access equipment and controls. Wetwell pumps will equalize running time during normal operations by alternating pumping from Pump 1 to Pump 2. Mercury float switches will activate the first pump at a set elevation and, in the event the liquid level continues to rise, the second pump will automatically be activated. When the liquid level is lowered to a set elevation, the pump will be switched off. A low and high level mercury float switch will activate a visual alarm on the control panel of the pump station. Details of the leachate removal system are shown on the permit drawings.

Leachate will be pumped from the pumping stations to above ground holding tanks for storage or recirculated. The holding tanks will be bolted steel storage tanks coated with a two-component, spray applied, factory baked epoxy. Presently, two (2) 138,000 gallon tanks have been installed; other tanks will be added if needed.

A lined containment area will be constructed around the holding tanks. The capacity of the secondary containment area will exceed total tank volume by ten percent (10%). The containment area will be lined with concrete or two (2) feet of compacted clay.

3.2.3 Leachate Treatment and Disposal

Leachate will be handled in one of two ways, recirculation or disposing off-site. If leachate is recirculated, it will be applied by two methods depending on weather conditions at the facility. For both recirculation methods, leachate will be applied within lined areas only. If the liquid is applied to the working face or intermediate areas, it will be applied only during dry weather periods to ensure no runoff occurs. During wet weather periods, the leachate may be applied by subsurface application techniques so that stormwater is not exposed to leachate during the recirculation process.

Leachate that is not recirculated will be transferred from the holding tanks to a properly licensed treatment facility for treatment and disposal. Documentation of acceptance from the properly licensed treatment facility will be maintained in the landfill operating record. TSL reserves the right to use any properly licensed treatment facility that agrees to accept the leachate.

As the generation of leachate increases, approval for the use of constructed wetlands for on-site treatment of the leachate may be requested. The constructed wetlands serve to purify the water through a number of natural processes, including uptake by plants and recycling and degradation by the microbial and periphyton communities.

Any future request for alternative disposal of leachate will be submitted to the Department for approval prior to implementation.

3.3 SURFACE DRAINAGE

The drainage system is designed to control stormwater runoff/run-on from a twenty-five (25) year, twenty-four (24) hour storm event. The system will consist of permanent and temporary control structures designed to protect water quality during active operations and after closure of the site. The permit drawings show details of the permanent control structures. The topography of the areas is such that no off-site stormwater will run onto the disposal unit. A Best Management Practices Plan for handling stormwater will be located on-site.

As much stormwater as possible will be diverted away from the working face. That stormwater which comes into contact with waste, will flow to the leachate collection system. Waste filling will start in the lower ends of the cells. Temporary stormwater management berms will be constructed in landfill cells above the active waste disposal area to keep as much stormwater as practical from coming into contact with the waste. The stormwater trapped behind the berm will be diverted to the site drainage system. In the event the water behind the berm comes into contact with the waste, it can be released into the leachate collection system.

Permanent ditches, terraces, inlets, and pipes will intercept stormwater from disturbed areas. These control structures will convey stormwater to sedimentation ponds which allow sediment to settle out of the runoff before releasing the water off-site. Stormwater will be managed in accordance with the Best Management Practices Plan contained herein and all NPDES permit conditions.

Terraces, to control surface water runoff, will be constructed along the Landfill slopes. Terrace details are shown in the permit drawings.

3.4 AIR CRITERIA

Open burning of waste will not be allowed. Facility practices will comply with State Implementation Plans under the Clean Air Act. Variances for the infrequent burning of land clearing debris, agricultural waste, silvicultural waste, diseased trees and debris from emergency clean up operations may be granted by the Department. Approval from the Department and appropriate burn permits will be obtained prior to any burning activities.

3.5 GROUNDWATER MONITORING WELLS

Groundwater monitoring wells will be no more than one hundred fifty (150) meters from the waste disposal limits at locations that will yield representative samples of the uppermost aquifer beneath the site. The plan for individual well placement, well depth and construction is shown on the permit drawings. The monitoring well plan will be approved by the Department prior to placement. Well specifications, sampling and analysis are discussed in section 9.0 herein.

3.6 FINAL COVER

Final cover of the facility will consist of a low permeability clay cap, geomembrane, a geotextile filter fabric, a drainage layer and an erosion/vegetative layer.

Upon reaching final grades, an eighteen-inch (18") thick layer of cohesive clay soil with a hydraulic conductivity of 1×10^{-5} cm/sec or less, compacted in six-inch (6") lifts, will be placed over the waste. The clay soils will serve as a foundation for the geomembrane and provide a secondary barrier to reduce infiltration of stormwater into the waste.

The geomembrane will consist of a forty (40) mil. or thicker, cap over the clay soil foundation The low permeability of the geomembrane will reduce the infiltration of stormwater into the waste. Textured geomembrane will be used as necessary on side slopes to enhance stability. A geotextile filter fabric will be placed over the geomembrane to provide protection to the geomembrane and to enhance drainage.

A twelve-inch (12") sandy soil of moderate permeability will be placed over the geomembrane and geotextile as protection and to promote proper drainage of stormwater off the cap, therefore providing added safety in slope stability. The drainage layer will also provide an adequate base for the erosion layer.

The erosion layer will consist of six (6) inches of compacted topsoil or enriched soil capable of supporting vegetation. Permanent vegetation will be planted over the entire landfill. The vegetation selected will not have roots capable of penetrating the infiltration layer; will have ample density to minimize soil erosion; and will be sufficiently self-supportive to survive and function with minimal maintenance.

Maximum final grades on the landfill will be twenty-five percent (25%) and minimum grades will be five percent (5%). Details of the final cover design and final landfill grades are shown on the permit modification drawings. The QA/QC Plan for the construction is included as Attachment 12 of the permit application.

4.0 GENERAL OPERATIONAL STANDARDS

4.1 PROTECTION OF HEALTH AND ENVIRONMENT

All operational procedures of TSL will be directed toward protection of human health and the environment. The procedures set forth herein are designed with this purpose. Should any condition occur during the life of this facility which would pose a threat to human health or the environment, immediate action will be taken to correct that condition. Environmental monitoring and treatment structures will be located throughout the site. Facility operations will be conducted in a manner that will not compromise the integrity of these structures.

4.2 SITE ACCESS

All waste coming to the facility will enter on a paved entrance road from Alabama Highway Number 41. Scales and an office facility will be located near the Landfill entrance. Vehicles will stop at the office facility upon entering the Landfill. Sufficient area will be provided to allow space for several vehicles near the office facility.

Only persons authorized by the landfill manager will be permitted access to the site. No access will be allowed except when a landfill attendant is on duty.

4.2.1 Access Barriers

The perimeter of the property is approximately two and one-half (2½) miles long. A significant portion of this boundary is dense bottom land through which vehicular access is restricted by natural barriers. Fencing, gates and earthen berms will be used to augment natural barriers in controlling unauthorized vehicular access to the facility and illegal dumping of waste. Gates will be kept locked except when an attendant is on duty.

4.2.2 Haul Roads

Temporary haul roads will be utilized to deliver waste to the working face of cells. Because cell locations will change, barricades or other directional indicators will be used, as needed, to provide safe and efficient access to the working face. Landfill personnel will direct vehicles to the proper disposal area and be responsible for orderly traffic flow at the Landfill. Traffic control signs or directional signs will be located near the entrance to the facility as required for safe operation.

The temporary roads will be constructed of compacted natural soils. Wet weather conditions may also necessitate placement of crushed stone or gravel over certain portions of the haul roads to assure all weather access to the working face. A stockpile of crushed stone or gravel may be maintained on-site for this purpose.

4.2.3 Signage

A sign will be posted at the landfill entrance that includes the name of the Landfill; the permittee and the owner; the days and hours of operation; the disposal fees; and the types of waste which are acceptable for disposal at TSL. The name and telephone number of the Department will also be given to identify the agency responsible for the facility.

4.2.4 Public Accommodation

Due to the changing nature of the active disposal area, certain conditions may be found unsuitable for use by the general public. Should such conditions occur, the landfill supervisor should initiate measures that will allow for the safe and convenient disposal of waste by non-commercial vehicles.

This may be accomplished by directing disposal to areas set aside for this purpose or by use of a conveniently located drop off area for household waste and recyclables. An area near the maintenance area has been reserved for this purpose.

4.3 ACCEPTABLE WASTE

4.3.1 General

Waste that is acceptable for disposal at TSL is all non-hazardous, noninfectious, putrescible and non-putrescible solid waste, including, but not limited to household garbage, commercial waste, industrial scrap materials and processing waste, construction and demolition waste, yard waste, agricultural waste, paper and similar material, packaging, food waste and related by-products, sludges, ash, tires, drilling waste, contaminated soils and all other similar materials and special waste generated within the service area that is approved by the Department for disposal in a sanitary landfill.

4.3.2 Industrial Waste

Approved industrial users will be identified prior to disposal of industrial waste. Each generator must provide the landfill manager with current written certification from Alabama Department of Environmental Management that the material is acceptable for disposal at TSL. At a minimum, generators must renew certification by the Department biennially (every two years). Copies of such certifications will be placed in the operating record kept on file at the Landfill office.

4.3.3 Authorized Waste

Only waste approved for disposal by the Permit will be accepted at Timberlands. Waste originating from the service area described in Section 1.9 is permitted.

4.4 WASTE MONITORING AND INSPECTION

4.4.1 Monitoring for Regulated Waste

Waste accepted at this facility will be only that waste specified by the permit or waste that is otherwise approved by the Department for disposal at TSL. Any unapproved waste coming to the site for disposal will be refused.

An area will be set aside where incoming waste can be isolated and inspected prior to accepting it for disposal. Landfill personnel will be trained to conduct visual inspections to identify potentially regulated waste. Landfill attendants and equipment operators will also observe waste as it is unloaded at the working face to identify inappropriate materials.

Random inspection of incoming loads will be performed and a record will be kept of all inspections. Any incoming load that may have containerized, "red bag," or liquid waste will be considered a suspicious load and will immediately be isolated and inspected. The hauler will be required to identify the waste source and/or to provide documentation from the Department verifying the waste is approved for disposal at this facility.

The main focus of load inspection will be on vehicles containing industrial and commercial wastes. Landfill personnel will receive training in methods to detect unacceptable waste loads. Such loads would include those which may contain waste in drums or other containers not normally used for disposal; loads with DOT or other descriptive labels; loads which may contain untreated medical waste; loads which may contain liquids; and loads which may contain soils or rags contaminated with PCB's or other hazardous material. Any unidentified waste suspected of containing hazardous materials will be handled and stored as hazardous waste until proven otherwise.

Landfill personnel will be instructed in waste inspection, handling and safety procedures. Unacceptable waste will be refused. Only waste collected within the designated service area of the facility will be accepted. The Department will be immediately notified of any waste found to contain hazardous waste, untreated medical waste, PCB's or other regulated waste and a record of the action will be placed in the operating record.

4.4.2 Recording of Waste Accepted

Each load of waste accepted for disposal will be recorded to show the following: the volume; the date and time the waste was received; and the identity of the hauler (name of firm, driver, vehicle i.d., etc.). Scales will be provided at the Landfill to measure waste volumes by weight.

4.5 PERMANENT CONTROL POINTS

4.5.1 Horizontal and Vertical Control

A coordinate system has been established for the site. The coordinate location of improvements is shown on the permit drawings. Horizontal and vertical control points will be set on the ground for construction of the facility. Sufficient control points will be maintained throughout the life of the facility in order to provide accurate construction of the facility in accordance with the permit drawings.

4.5.2 Permanent Boundary Markers

The property boundary is identified by permanent iron markers set at property corners. Posts, fencing and other permanent boundary markers, which are intervisible from one point to the next, will be set at intermediate points along the boundary so that the property limits may be easily identified. A boundary plat and legal description may be found in the permit drawings.

4.6 OPEN BURNING

No burning of waste will be permitted at the Landfill. Burning may be permitted for construction purposes, such as the clearing of trees, stumps, and brush. All such burning will be at least two hundred (200) feet away from lined portions of the Landfill. No burning will be allowed on previously filled areas. All burning will be in accordance with regulations and a burn permit will be secured prior to the act.

4.7 BUFFER ZONES

4.7.1 Perimeter Buffer

An area, at least one hundred (100) feet in width, around the perimeter of the site, is designated as the perimeter buffer zone. No waste will disposed of within the perimeter buffer. Roads, drainage structures, personnel facilities, equipment facilities, and other landfill appurtenances may be located in the perimeter buffer zone. The buffer zone will be cleared as needed to construct improvements or for cover material. Landscaping or berms may be placed within the buffer to provide a visual barrier between the waste disposal unit and adjacent land.

Vegetation will be maintained throughout the buffer zone. Hay bales and/or silt fences will be used as needed to prevent off-site siltation from clearing, excavating or stockpiling activities. Any buffer areas so disturbed will be revegetated to prevent erosion.

4.7.2 Wetlands Buffer

An additional buffer area is designated as the Wetlands Buffer Zone. The wetlands buffer maintains at least one hundred (100) feet between wetlands and the limits of the waste disposal unit. Permanent vegetation will be maintained in this buffer to reduce erosion into the wetlands.

4.8 LANDFILL MANAGEMENT

4.8.1 Supervision of Operations

BFI will be responsible for all Landfill operations. A Landfill Manager will supervise daily operations of the facility. The Department will be advised of the name and telephone number of the Landfill Manager and any subsequent changes in the position that may occur. The Landfill Manager will direct operations in such a manner that no health, nuisance or aesthetic problems result. It will be the Manager's responsibility to ensure that operations are performed in accordance with procedures outlined in this operational plan and in related plans, documents and regulations referenced herein.

4.8.2 Adequate Personnel

Landfill management will provide adequate personnel to operate the facility in accordance with procedures described herein. The number of personnel will vary in proportion to the amount of waste received at the facility. Minimum personnel on duty at the facility will include a site manager, gate attendant and an equipment operator.

4.8.3 Personnel Training

Landfill management will provide adequate training for all facility personnel so that they may properly and safely perform their job in accordance with procedures described herein.

4.9 PERSONNEL FACILITIES

An office facility will be provided for landfill employees. The facility will be located on-site and will include safe drinking water, sanitary hand-washing and toilet facilities. Copies of landfill construction and operational plans, plus other pertinent landfill operating records, will be kept within the facility. The building will be appropriately located and properly vented to eliminate the possibility of landfill gas accumulation.

4.10 EQUIPMENT

Equipment used to operate the facility will depend on the volume of waste received and will vary throughout the life of the site. Minimum equipment dedicated to landfill use will be equipment which are capable of: spreading waste and cover material; performing minor excavation; and are of adequate size and durability to compact materials as specified herein.

It is not planned to keep equipment on-site for major clearing and excavation of cells or for back-up. Equipment for this work will be contracted as needed. Additional or substitute equipment will also be provided to assure sufficient equipment is available to properly operate the facility and handle the volume of waste received.

4.11 COMMUNICATIONS

A telephone will be located in the office facility. Emergency numbers will be posted where they are readily available from the telephone. The Department will be given the telephone number at the facility and will be advised of any subsequent change of the number. Two-way radios may be used on-site to facilitate communications between site management and operators.

4.12 HOURS OF OPERATION

The hours of facility operation will be set by landfill management. Landfill personnel may be on duty for additional periods to prepare the facility for receipt of waste and to properly close the site after the daily operations. Standard hours the facility will receive waste will be within the following hours:

5:00 am to 6:00 pm	Monday through Friday
5:00 am to 4:00 pm	Saturday

Holidays when the facility will be closed to the public are:

New Years Day
Thanksgiving Day
Christmas Day

The hours for disposal of waste may be adjusted by landfill management to meet needs of haulers, to respond to emergencies, or other special conditions.

A landfill attendant will be on duty during all hours of operation. The standard hours and days the facility is open to the public will be posted at the landfill entrance. The Department will be advised of any change in operating hours outside those mentioned above.

4.13 ACCIDENT PREVENTION AND SAFETY

All landfill employees will be instructed in proper operating and emergency procedures. An adequate inventory of first aid supplies will be maintained at the site. The landfill manager will be capable of administering elementary first aid. Emergency phone numbers will be readily available in the office facility.

Personnel working on a landfill should be made aware that gas emitted from a landfill is potentially explosive and can asphyxiate a person. Gas dispersed into the atmosphere generally poses little threat. However, safety precautions are needed when working around enclosed areas such as pipes, inlets, structures, etc. Workers should not enter an enclosed space without checking for methane gas and/or wearing a safety harness and have another person standing by to pull him or her to safety. Breathing apparatus may be advisable when working in conditions where concentrations of gas may be found. Smoking, sparks or flames should be avoided.

5.0 OPERATIONAL PROCEDURES

5.1 UNLOADING OPERATIONS

5.1.1 Traffic Flow and Parking

The office facility and scales will be located near the landfill entrance. All vehicles transporting waste for disposal will stop at the office facility upon entering the landfill. Waste will be weighed and the volume recorded in tons.

Sufficient area will be provided to allow on-site space for several vehicles near the office facility. Additional on-site space is provided for load inspections. The inspection area is isolated from the entrance scales so that vehicles delayed for inspection will not impede other landfill traffic.

After the waste has been accepted for disposal, landfill personnel will direct vehicles to the proper disposal area and be responsible for orderly traffic flow. Directional signs, barricades, speed limits or other signals will be posted as needed to assure a safe and orderly flow of traffic.

5 1.2 Working Face

The active working face of the Landfill will be confined to as small an area as possible and coordinated with spreading and compacting operations. The systematic placement of refuse will reduce work, minimize scattering of refuse, and expedite unloading of collection vehicles.

Waste which requires special handling may be directed to an alternate disposal area, away from the primary working face. This would include waste which requires immediate covering such as loads of asbestos, large dead animals, bulk waste, materials that could easily become airborne and seafood or other very foul smelling waste. Special handling needs will be determined as the waste is accepted for disposal and landfill personnel will direct haul vehicles to the proper disposal area.

5.1.3 Wet Weather Operations

Except for extreme conditions, landfilling will continue during wet weather. A designated wet weather working face or wet weather haul roads may be provided when direct access to the primary working face is not practical. Landfill personnel will direct vehicles to such disposal areas as needed.

5.2 FILL AND COMPACTION PLANS

A landfill attendant will direct unloading of waste at the working face in a manner to achieve the most advantageous mixture of materials practical in order to obtain optimum compaction of waste. Loads containing lumber, large limbs or other bulk waste that is not highly compactable, may be placed to one side of the working face. This waste can later be thoroughly crushed and incorporated into the working face. This mixture of waste materials allows for better compaction and filling of voids.

The waste will be mixed and spread over the working face and then compacted. Additional waste or cover material may then be placed over the compacted waste. In general, the slope of the working face will typically be 25° (or 4 to 1 slope).

5.3 LANDFILL COVER

5.3.1 Daily Cover

All waste will be covered a minimum of once each working day at the end of the day's operations. The significant function of daily cover material is to control disease vectors, odor, litter, fire and moisture in the waste. On-site soil or tarps will be used for cover material. Any other use of alternative material for cover will be approved by the Department prior to use.

Daily cover deposited on the working face may be removed for reuse as daily cover. The stripped soil will be segregated and stockpiled away from the active face for reuse. When reapplying the stripped cover, fresh soil must be added as needed to ensure that all garbage is covered with at least six inches of soil.

5.3.2 Intermediate Cover

The function of intermediate cover is generally the same as daily cover but includes possible service as a road base and stabilizes an area for a longer period of time. On-site soils will be used for intermediate cover and will be applied in the same manner as daily soil cover, but the minimum compact depth will be one (1) foot.

Areas that have not actively received waste for three (3) months will be covered with intermediate cover within thirty (30) days. The cover will be graded to prevent erosion or ponding of surface water and prepared for the establishment of a vegetative cover. It is not necessary to place topsoil over intermediate cover, however, the area should be fertilized, mulched, and seeded to establish a vegetative cover sufficient to prevent erosion.

Periodic grading and compacting may be necessary to repair cracks or depressions that develop because of moisture loss and settlement of the fill. Periodic inspection and maintenance of the intermediate cover will be performed in order to assure proper functioning of the cover.

5.3.3 Final Cover

Final cover serves to minimize the infiltration of water into the waste; promotes good surface drainage; supports permanent vegetation; and functions on a long term basis. Final cover requirements have been presented in section 3.6 herein.

Final grades and final cover construction will be performed in accordance with details shown on the permit drawings.

5.4 FIRE PROTECTION

Fire protection for the TSL area is provided by Wallace Volunteer Fire Department. Emergency fire extinguishers will be located within the office facility as well as on each major piece of landfill equipment. The telephone number of the Wallace Volunteer Fire Department will be included on the list of emergency numbers maintained in the Landfill office.

Landfill personnel will be trained in fire prevention and protection procedures appropriate to a landfill.

5.5 SALVAGING/SCAVENGING

No scavenging will be allowed at the Landfill and no salvaging will be allowed at the working face. Loads containing recyclable materials, but no putrescible waste, may be directed away from the working face. Such loads may be deposited in designated areas of the Landfill for separation and/or storage until such time as the salvaged material can be returned for recycling.

5.6 ODOR CONTROL

Odors at a landfill are controlled by properly compacting waste, applying cover material, prevention of ponded water, proper management of the leachate system and control of landfill gases. Proper operating practices for each item are addressed in this manual. In the event an odor problem occurs, the landfill manager will be responsible for evaluating the source and taking action appropriate to correct the problem.

5.7 DUST CONTROL

If necessary, dust raised by traffic will be controlled by wetting roads with water or other acceptable means. Dust generated from stockpiled soils or excavation activities should be minimized by planting temporary vegetation.

As filling progresses above natural ground, maintaining a small working face and prompt placement of intermediate and final cover/vegetation will help to control dust.

5.8 VECTOR CONTROL

Vectors will be controlled by placement of daily cover and through proper operating practices that minimize the availability of a food source. In the event a vector problem should occur, it will be the responsibility of the landfill manager to take appropriate measures, such as placement of additional cover or use of a professional exterminator, to control vectors. The Department will be notified of any vector problem and the action taken.

5.9 LITTER CONTROL

Blowing litter will be kept to a minimum by maintaining a small working face and properly compacting and covering the waste. Litter will be picked up regularly in normal housekeeping activities. Certain loads of waste are more susceptible to becoming airborne than others. Such loads should be promptly covered with soil or other waste to minimize conditions that generate excessive litter.

In the event that litter problems should occur, appropriate litter barriers will be maintained around the working face or perimeter of the Landfill. Litter barriers may be constructed by using rows of natural materials, such as limbs or brush, or with temporary fencing or screening. As filling progresses above natural ground, it may be necessary to install relatively permanent fencing in some areas to control litter.

Particular attention should be paid to preventing litter from blowing onto Alabama Highway No. 41. The site, and roadway near the entrance to the site, should be policed regularly to pick up any litter that has occurred.

5.10 EQUIPMENT MAINTENANCE

Routine maintenance of landfill equipment will be performed in accordance with manufacturer's recommendations as well as with accepted ECEC maintenance procedures. An area is reserved for future construction of a building for storage and maintenance of equipment. It will have paved flooring to contain any inadvertent loss of fluids, oil, grease, or gasoline from equipment.

When performing maintenance outside of the equipment building, appropriate measures will be taken to prevent loss of fluids that could contaminate soils, groundwater or stormwater runoff. Such measures may include the placement of visqueen or other impermeable material to contain fluids; the use of absorptive materials to collect spills; prompt clean up of the area; the construction of berms to prevent stormwater run-on to the area or similar measures. Any potentially contaminated material, or soils contaminated by fluids generated during maintenance activities, will be properly disposed.

The facility will also have an above ground fuel storage tank. A containment dike will be constructed around the tank which will exceed the capacity of the tank by ten percent (10%).

5.11 SPILL PREVENTION CONTROL AND COUNTERMEASURES

Above ground tanks for storing diesel fuel and leachate storage will be located on-site. All tank valves and containment area valves will remain closed except when in use. A landfill attendant, who is familiar with proper operating procedures and spill prevention and control measures, will be on duty to open valves and will remain on duty to oversee procedures.

A containment area will be constructed around the tanks. It will provide containment that exceeds the total storage volume of the tanks by ten percent (10%). The containment area will be lined with concrete or a compacted clay liner. Stormwater that collects in the containment areas will be removed and disposed of properly. The containment area will be drained by the use of manual valves or pumps. In the event of a spill from either tank, it will be a priority for landfill equipment and personnel to be available to take expeditious action to protect human health and the environment. Alabama Department of Environmental Management should be called to report the spill. The telephone number will be on the list of emergency numbers maintained in the Landfill office.

In filling the fuel tanks, unloading of transport vehicles will meet minimum guidelines and regulations required by the Alabama Highway Department. A landfill attendant will make periodic inspections of the unloading and fueling area, tanks, tank supports, hoses, containment berms and piping to detect signs of minor spills or leakage. If deficiencies are noted, appropriate action will be taken to immediately correct the cause and clean up the area.

Should a diesel fuel spill occur, no free liquids will be disposed of in the landfill. Absorptive material will be used to collect unusable fuel or it will be pumped to a transport vehicle and taken to a permitted facility for disposal. Contaminated soil and other materials will be excavated and, if approved by the Department, may be deposited in the lined disposal area at the Landfill. Contaminated material, not approved by the Department for disposal at TSL, will be taken to a facility permitted to handle the waste. After all contamination has been removed, the containment area will be reconstructed in accordance with permit drawings and measures will be implemented to prevent recurrence.

Should a leachate spill occur, free liquids will be returned to the leachate collection system for treatment and disposal. Contaminated soil will be excavated and disposed of in the lined disposal area. The containment area will be reconstructed in accordance with permit drawings and measures will be implemented to prevent recurrence.

5.12 COMPOSTING OF YARD WASTE

No immediate plans for composting of yard waste are included in the operation of the Landfill. However, the Landfill layout allows sufficient space to be used for this purpose. Any composting activities performed at the site will employ management practices that prevent surface water pollution, insect, vector or other problems that would be inconsistent with proper management of the Landfill.

5.13 SPECIAL WASTE HANDLING

Waste that requires special handling will be identified as it is received at the facility and accepted for disposal. For the purposes of this discussion, special waste will include waste that requires immediate covering, waste brought in by non-commercial vehicles, sludges (including drilling waste) and asbestos.

Any very foul smelling waste, large dead animals or waste that may easily become airborne will be placed in an area where it can be promptly covered after offloading. Certain conditions, such as heavy commercial traffic or the location of the working face, may warrant the use of dumpsters or an alternate disposal area by non-commercial vehicles. Traffic safety and efficient operations will be determining factors as to whether alternate public accommodations are needed. A landfill attendant will direct vehicles to the proper disposal area.

5.13.1 Sludge

Prior to accepting sludges for disposal, current certification of approval from the Department will be obtained from the generator and will be kept on file at the Landfill. The Paint Filter Liquids Test (SW846 Method 9095) will be conducted on sludges to assure that no free liquids are introduced into the Landfill. When these procedures have been performed, the sludge may then be determined to be acceptable for disposal.

Sludges will be disposed of at the working face and commingled with other waste so that it is mixed and distributed throughout the waste pile. They should be spread and compacted down into the waste in alternating layers. The acceptance of large volumes of sludge should be metered to assure sufficient refuse is available to provide bulking as sludges are introduced into the working face. Limiting the amount of sludge disposed of at one time will assure equipment mobility is not restricted. Properly compacting the sludge into the waste will minimize odors.

5.13.2 Asbestos

Asbestos-containing material arriving at the site for disposal must be properly labeled and containerized. Asbestos will be delivered to an area where it can be buried promptly after unloading.

Landfill personnel unloading the asbestos and equipment operators must wear respirators when handling the material. Asbestos waste must be covered with at least twelve inches (12") of non asbestos containing material.

5.14 EMERGENCY RESPONSE

Landfill attendants will be instructed in procedures to follow in event of an emergency. A list of emergency telephone numbers will be kept current and placed where it is easily accessible in the office facility.

To the extent possible, TSL will respond to community needs in the event of a natural disaster, such as a tornado or hurricane, that requires rapid disposal of large volumes of material. The hours of operation may be extended, as appropriate, to respond to a disaster. The landfill attendants will direct waste disposal operations in as orderly a means as practical. Permission may be given by the Department to burn clean-up debris resulting from a catastrophic event. However, no burning of debris at the Landfill will be permitted without prior approval of the Department and other appropriate agencies. The location of burn activities should be consistent those outlined herein.

5.15 PROTECTION OF THE LINER SYSTEM

The Quality Control/Quality Assurance Plan describes measures designed to assure quality in the construction of the composite liner, the leachate collection systems and the drainage layer/protective cover (liner system). However, after constructing the liner system to the standards set forth in the QA/QC Plan, components of the system are subject to damage from exposure to the weather and work activities. Therefore, in addition to the construction procedures, precautions will be implemented during Landfill operations to maintain the integrity of the system.

The initial lift of waste place over the drainage layer/protective blanket will be placed in a manner to protect the twenty-four-inch (24") blanket. The lift may not be compacted as densely as following layers. Landfill equipment will remain on the waste layer as the lift is spread over the protective blanket. Spreading will be mainly by forward and backward movement, with turning kept to a minimum. As filling progresses, these procedures will be used for placing the initial lift of waste over the side slopes.

The use of equipment over the protective blanket will be avoided. Haul vehicles will not be allowed over the blanket until it is covered by additional soil or waste. Prior to covering with waste, periodic visual inspections of the exposed liner system will be made to detect faults. Protection of the leading edge of the liner is addressed in the QA/QC Plan.

5.16 LEACHATE MANAGEMENT

Leachate from the Landfill will be collected in the leachate collection system described in section 3.2 of this manual. The collection lines will be cleaned out as needed to maintain an unobstructed flow through the system. Sump pumps and submersible pumps will be maintained in accordance with manufacturers recommendations. Tanks will be inspected periodically for signs of leakage. Stormwater collecting within the secondary containment area will be pumped into the leachate holding tanks. A spill prevention control and countermeasure plan, to address any inadvertent release from the tanks.

6.0 OPERATING RECORD

A permanent operating record of TSL will be maintained. It will contain data pertinent to siting, permitting, operating and closing the facility. The purpose of the record is to demonstrate compliance with regulations and to perpetuate an historical account of TSL operations. It will be retained at the landfill. Current records, of the preceding three (3) years, will be kept at the office facility located on the site. The operating record will be available for inspection by the Department at all reasonable times.

6.2.3 Industrial Waste Certification

Copies of current certification of approval from the Department to allow disposal of a specific industrial waste at TSL will be placed in the operating record and kept in the Landfill office. No industrial waste will be accepted unless Department approval is on file.

6.3 ENVIRONMENTAL MONITORING RECORDS

6.3.1 Explosive Gas Monitoring Reports

Explosive gas monitoring will be conducted at the facility a minimum of once each quarter. Gas monitoring results will be placed in the operating record and the Department will be notified. Additional requirements of gas monitoring records are discussed in section 7.1.3 herein.

6.3.2 Groundwater Monitoring Reports

Details of the groundwater monitoring plan and monitoring requirements are addressed in section 9.0 herein. Subsequent groundwater monitoring reports and demonstrations that will be placed in the record include: certification of well installation or decommission; sampling and analysis reports; and notices of assessment monitoring requirements.

6.3.3 Composite Liner System Documentation

System design plans, specifications and documentation procedures have been submitted to the Department as attachments to the permit application and will be placed in the operating record.

6.3.4 Stormwater Monitoring

Monitoring of stormwater discharge will be conducted in accordance with NPDES permit conditions. Discharge Monitoring Reports (DMR) will be placed in the operating record and submitted to the Department in compliance with the requirements of the permit.

6.4 CLOSURE AND POST-CLOSURE PLANS

Closure and post-closure plans have been submitted to the Department as attachments to the permit application. Any revisions to these plans, notices or reports generated in accordance with the procedures outlined herein will be placed in the operating record and submitted to the Department.

6.5 OTHER RECORDS

6.5.1 Financial Assurance

Any cost estimates or financial assurance documentation required by regulations will be placed in the operating record and submitted to the Department.

6.5.2 Miscellaneous

Other documents pertinent to the facility's operations will also be placed in the record. Such items may include personnel training records, copies of variances approved by the Department, waivers, special operating conditions, etc.

7.0 EXPLOSIVE GAS MANAGEMENT PLAN

7.1 EXPLOSIVE GAS MONITORING AND REPORTING

7.1.1 General

The decomposition of waste results in gases being produced. These gases are called "landfill gases" and are composed primarily of methane and carbon dioxide. Monitoring points will be located around the perimeter of the facility to detect methane gas.

The lower explosive limit (LEL) of methane gas is five percent (5%) by volume in air. Explosive gas will not exceed LEL at the landfill boundary nor twenty-five percent (25%) LEL in structures. This section addresses monitoring for explosive gas at the site to assure compliance with those limits is maintained.

7.1.2 Location of Monitoring Points

Monitoring for explosive gas will be conducted along the perimeter of the facility. The distance between monitoring points should not exceed three hundred (300) feet. In areas where occupied dwellings are located within one thousand (1000) feet of the boundary, monitoring points will be spaced not more than one hundred (100) feet apart in the vicinity of such dwellings.

The general location of perimeter monitoring points is shown on the permit drawings. The exact location of these points will be determined in the field. Low areas, that may be underlain by saturated soils, will be avoided when locating monitoring points. They will be located between the waste disposal unit and the facility boundary.

A gas alarm will be installed in each on-site structure.

7.1.3 Monitoring Procedures

Explosive gas monitoring should be conducted at least once each quarter. Since gas from landfilling activities will not be produced during initial operations, reports from the first years of operation will provide background data specific to the site.

In addition to instrument readings, visual inspection should also be conducted to detect conditions that may indicate gas migration. Dying trees, or other signs of unexplained distressed vegetation, may indicate the presence of methane. If such conditions are encountered near the perimeter of the site, the area should be marked; a description of conditions noted or photographs taken; and gas monitoring conducted in the area. If no methane is detected, visual inspection of the area should be repeated at least every quarter to determine if conditions have worsened and what further action may be necessary.

Should readings indicate gas levels in excess of LEL at the facility boundary or twenty-five percent (25%) LEL in structures, the following immediate action should be taken:

(a) Take all necessary steps to assure protection of human health and property.

(b) Notify the Department of the findings and action taken.

Subsequent to this immediate response, an investigation will be made to determine the probable cause of the problem. A report of the gas levels detected and the immediate action taken will be placed in the operating record within seven (7) days. A remedial action plan will then be developed and submitted to the Department within fourteen (14) days. It will be implemented after approval by the Department.

7.1.4 Reporting

Within thirty (30) days of completion of quarterly explosive gas monitoring, a report, documenting levels of gas detected, will be submitted to the Department and placed in the operating record. Reports should be directed to:

Alabama Department of Environmental Management

1751 Congressman W. L. Dickinson Drive
Montgomery, Alabama 36130

Attn: Solid Waste Branch, Land Division

The monitoring report should contain the following data:

A. Name and permit number of the facility;
B. Date of monitoring;
C. Weather conditions (temperature, barometric pressure and general conditions at the time of monitoring);
D. Equipment used;
E. Percent of gas concentration;
F. Layout plan showing the location of the monitoring points; and
G. Name and signature of person performing the testing.

7.1.5 Construction of Monitoring Stations

Permanent or temporary monitoring points may be used to conduct explosive gas monitoring. Temporary points are constructed with a bar hole punch, post hole digger or similar tool. The hole must be a minimum of six (6) feet deep. Readings should be taken in the same general location on each monitoring event.

Permanent gas monitor stations will be constructed around the perimeter of the facility in accordance with the following general procedures and in the general location shown on the permit drawings.

7.1.6 Equipment

Typical equipment used to monitor the specified concentrations is commonly referred to as a combustible gas indicator. Readings are expressed in percent of natural gas by volume. A gas detector (such as Gascope Combustible Gas Indicator Model 62S), which measures the concentration of gas as a percent of the LEL, may be used in place of the gas indicator. However, should the gas detector indicate concentrations at the 100% LEL level, additional equipment will be needed to determine the exact concentration of gas.

The permittee will be responsible for making suitable gas monitoring equipment available for use at the site.

7.2 LANDFILL GAS CONTROL

Plans for an active gas venting system are shown on Drawing 16 of the permit drawings. This system will be installed in phases as Landfill cells are closed.

The gas may be recovered if feasible uses are found or it may be flared to dispose of it by combustion. Detailed plans for a gas extraction system will be submitted to the Department for approval prior to implementation.

8.0 BEST MANAGEMENT PRACTICES PLAN

8.1 GENERAL

Permanent drainage structures of TSL are designed to protect water quality by controlling detrimental effects from stormwater runoff. However, in addition to these permanent control structures, interim measures to protect water quality must be used during the active life of the facility. The measures described herein comprise best management practices (BMP) that will be used during construction and operation of the facility. The practices discussed address sediment and erosion control, good housekeeping and stormwater management.

It is the nature of a landfill for active areas to change location throughout the life of the facility. Therefore no attempt can be made to locate the exact area in which a BMP should be implemented nor to define which BMP is applicable to a given situation. This plan outlines standard practices which have been shown to be effective in controlling adverse environmental impacts from land disturbing activities. The intent of this plan is to provide information on control measures that will be employed in managing the landfill. The landfill manager will be responsible for the day to day implementation of the BMP plan.

8.2 CRITICAL AREAS

The critical areas for controlling detrimental impacts from stormwater are on long, steep slopes; areas with highly erodible soils; and areas where stormwater could come in contact with the waste. It is not only important to protect off-site areas from degradation which could be caused by runoff; it is equally important to protect the integrity of landfill containment system.

The facility will be inspected to ensure that BMPs are continually implemented and are effective. Such inspections will include an investigation of all structures that function to prevent stormwater pollution or to remove pollutants from stormwater.

8.3 SEDIMENT AND EROSION CONTROL

8.3.1 Vegetation

Sediment and erosion are best controlled at the source and vegetation is the most effective means of protection. It dissipates a large portion of the energy of rain as it falls on the ground surface; slows and reduces runoff; roots help hold soil in place; and it tends to trap sediment. Temporary or permanent vegetation should be established at the earliest opportunity on all exposed surfaces. This may even include stockpiles of soil that will not be used for long periods of time. Management practices should minimize the area and time period during which bare soil will be exposed. Vegetation in buffers or other undisturbed areas should be protected. Areas to be seeded should be sufficiently compacted to prevent erosion of the soil and disked, as needed, to assist in germination.

A temporary seed mix should be used in areas that will be exposed for more than a few months. More permanent seeds should be mixed with temporary seeds if areas will be exposed for longer periods. Mulch is often needed on steep slopes. It will reduce runoff, allow more water to infiltrate into the soil and help hold seed in place. Fertilizer or lime may be needed to assure germination and establish the vegetation. These should be used in accordance with manufacturer's instructions and State and federal regulations.

8.3.2 Control Structures

The facility is designed so that permanent ditches, terraces, inlets and pipes will intercept stormwater from disturbed areas. These structures will convey stormwater to ponds where sediment will settle out before water is released into natural drainage channels to flow off-site. Landfill construction should not interfere with the control characteristics of the permanent drainage structures. Temporary diversion devices should be compatible with the overall drainage system of the site.

8.3.3 Typical Practices

(a) Temporary Ditch Pipes

If a temporary haul road or other barrier will obstruct a ditch, measures should be taken to assure that water flow will not be interrupted. A pipe may be laid in the ditch and the haul road built up over the pipe. The pipe must be sized to accommodate the anticipated calculated flow. As the location of the haul roads changes, pipes may be removed and reused at other locations. Pipes may also be used to provide a positive drain outlet from temporary berms or diversion ditches.

(b) Temporary Diversion Berms

Earthen berms may be constructed at the top of slopes to divert the water away from the slope. This can be accomplished by using a dozer to move soil up the slope, depositing it at the crest to form a ridge, and compacting the soil. Water behind the berm must have a positive outlet with runoff diverted to the overall drainage system of the facility.

(c) Sediment Controls

Hay bales, silt fence or other sediment control devices will be used to minimize silt washing into pipes, ditches, ponds or cells. Details of hay bale or silt fence installation are found in the permit drawings. Such barriers must be carefully placed so they will trap silt and not interfere with construction or water flow. Sediment must be removed on a regular basis to maintain function.

(d) Temporary Energy Dissipators

The velocity of runoff down steep drainage channels can cause scouring and erosion problems. Sand bags, rip rap, gabions or similar materials can be used to dissipate the energy of the water flow. They should be firmly anchored in a stable area at the toe of the slope and may also be placed along the entire length of a slope in a manner that will reduce the speed of the water.

(e) Temporary Diversion Ditches

Temporary ditches can be excavated to intercept water that would run onto slopes, into cells, roads or other areas where it needs to be controlled. Water from temporary diversion ditches will be conveyed to an area where it can be handled by the permanent drainage system.

Diversion ditches that could collect large amounts of sediment, should be compacted, vegetated, lined, or otherwise constructed to trap sediment and control erosion.

(f) Temporary Haul Roads

Roads on a landfill must be sufficiently stabilized to allow all weather traffic. Such roadway stabilization will also reduce on-site erosion. Wherever possible, swales should be constructed along the shoulder to control runoff from the roadway. The roadways should be cross-sloped to drain into the swales. Sediment collecting in the swales must be removed on a regular basis. Side slopes will be seeded.

8.4 GOOD HOUSEKEEPING

BMPs should also include measures to minimize the transport of pollutants other than sediment. Such materials as pesticides and fertilizers should be applied using proper techniques. Manufacturers instructions and State and federal regulations should be strictly adhered to when using these materials. Landfill leachate, water that has come into contact with waste, fluids from vehicles and litter should be prevented from reaching runoff waters.

TSL is designed so that water which comes into contact with waste will flow to the leachate collection system. All such contact water will be collected, treated and disposed of in accordance with procedures approved by the Department.

Wastewater from the vehicle maintenance area will be properly treated. Used oils and other fluids will be collected in containers and disposed of in an approved manner. Paper, rags and other material which have come into contact with fluids will be disposed of in the sanitary landfill.

Measures will be taken to control litter that could be washed into runoff waters. On-site litter will be picked up on a regular basis and wind screens will be used to minimize blowing litter. Litter reaching sedimentation ponds can easily be removed from the ponds and deposited in the Landfill.

8.5 STORMWATER OUTFALL

The stormwater system of the facility is designed to control runoff from a twenty-five (25) year, twenty-four (24) hour storm event. Water from all disturbed areas will be intercepted by permanent control structures and collected in ponds. In addition to their design capacity, the ponds will have three (3) feet of free board.

Discharge of pond water will be managed through the use of outlet control structures consisting of standpipes with primary orifices and overflow/emergency outlet structures. The primary orifices will be sized and set vertically to maximize the retention of the stormwater to provide the deposition of sediment and debris. The ponds will be provided a minimum of two (2) feet of permanent pool storage. The overflow/emergency outlet structures will consist of either the standpipe or a weir designed to overflow in a storm event exceeding a twenty-five (25) year storm. Discharge from the ponds will be monitored in accordance with NPDES permit requirements.

cover, drainage system, monitoring system or other component of the containment system.

10.3 CLOSURE RECORDS

Upon completion of closure construction, the permittee will request approval from the Department certifying the Landfill has been closed in accordance with regulations. Upon closure approval from the Department, the permittee of the facility will place a notation on the land deed, plat or other legal instrument that will become part of any future transfer of the property. The notation will be prominently displayed and the instrument will contain the following information:

(a) The land has been used for a solid waste disposal facility.
(b) Future activities on the property may not disturb the integrity or function of the containment or monitoring systems.
(c) The location and dimensions of the disposal facility, with respect to permanently surveyed benchmarks, as prepared and sealed by a Professional Land Surveyor registered in the state of Alabama.
(d) The name of the Permittee or operating agency, the type of disposal facility and the beginning and closure dates of disposal activities.
(e) Certification by a Professional Engineer, registered in the state of Alabama, that all closure requirements have been completed as determined necessary by the Department.

Within ninety (90) days of closure approval from the Department, the permittee or owner will record the legal instrument containing the above information in the office of Judge of Probate, Escambia County, Alabama. A certified copy of the recorded instrument will be placed in the operating record and submitted to the Department within one-hundred twenty (120) days.

10.4 FINANCIAL ASSURANCE FOR CLOSURE

The owner or operator of TSL will provide financial assurance for closure of TSL in accordance with regulatory requirements.

11.0 POST-CLOSURE CARE

11.1 GENERAL SCOPE OF WORK AND MAINTENANCE PROCEDURES

After a landfill is closed, waste that has been buried continues to decompose. This causes several processes to occur that make the site unsettled for an indefinite period of time. Therefore, a closed landfill needs to be inspected and maintained on a regular basis to insure that these conditions do not impair the function of the containment system. Maintenance of the closed landfill is a long-term responsibility for the permittee.

The general requirements of a closed landfill, the associated problems, and procedures to be used to inspect and maintain the closed landfill are discussed herein. Descriptions of construction and the purpose and function of features have been provided to give a clear understanding of maintenance objectives. Personnel responsible for inspecting and maintaining the Landfill should be thoroughly familiar with these guidelines. The Department will be notified of the name, address and telephone number of the contact person responsible for post-closure care of the facility.

11.1.1 Landfill Cap

The site will be graded so that rainwater will run off the site and no water will stand on the surface. The vegetation controls erosion and further absorbs some of the rainwater. It is important that this cap be repaired and maintained so that it continues to keep water out of the waste.

Minor surface cracks and trapped pockets of water can be corrected by placing soil on the area, grading the area to provide positive drainage, compacting the soil and reseeding the area. More severe problems will need further action.

11.1.2 Settlement

Many different types of waste are disposed of in a landfill. As each waste decomposes, the original volume of that waste is reduced. Some waste decomposes very rapidly and undergoes a large reduction in volume. Other waste decomposes more slowly and the volume reduction is considerably less.

As this decomposition occurs, settlement of the filled area becomes evident. Some portions of the site may settle fairly rapidly, while other areas appear relatively stable. This results in uneven (differential) settlement of the landfill surface that may cause water to pond, cracks in the surface and can disrupts proper drainage of the site.

The entire filled area can also settle at a more uniform rate. This is referred to as subsidence and may result in the same problems as differential settlement. The majority of settlement in a landfill usually occurs in the first five (5) years after closure. If settlement is noticeable on a closed landfill, corrective action needs to be taken.

11.1.3 Landfill Gases

Gas monitor stations will be located at the facility to monitor for migration of explosive gases. These structures are typically one (1) or two (2) inch PVC pipes rising two (2) to four (4) feet above ground and are located around the perimeter of the site. These gas monitoring probes will be installed as per the phasing plan on Drawing 16 of the permit drawings.

11.1.4 Drainage and Erosion Control

Stormwater running across the landfill surface can cause erosion. The stormwater runoff is controlled by the final grading and drainage plan of the site. Stormwater runoff from TSL flows to terraces, pipes, ditches and sedimentation ponds that are a part of the overall drainage system. This system has been designed to control stormwater runoff and deter erosion.

Sedimentation ponds are designed to prevent siltation from washing off-site. The ponds have outfall structures that control the rate at which water is released. Silt that collects in the bottom of the ponds is normal and indicates that the ponds are functioning properly. However, the silt needs to be removed when large quantities accumulate. Silt that is relatively dry may be placed on areas of the landfill where it is unlikely to wash away. It should be spread evenly over the surface in thin layers that will not harm vegetation or the area should be revegetated as needed.

In addition to drainage structures to direct the flow of water, the Landfill is also planted with grass or other vegetation. This vegetation is an integral part of controlling erosion. The vegetative cover should be mowed two or three times each year.

The County Agent may be consulted to determine the most advantageous mowing schedule to maintain healthy vegetation at the site. The schedule may vary from year to year and should remain flexible to accommodate weather conditions. However, the following factors should be considered.

(a) Fertilizer needs;
(b) Mowing prior to inspection and/or monitoring;
(c) Regermination; and
(d) Prevention of grass fires.

All of these elements of the site's drainage and erosion control system must be maintained in order to work properly. Minor problems such as bald spots in the vegetative cover or minor scouring of ditches or ponds can be corrected by routine maintenance. More severe problems may require further action.

11.1.5 Leachate

A system of perforated pipes collects the leachate from the bottom of the lined disposal area and then flows to internal sumps. It is pumped from sump access pipes to double-walled leachate lines which convey it to pump stations and then to holding tanks. The leachate is removed from the tank for transport to a wastewater treatment plant. The frequency with which the leachate will be removed will vary with the amount of leachate produced. Approval to recirculate leachate has been granted by ADEM and recirculation is also a method that may be used.

The pumping stations and manholes are sealed structures where gases and/or fumes may accumulate. Appropriate safety precautions described herein should be taken when opening the wells.

Holding tanks should be inspected for signs of leaks and to assure that locks are in place on the valves and there are no visible signs of leakage. If deficiencies are found, immediate measures should be initiated to correct the problem and restore the system to proper working order.

11.1.6 Access Control

When the facility is closed, barriers to control vehicular access to the Landfill will be in place. The barriers may consist of fencing or they may be natural barriers, such as dense vegetation. The perimeter of the site will be inspected to assure that the site is secure from access by unauthorized personnel. Any gap found in a perimeter barrier will be repaired.

11.1.7 Stormwater Monitoring

Landfill sites are required to monitor stormwater leaving the site. Samples of the stormwater must be collected and analyzed according to the schedule and conditions stated on the NPDES permit. Analysis must be done by a laboratory certified to perform these services.

It is required that water samples be collected during a "storm event" (rain) of 0.1" of rain or greater that occurs at least seventy-two (72) hours after a rain of 0.1" or greater. Therefore, sampling is dependent upon rainfall. If rain data in the vicinity is not available, rain will be monitored at the site to determine if rainfall is sufficient to sample the runoff.

To collect the sample, an uncontaminated sample container is rinsed twice with the stormwater before the sample is collected. To assure the water is well mixed, samples should be collected near the center of the flow channel. The estimated flow or a measurement of water depth in the monitor channel should be recorded. All reports should be properly signed and submitted on standard Department forms by the 28th day of the month following the monitor period.

11.1.8 Miscellaneous

Weeds growing along fence rows, monitoring or venting structures, drainage structures, etc., may cause no specific problems at the site. However, this condition can hinder inspection and monitoring, make monitor structures more prone to damage, and detract from the well maintained appearance of the facility. Herbicides may be used to kill weeds if the work is performed by a person certified to use such material, following manufacturer's recommended procedures.

The site will also be inspected for the presence of animal burrows which could damage the Landfill cover and conditions which could attract disease vectors.

11.2 GENERAL INSPECTION AND MONITORING PROCEDURES AND SCHEDULE

All areas of the Landfill should be inspected according to the schedule and procedures set forth herein. A written report of the site inspection, deficiencies found and maintenance activities will be completed and kept with the facility operating records.

11.2.1 Landfill Inspection

The entire property should be walked in order to properly inspect the Landfill and locate any problems that need to be addressed. Maintenance required should be performed subsequent to the inspection.

11.2.2 Inspection Schedule

For the first year after closure, a thorough inspection of the Landfill will be performed monthly. In the event no unforeseeable problems are indicated after closure of the facility, the following schedule for inspecting and maintaining the facility will be followed. Additional inspections will also be conducted after major storm events.

YEAR AFTER CLOSURE	INSPECTION/MAINTENANCE SCHEDULE
1	Monthly
2	Quarterly
3	Quarterly
4	Semi-annually
5	Semi-annually
6	Annually
7	Annually
8	Two year interval
10	Two year interval
12	Three year interval
15	Five year interval
20	Five year interval
25	Five year interval
30	Final inspection

Subsequent to final inspection, an independent engineer, registered in the State of Alabama, will certify that post-closure care has been conducted in accordance with this plan. Certification will be placed in the operating record and the Department will be notified.

11.2.3 Environmental Monitoring

Environmental monitoring should be performed by personnel qualified to monitor and report on conditions at the Landfill. Monitoring parameters and frequencies are shown herein. All monitoring will be performed in accordance with regulatory requirements. If after closure, a reduction in monitoring parameters or frequencies are indicated, a specific request for such reduction will be submitted to the Department for approval.

Reports to regulatory authorities must be properly signed and submitted in a format or on a form approved for such reports. The permittee is responsible for seeing that all monitoring and reporting is completed within specified time frames. Environmental monitoring reports will be placed and the operating record and the Department will be notified.

11.3 FINANCIAL ASSURANCE FOR POST-CLOSURE

The owner or operator of the landfill will provide financial assurance for post-closure care of Timberlands Sanitary Landfill in accordance with regulatory requirements.

TIMBERLANDS
SANITARY LANDFILL

OPERATIONAL PLAN

APPENDIX A

Quarterly Volume Report

SOLID WASTE - QUARTERLY REPORT OF VOLUME

Name of Facility____ Permit No____________________

For The Quarter Ending (March, June, Sept., Dec.) (CIRCLE APPROPRIATE MONTH) ________________Year

	Month________		Month________		Month________	
	Volume*		Volume*		Volume*	
(DATE)	In-State	Out-Of-State	In-State	Out-of-State	In-State	Out-of-State
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
TOTALS						

TOTAL FOR QUARTER	In-State	Out-of-State	AVERAGE DAILY	In-State	Out-of-State

*VOLUME: CAN BE EXPRESSED IN TONS.

Report Submitted BY:____________________________________
(Signature of Permittee or His Designee)

Report To: ADEM
Solid Waste Section
1751 Congressman W. L. Dickinson Drive
Montgomery, AL 36130

!!!REPORT DUE BY THE 15th OF THE MONTH
FOLLOWING THE REPORTING QUARTER!!!

TIMBERLANDS
SANITARY LANDFILL

OPERATIONAL PLAN

APPENDIX B

Tables of Sample
Preservation Procedures
and Holding Times

TABLE 1
Preservation Procedures and Holding Times

Parameter	EPA Method	Recommended Container	Preservative Indicators of Groundwater Contamination	Holding Time	Volume Required for One Analysis
pH	150.1	T,P,G	Field Determined	None	25 ml
Specific Conductance	120.1	T,P,G	Field Determined	None	100 ml
Chlorides	325.3	T,P,G	4°C	28 days	50 ml
Inorganics 40 CFR 258 Appendix I	SW-846 including either Method 6010 or a 7000 series method	T,P	Total Metals Field Acidified to pH 2 with HNO_3 Dissolved Metals 1. Field filtration is possible 2. Acidify the filtrate to pH 2 with HNO_3	6 months 6 months	1,000 ml 1,000 ml
Nitrate/Nitrite	353.3	T,P,G	4°C/H_2SO_4 to pH2	14 days	1,000 ml
Volatile Organics 40 CFR 258 Appendix I	SW846 including Method 860	G,T-lined septa or caps	Cool 4°C	7-14 days (extract in 5 days)	60 ml
Sulfate	375.2/9035	P	Cool 4°C	14 days	500 ml

P = polyethylene
G = glass
T = Fluorocarbon resins (Teflon, PTFE, FEP, etc.)
HCl = Hydrochloric Acid
HNO_3 = Nitric Acid
H_2SO_4 = Sulfuric Acid
NaOH = Sodium Hydroxide

ALABAMA
LICENSED
Daniel E. Cheek
No. 35305
PROFESSIONAL
3/18/19
ENGINEER
DANIEL E. CHEEK

Timberlands Sanitary Landfill - Operational Plan

Appendix C

Landfill Gas Caisson Wells

1. General

   To improve the overall effectiveness of the landfill gas (LFG) collection system, vertical wells may be installed utilizing a bottom-up caisson method allowing full extension through the waste profile from the top of protective cover to the top of waste. Initial installation will occur with the first waste lift in a new cell, and subsequent extensions will follow the progression of fill operations. The gas wells will ultimately be extended up to the final cover system for connection to a LFG wellhead. Details for initial installation and raising of the caisson well are included in the engineering plans.

2. Installation

   Gas well locations should be coordinated with the planned layout of the LFG well field and should generally be located near the perimeter areas of future cells where drilling restrictions limit the allowable depth of a typical well installation. They should not be installed over leachate drainage columns, sumps, sump risers, or cleanouts.

   Initial construction will consist of a 6 ft tall rock pad (8 ft by 8 ft) to be installed over the protective cover following construction and certification of the new cell. The top four corners of the pad will be surveyed. After placement of an initial 10'-15' waste layer, the surveyed pad corners will be staked to facilitate waste excavation to the top of the rock pad. The caisson pipe will be set vertically and located on top and in the center of the rock pad. The excavation pit will be backfilled with waste. For the initial 15', the caisson pipe will be filled with gravel to the ground surface and capped. Perforated pipe shall not be installed in the vertical column within 15 ft of the flexible membrane liner. Soil should be mounded several feet high around the base of the caisson pipe to help maintain verticality and provide protection during normal operations.

3. Operating Procedure

   Following initial installation, waste filling of the area should proceed until the top of waste is within 2 to 3 feet of the top of the caisson pipe, at which point it should be raised. The cap is removed and perforated pipe is inserted into the caisson and extended to +/- 8.5 ft above the existing waste surface. Gravel is then backfilled to existing grade and the caisson is lifted to +/- 10 ft above the existing waste surface, and +/- 1.5 ft above the end of the perforated pipe to facilitate future connection. Subsequent raises will begin with an extension of the perforated pipe with pipe sleeves and bolt connections. The caisson is re-capped and soil is again mounded several feet high around the base of the pipe prior to resuming fill operations. This process is continued until the well is ultimately transitioned for connection to an LFG collection wellhead (designed by others).

HHNT

HODGES, HARBIN,
NEWBERRY & TRIBBLE, INC.

Consulting Engineers

March 18, 2019

Mr. C. Blake Holden
Solid Waste - Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

Re: Timberlands Sanitary Landfill
Variance Request
Permit No. 27-08
HHNT Project No. 6703-718-01

Dear Mr. Holden:

On behalf of Republic Services Inc., Hodges, Harbin, Newberry and Tribble, Inc. is requesting that all previously approved variances for the subject facility be included in the facility's renewed permit. A list of the previously approved variances that were contained in Section X of the facility's Solid Waste Disposal Facility Permit is provided below:

1. The Permittee is granted a variance to Rule 335-13-4-.20(2)(c)2. requiring the maximum final grade of the final cover system shall not exceed 4 to 1. The maximum final slope of 3.5 to 1 shall be allowed along the toe of the slope in Cell 1 and Cell 3-B. The final slope above the 243-foot elevation shall be 4 to 1 in Cell 1 and Cell 3-B. The final slopes in the remaining cells shall not exceed 4 to 1.

2. The Permittee is granted a variance to Rule 335-13-4-.22(1)(c) requiring a daily completed cell shall not exceed 8 feet in vertical thickness measured perpendicular to the slope of the preceding cell. The Permittee shall be allowed a vertical thickness of 15 feet. (See Section III.I.)

Should you have any questions, please call.

Sincerely,

HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.

Daniel E. Cheek

Daniel E. Cheek, P.E.
Professional Engineer

DEC/cm

cc: Michael Guy

LANCE R. LEFLEUR
DIRECTOR

KAY IVEY
GOVERNOR

Alabama Department of Environmental Management
adem.alabama.gov
1400 Coliseum Blvd. 36110-2400 ▪ Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 ▪ FAX (334) 271-7950

July 12, 2019

MEMORANDUM

To: Blake Holden
Engineering Section
Solid Waste Branch

From: Wesley S. Edwards
Hydrogeology Section
Groundwater Branch

RE: Groundwater Monitoring Plan
Timberlands LF #27-08
Escambia County, Alabama

Summary

The Department has received the Groundwater Monitoring Plan for the Timberlands Landfill No. 27-08. The ADEM Solid Waste Branch requested that the Hydrogeology Unit evaluate the submittal and provide pertinent comments and recommendations. This report is a result of that request.

Comments

The submitted Plan adequately addresses regional geology, hydrogeology, stratigraphy, well construction, sample collection, and well abandonment. The Monitoring Plan should include a detailed description and map of site wells, a potentiometric figure, boring logs, a detailed description of the statistical methods used to comply with solid waste regulations, and other relevant information. An adequate monitoring plan should be submitted that follows the format of the Alabama Groundwater Monitoring Reporting Guidance for Solid Waste Facilities provided on the ADEM website (http://adem.alabama.gov/programs/land/landforms/ALGWMonitoringReportGuidanceMarch2011.pdf).

LANCE R. LEFLEUR
DIRECTOR

ADEM

KAY IVEY
GOVERNOR

Alabama Department of Environmental Management
adem.alabama.gov
1400 Coliseum Blvd. 36110-2400 ▪ Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 ▪ FAX (334) 271-7950

July 16, 2019

CERTIFIED MAIL 91 7199 9991 7039 3087 3132
RETURN RECEIPT REQUESTED

Mr. Andrew Rodgers
Republic Services, Inc.
22800 Highway 41
Brewton, Alabama 36426

Re: Permit Renewal - Groundwater Monitoring Plan
Timberlands Sanitary Landfill
Permit No. 27-08
Escambia County, Alabama

Dear Mr. Rodgers,

The Department has reviewed the Groundwater Monitoring Plan, dated March 19, 2019, for the above referenced facility. After review, the following comments and recommendations were made.

- The submitted Plan adequately addresses regional geology, hydrogeology, stratigraphy, well construction, sample collection, and well abandonment. The Monitoring Plan should include a detailed description and map of site wells, a potentiometric figure, boring logs, a detailed description of the statistical methods used to comply with solid waste regulations, and other relevant information. An adequate monitoring plan should be submitted that follows the format of the Alabama Groundwater Monitoring Reporting Guidance for Solid Waste Facilities provided on the ADEM website http://adem.alabama.gov/programs/land/landforms/ALGWMonitoringReportGuidanceMarch2011.pdf.

In order for the Department to consider the permit renewal, please review all comments and provide the suggested information within the next 45 days of receipt of this letter. If you should have any questions, please contact Mr. Blake Holden of the Solid Waste Branch at (334)-274-4248.

Sincerely,

S. Scott Story, Chief
Solid Waste Engineering Section
Land Division

SSS/bh

Cc: Daniel Cheek

PERMIT RENEWAL PLANS WITH MINOR MODIFICATIONS
FOR
TIMBERLANDS SANITARY LANDFILL

ESCAMBIA COUNTY, ALABAMA

22800 HIGHWAY 41
BREWTON, AL 36426

JUNE, 2014

REVISED: MARCH 2019

H1

SITE OPERATOR:

REPUBLIC
SERVICES, INC.™

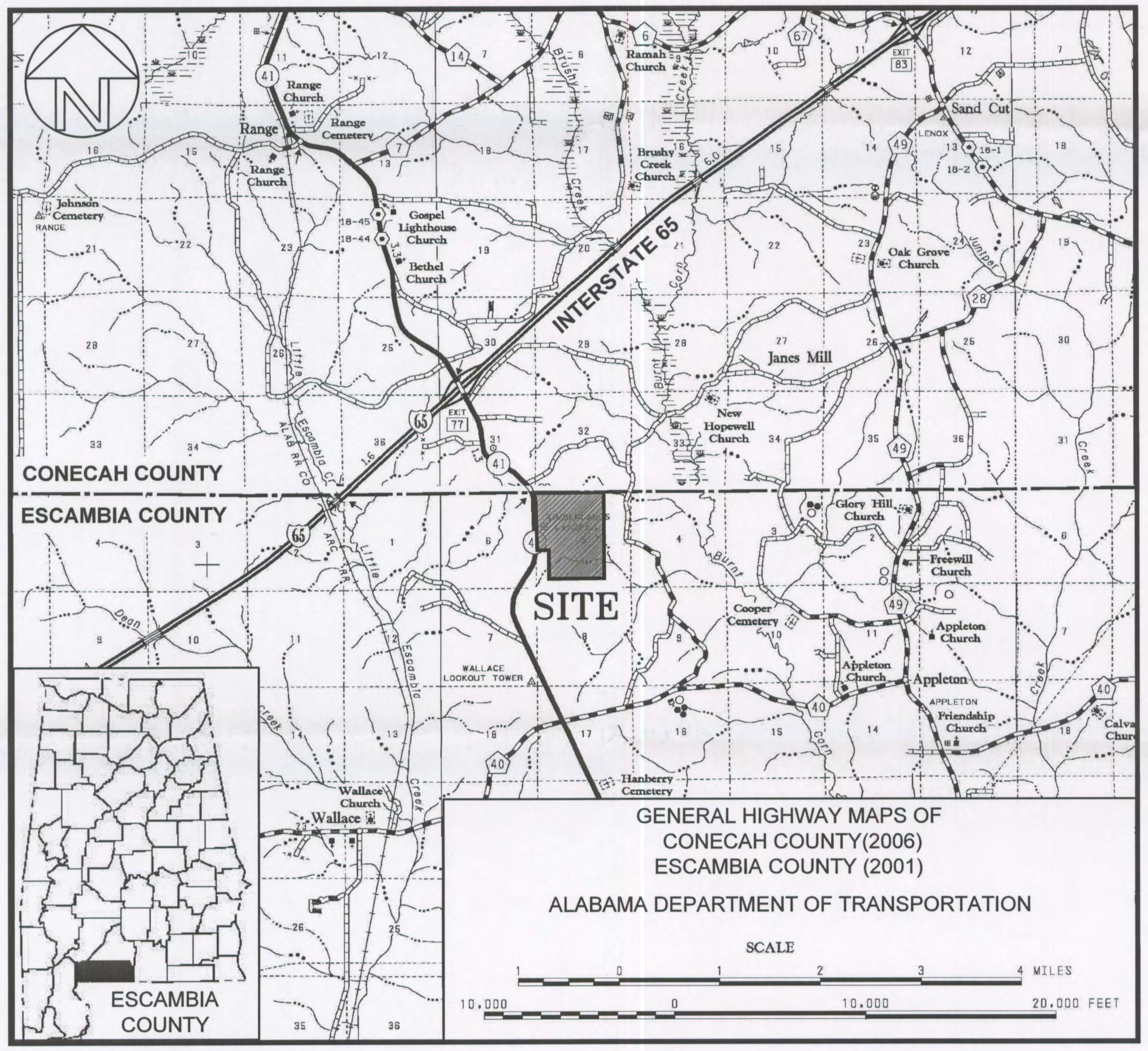
BFI WASTE SYSTEMS OF ALABAMA, LLC
22800 HIGHWAY 41
BREWTON, AL 36426

PROPERTY OWNER:

ESCAMBIA COUNTY ENVIRONMENTAL CORPORATION
2191 IVY CREEK CHURCH ROAD
RUTLEDGE, AL 36071

PERMIT RENEWAL BY:

Terracon
4040 ROYAL DRIVE, SUITE 100
KENNESAW, GA 30144
(770) 924-9799
www.terracon.com



GENERAL HIGHWAY MAPS OF
CONECAH COUNTY(2006)
ESCAMBIA COUNTY (2001)
ALABAMA DEPARTMENT OF TRANSPORTATION

SCALE
1 0 1 2 3 4 MILES
10,000 0 10,000 20,000 FEET

LOCATION MAP

INDEX TO SHEETS

SHEET #	TITLE
1	COVER SHEET
2	BOUNDARY SURVEY
3	SITE PLAN
4	POTENTIOMETRIC MAP (2013)
5	SUBGRADE PLAN
6	LEACHATE COLLECTION PLAN
7	FINAL GRADING PLAN
8	STORMWATER MANAGEMENT PLAN
9	CROSS-SECTION A-A
10	CROSS-SECTION B-B
11	SURFACE & GROUND WATER MONITORING PLAN
12	LANDFILL GAS MANAGEMENT PLAN
13	CONSTRUCTION DETAILS (I)
14	CONSTRUCTION DETAILS (II)
15	CONSTRUCTION DETAILS (III)
16	CONSTRUCTION DETAILS (IV)
17	GAS CAISSON WELL CONSTRUCTION DETAILS

H1
H1

HHNT
HODGES, HARBIN,
NEWBERRY & TRIBBLE, INC.
Consulting Engineers
3920 ARKWRIGHT ROAD, SUITE 101 - MACON, GEORGIA 31210
(478) 743-7175

REVISION DATE: 03-13-2019

No. 35305
DANIEL E. CHEEK
3/18/19
Daniel E. Cheek

THE PREVIOUS VERSION OF THIS PERMIT DRAWING WAS PREPARED AND SEALED BY TERRACON, INC. (CLAIRE N. BACON, PE #34105-E), DATED JUNE 3, 2014. HHNT ONLY CERTIFIES THE REVISIONS CLOUDED ON THIS DRAWING AND DENOTED WITH A REVISION TAG.

H1

REV (R) SUB (S)	DATE	BY	DESCRIPTION
0	3/20/09	EJW	DRAFT REVIEW
1	5/12/09	EJW	SUBMITTAL TO A.D.E.M.
2	8/19/09	EJW	REVISED CELL LINER DETAIL
3	2/09/10	CRW	MINOR MOD w/o ALT. CAP
4	8/04/11	TSR	REMOVED FINAL COVER ALT.
5	8/19/11	TSR	SUBMITTAL TO ADEM
6	2/4/14	CNB	PERMIT RENEWAL w/ MINOR MODS
7	6/3/14	CNB	REVISIONS PER CLIENT COMMENTS

Terracon
Consulting Engineers and Scientists
4040 ROYAL DR., SUITE 100 KENNESAW, GA 30144
PH. (770) 924-9799 FAX (770) 924-7866

REPUBLIC
SERVICES, INC.™
22800 HIGHWAY 41 BREWTON, AL 36426

COVER SHEET

PERMIT RENEWAL PLANS WITH MINOR MODS
SOLID WASTE PERMIT #27-08
TIMBERLANDS SANITARY LANDFILL
ESCAMBIA COUNTY, ALABAMA

DRAWN BY: CNB
APPVD. BY: CWM
JOB NO. EJ137474

DRAWING
1

Last Saved By: RHOLDER Date: 3/15/2019 3:26 PM File: P:\REPUBLIC – TIMBERLANDS\PROJECTS\SOLID WASTE PERMIT RENEWAL\TL-PERMIT RENEWAL_BASE.DWG

LANDFILL PARCEL PROPERTY BOUNDARY (346.73 ACRES) :

STATE OF ALABAMA

COUNTY OF ESCAMBIA

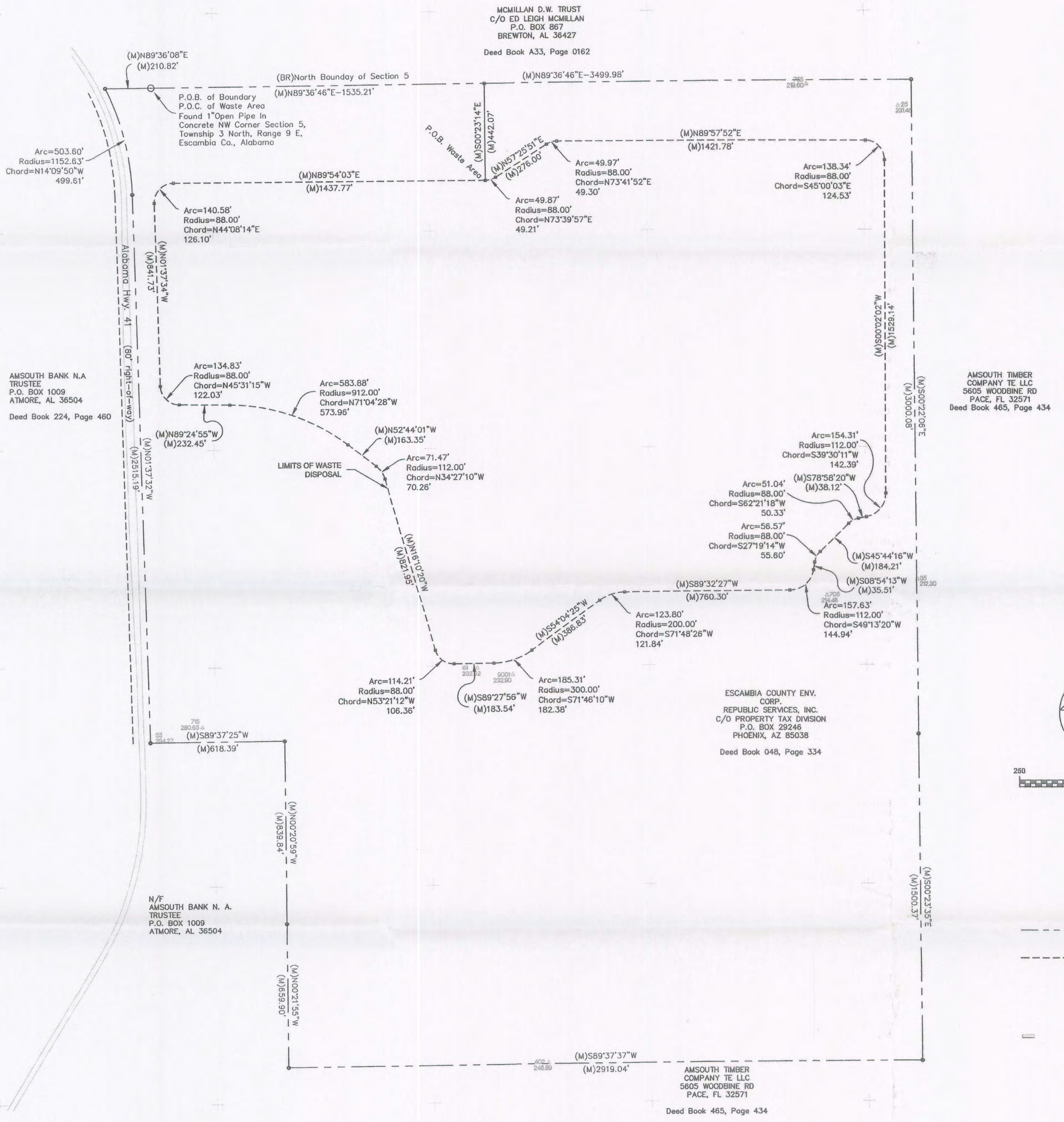
A part of Sections 5 and 6 of Township 3 North, Range 9 East, Escambia County, Alabama described as follows:

BEGIN at the Northwest Corner of said Section 5;
Thence N89°36'46"E along the North Boundary of said Section 5, 3499.98 feet to a 3/8" Capped Iron PLS 10675;
Thence S00°22'06"E, 3000.08 feet to a 3/8" Capped Iron PLS 10675;
Thence S00°23'35"E, 1500.37 feet to a 3/8" Capped Iron PLS 10675;
Thence S89°37'37"W, 2919.04 feet to a 3/8" Capped Iron PLS 10675;
Thence N00°21'55"W, 659.90 feet to a 3/8" Capped Iron PLS 10675;
Thence N00°20'59"W, 839.84 feet to a 3/8" Capped Iron PLS 17253;
Thence S89°37'25"W, 618.39 feet to a 3/8" Capped Iron PLS 10675 on the East right-of-way of Alabama Highway 41;
Thence N01°37'32"W along said right-of-way, 2515.19 feet to a 3/8" Capped Iron PLS 10675;
Thence Northwesterly along the Arc of a curve to the left 503.60 feet, (Radius 1152.63 feet, Chord N14°09'50"W, 499.61 feet) to a 3/8" Capped Iron PLS 10675;
Thence N89°36'08"E, 210.82 feet to the POINT OF BEGINNING.
Contains 346.73 acres, more or less.

LIMITS OF WASTE DISPOSAL AREA (134.32 ACRES):

A part of Sections 5 and 6 of Township 3 North, Range 9 East, Escambia County, Alabama described as follows:

COMMENCE at the Northwest Corner of said Section 5;
Thence N89°36'46"E along the North Boundary of said Section 5, 1535.21 feet;
Thence S00°23'14"E, 442.07 feet to the POINT OF BEGINNING;
Thence Northeasterly along the Arc of a curve to the left, 49.87 feet (Radius 88.00 feet, Chord N73°39'57"E, 49.21 feet);
Thence N57°25'51"E, 276.00 feet;
Thence Northeasterly along the Arc of a curve to the right, 49.97 feet (Radius 88.00 feet, Chord N73°41'52"E, 49.30 feet);
Thence N89°57'52"E, 1421.78 feet;
Thence Southeasterly along the Arc of a curve to the right, 138.34 feet (Radius 88.00 feet, Chord S45°00'03"E, 124.53 feet);
Thence S00°02'02"W, 1529.14 feet;
Thence Southwesterly along the Arc of a curve to the right, 154.31 feet (Radius 112.00 feet, Chord S39°30'11"W, 142.39 feet);
Thence S78°58'20"W, 38.12 feet;
Thence Southwesterly along the Arc of a curve to the left, 51.04 feet (Radius 88.00 feet, Chord S62°21'18"W, 50.33 feet);
Thence S45°44'16"W, 184.21 feet;
Thence Southwesterly along the Arc of a curve to the left, 56.57 feet (Radius 88.00 feet, Chord S27°19'14"W, 55.60 feet);
Thence S08°54'13"W, 35.51 feet;
Thence Southwesterly along the Arc of a curve to the right, 157.63 feet (Radius 112.00 feet, Chord S49°13'20"W, 144.94 feet);
Thence S89°32'27"W, 760.30 feet;
Thence Southwesterly along the Arc of a curve to the left, 123.80 feet (Radius 200.00 feet, Chord S71°48'26"W, 121.84 feet);
Thence S54°04'25"W, 386.83 feet;
Thence Southwesterly along the Arc of a curve to the right, 185.31 feet (Radius 300.00 feet, Chord S71°46'10"W, 182.38 feet);
Thence S89°27'56"W, 183.54 feet;
Thence Northwesterly along the Arc of a curve to the right, 114.21 feet (Radius 88.00 feet, Chord N53°21'12"W, 106.36 feet);
Thence N16°10'20"W, 821.95 feet;
Thence Northwesterly along the Arc of a curve to the left, 71.47 feet (Radius 112.00 feet, Chord N34°27'10"W, 70.26 feet);
Thence N52°44'01"W, 163.35 feet;
Thence Northwesterly along the Arc of a curve to the left, 583.88 feet (Radius 912.00 feet, Chord N71°04'28"W, 573.96 feet);
Thence N89°24'55"W, 232.45 feet;
Thence Northwesterly along the Arc of a curve to the right, 134.83 feet (Radius 88.00 feet, Chord N45°31'15"W, 122.03 feet);
Thence N01°37'34"W, 841.73 feet;
Thence Northeasterly along the Arc of a curve to the right, 140.58 feet (Radius 88.00 feet, Chord N44°08'14"E, 126.10 feet);
Thence N89°54'03"E, 1437.77 feet to the POINT OF BEGINNING.
Contains 134.32 acres, more or less.



LEGEND:

- EXTERIOR PROPERTY LINE
- LIMIT OF WASTE DISPOSAL

GENERAL NOTES:

1. THE LIMITS OF WASTE DISPOSAL IS DEFINED BY THE LEGAL DESCRIPTION PROVIDED ABOVE, BASED ON THE GRAPHICAL LINE SHOWN ON THIS PLAN, AS PREPARED BY C&C SURVEYING, INC., DATED 3-3-2014.
2. EXISTING TOPOGRAPHY IS FROM AN AERIAL SURVEY BY SOUTHERN RESOURCES MAPPING CORPORATION, DATED FEBRUARY, 2013.
3. THE PROPERTY LINE OF THE OF LANDFILL PARCEL WAS RETAINED FROM THE PREVIOUS SITE PERMIT DRAWINGS. THE PROPERTY LINE OF THE SOUTH PARCEL IS DRAWN ACCORDING TO THE BEARINGS AND DISTANCES PROVIDED IN THE FIGURE "PROJECT LOCATION MAP FOR BFI TIMBERLANDS LANDFILL" BY BARGE, WAGGONER, SUMNER, AND CANNON, INC., SURVEY DATE AUGUST 30, 1995.
4. THE PROPERTY LINE BOUNDARY WAS CONFIRMED AND A LEGAL DESCRIPTION PREPARED, BY C&C SURVEYING, INC., DATED 3-3-2014.

SURVEYOR'S NOTES:

1. BEARINGS SHOWN ARE "GEODETIC" AND WERE DERIVED FROM SOLAR OBSERVATIONS.
2. ORIGINAL BOUNDARY SURVEY PERFORMED BY McCRORY AND WILLIAMS, INC., AND VERIFIED BY BARGE, WAGGONER, SUMNER, AND CANNON, INC., IN SEPTEMBER 1995.
3. TO CONVERT FROM GEODETIC COORDINATE SYSTEM (AS SHOWN) TO THE LOCAL COORDINATE SYSTEM - PICK PROJECT COORDINATE AT POINT NORTH 458,661.4047 EAST 2,064,718.2724 AND MOVE TO NORTH 10,000 EAST 1,000 AND ROTATE FROM THIS POINT CLOCKWISE 00d45'50".

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REV (R) SUB (S)	DATE	BY	DESCRIPTION
0	3/20/09	EJW	DRAFT REVIEW
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6	2/4/14	CNB	PERMIT RENEWAL w/ MINOR MODS
7	6/3/14	CNB	REVISIONS PER CLIENT COMMENTS

Terracon
Consulting Engineers and Scientists
4040 ROYAL DR., SUITE 100 KENNESAW, GA 30144
PH. (770) 924-9799 FAX (770) 924-7866

REPUBLIC SERVICES, INC.™
22800 HIGHWAY 41 BREWTON, AL 36426

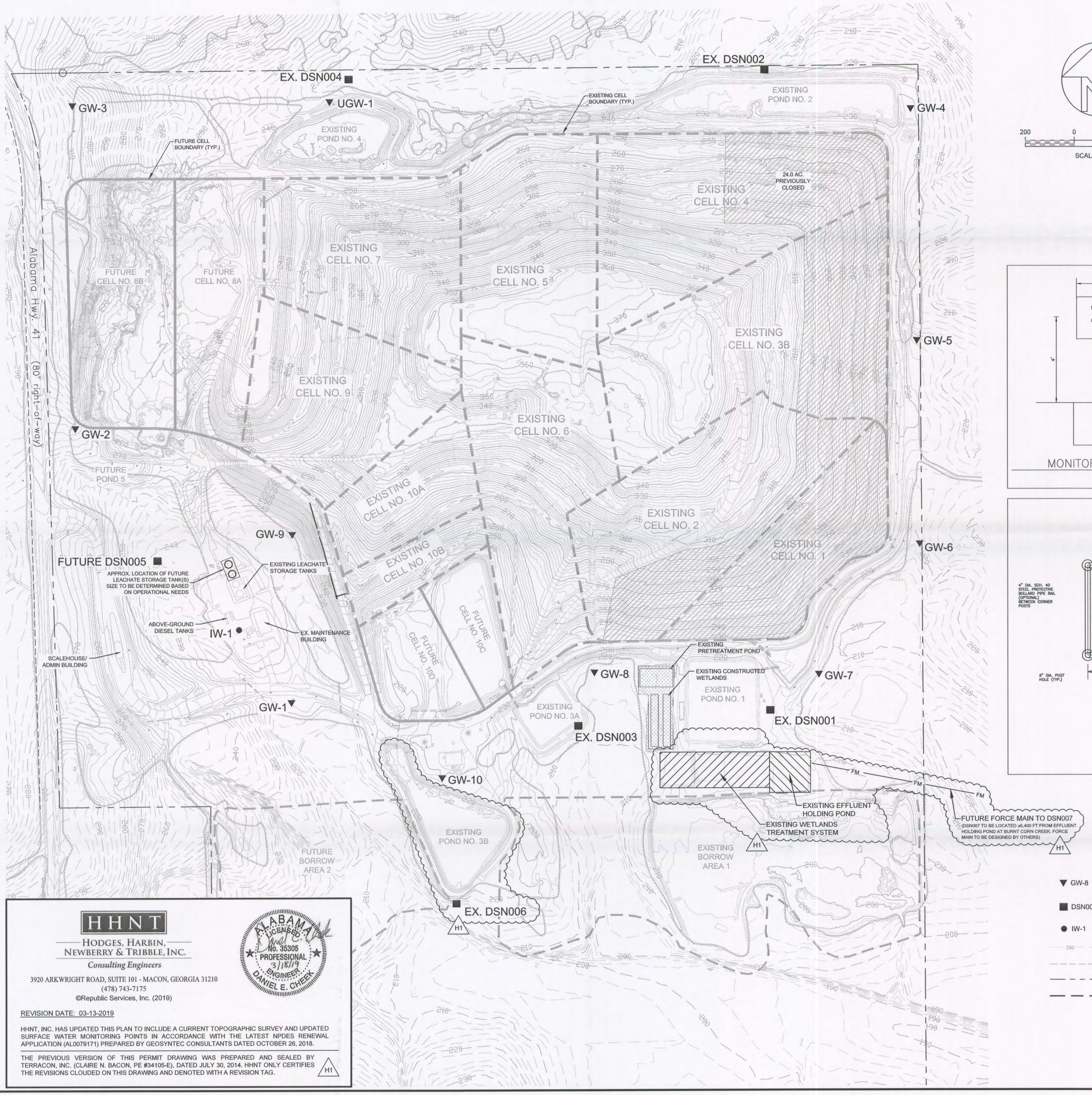
ALABAMA LICENSED No. 34105-E PROFESSIONAL ENGINEER CLAIRE N. BACON

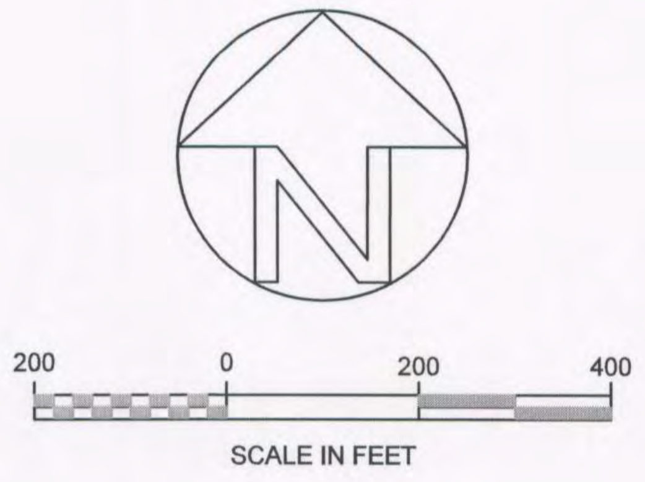
BOUNDARY SURVEY

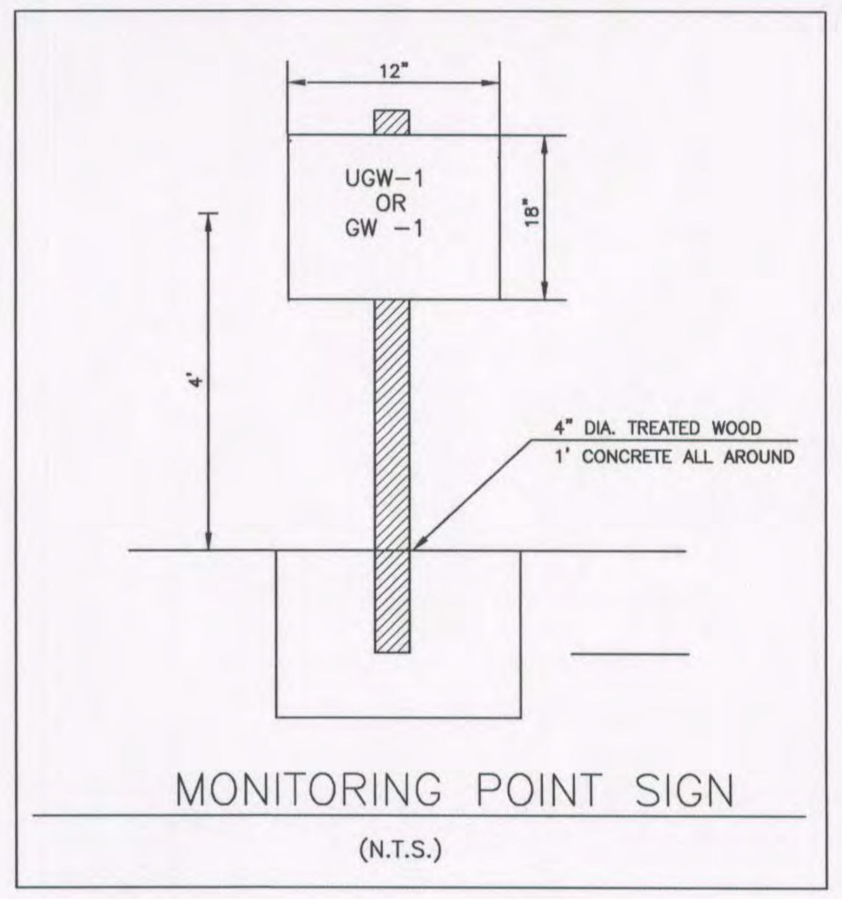
PERMIT RENEWAL PLANS WITH MINOR MODS
SOLID WASTE PERMIT #27-08
TIMBERLANDS SANITARY LANDFILL
ESCAMBIA COUNTY, ALABAMA

DRAWN BY:	CNB
APPVD. BY:	CWM
JOB NO.	EJ137474

DRAWING
2

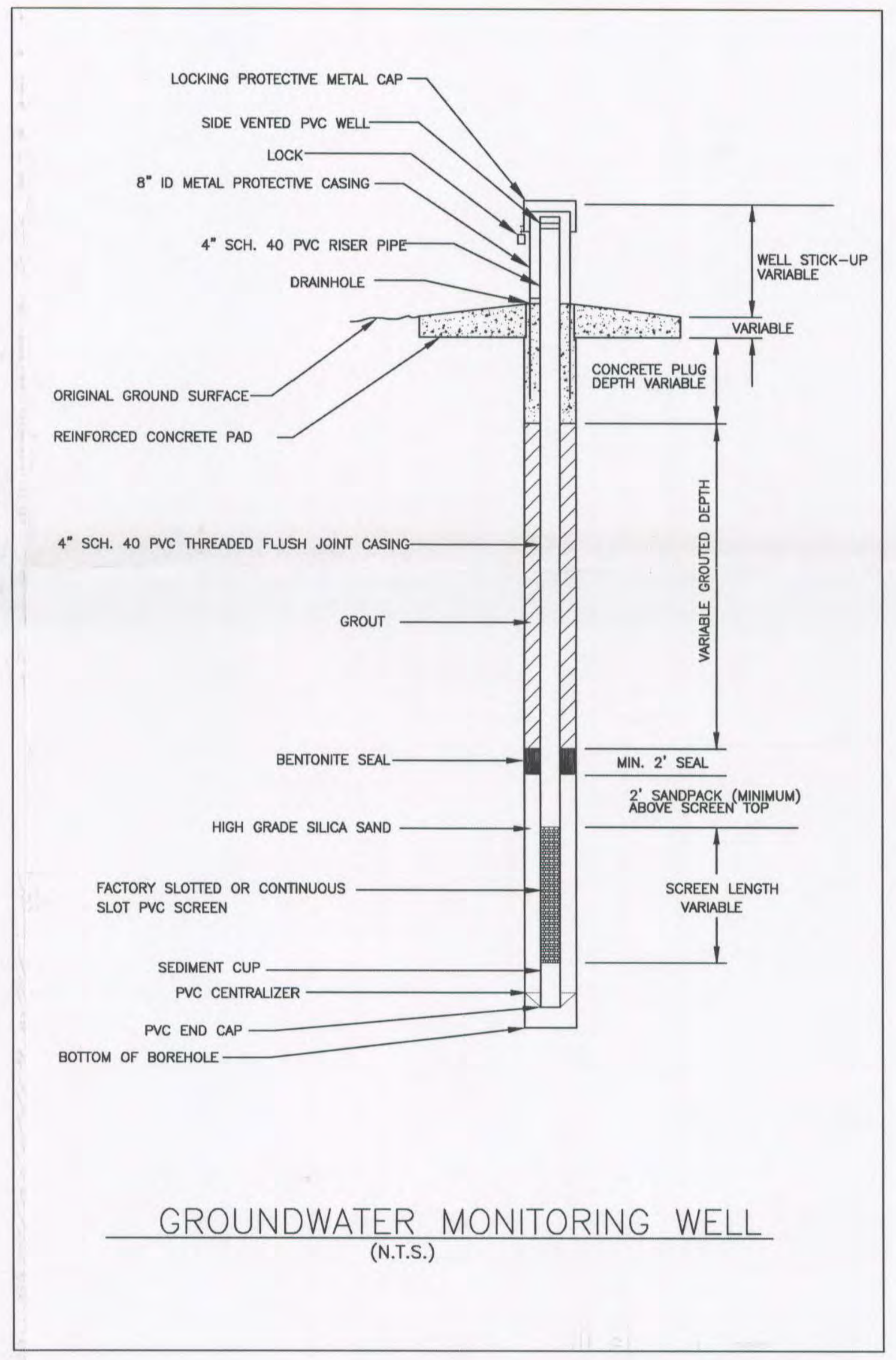






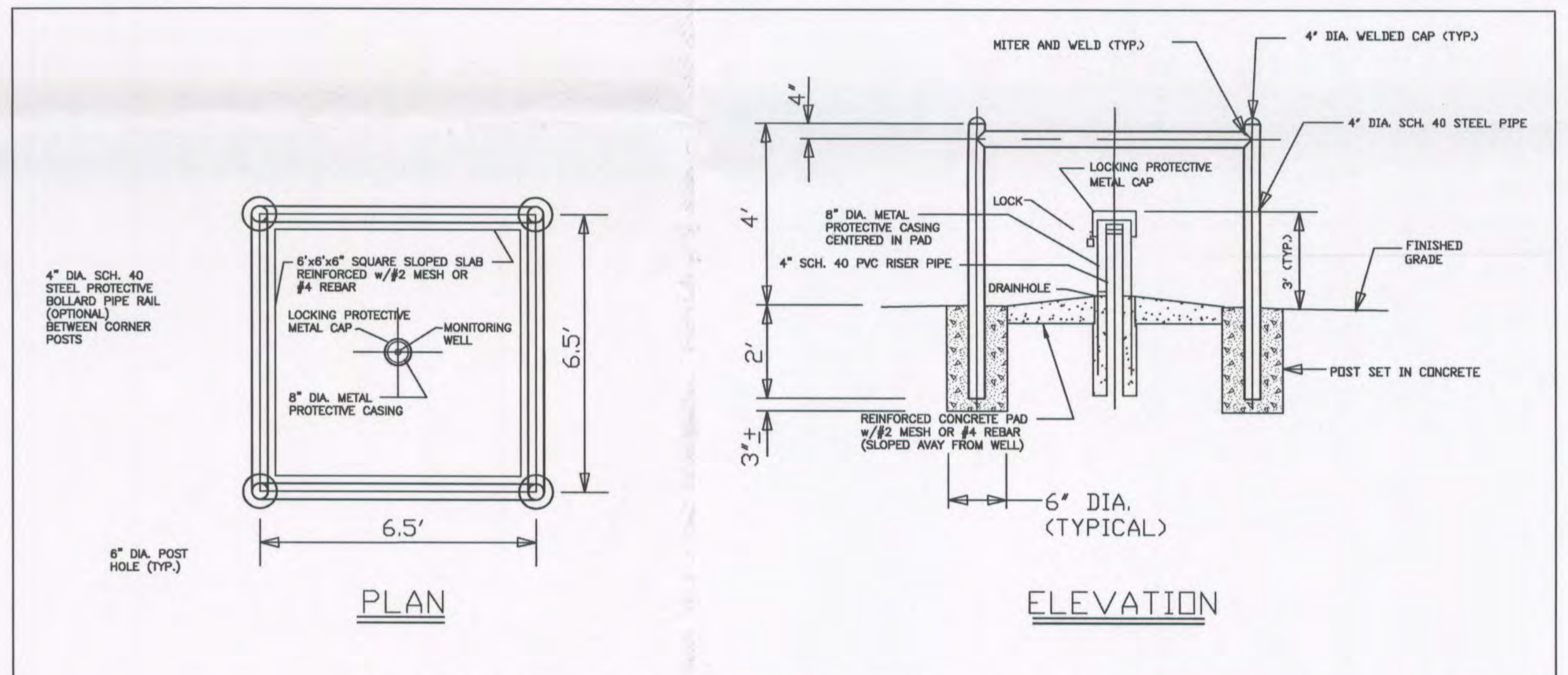
MONITORING POINT SIGN

(N.T.S.)



GROUNDWATER MONITORING WELL

(N.T.S.)



PROTECTION FOR GROUNDWATER MONITORING WELLS

(N.T.S.)

LEGEND:

▼ GW-8	EXISTING GROUNDWATER MONITORING WELL
■ DSN002	CURRENT OR FUTURE SURFACE WATER MONITORING POINT
● IW-1	INDUSTRIAL WELL
— 280 —	EXISTING MAJOR CONTOUR
– – – – –	EXISTING MINOR CONTOUR
—— – – ——	EXTERIOR PROPERTY LINE
—— —— ——	LIMIT OF WASTE DISPOSAL

NOTES:

1. GROUNDWATER MONITORING WELLS UGW-1, GW-6 AND GW-7 WERE INSTALLED BY EMCON SOUTHEAST, IN SEPTEMBER, 1993. GROUNDWATER MONITORING WELL GW-8 WAS INSTALLED BY EMCON SOUTHEAST, IN MAY, 1994. INDUSTRIAL WELL IG-1 WAS INSTALLED ON NOVEMBER 1, 1994 BY WATER WELL DRILLER, WAYNE BLAIR. GROUNDWATER MONITORING WELLS GW-5 AND GW-4 WERE INSTALLED BY ATLANTA TESTING & ENGINEERING, IN JULY 1996. GW-10 WAS INSTALLED UNDER THE SUPERVISION OF HDR PERSONNEL ON MARCH 5 THROUGH 9, 2007.
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HHNT

HODGES, HARBIN,
NEWBERRY & TRIBBLE, INC.
Consulting Engineers

3920 ARKWRIGHT ROAD, SUITE 101 - MACON, GEORGIA 31210
(478) 743-7175

ALABAMA LICENSED No. 35305 PROFESSIONAL ENGINEER DANIEL E. CHEEK
3/18/19
Daniel E. Cheek

REVISION DATE: 03-13-2019

HHNT, INC. HAS UPDATED THIS PLAN TO INCLUDE A CURRENT TOPOGRAPHIC SURVEY AND UPDATED SURFACE WATER MONITORING POINTS IN ACCORDANCE WITH THE LATEST NPDES RENEWAL APPLICATION (AL0079171) PREPARED BY GEOSYNTEC CONSULTANTS DATED OCTOBER 26, 2018.

THE PREVIOUS VERSION OF THIS PERMIT DRAWING WAS PREPARED AND SEALED BY TERRACON, INC. (CLAIRE N. BACON, PE #34105-E), DATED JULY 30, 2014. HHNT ONLY CERTIFIES THE REVISIONS CLOUDED ON THIS DRAWING AND DENOTED WITH A REVISION TAG. H1

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REPUBLIC SERVICES, INC.™
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GROUND & SURFACE WATER MONITORING PLAN

PERMIT RENEWAL PLANS WITH MINOR MODS
SOLID WASTE PERMIT #27-08
TIMBERLANDS SANITARY LANDFILL
ESCAMBIA COUNTY, ALABAMA

DRAWN BY:	CNB
APPVD. BY:	CWM
JOB NO.	EJ137474

DRAWING
11

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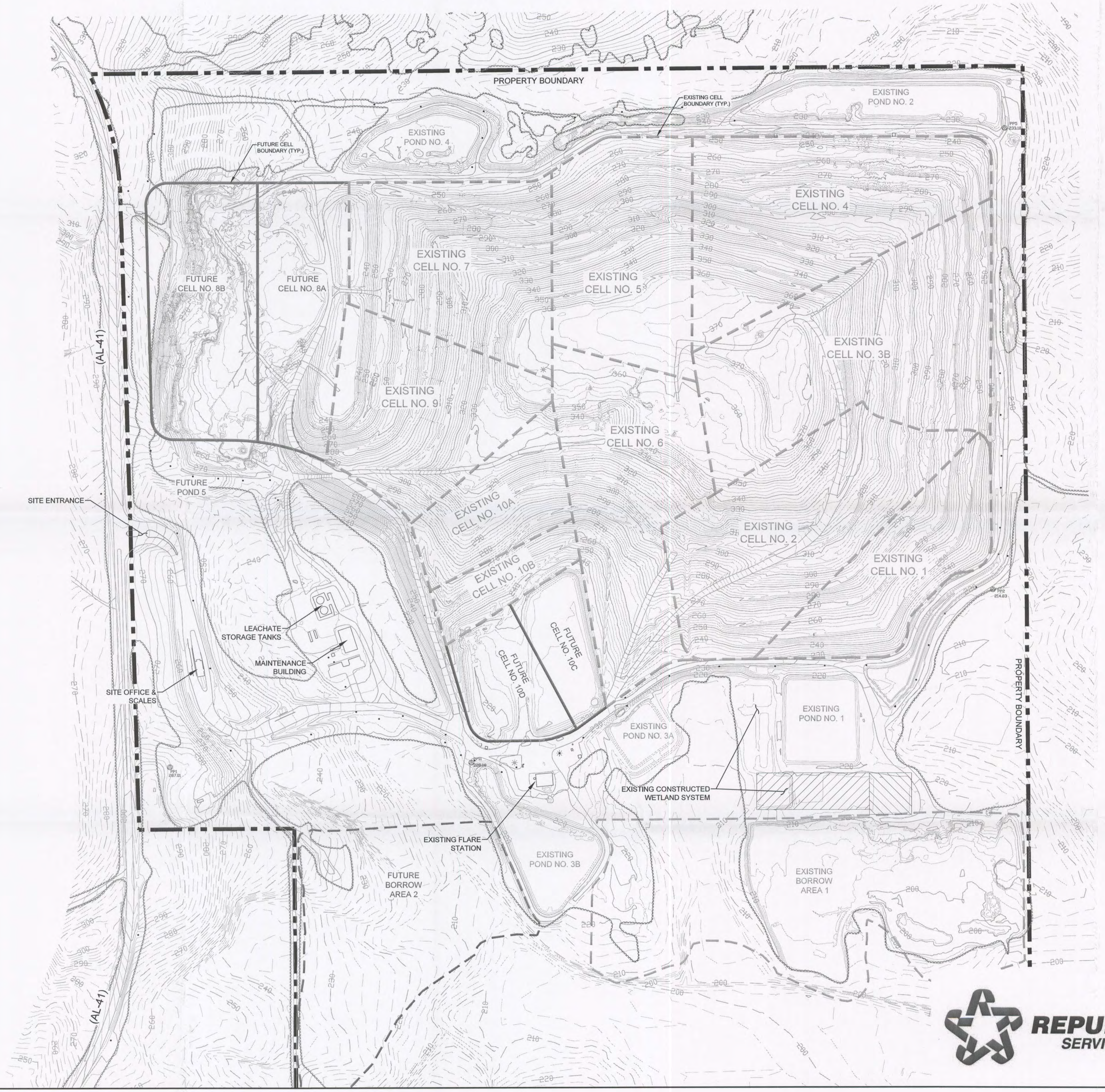


NOTES:

1. PROPERTY BOUNDARY & WASTE LIMITS FROM 2014 PERMIT DRAWINGS BY TERRACON.
2. BOUNDARY NOTES FROM TERRACON DRAWINGS:
   ORIGINAL BOUNDARY SURVEY BY McCRORY AND WILLIAMS, INC., AND VERIFIED BY BARGE, WAGGONER, SUMNER, AND CANNON, INC. IN SEPTEMBER 1995. BOUNDARY SURVEY WAS RECONFIRMED BY C&C SURVEYING, INC., IN MARCH, 2014.
3. EXISTING TOPOGRAPHIC SURVEY BY COOPER AERIAL SURVEYS CO. DATED JANUARY 25, 2019.

LEGEND

— · · —	PROPERTY LINE
———	PERMITTED WASTE BOUNDARY
— — —	EXISTING CELL BOUNDARY
—102—	2' CONTOUR
—100—	10' CONTOUR
- -102- -	2' CONTOUR (DENSELY WOODED)
- -100- -	10' CONTOUR (DENSELY WOODED)

No. 35305
3/18/19
DANIEL E. CHEEK

200 100 0 200 400
GRAPHIC SCALE IN FEET

N

NOT FOR CONSTRUCTION

EXISTING TOPOGRAPHIC CONDITIONS

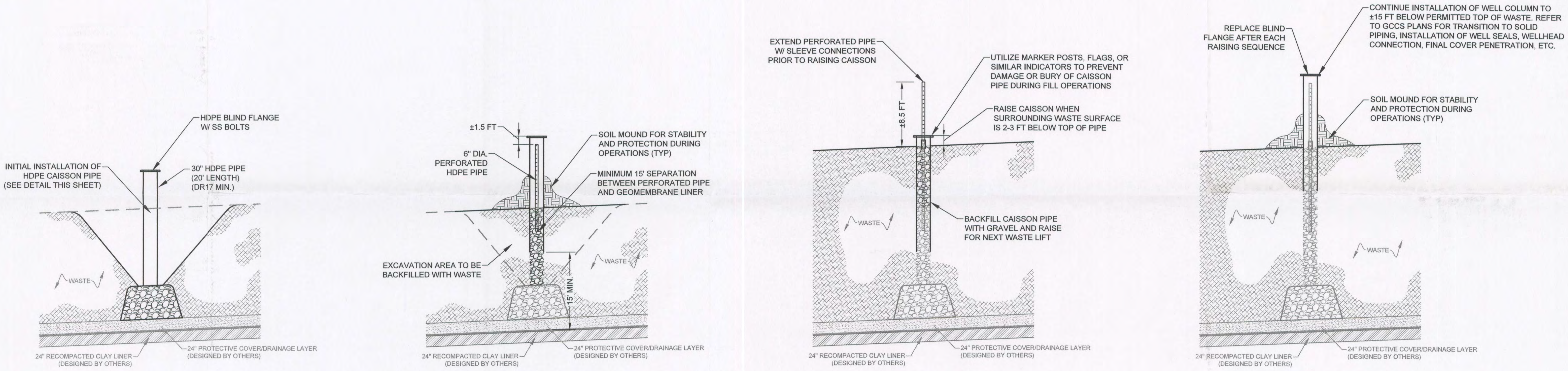
TIMBERLANDS SANITARY LANDFILL
FOR
REPUBLIC SERVICES, INC.
ESCAMBIA COUNTY, ALABAMA

HHNT
HODGES, HARBIN,
NEWBERRY & TRIBBLE, INC.
Consulting Engineers

(478) 743-7175
(478) 743-7175 (FAX)

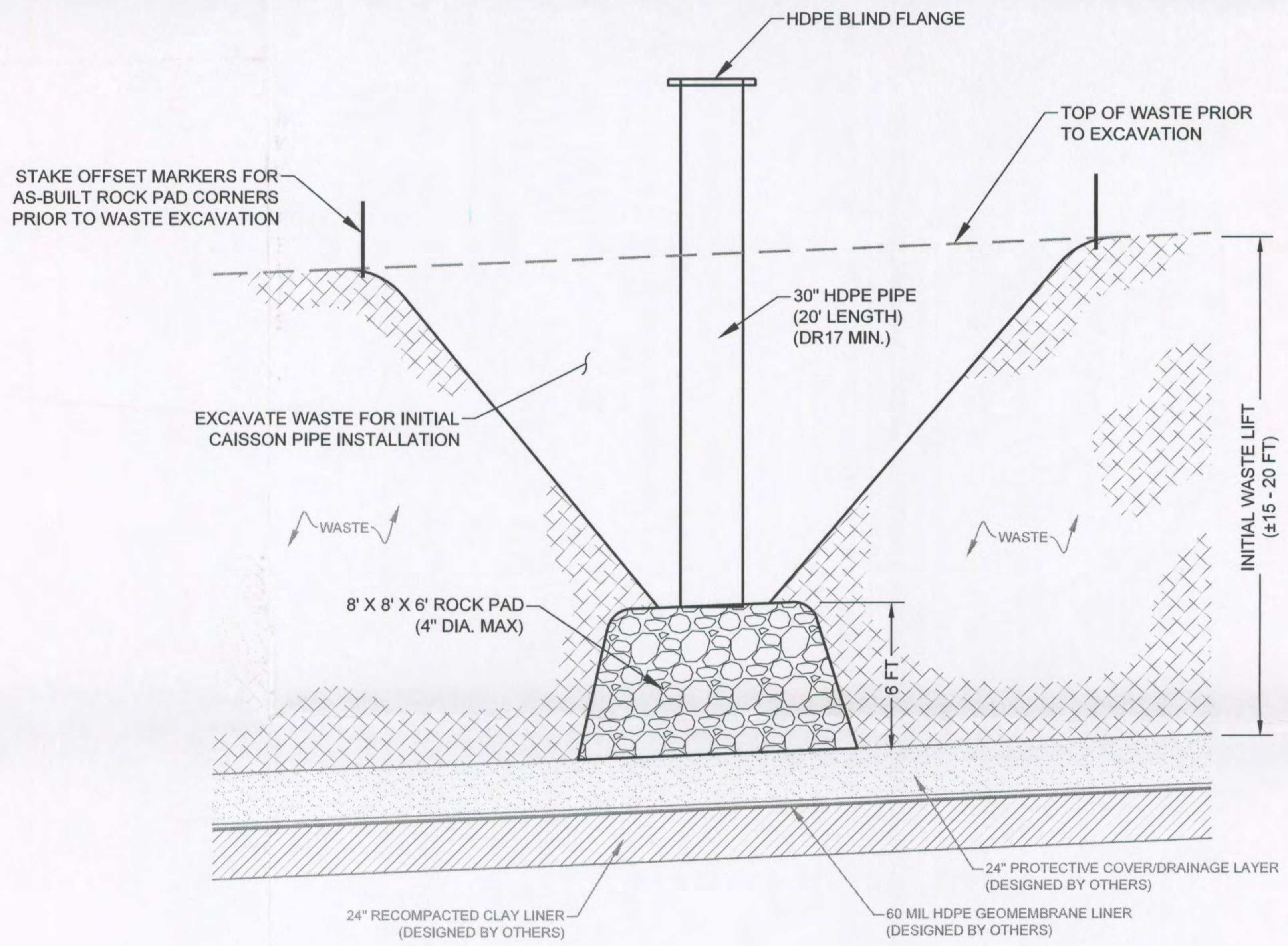
3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-948-01	TL-2019 SURVEY.DWG	EDIT 03-13-2019
SCALE	1" = 200'	SHEET 1 OF 1	
DATE	MARCH 2019		



CAISSON GAS WELL - OPERATIONAL SEQUENCE

SCALE: 1"=10'



CAISSON GAS WELL - INITIAL INSTALLATION

SCALE: 1"=5'

NOTES:

1. CAISSON WELLS ARE INTENDED TO BE USED FOR NEW OR FUTURE CELL CONSTRUCTION AND SHALL BE CONSTRUCTED FROM THE BOTTOM OF THE CELL FLOOR AND UP AS WASTE FILLING PROGRESSES.
2. FREQUENCY AND LOCATION OF GAS CAISSON WELLS TO BE FIELD DETERMINED AND COORDINATED TO SUPPORT THE GAS COLLECTION SYSTEM.
3. HHNT RECOMMENDS SURVEYING THE CENTER LOCATION AND TOP ELEVATION OF THE CAISSON PIPE PRIOR TO EACH RAISING SEQUENCE. FREQUENCY OF CAISSON PIPE RAISING MAY BE FIELD ADJUSTED.
4. CAISSON WILL BE FIELD SUPPORTED AS NEEDED TO REMAIN VERTICAL AND PLUMB.
5. CAISSON PIPE MAY BE MANUFACTURED OR MODIFIED WITH LIFT HOOKS TO FACILITATE RAISING.
6. END OF THE CAISSON PIPE SHALL BE FITTED WITH A FLANGED ADAPTER THAT IS BUTT-FUSION WELDED TO THE CAISSON. THE BLIND FLANGE SHALL BE CONNECTED WITH STAINLESS STEEL NUTS & BOLTS.
7. 6" HDPE PERFORATED PIPE SHALL BE CONNECTED USING PIPE SLEEVES & STAINLESS STEEL BOLTS. PERFORATION PATTERN SHALL BE (4) - 3/8" DIA. HOLES SPACED EVERY 3 INCHES.
8. FINAL DESIGN FOR TOP OF CAISSON TRANSITION TO GAS COLLECTION WELL TO BE COMPLETED BY OTHERS.

No. 35305
DANIEL E. CHEEK
3/18/19

GAS CAISSON WELL CONSTRUCTION DETAILS

MINOR MODIFICATION
TIMBERLANDS SANITARY LANDFILL
FOR
REPUBLIC SERVICES, INC.
ESCAMBIA COUNTY, ALABAMA

HHNT
HODGES, HARBIN,
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Consulting Engineers

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3920 ARKWRIGHT RD.
SUITE 101
MACON, GEORGIA 31210

PROJ. NO.	6703-948-01	TL-MODIFICATION DETAILS.DWG	EDIT 03-13-2019
SCALE	VARIES	DRAWING 17 OF 17	
DATE	MARCH 2019		

HHNT
HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.
Consulting Engineers

September 17, 2019

Mr. C. Blake Holden
Solid Waste - Engineering Section
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

RECEIVED
SEP 19 2019
LAND DIVISION

Re: **Response to Comments**
Timberlands Sanitary Landfill
Solid Waste Permit (#27-08) Renewal & Minor Modification
HHNT Project No. 6703-948-01

Dear Mr. Holden:

We have reviewed the department's comments in a letter dated July 16, 2019. In response and on behalf of Republic Services, Inc., we have enclosed the following documents pertaining to the Groundwater Monitoring Plan, as requested.

1. Revised Drawing #11 – Ground & Surface Water Monitoring Plan (03-18-2019)
2. Permitted Drawing #4 – Potentiometric Map (06-03-2014)
3. Initial Site Boring Logs (September 1994)
4. GW Statistical Analysis Plan (April 2001)

Additionally, please note that Republic will be submitting an additional renewal fee check in the amount of $18,635, under separate cover, in order to allow the permit renewal to be issued for 10 years, as discussed.

We appreciate your assistance with this project. Please let me know if there is anything else that you need, or if you have any questions, please call.

Sincerely,

HODGES, HARBIN, NEWBERRY & TRIBBLE, INC.

Daniel E. Cheek

Daniel E. Cheek, P.E.
Principal

DEC/sc

Enclosure
cc: Michael Gay (w/o enclosure)

3920 Arkwright Road, Suite 101 • Macon, Georgia 31210 • (478) 743-7175 • Fax (478) 743-1703 • www.hhnt.com
SAVANNAH • ATLANTA • **MACON** • STATESBORO • BRUNSWICK

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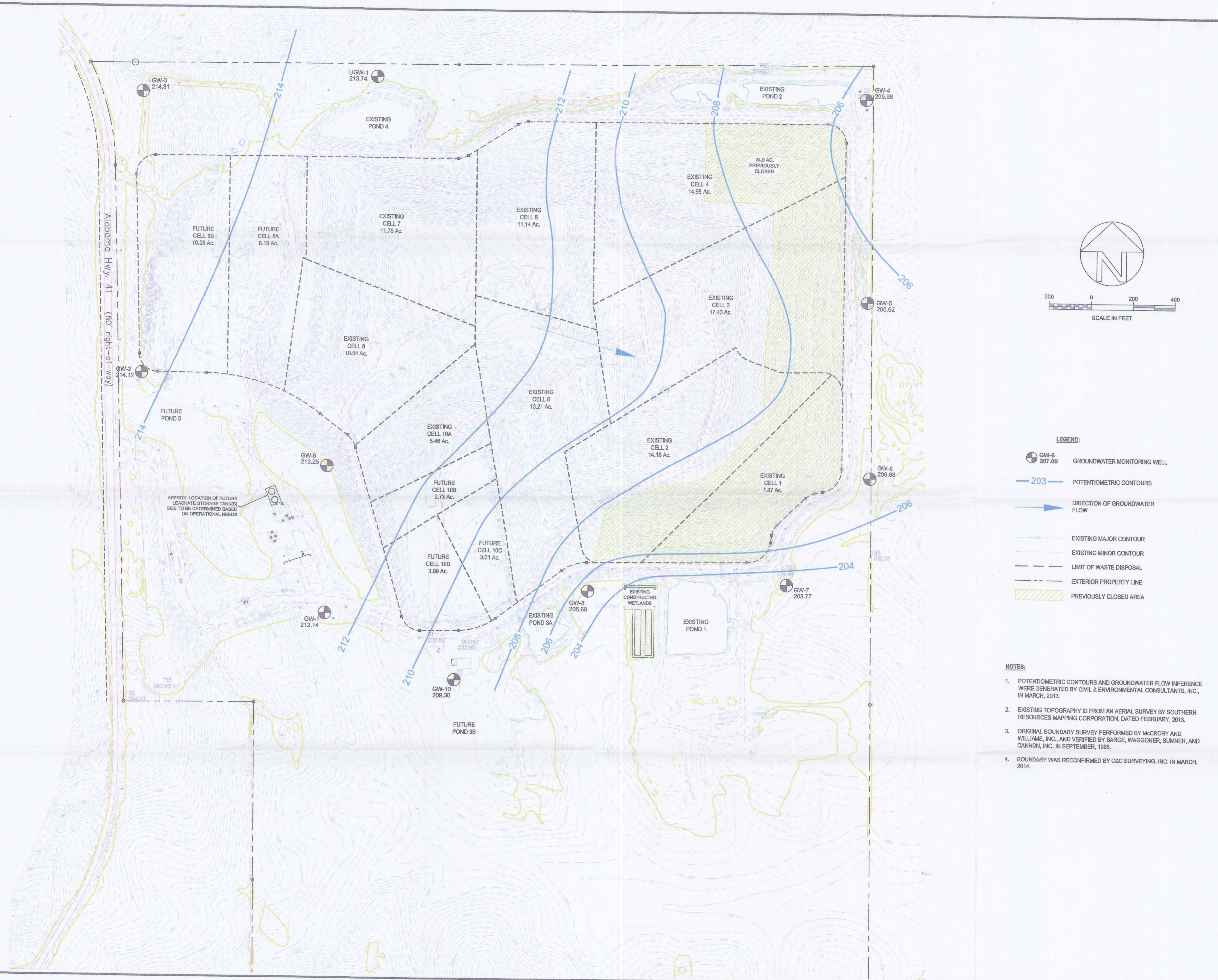

NOTES:

1. POTENTIOMETRIC CONTOURS AND GROUNDWATER FLOW INFERENCE WERE GENERATED BY CIVIL & ENVIRONMENTAL CONSULTANTS, INC., IN MARCH, 2013.
2. EXISTING TOPOGRAPHY IS FROM AN AERIAL SURVEY BY SOUTHERN RESOURCES MAPPING CORPORATION, DATED FEBRUARY, 2013.
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REPUBLIC SERVICES, INC.™
22800 HIGHWAY 41 BREWTON, AL 36426

No. 34105-E
CLAIRE N. BACON

POTENTIOMETRIC MAP (2013)

PERMIT RENEWAL PLANS WITH MINOR MODS
SOLID WASTE PERMIT #27-08
TIMBERLANDS SANITARY LANDFILL
ESCAMBIA COUNTY, ALABAMA

DRAWN BY: CNB
APPVD. BY: CWM
JOB NO. EJ137474

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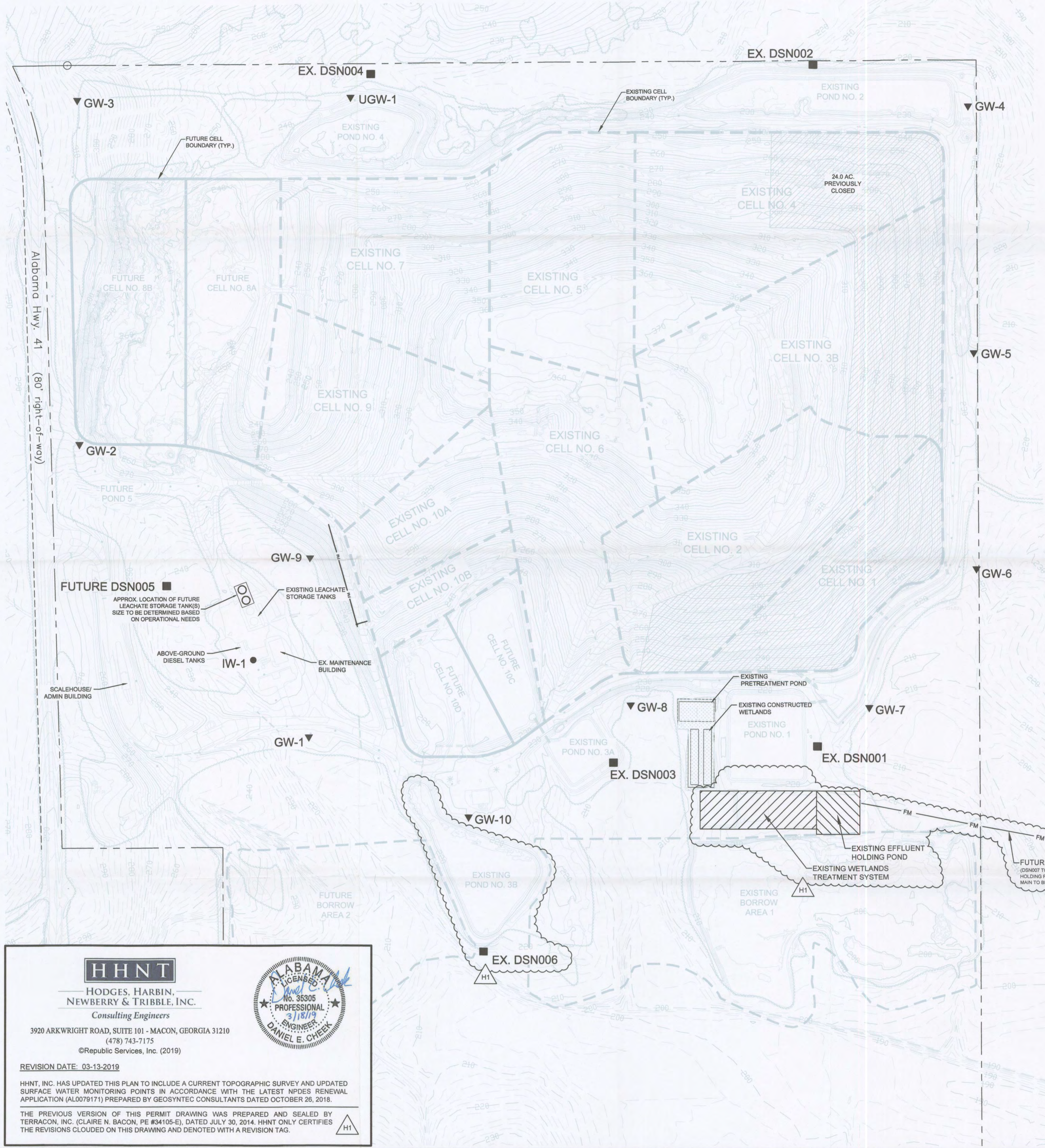
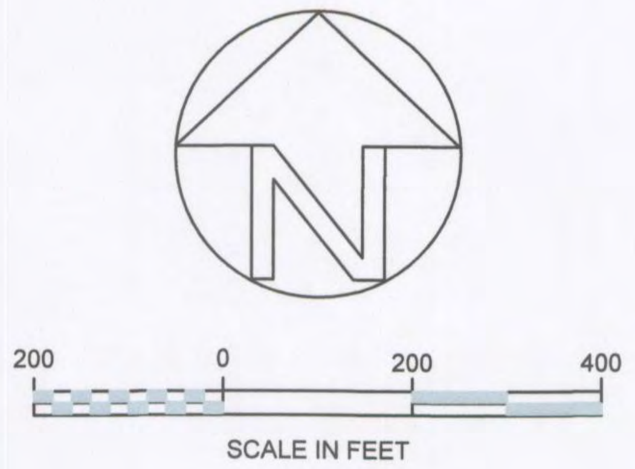
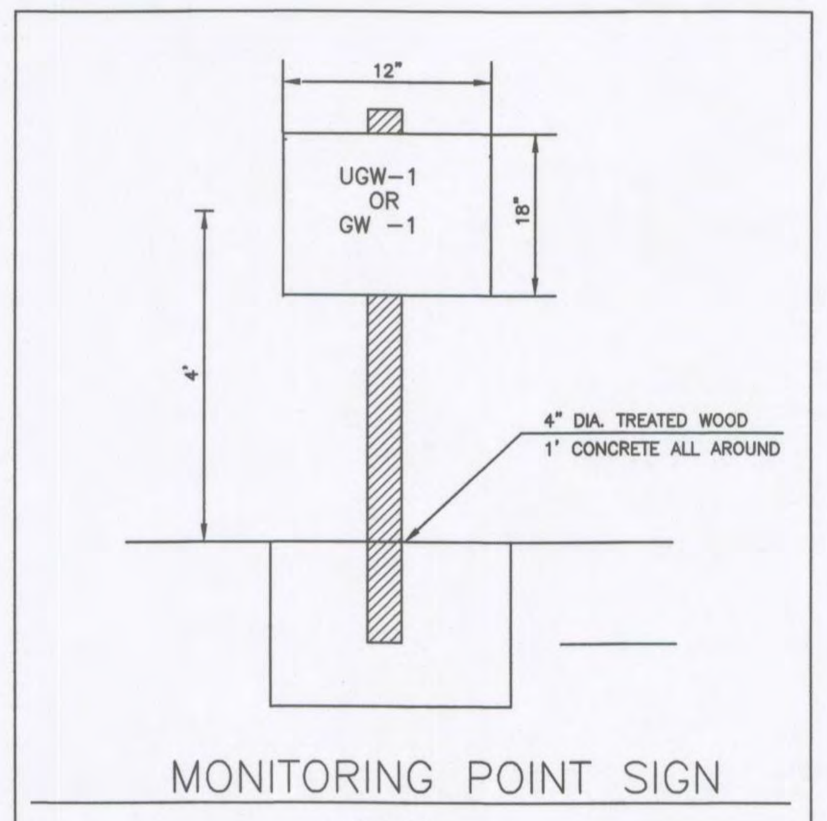
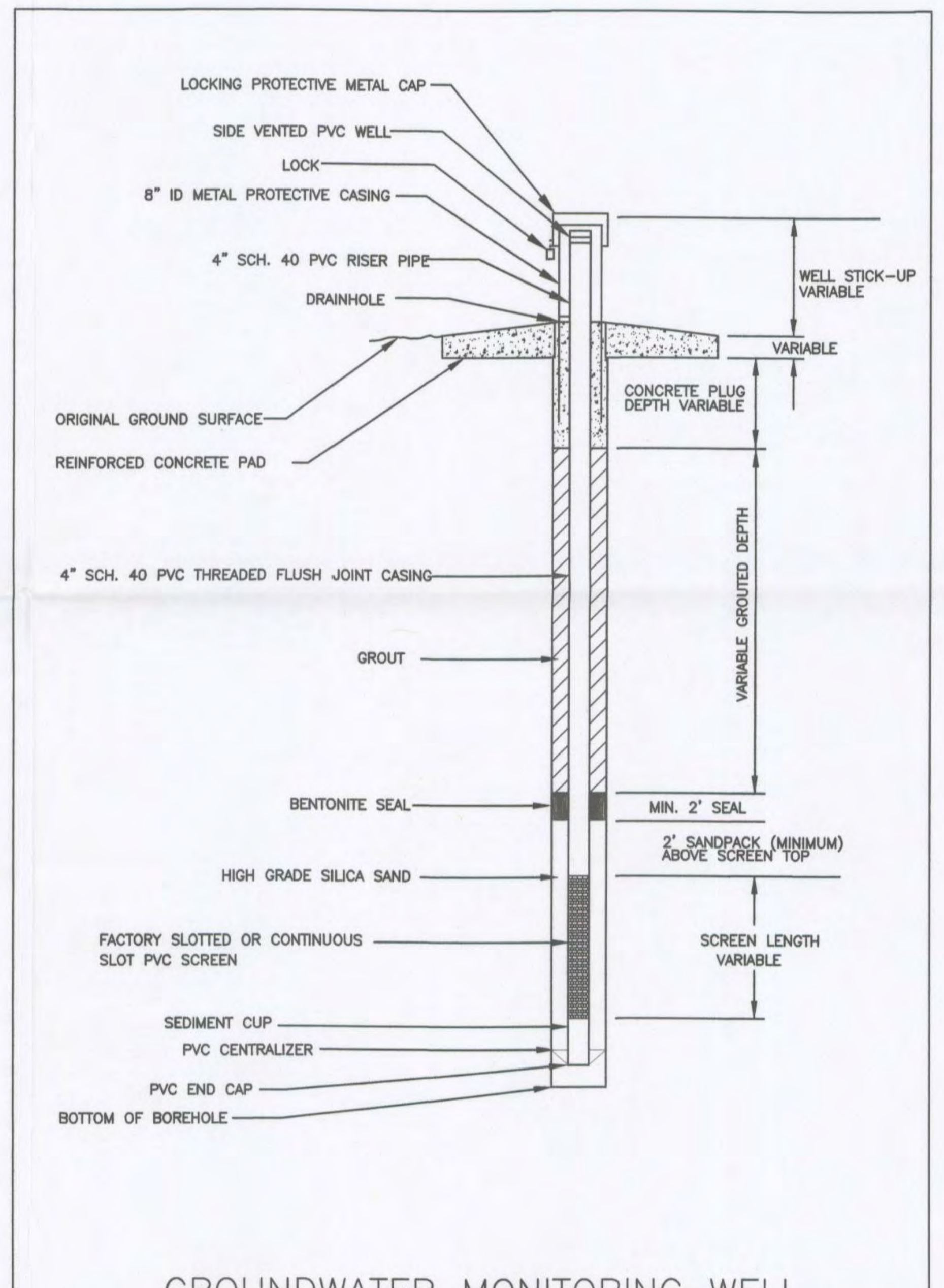






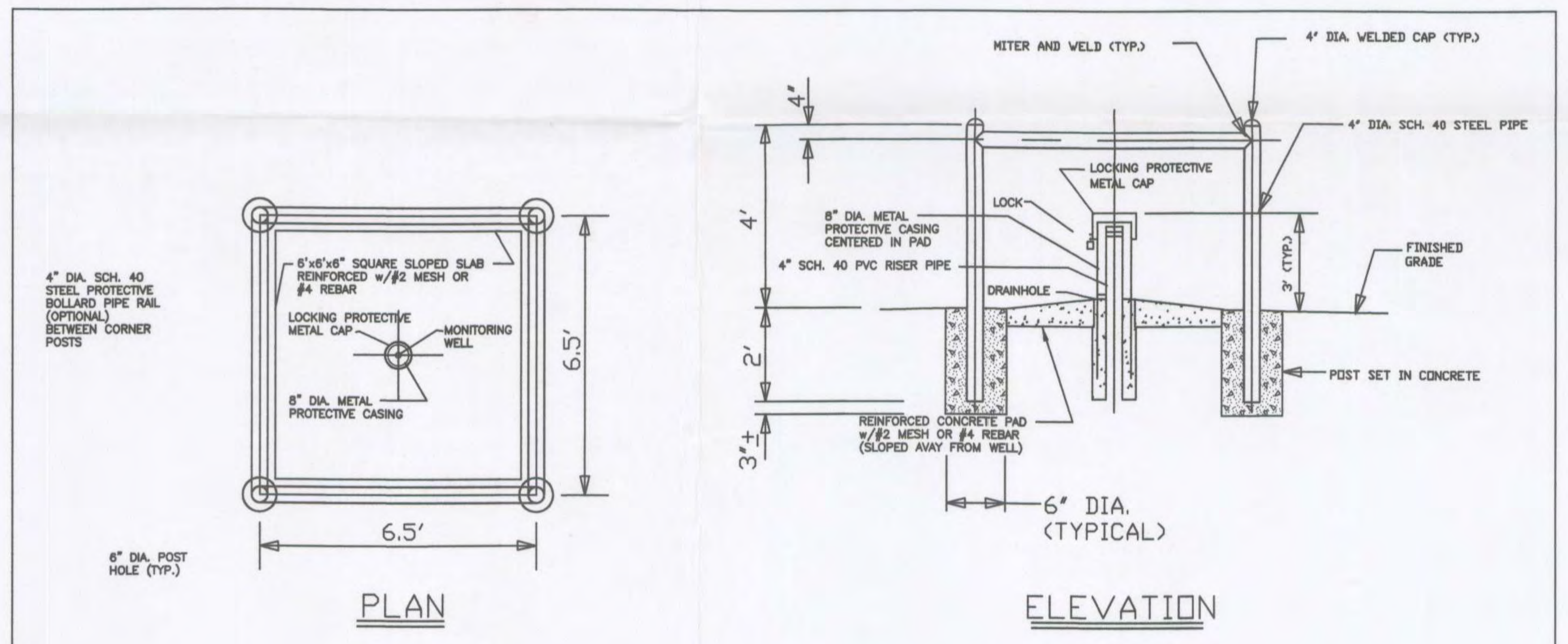
MONITORING POINT SIGN

(N.T.S.)



GROUNDWATER MONITORING WELL

(N.T.S.)



PROTECTION FOR GROUNDWATER MONITORING WELLS

(N.T.S.)

LEGEND:

▼ GW-8	EXISTING GROUNDWATER MONITORING WELL
■ DSN002	CURRENT OR FUTURE SURFACE WATER MONITORING POINT
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(478) 743-7175

ALABAMA LICENSED No. 35305 PROFESSIONAL ENGINEER DANIEL E. CHEEK
Daniel E. Cheek
3/18/19

REVISION DATE: 03-13-2019

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REPUBLIC SERVICES, INC.™
22800 HIGHWAY 41 BREWTON, AL 36426

GROUND & SURFACE WATER MONITORING PLAN

PERMIT RENEWAL PLANS WITH MINOR MODS
SOLID WASTE PERMIT #27-08
TIMBERLANDS SANITARY LANDFILL
ESCAMBIA COUNTY, ALABAMA

DRAWN BY:	CNB
APPVD. BY:	CWM
JOB NO.	EJ137474

DRAWING
11

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TIMBERLANDS SANITARY LANDFILL

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

Timberlands Sanitary Landfill
Escambia County, Alabama

Prepared for
Browning Ferris Industries
P.O. Box 3151
Houston, Texas 77253

August 10,1994
(Revised September,1994)

Prepared by

EMCON Southeast
1560 Oakbrook Drive
Suite 100
Norcross, Georgia 30093

Project 2055.014.94

CONTENTS

FIGURES AND DRAWINGS

Figures

Drawings

Timberlands Sanitary Landfill
Hydrogeology Report

The material and data in this report were prepared under the supervision and direction of the undersigned.

Mitchell T. Guthrie

Mitchell T. Guthrie, P.G.
Senior Geologist

9-9-94
Date

Alabama Registered Professional Engineer
15172
William E. Higginbotham

William E. Higginbotham, P.E.
Vice President

9/9/94
Date

Mark Ballew

Mark A. Ballew
Group Leader Solid Waste Services

9/9/94
Date

APPENDIX A

BORING LOGS

B SERIES

BORINGS B-1 THROUGH B-3

MAY 1992

SOIL BORING LOG

BORING B-1

PROJECT: ESCAMBIA COUNTY LANDFILL   JOB No: 92-080

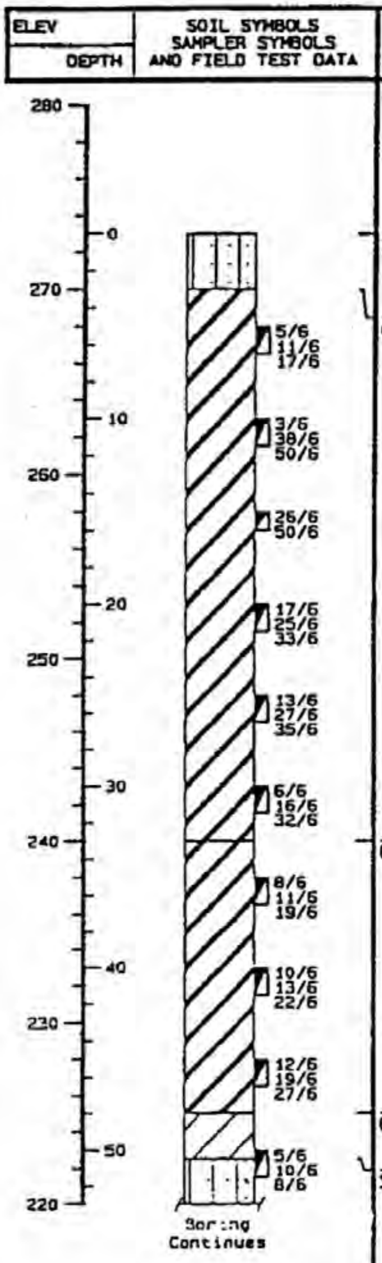
PROJECT LOCATION: BREWTON, ALABAMA

BORING NUMBER: B-1   BORING ELEVATION: +273.0 FEET

BORING LOCATION: SEE TEST LOCATION PLAN

DATE DRILLED: 5/11/92   METHOD: HOLLOW STEM AUGER

WATER LEVEL WAS: 58.9 FEET   ON: 5/14/92

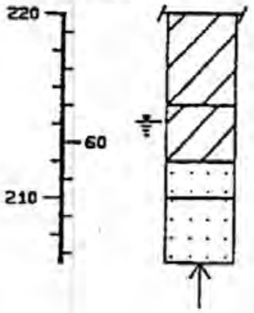


USCS	DESCRIPTION	SPT N	NM %	LL %	-200 %
SM	Very Firm Reddish Brown Silty SAND with Gravel and some Clay				
CH	Hard Mottled Tan and Red CLAY with Possible Rock Seams Between 10' to 15'	28	14.6		
		88	18.0	54	73.9
		50	14.6		
		58	17.6		
		62	18.3	54	85.0
		48	18.1		
CH	Hard Mottled Brown and Lt. Gray CLAY	30	22.0		
		35	23.7	69	99.6
		46	18.6		
CL	Very Stiff Gray Sandy CLAY	18	18.4		
SM	Firm Gray Fine Silty Clayey SAND w/1" Fine Silty Sand Seam				

SOIL BORING LOG

BORING B-1

PROJECT: ESCAMBIA COUNTY LANDFILL JOB No: 92-080
PROJECT LOCATION: BREWTON, ALABAMA
BORING NUMBER: B-1 BORING ELEVATION: +273.0 FEET
BORING LOCATION: SEE TEST LOCATION PLAN
DATE DRILLED: 5/11/92 METHOD: HOLLOW STEM AUGER
WATER LEVEL WAS: 58.9 FEET ON: 5/14/92

ELEV DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	SPT N	NM %	LL %	-200 %
		CL-CH	Very Stiff Gray CLAY and Orange Silty Sandy CLAY w/s Fine Silty Sand				
		CL-SC	Hard Gray and Tan Sandy Silty CLAY				
		SP-SM	Very Dense Tan and Orange Fine to Medium SAND with some Silt				
		SP	Very Dense Tan Medium to Coarse SAND with Gravel				

Legend:

Symbol:	Description:	Symbol:	Description:
▥	Sand with > 12% Silt	▨	Clay LL > 50
▨	Clay LL < 50	⁙	Sand < 5% Silt and Clay
▨	Sand with Plastic Fines	□ 7/6 5/6	Standard penetration test. 140 lb. hammer dropped 30"
□	Undisturbed thin wall Shelby tube	▽ □	Water measured at time indicated
□ ↑	End of Boring		

Notes:

1. Test pits were constructed using a large trackhoe with a maximum excavation depth of approximately 20 feet.
2. Soil test borings were drilled with a CME-55 drill rig using 3.25 inch I.D. hollow stem augers.
3. Boring locations and elevations were surveyed by McCrory and Williams, Inc.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs. Abbreviations used are:

   DD - Natural Dry Density (pcf)
   NM - Natural Moisture Content (%)
   UC = Unconfined Compression (psf)
   -200 = Percent Passing #200 Sieve (%)
   SPT - Standard Penetration Resistance
   LL - Liquid limit
   PI - Plasticity Index
   pH = Soil pH (%)
   SS = Soluable Sulfates

TABLE 4
GROUNDWATER LEVELS
AUGUST 23,1994

Boring/Well Number	Top of Casing Elevation	Depth to Groundwater (feet, MSL)	Groundwater Elevation (feet, MSL)
B-5	255.03	36.65	218.38
B-6 (A)	282.99	65.90	217.09
B-7	234.70	19.55	215.15
B-8	237.39	23.35	214.04
B-9	253.80	40.20	213.60
UGW-1	234.38	16.35	218.03
GW-6	222.00	11.70	210.30
GW-7	214.6	8.25	206.35
GW-8	215.76	7.45	208.31

The groundwater flow directions are generally to the south, southeast, and northeast. The average hydraulic gradient, by area, as determined from the potentiometric contours was 0.012 in the southern area, 0.007 in the southeastern area, and 0.007 in the northeastern area. In-situ hydraulic conductivity tests were performed for groundwater monitoring wells UGW-1, GW-6, and GW-7 using methods developed by Hvorslev (1951). Both slug-in and slug-out tests were conducted on each well. Coefficients of permeability for each test are given below:

Well I.D.	Slug-In	Slug-Outs	Average K
GW-6	K=5.0 x 10-5 cm/sec	K=1.0 x 10-4 cm/sec	7.5 x 10-5 cm/sec
GW-7	K=1.44 x 10-3 cm/sec	K=2.53 x 10-3 cm/sec	1.99 x 10-3 cm/sec
UGW-1	K=5.0 x 10-5 cm/sec	K=5.0 x 10-5 cm/sec	5.0 x 10-5 cm/sec

The approximate groundwater flow rate for the site was calculated using Darcy's Equation V=Ki/Ne where:

V = velocity of groundwater
K = Hydraulic conductivity
i = hydraulic gradient
Ne = Effective porosity

Note: The effective porosity (Ne) was estimated to be 35% based on typical laboratory values for similar soil types, since no soil samples from any of the explorations were specifically tested for effective porosity.

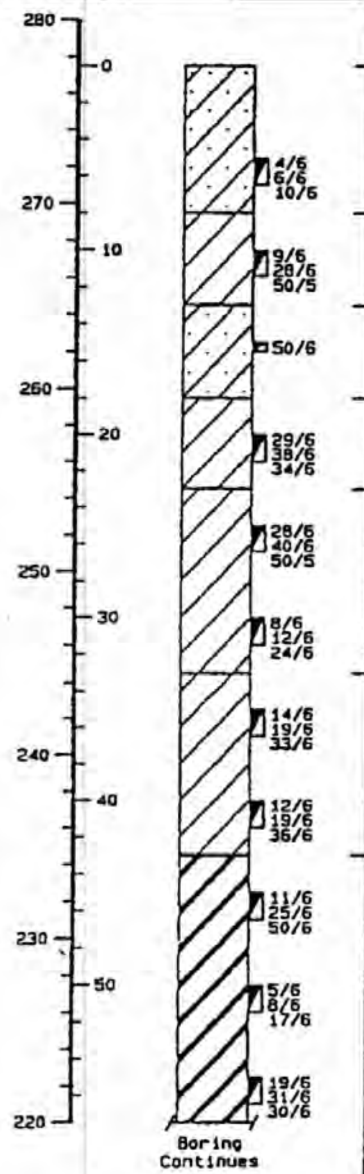
Timberlands Sanitary Landfill
Production Water Well Log
Four (4) Inch Diameter Well/Leachate Treatment Area
Driller: Wayne Blair
November 1994

Elevation	Depth	Description	Thickness	Interpreted Stratigraphy
+235	0	Clay	20	
+215	20	Sand & Gravel	50	
+165	70	Clay (yellow)	50	Miocene, undifferentiated
+115	120	Sand (Brown)	90	
+25	210	Clay (blue)	70	
-45	280	Limestone	110	Oligocene Series
-155	390	Sandy Limestone	20	Possibly the Chickasawhay Limestone
-175	410	Boring Terminated		

SOIL BORING LOG

BORING B-2

PROJECT: ESCAMBIA COUNTY LANDFILL JOB No: 92-080
PROJECT LOCATION: BREWTON, ALABAMA
BORING NUMBER: B-2 BORING ELEVATION: +277.5 FEET
BORING LOCATION: SEE TEST LOCATION PLAN
DATE DRILLED: 5/12/92 METHOD: HOLLOW STEM AUGER
WATER LEVEL WAS: 61.1 FEET ON: 5/14/92



SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	SPT N	NM %	LL %	-200 %
4/6 6/6 10/6	SC	Firm Tan, Orange and Purple Silty Clayey SAND	16	19.4	37	38.1
9/6 28/6 50/5	CL	Very Hard Mottled Orange, Purple and Gray CLAY	78+	15.9		
50/6	SC-CL	Very Dense Tan and Orange Silty Clayey SAND w/some Gray Silty Sandy Clay	50-6	14.4	30	28.3
29/6 38/6 34/6	CL	Very Hard Mottled Red and Gray Silty Sandy CLAY	72	15.8		
28/6 40/6 50/5	CL	Very Hard to Hard Mottled Orange and Gray CLAY	90+	15.5	40	90.9
8/6 12/6 24/6			36	22.4		
14/6 19/6 33/6	CL	Very Hard Mottled Gray, Purple and Brown CLAY	52	20.2	42	81.3
12/6 19/6 36/6			55	21.4		
11/6 25/6 50/6	CL-CH	Very Hard to Very Stiff Mottled Gray and Brown CLAY	75	22.4		
5/6 8/6 17/6			25	24.1	72	94.6
19/6 31/6 30/6			61	16.0		

SOIL BORING LOG

BORING B-2

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PROJECT LOCATION: BREWTON, ALABAMA
BORING NUMBER: B-2 BORING ELEVATION: +277.5 FEET
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DATE DRILLED: 5/12/92 METHOD: HOLLOW STEM AUGER
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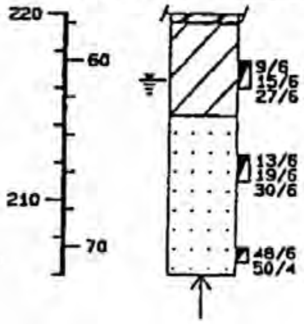
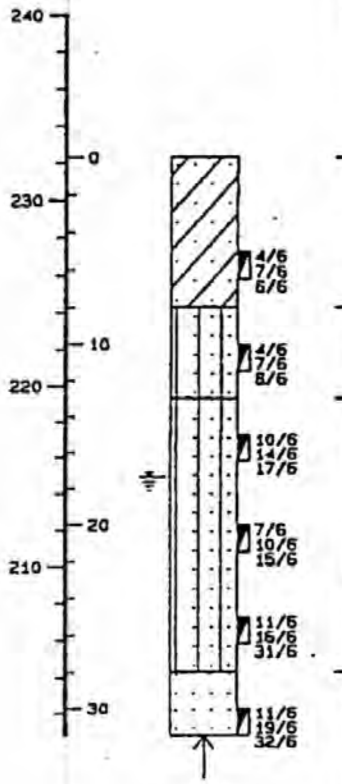


ELEV DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	SPT N	NM %	LL %	-200 %
	9/6 15/6 27/6	CL-SC	Hard Tan and Gray Sandy Silty CLAY w/Pea Gravel	42	15.7		72.8
	13/6 19/6 30/6	SP-SM	Dense to Very Dense Lt. Brown Fine to Medium SAND with some Silt and Gravel	49	20.9		4.9
	48/6 50/4			50-4	14.7		8.7

SOIL BORING LOG

BORING B-3

PROJECT: ESCAMBIA COUNTY LANDFILL JOB No: 92-080
PROJECT LOCATION: BREWTON, ALABAMA
BORING NUMBER: B-3 BORING ELEVATION: +232.3 FEET
BORING LOCATION: SEE TEST LOCATION PLAN
DATE DRILLED: 5/13/92 METHOD: HOLLOW STEM AUGER
WATER LEVEL WAS: 17.4 FEET ON: 5/14/92



ELEV DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	SPT N	NM %	LL %	-200 %
	4/6 7/6 6/6	SC-CL	Firm Mottled Red and Brown Fine to Medium Silty Clayey SAND	13	17.2		50.0
	4/6 7/6 8/6	SM	Firm Tan Fine to Medium Silty SAND	15	9.6		8.6
	10/6 14/6 17/6	SM-SC	Very Firm to Dense Tan Fine to Medium Clayey Silty SAND w/Pea Gravel	31	10.1		
	7/6 10/6 15/6			25	17.4		
	11/6 16/6 31/6			47	12.5		
	11/6 19/6 32/6	SP	Very Dense Gray Medium to Coarse SAND with some Gravel, SILT and CLAY	51	13.8		3.5

B SERIES

BORINGS B-4 THROUGH B-10

DECEMBER 1992

JANUARY 1993

DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 271.97 ASPHALT GROUND 269.3	MATERIAL DESCRIPTION	DEPTH IN FEET
0						Fine to coarse SAND, medium dense, red, orange, some fine gravel, trace clay, moist, non-plastic, friable (SP - SW)	
2.5							2.5
5.0	8 8 12	20	S-1				5.0
7.5					261.3	Tertiary/Pliocene Citronelle Formation (Tc)	7.5
						CLAY, very stiff, orange, tan, light gray, trace fine sand, dry, high plasticity, blocky (CH)	
10.0	6 7 12	19	S-2				10.0
12.5						-- red brown @ 13.0', orange along dessication cracks, frequent red-brown limonite lenses	12.5
15.0	11 12 14	26	S-3				15.0
17.5					251.3	– – – – – – – – – – – – – – – – – –	17.5
						CLAY, hard, light gray, trace fine to medium rock fragments (limonite), dry, high plasticity, blocky (CH)	
20.0	12 14 21	35	S-4				20.0
22.5						BORING B-4 CONTINUED	22.5

MONITORING WELL DETAIL

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:00AM	ON	12-17-92
FINAL	61.5	@	3:00PM	ON	12-17-92
WATER	60.0	@	3:05PM	ON	12-17-92
WATER	59.8	@	1:00PM	ON	12-20-92
WATER	59.8	@ 12:00PM		ON	12-23-92

BORING LOG B-4

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Escambia County, Alabama

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 271.97 ASPHALT GROUND 269.3	MATERIAL DESCRIPTION	DEPTH IN FEET
						-- increase in limonite lenses @ 23.0'	
25.0	14 21 24	45	S-5				25.0
27.5							27.5
						-- frequent orange (oxidized pockets) @ 28.0'	
30.0	14 13 21	34	S-6				30.0
32.5							32.5
					236.3	Tertiary/Miocene #1 Blue Marker (Tcp)	
						CLAY, hard, tan, orange, mottled light gray, moist, high plasticity, mottled (CH)	
35.0	16 18 23	41	S-7				35.0
37.5							37.5
						— becoming more light gray @ 38.0'	
40.0	12 13 17	30	S-8				40.0
42.5							42.5
					226.3	Tertiary/Miocene #2 Orange Marker (Tcp)	
						Fine SAND, medium dense, orange, trace clay and silt, moist, non-plastic, friable (SP)	
45.0						BORING B-4 CONTINUED	45.0

MONITORING WELL DETAIL

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:00AM	ON	12-17-92
FINAL	61.5	@	3:00PM	ON	12-17-92
WATER	60.0	@	3:05PM	ON	12-17-92
WATER	59.6	@	1:00PM	ON	12-20-92
WATER	59.6	@	12:00PM	ON	12-23-92

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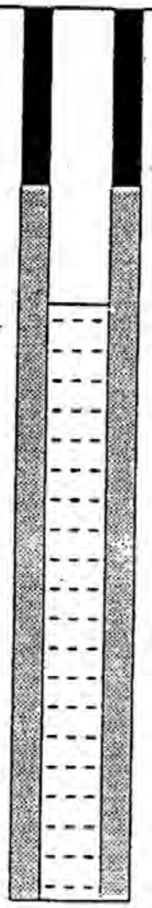
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 271.97 ASPHALT GROUND 269.3	MATERIAL DESCRIPTION
	12 12 13	25	S-9			— occasional clay balls @ 45.0'
47.5					221.3	Fine SAND, medium dense, buff, tan, lavender, trace clay, moist, non-plastic, laminated in part, friable (SP)
50.0	9 9 10	19	S-10			
52.5						
55.0	10 10 11	21	S-11			
57.5				▼	212.4	
60.0	0 0 21	21	S-12			— weight of rods advanced spoon from 60.0' - 61.0'
					207.8	Tertiary/Miocene (Tcp)
62.5						
65.0						
67.5						BORING B-4 CONTINUED

MONITORING WELL DETAIL



	DEPTH (FT)		TIME		DATE
START	00.0	@	10:00AM	ON	12-17-92
FINAL	- 61.5	@	3:00PM	ON	12-17-92
WATER	60.0	@	3:05PM	ON	12-17-92
WATER	59.6	@	1:00PM	ON	12-20-92
WATER	59.6	@	12:00PM	ON	12-23-92

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE	NUMBER	WATER LEVEL	ELEV. CASING 271.97 ASPHALT GROUND 269.3	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
70.0									70.0
72.5									72.5
75.0									75.0
77.5									77.5
80.0									80.0
82.5									82.5
85.0									85.0
87.5									87.5
90.0									90.0

NOTES:

1. Boring terminated @ 61.5'
2. Groundwater levels measured by SES, Inc. on 12-23-92
3. Boring locations and monitoring well elevations surveyed by McCrory & Williams on 12-24-92

MONITORING WELL LEGEND:

☐	Soil	45.0' - 00.0'
☐	1.25" ID PVC Riser	50.0' + 2.67'
■	Bentonite Pellets	48.0' - 45.0'
▨	Sand Pack (250 lbs of 20-40)	60.0' - 48.0'
- - -	1.25" ID PVC Screen	60.0' - 50.0'

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:00AM	ON	12-17-92
FINAL	61.5	@	3:00PM	ON	12-17-92
WATER	60.0	@	3:05PM	ON	12-17-92
WATER	59.8	@	1:00PM	ON	12-20-92
WATER	59.8	@	12:00PM	ON	12-23-92

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 255.03 ASPHALT GROUND 252.1	MATERIAL DESCRIPTION	DEPTH IN FEET
	3 3 2	5	S-1			Fine SAND, loose, tan, light brown, trace clay and organics, moist, non-plastic, friable, occasional root hairs (SP)	
2.5							2.5
5.0					246.6	Tertiary/Pliocene Citronelle Formation (Tc)	5.0
	5 8 9	17	S-2			-- limonite @ 5.5' CLAY, very stiff, orange, red-brown, tan, some fine sand, trace fine gravel (subround), dry, high plasticity, blocky, frequent light gray, fine sand clay seams (CH)	
7.5							7.5
					243.1	– – – – – – – – – – – – – – – – – –	
10.0						CLAY, very stiff, red-brown, brown, light gray, orange, tan, trace fine to medium rock fragments (limonite), dry, high plasticity, blocky, oxidation along root tubes and dessication cracks (CH)	10.0
	5 8 11	19	S-3				
12.5							12.5
					239.1	– – – – – – – – – – – – – – – – – –	
						CLAY, very stiff, light gray, dry, high plasticity, blocky (CH)	
15.0							15.0
	6 9 12	21	S-4				
17.5							17.5
					234.1	– – – – – – – – – – – – – – – – – –	
						CLAY, very stiff, orange, red-orange, tan, light gray, trace fine sand, dry, high plasticity, evident dessication features, occasional limonite (CH)	
20.0							20.0
	9 11 16	27	S-5		231.1	Tertiary/Miocene #1 Blue Marker (Tcp)	
						CLAY, very stiff, light gray, dry, high plasticity (CH)	
22.5						BORING B-5 CONTINUED	22.5

MONITORING WELL DETAIL

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:30AM	ON	12-18-92
FINAL	46.5	@	12:20PM	ON	12-18-92
WATER	42.8	@	12:25PM	ON	12-18-92
WATER	40.4	@	1:00PM	ON	12-20-92
WATER	40.4	@	12:00PM	ON	12-23-92

BORING LOG B-5

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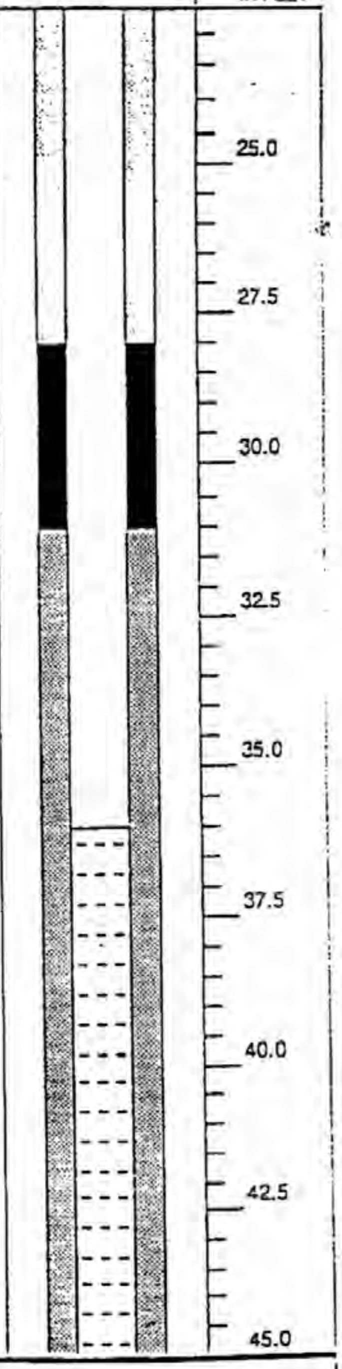
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 255.03 ASPHALT GROUND 252.1	MATERIAL DESCRIPTION
					229.1	Tertiary/Miocene #2 Orange Marker (Tcp)
						Clayey, fine SAND, medium dense, light gray, tan, some fine sand and silt lenses, moist, medium plasticity, friable (SC)
25.0						-- fine sandy silt lense @ 25.0'
	9 11 12	23	S-6		226.1	
						Fine sandy CLAY, very stiff, tan, orange, moist, medium plasticity (SC)
27.5						-- tan mottle @ 28.0'
30.0						
	14 17 21	38	S-7		221.6 221.1	Fine SAND, dense, orange, some clay, moist, non-plastic, friable (SP)
32.5						Fine to medium SAND, medium dense, orange, tan, dry, non-plastic, friable, frequent clayey sand seams (SW-SP) -- very fine to fine black, carbonaceous material or heavy minerals @ 34.0'
35.0	11 16 14	30	S-8			-- moist @ 35.0' — banding @ 35.5' -- orange-pink @ 36.0'
37.5					214.1	Fine to coarse SAND (clean Qtz), medium dense, pink, light orange, tan, lavender, wet, non-plastic, friable (SW)
40.0	10 14 13	27	S-9	▼	214.6 211.1	Fine to medium SAND (subangular to subround Qtz), medium dense, pink, tan, wet, non-plastic, friable (SW)
42.5						
45.0						



BORING B-5 CONTINUED

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:30AM	ON	12-18-92
FINAL	46.5	@	12:20PM	ON	12-18-92
WATER	42.8	@	12:25PM	ON	12-18-92
WATER	40.4	@	1:00PM	ON	12-20-92
WATER	40.4	@	12:00PM	ON	12-23-92

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE	NUMBER	WATER LEVEL	ELEV. CASING 255.03 ASPHALT GROUND 252.1	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
11 16 17	■	33	S-10			206.6	-- fine sand, tan, some clay seam @ 45.5' (2")	▨ - - - ▨	
						205.6	Fine to coarse SAND, dense, tan, trace clay (SP)		
							Tertiary/Miocene (Tcp)		
47.5									47.5
50.0									50.0
52.5									52.5
55.0									55.0
57.5									57.5
60.0									60.0
62.5									62.5
65.0									65.0
67.5									67.5

NOTES:

1. Boring terminated @ 46.5'
2. Groundwater levels measured by SES, Inc. on 12-23-92
3. Boring locations and monitoring well elevations surveyed by McCrory & Williams on 12-24-92

MONITORING WELL LEGEND:

□	Soil	28.0' - 00.0'
□	1.25" ID PVC Riser	36.0' + 2.93'
■	Bentonite Pellets	31.0' - 28.0'
▨	Sand Pack	46.0' - 31.0'
- - -	1.25" ID PVC Screen	46.0' - 36.0'

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:30AM	ON	12-18-92
FINAL	46.5	@	12:20PM	ON	12-18-92
WATER	42.8	@	12:25PM	ON	12-18-92
WATER	40.4	@	1:00PM	ON	12-20-92
WATER	40.4	@	12:00PM	ON	12-23-92

BORING LOG B-5

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 314.21 ASPHALT GROUND 311.5	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
						Fine to medium SAND, medium dense, brown, tan, orange, trace clay and coarse sand and fine gravel, moist, non-plastic, friable (SW)		
2.5					308.5			2.5
						Fine to coarse SAND, medium dense, orange, tan, some fine gravel, dry, non-plastic, friable (SW-GW)		
5.0								5.0
	7 6 7	13	S-1					
7.5								7.5
						-- red-orange, trace clay @ 8.0'		
10.0								10.0
	13 10 7	17	S-2					
12.5								12.5
					297.5	Tertiary/Pliocene Citronelle Formation (Tc)		
15.0						Clayey SILT, very stiff, orange, tan, light gray, some fine sand, dry, low plasticity, mottled, visible solution (fluid) pathways (ML)		15.0
	9 11 13	24	S-3					
17.5								17.5
					293.5			
						CLAY, hard, purple, red, orange, occasional orange tan mottle, some silt, trace fine sand, dry, high plasticity, mottled (CH) -- variegated, dessication feature 18.0' - 20.5'		
20.0								20.0
	12 12 21	33	S-4					
22.5						BORING B-6 CONTINUED		22.5

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:45AM	ON	12-19-92
FINAL	96.5	@	10:30AM	ON	12-20-92
WATER	45.0	@	2:00PM	ON	12-19-92
WATER	72.3	@	12:00PM	ON	12-20-92
WATER	64.0	@	1:00PM	ON	12-20-92

BORING LOG B-6

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 314.21 ASPHALT GROUND 311.5	MATERIAL DESCRIPTION	DEPTH IN FEET
25.0							25.0
	8 12 16	28	S-5		285.5	-- pieces lignite and root fibers @ 26.0' CLAY, very stiff, orange, brown, tan, some silt, trace fine sand, dry, high plasticity, mottled, dessication features (CH) -- tan orange with light gray sandy clay, occasional lavender color @ 27.0'	
27.5							27.5
30.0							30.0
	8 8 14	22	S-6		280.5	CLAY, very stiff, red, brown, tan, light gray, some silt, trace fine sand, moist, high plasticity, mottled in part, frequent limonite partings (CH)	
32.5							32.5
					277.5	Fine sandy CLAY, dense, red, brown, tan, orange, light gray, purple, dry, medium plasticity, mottled in part, friable, frequent iron stains, frequent fine sand seams, occasional limonite (SC) -- fine vericolored sand @ 35.0' - 35.5'	
35.0	13 15 18	33	S-7				35.0
					274.5	Fine to medium SAND, very dense, buff, light gray, light lavender, some clay, moist, non-plastic, friable, occasional orange tan mottle (SP)	
37.5							37.5
40.0							40.0
	31 29 27	56	S-8				
42.5						-- mottled lavender with carbonaceous material or heavy minerals (finely desseminated) @ 43.0' - 45.5' -- tan @ 44.0' - 45.5'	42.5
45.0					266.5	BORING B-6 CONTINUED	45.0

MONITORING WELL DETAIL

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:45AM	ON	12-19-92
FINAL	96.5	@	10:30AM	ON	12-20-92
WATER	45.0	@	2:00PM	ON	12-19-92
WATER	72.3	@	12:00PM	ON	12-20-92
WATER	64.0	@	1:00PM	ON	12-20-92

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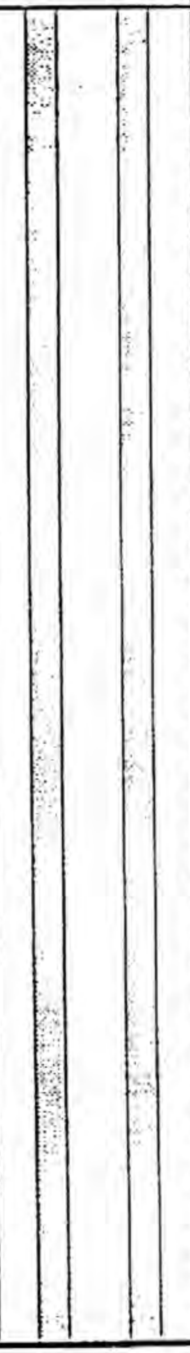
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 314.21 ASPHALT GROUND 311.5	MATERIAL DESCRIPTION	DEPTH IN FEET
	7 17 21	38	S-9			CLAY, hard, light gray, tan, moist, high plasticity, blocky, banded--frequent fine to medium sand seams , frequent limonite pieces, multiple sand lenses throughout section (CH)	
47.5							47.5
50.0							50.0
	50/5	50/5	S-10			-- tan, brown, orange sandy silt @ 50.5' - 52.0'	
52.5							52.5
55.0							55.0
57.5							57.5
60.0							60.0
	50/5	50/5	S-11			-- hard drill, occasional limonite pieces @ 60.0'	
62.5							62.5
					248.5	- - - - - - - - - - - - - - - - - -	
				▼	250.2	CLAY, hard, red-brown, purple, tan, light gray, orange, trace fine sand, dry, medium plasticity, blocky, waxey, limonite, dessication features (CL)	
65.0							65.0
	50/4	50/4	S-12				
67.5							67.5

MONITORING WELL DETAIL



BORING B-6 CONTINUED

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:45AM	ON	12-19-92
FINAL	98.5	@	10:30AM	ON	12-20-92
WATER	- 45.0	@	2:00PM	ON	12-19-92
WATER	-72.3	@	12:00PM	ON	12-20-92
WATER	- 64.0	@	1:00PM	ON	12-20-92

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE	NUMBER	WATER LEVEL	ELEV. CASING 314.21 ASPHALT GROUND 311.5	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
70.0									70.0
72.5									72.5
							-- easier drilling @ 73.0'		
75.0									75.0
	18 28 31	59	S-13			235.5	Tertiary/Miocene #1 Blue Marker (Tcp)		
77.5							CLAY, hard, tan, mottled light gray, dry, high plasticity, blocky, waxey, mottle appears along burrows or root tubes?) (CH)		77.5
80.0			UDS-1						80.0
82.5									82.5
85.0									85.0
87.5									87.5
90.0							BORING B-6 CONTINUED		90.0

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:45AM	ON	12-19-92
FINAL	96.5	@	10:30AM	ON	12-20-92
WATER	45.0	@	2:00PM	ON	12-19-92
WATER	72.3	@	12:00PM	ON	12-20-92
WATER	64.0	@	1:00PM	ON	12-20-92

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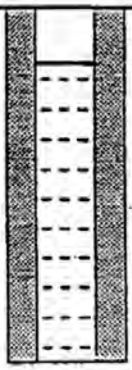
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 314.21 ASPHALT GROUND 311.5	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
	18 21 23	44	S-14					
92.5					218.5	Tertiary/Miocene #2 Orange Marker (Tcp)		92.5
						CLAY, very stiff, tan, light gray, some fine sand, moist, medium plasticity, mottled in part, laminated (seasonal high water) (CL-SC)		
95.0								95.0
	13 12 14	26	S-15		215.0			
97.5								97.5
100.0								100.0
102.5	4 7 9	16			208.0			102.5
						Fine SAND, tan, medium dense, wet, non-plastic (SP)		
105.0								105.0
107.5								107.5
	6 10 12	22			202.0	Tertiary/Miocene (Tcp)		
110.0								110.0
112.5								112.5



BORING B-6 CONTINUED

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:45AM	ON	12-19-92
FINAL	96.5	@	10:30AM	ON	12-20-92
WATER	45.0	@	2:00PM	ON	12-19-92
WATER	72.3	@	12:00PM	ON	12-20-92
WATER	64.0	@	1:00PM	ON	12-20-92

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 314.21 ASPHALT GROUND 311.5	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
115.0								115.0
117.5								117.5
120.0								120.0
122.5								122.5
125.0								125.0
127.5								127.5
130.0								130.0
132.5								132.5
135.0								135.0

NOTES:

1. Boring terminated @ 96.5'
2. Groundwater levels measured by SES, Inc. on 12-23-92
3. Boring locations and monitoring well elevations surveyed by McCrory & Williams on 12-24-92
4. Stratigraphy from 96.5' to 109.5' estimated from B-6A located 300' to the south
5. Groundwater level assumed from B-6A

MONITORING WELL LEGEND:

░	Soil	82.0' - 00.0'
☐	1.25" ID PVC Riser	91.0' + 2.71'
■	Bentonite Pellets (50 lbs)	84.0' - 82.0'
▒	Sand Pack (150 lbs of 20-40)	96.0' - 84.0'
- - -	1.25" ID PVC Screen	96.0' - 91.0'

	DEPTH (FT)		TIME		DATE
START	00.0	@	10:45AM	ON	12-19-92
FINAL	96.5	@	10:30AM	ON	12-20-92
WATER	45.0	@	2:00PM	ON	12-19-92
WATER	72.3	@	12:00PM	ON	12-20-92
WATER	64.0	@	1:00PM	ON	12-20-92

64.

BORING LOG B-6

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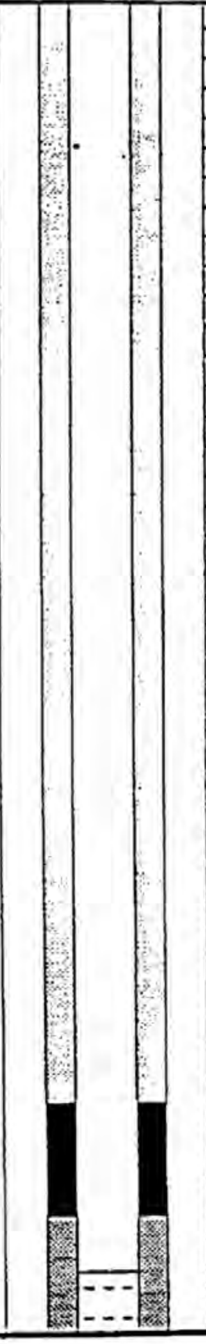
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE	NUMBER	WATER LEVEL	ELEV. CASING 282.99 ASPHALT GROUND 278.80	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
47.5							NOTES: 1. Straight auger from surface to 70.0' by SES, Inc. 2. Boring terminated @ 76.5' 3. Groundwater levels measured by SES, Inc. on 12-23-92 4. Boring locations and monitoring well elevations surveyed by McCrory & Williams on 12-24-92		47.5
50.0									50.0
52.5									52.5
55.0									55.0
57.5									57.5
60.0									60.0
62.5									62.5
					▼	213.0			
65.0									65.0
67.5							BORING B-6A CONTINUED		67.5



	DEPTH (FT)		TIME		DATE
START	00.0	@	AM	ON	12-23-92
FINAL	76.5	@	PM	ON	12-23-92
WATER	64.0	@	2:00PM	ON	12-23-92
WATER		@		ON	
WATER	-	@		ON	

BORING LOG B-6A

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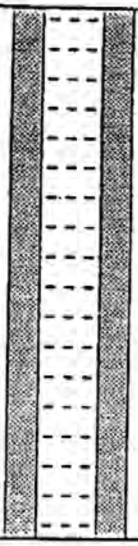
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 282.99 ASPHALT GROUND 278.80	MATERIAL DESCRIPTION
70.0	4 7 9	16			207.8	CLAY, very stiff, tan, light gray, some sand, medium plasticity (CL)
72.5 75.0	6 10 12	22			202.3	Fine SAND, tan, medium dense, wet, non-plaastic (SP) Tertiary/Miocene (Tcp)
77.5 80.0 82.5 85.0 87.5 90.0						

MONITORING WELL DETAIL



MONITORING WELL LEGEND:

▨	Soil	63.5' - 00.0'
☐	2" ID PVC Riser	66.5' + 4.19'
■	Bentonite Pellets	65.5' - 63.5'
▩	Sand Pack	76.5' - 65.5'
- - -	2" ID PVC Screen	76.5' - 66.5'

	DEPTH (FT)		TIME		DATE
START	00.0	@	AM	ON	12-23-92
FINAL	76.5	@	PM	ON	12-23-92
WATER	64.0	@	2:00PM	ON	12-23-92
WATER		@		ON	
WATER		@		ON	

64.

BORING LOG B-6A

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 234.7 ASPHALT GROUND 230.0	MATERIAL DESCRIPTION	DEPTH IN FEET
	3 2 1	3	S-0			Clayey, fine SAND, dark gray-black, some silt, moist, low plasticity (SC) -- buff @ 1.0'	
2.5							2.5
					227.0	- - - - - - - - - - - - - - - -	
						Silty CLAY, hard, orange, red, light gray, frequent clay partings, some fine to coarse rock fragments (limonite), dry, medium plasticity, mottled in part (SC)	
5.0							5.0
	6 14 18	32	S-1				
7.5							7.5
					222.0	Quaternary/Recent (Qal)	
						Fine to coarse SAND, dense, orange, tan, trace fine gravel and clay, dry, non-plastic, banded in part, friable (SW)	
10.0							10.0
	9 21 26	47	S-2				
12.5							12.5
					217.0	- - - - - - - - - - - - - - - -	
						Fine to medium SAND, medium dense, orange, tan, trace clay, wet, non-plastic, friable (SP - SW)	
15.0							15.0
	6 9 14	23	S-3				
17.5							17.5
					212.0	- - - - - - - - - - - - - - - -	
					215.5	Fine SAND, dense, orange, tan, some clay, wet, non-plastic, friable (SP - SC)	
20.0							20.0
	11 14 21	35	S-4				
					208.5	Tertiary/Miocene (Tcp)	
22.5						BORING B-7 CONTINUED	22.5

MONITORING WELL DETAIL

	DEPTH (FT)		TIME		DATE
START	00.0	@	9:30AM	ON	12-21-92
FINAL	21.5	@	10:30AM	ON	12-21-92
WATER	15.6	@	10:40AM	ON	12-21-92
WATER	19.2	@	1:00PM	ON	12-23-92
WATER		@		ON	

BORING LOG B-7

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 234.7 ASPHALT GROUND 230.0	MATERIAL DESCRIPTION	MONITORING WELL DETAIL	DEPTH IN FEET
25.0								25.0
27.5								27.5
30.0								30.0
32.5								32.5
35.0								35.0
37.5								37.5
40.0								40.0
42.5								42.5
45.0								45.0

NOTES:

1. Boring terminated @ 21.5'
2. Groundwater levels measured by SES, Inc. on 12-23-92
3. Boring locations and monitoring well elevations surveyed by McCrory & Williams on 12-24-92

MONITORING WELL LEGEND:

☐	Soil	10.5' - 00.0'
☐	1.25" ID PVC Riser	15.5' + 4.70'
■	Bentonite Pellets (50 lbs)	14.0' - 10.5'
▨	Sand Pack (50 lbs of 20–40)	21.5' - 14.0'
⬚	1.25" ID PVC Screen	21.5' - 15.5'

	DEPTH (FT)		TIME		DATE
START	00.0	@	9:30AM	ON	12-21-92
FINAL	21.5	@	10:30AM	ON	12-21-92
WATER	15.6	@	10:40AM	ON	12-21-92
WATER	19.2	@	1:00PM	ON	12-23-92
WATER		@		ON	

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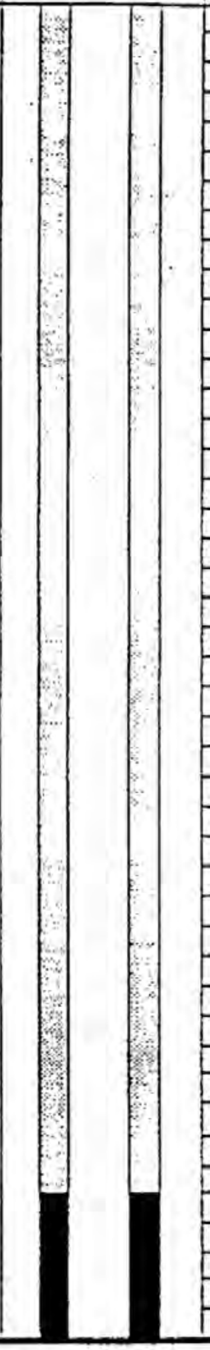
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 237.39 ASPHALT GROUND 234.8	MATERIAL DESCRIPTION	DEPTH IN FEET
						Fine SAND, buff-tan, some clay, trace fine gravel, moist, low plasticity, friable (SP)	
2.5							2.5
					230.8	Quaternary/Recent (Qal)	
5.0						CLAY, very stiff, orange, some fine sand, moist, medium plasticity, laminated (CL)	5.0
	6 9 8	17	S-1		228.8	Tertiary/Miocene #2 Orange Marker (Tcp)	
						-- root @ 6.0' CLAY, stiff, light gray, banded orange, trace silt and lignite, moist, high plasticity, mottled in part, occasional red brown partings (CH) -- frequent silty clay, orange, tan, some fine sand lenses @ 8.0'	
7.5			UDS-1				7.5
10.0							10.0
	5 5 6	11	S-2				
12.5							12.5
15.0							15.0
	6 7 6	13	S-3				
17.5							17.5
					215.8	— — — — — — — — — — — — — — —	
20.0						CLAY, stiff, dark gray (marsh), moist, high plasticity, abundant plant material, pieces of lignite (CH)	20.0
	4 5 6	11	S-4				
22.5						BORING B-8 CONTINUED	22.5

MONITORING WELL DETAIL



	DEPTH (FT)		TIME		DATE
START	00.0	@	11:20AM	ON	12-21-92
FINAL	35.0	@	12:40PM	ON	12-21-92
WATER	30.0	@	12:45PM	ON	12-21-92
WATER	23.3	@	1:00PM	ON	12-23-92
WATER		@		ON	

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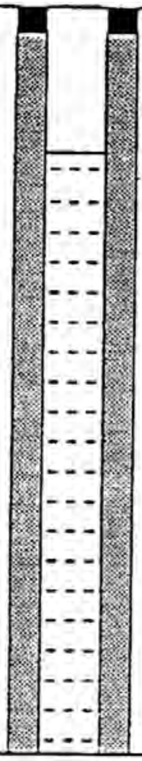
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING 237.39 ASPHALT GROUND 234.8	MATERIAL DESCRIPTION
				▼	214.4	
25.0	6 7 7	14	S-5		208.8	-- carbonized wood pieces @ 25.5'
27.5						CLAY, stiff, orange, buff, moist, high plasticity, laminated (CH)
30.0	16 38 50	88	S-6		203.8	
32.5						Fine to medium SAND, orange, trace clay, wet, non-plastic, friable (SP) -- 1" orange laminated silt on top of sand
35.0					199.8	Tertiary/Miocene (Tcp)
37.5						
40.0						
42.5						
45.0						

MONITORING WELL DETAIL



NOTES:

1. Boring terminated @ 35.0'
2. Groundwater levels measured by SES, Inc. on 12-23-92
3. Boring locations and monitoring well elevations surveyed by McCrory & Williams on 12-24-92

MONITORING WELL LEGEND:

▨	Soil	20.0' - 00.0'
☐	2" ID PVC Riser	25.0' + 2.59'
■	Bentonite Pellets (50lbs)	23.0' - 20.0'
▨	Sand Pack (50 lbs of 20-40)	35.0' - 23.0'
- - -	2" ID PVC Screen	35.0' - 25.0'

	DEPTH (FT)		TIME		
START	00.0	@	11:20AM	ON	12-21-92
FINAL	35.0	@	12:40PM	ON	12-21-92
WATER	30.0	@	12:45PM	ON	12-21-92
WATER	23.3	@	1:00PM	ON	12-23-92
WATER	--	@		ON	

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING ASPHALT GROUND 253.80	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	WASH 200	PID READING* FIELD	LAB**	MONITORING WELL DETAIL	DEPTH IN FEET
						CLAY, very stiff to hard, brown to gray, trace silt, moist, low-plastic to plastic, (CL)						
2.5												2.5
5.0	9 12 13	25	S-1		248.8							5.0
7.5												7.5
10.0	10 18 50	68	S-2									10.0
12.5						Silty CLAY, very stiff, red to gray, trace fine sand, dry, dry, plastic, (ML-CL)						12.5
15.0	8 12 14	26	S-3									15.0
17.5												17.5
20.0	9 9 12	21	S-4			CLAY, very stiff, gray, brown, and red, some silt, trace sand, moist, plastic (ML-CL)						20.0
22.5												22.5
25.0						BORING B-9 CONTINUED						25.0

	DEPTH (FT)		TIME	ON
START	0	@	9:00a.m.	ON 12/22/92
FINAL	46.5	@	1:30p.m.	ON 12/22/93
WATER	35.5	@	2:00p.m.	ON 12/22/93
WATER		@		ON
WATER		@		

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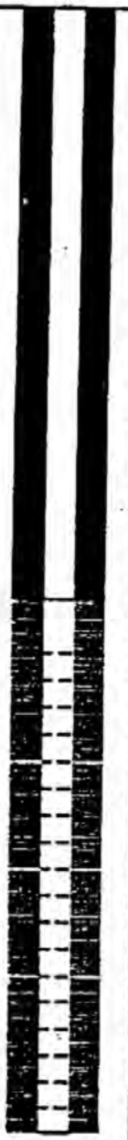
DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING ASPHALT GROUND 253.80	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	WASH 200	PID READING* FIELD	LAB*	MONITORING WELL DETAIL	DEPTH IN FEET
25.0	6 7 9	16	S-5			CLAY, very stiff, gray, brown, and red, some silt trace sand, moist, plastic (ML-C-)						25.0
27.5												27.5
30.0	9 11 14	25	S-6									30.0
32.5												32.5
35.0	7 10 15	25	S-7									35.0
37.5						Fine SAND, firm, yellow to white-gray, wet, non-plastic triable, frequent clayey sand seams (SW-SP)						37.5
40.0	9 14 16	30	S-8									40.0
42.5												42.5
45.0	10 11 14	25	S-9									45
47.5												47.5
50.0												



DEPTH (FT) TIME ON

START ______ @ ______ ON

FINAL ______ @ ______ ON

WATER ______ @ ______ ON

WATER ______ @ ______ ON

WATER ______ @ ______

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DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING ASPHALT GROUND 247.00	MATERIAL DESCRIPTION	MOISTURE CONTENT (%)	WASH 200	PID READING* FIELD	PID READING* LAB**	MONITORING WELL DETAIL	IN FEET
2.5												2.5
5.0	14 14 16	25	S-1		242	Clayey SAND, very stiff to hard, tan, with gravel (SW)						5.0
7.5												7.5
10.0	5 11 12	23	S-2		237	Silty CLAY, red-gray (CL)						10.0
12.5												12.5
15.0	14 15 16	31	S-3		232	Sandy CLAY, tan-gray (CL)						15.0
17.5												17.5
20.0	14 15 15	30	S-4		227	SAND, fine to medium silt, tan (SM)						20.0
22.5												22.5
25.0												25.0

BORING B-10 CONTINUED

	DEPTH (FT)		TIME	ON
START	0	@	9:00a.m.	ON 1/16/93
FINAL	46.5	@	1:30p.m.	ON 1/16/93
WATER	35	@	2:00p.m.	ON 1/16/93
WATER		@		ON
WATER		@		

BORING LOG B-10

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CGC 92-429

Proposed Solid Waste Facility
Escambia County, Alabama

DEPTH IN FEET	SAMPLE TYPE	N VALUE	SAMPLE NUMBER	WATER LEVEL	ELEV. CASING ASPHALT GROUND 247.00	MATERIAL DESCRIPTION	MOISTURE (%)	CONTENT	WASH 200	PID READING* FIELD	LAB**	MONITORING WELL DETAIL	DEPTH IN FEET
25.0	12 12 14	26	S-5		222	Sand, fine to medium, white (SP)							25.0
27.5													27.5
30.0	15 16 17	33	S-6		217	Sand, fine to medium, white (SP)							30.0
32.5													32.5
35.0	27 31 36	67	S-7		212	fine to medium silty SAND,orange, with gravel (GM)							35.0
37.5													37.5
40.0	12 27 31	58	S-8		207	fine to medium silty SAND,orange, with gravel (GM)							40.0
42.5													42.5
45.0	12 12 14	26	S-9		202	# fine to medium silty SAND,orange, with gravel (GM)							45
47.5													47.5
50.0													

	DEPTH (FT)		TIME	ON
START	______	@	______	ON
FINAL	______	@	______	ON
WATER	______	@	______	ON
WATER	______	@	______	ON
WATER	______	@	______	

BORING LOG B-10

Page 2 of 2

CGC 92-429

Proposed Solid Waste Facility
Escambia County, Alabama

C SERIES

BORINGS C-1 THROUGH C-10

APRIL 21, 1993 THROUGH APRIL 23, 1993

CGC

Chattahoochee Geotechnical Consultants, Inc.
Log of Boring

Project Name: Escambia County Landfill
Client: BFI
Location: Escambia County, Alabama

Project No.: 2055.924.26
Boring No.: C-1
Date: 4/23/93

Elevation	Description	Depth	Samples				Drilling Observations
0258.30	Topsoil: 14 "	(feet)	#	Type	Blows/6"	Recov	SPT Boring
	SAND; very loose, dark brown, some silt, trace mica, wet, non plastic: COASTAL PLAIN		1	SS	2-2-2		No groundwater encountered at time of drilling.
	Medium Sandy CLAY; stiff, brown/gray, trace mica, moist, plastic: COASTAL PLAIN	5.0	2	SS	4-6-8		
0248.30	Silty SAND; firm, red/brown, trace mica, moist, non plastic: COASTAL PLAIN	10.0	3	SS	5-6-5		
	Boring terminated at: 10.0 feet.						
		15.0					
		20.0					
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name: Escambia County Landfill
Client: BFI
Location: Escambia County, Alabama

Project No.: 2055.924.26
Boring No.: C-2
Date: 4/23/93

Elevation	Description	Depth (feet)	Samples #	Type	Blows/6"	Recov	Drilling Observations
0241.80	Topsoil: 10 "						SPT Boring
	SILT; soft to very stiff, brown, trace mica, sand, clay, moist, very low plastic: COASTAL PLAIN		1	SS	2-2-2		No groundwater encountered at time of drilling.
		5.0	2	SS	5-9-11		
0231.80	CLAY; very stiff, brown/gray, trace mica, dry, plastic, mottled: COASTAL PLAIN	10.0	3	SS	6-9-12		
	Boring terminated at: 10.0 feet.						
		15.0					
		20.0					
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name:	Escambia County Landfill	Project No.:	2055.924.26
Client:	BFI	Boring No.:	C-3
Location:	Escambia County, Alabama	Date:	4/23/93

Elevation	Description	Depth (feet)	Samples #	Type	Blows/6"	Recov	Drilling Observations SPT Boring
0228.70	Topsoil: 24 "						
	CLAY; firm to stiff, gray/brown, trace mica, moist, plastic: COASTAL PLAIN		1	SS	3-3-1		No groundwater encountered at time of drilling.
		5.0					
			2	SS	3-3-5		
0218.70		10.0					
	Boring terminated at: 10.0 feet.		3	SS	5-6-8		
		15.0					
		20.0					
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name:	Escambia County Landfill	Project No.:	2055.924.26
Client:	BFI	Boring No.:	C-4
Location:	Escambia County, Alabama	Date:	4/23/93

Elevation	Description	Depth	Samples				Drilling Observations
0246.10	Topsoil: 12 "	(feet)	#	Type	Blows/6"	Recov	SPT Boring
	SAND; loose, brown, trace mica, clay, moist, very low plastic: COASTAL PLAIN		1	SS	3-3-3		No groundwater encountered at time of drilling.
	CLAY; stiff, brown/gray, trace mica, sand, rock, moist, plastic, mottled: COASTAL PLAIN	5.0	2	SS	4-6-8		
		10.0	3	SS	5-6-10		
	SAND; firm, tan/gray, trace mica, clay, dry to moist, non plastic: COASTAL PLAIN	15.0	4	SS	15-14-12		
		20.0	5	SS	8-8-8		
		25.0	6	SS	9-9-10		
0216.10	Boring terminated at: 30.0 feet.	30.0	7	SS	7-9-13		
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)

UDS- Undisturbed Sample

DCP- Dynamic Cone Penetrometer

SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name:	Escambia County Landfill	Project No.:	2055.924.26
Client:	BFI	Boring No.:	C-5
Location:	Escambia County, Alabama	Date:	4/22/93

Elevation	Description	Depth	Samples				Drilling Observations
0287.70	Topsoil: 30 "	(feet)	#	Type	Blows/6"	Recov	SPT Boring
	Gravely SAND; firm, tan, trace mica, dry, non plastic: COASTAL PLAIN		1	SS	3-3-4		No groundwater encountered at time of drilling.
	Sandy CLAY; stiff to very stiff, orange/tan, trace mica, silt, moist, plastic, mottled: COASTAL PLAIN	5.0	2	SS	8-14-16		
		10.0	3	SS	9-15-15		
		15.0	4	SS	5-5-7		
	Silty CLAY; hard, gray, trace mica, sand, dry, plastic: COASTAL PLAIN						
		20.0	5	SS	25-30-50		
		25.0	6	SS	18-45-50/4"		
		30.0	7	SS	19-36-50/4"		
	CLAY; very stiff to hard, red/gray, trace mica, sand, dry, plastic, mottled: COASTAL PLAIN						
		35.0	8	SS	10-10-28		
		40.0	9	SS	18-26-41		
		45.0	10	SS	11-14-16		
		50.0	11	SS	11-15-20		

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name:	Escambia County Landfill	Project No.:	2055.924.26
Client:	BFI	Boring No.:	C-5 Pg. 2
Location:	Escambia County, Georgia	Date:	4/22/93

Elevation	Description	Depth	Samples				Drilling Observations
0287.70		(feet)	#	Type	Blows/6"	Recov	SPT Boring
	CLAY; very stiff to hard, red/gray, trace mica, sand, dry, plastic, mottled: COASTAL PLAIN (CONT'D)	50.0					
		55.0	12	SS	17-19-26		
	Clayey SAND; firm, brown, moist, low PLASTIC: COASTAL PLAIN						
		60.0	13	SS	11-14-16		
	Fine SAND; firm, tan/white, trace mica, rock, moist, non plastic, banded: COASTAL PLAIN						
		65.0	14	SS	10-11-12		
217.7		70.0	15	SS	11-11-12		
	Boring terminated at: 70.0 feet.						
		75.0					
		80.0					
		85.0					
		90.0					
		95.0					
		100.0					

LEGEND

SS- Split Spoon (sample)

UDS- Undisturbed Sample

DCP- Dynamic Cone Penetrometer

SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name:	Escambia County Landfill	Project No.:	2055.924.26
Client:	BFI	Boring No.:	C-6
Location:	Escambia County, Alabama	Date:	4/21/93

Elevation	Description	Depth (feet)	#	Type	Blows/6"	Recov	Drilling Observations
240.00±	Topsoil: 6 "						SPT Boring
	Gravely CLAY; stiff, brown, trace mica, dry, low plastic: COASTAL PLAIN		1	SS	12-8-7		No groundwater encountered at time of drilling.
	CLAY; stiff to very stiff, gray/red/brown, trace mica, sand, dry, plastic, mottled: COASTAL PLAIN	5.0	2	SS	6-7-8		
		10.0	3	SS	6-9-14		
		15.0	4	SS	5-7-8		
	Fine SAND; dense, tan, trace mica, clay, moist, very low plastic: COASTAL PLAIN	20.0	5	SS	14-15-17		
		25.0	6	SS	15-16-17		
210±	Boring terminated at: 30.0 feet.	30.0	7	SS	17-17-19		
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name: Escambia County Landfill
Client: BFI
Location: Escambia County, Alabama

Project No.: 2055.924.26
Boring No.: C-7
Date: 4/21/93

Elevation	Description	Depth	Samples				Drilling Observations
0227.90	Topsoil: 12 "	(feet)	#	Type	Blows/6"	Recov	SPT Boring
	Sandy CLAY; soft to very stiff, tan, trace mica, moist, plastic: COASTAL PLAIN		1	SS	2-2-2		Groundwater encountered at 19.5 feet at time of drilling.
		5.0	2	SS	4-10-12		
	Fine SAND; firm, tan, trace mica, clay, dry, very low plastic: COASTAL PLAIN	10.0	3	SS	5-7-9		
		15.0	4	SS	7-7-7		
0207.90		20.0	5	SS	8-9-11		
	Boring terminated at: '20.0 feet.						
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.
Log of Boring

Project Name: Escambia County Landfill
Client: BFI
Location: Escambia County, Alabama

Project No.: 2055.924.26
Boring No.: C-8
Date: 4/21/93

Elevation	Description	Depth (feet)	#	Type	Blows/6"	Recov	Drilling Observations
0222.40	Topsoil: 24 "						SPT Boring
	Sandy CLAY; very stiff, tan, trace mica, moist, plastic: COASTAL PLAIN		1	SS	1-2-3		Groundwater encountered at 13.0 feet at time of drilling.
		5.0	2	SS	3-9-10		
	Fine SAND; firm, tan, trace mica, rock, moist to wet, non plastic: COASTAL PLAIN	10.0	3	SS	6-6-7		
0207.40		15.0	4	SS	4-7-8		
	Boring terminated at: 15.0 feet						
		20.0					
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.
Log of Boring

Project Name:	Escambia County Landfill	Project No.:	2055.924.26
Client:	BFI	Boring No.:	C-9
Location:	Escambia County, Alabama	Date:	4/22/93

Elevation	Description	Depth (feet)	#	Type	Blows/6"	Recov	Drilling Observations SPT Boring
0224.20	Topsoil: 10 "						
	Fine Sandy CLAY; firm to stiff, brown/gray, trace mica, moist, plastic: COASTAL PLAIN		1	SS	4-3-3		No groundwater encountered at time of drilling.
		5.0	2	SS	4-4-9		
	SAND; firm, brown, trace mica, clay, moist, non plastic: COASTAL PLAIN	10.0	3	SS	5-7-9		
	Fine to Medium SAND; white/tan, trace mica, wet, non plastic, banded: COASTAL PLAIN	15.0	4	SS	5-5-4		
0207.70	Boring terminated at: 16.5 feet						
		20.0					
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

- SS- Split Spoon (sample)
- UDS- Undisturbed Sample
- DCP- Dynamic Cone Penetrometer
- SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.
Log of Boring

Project Name: Escambia County Landfill
Client: BFI
Location: Escambia County, Alabama

Project No.: 2055.924.26
Boring No.: C-10
Date: 4/22/93

Elevation	Description	Depth (feet)	#	Type	Blows/6"	Recov	Drilling Observations
0220.80	Topsoil: 10"						SPT Boring
	CLAY; firm to very stiff, brown/gray, trace mica, sand, dry, plastic, mottled: COASTAL PLAIN		1	SS	1-3-4		Groundwater encountered at 12.1 feet at time of drilling.
		5.0	2	SS	5-9-11		
	SAND; firm, brown/gray/tan, trace mica, dry, non plastic, banded: COASTAL PLAIN	10.0	3	SS	6-6-7		
		15.0	4	SS	4-7-7		
0204.30	Boring terminated at: 16.5 feet.						
		20.0					
		25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

MONITORING WELL
BORING LOGS

SEPTEMBER 1993
AND
MAY 1994

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name: Timberlands Landfill
Client: Browning Ferris Industries, Inc.
Location: Escambia County, Alabama

Project No.: 2055.924.26
Boring No.: UGW-1
Date: 9/19/93

Elevation	Description	Depth	Samples				Drilling Observations
231.7	Topsoil: 0 "	(feet)	#	Type	Blows/6"	Recov	SPT Boring
	Clayey SAND; firm, yellow to red, some silt, moist to wet, plastic: COASTAL PLAIN (SC)		1	SS	4-3-6-7	52%	Groundwater encountered at 11.8 feet at time of drilling.
			2	SS	6-6-8-6	58%	
		5.0	3	SS	6-6-7-7	65%	
			4	SS	6-6-7-8	75%	
		10.0	5	SS	9-9-10-9	30%	
			6	SS	8-8-8-9	50%	
	Medium to Coarse SAND; firm to dense, yellow to red brown, some silt, clay lenses, wet, low plastic, laminated: COASTAL PLAIN (SC)		7	SS	9-19-21-24	67%	
		15.0	8	SS	10-12-19-20	62%	
			9	SS	8-7-7-14	70%	
		20.0	10	SS	9-11-12-9	62%	
	Gravely Coarse SAND; firm to dense, yellow/tan/brown, some silt, trace clay, wet, very low plastic, non plastic: COASTAL PLAIN		11	SS	3-2-5-33	57%	
207.7			12	SS	16-20-17-18	63%	
	Boring terminated at: 24.0 feet.	25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

CGC

Chattahoochee Geotechnical Consultants, Inc.

Log of Boring

Project Name:	Timberlands Landfill	Project No.:	2055.924.26
Client:	Browning Ferris Industries, Inc.	Boring No.:	GW-6
Location:	Escambia County, Alabama	Date:	9/18/93

Elevation	Description	Depth (feet)	Samples #	Type	Blows/6"	Recov	Drilling Observations SPT Boring
219.2	Topsoil: 0 "						
	Silty Fine to Medium SAND; firm to loose, yellow/red, some clay, moist to wet, low plastic: COASTAL PLAIN (ML-SC)	5.0	1	SS	3-3-4-6	47%	Groundwater encountered at 13.7 feet at time of drilling.
			2	SS	7-8-8-13	80%	
		10.0	3	SS	10-9-7-7	83%	
	Medium to Coarse SAND; firm, yellow/red/brown, some silt, clay, wet, low plastic, banded: COASTAL PLAIN (SC)		4	SS	4-5-8-8	68%	
		15.0	5	SS	5-5-6-6	73%	
			6	SS	4-4-9-11	30%	
			7	SS	8-9-8-8	48%	
		20.0					
	Gravely SAND; firm to loose, yellow/red, some silt, clay, wet, very low plastic to non plastic: COASTAL PLAIN (SP-GC)		8	SS	2-3-3-4	30%	
			9	SS	13-11-11-11	30%	
		25.0	10	SS	8-7-8-8	30%	
193.2	Boring terminated at: 26.0 feet.						
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetromet
SPT- Standard Penetration Tes

CGC

Chattahoochee Geotechnical Consultants, Inc.
Log of Boring

Project Name: Timberlands Landfill
Client: Browning Ferris Industries, Inc.
Location: Escambia County, Alabama

Project No.: 2055.004.03
Boring No.: GW-7
Date: 3/19/92

Elevation	Description	Depth	Samples				Drilling Observations
212.2	Topsoil: 0 "	(feet)	#	Type	Blows/6"	Recov	SPT Boring
	Very Clayey SAND; firm, yellow/red, some silt, moist to wet, plastic to low plastic, mottled: COASTAL PLAIN (CL-SC)	5.0	1	SS	5-7-11-17	75%	Groundwater encountered at 7.0 feet at time of drilling.
	Fine SAND; firm, yellow/red, some silt, clay, wet, very low plastic: COASTAL PLAIN (SC)	10.0	2	SS	4-3-4-7	43%	
			3	SS	3-4-7-9	30%	
			4	SS	4-9-10-11	41%	
		15.0	5	SS	3-6-6-9	43%	
			6	SS	3-4-7-8	37%	
	Gravely Medium to Coarse SAND; firm, red/brown/yellow, some silt, clay; wet, very low plastic to non plastic: COASTAL PLAIN (SC-GC)	20.0	7	SS	7-10-8-8	42%	
190.2			8	SS	2-3-4-7	57%	
	Boring terminated at: 22.0 feet.	25.0					
		30.0					
		35.0					
		40.0					
		45.0					
		50.0					

LEGEND

SS- Split Spoon (sample)
UDS- Undisturbed Sample
DCP- Dynamic Cone Penetrometer
SPT- Standard Penetration Test

EMCON
Southeast

LOG of BORING

Project Name:	**Timberlands Sanitary Landfill**	Project No.:	**2055.012.94**
Client:	**BFI**	Boring No.:	**GW-8 Pilot Boring**
Location:	**Escambia County, Alabama**	Date:	**5/9/94**

Elevation 212.7	Description	Depth	Samples				Drilling Observations
G.S.	Topsoil: 6"	(feet)	No.	Type	Blows/6"	Recov.	SPT Boring
	Clayey SAND, firm to dense, brownish yellow to YR 6/8 to light gray, some silt, trace gravel, moist, low plastic, mottled; Coastal Pln		1	SS	2-2-5-7		USCS/(SC) gravel size is 0.5 to 2 cm. in diameter
		5.0	2	SS	8-6-8-8.		
			3	SS	4-8-12-16		
			4	SS	7-9-12-14		
		10.0	5	SS	9-10-10-11		
	SAND, firm to dense, light brown 10YR 8/3 to brownish yellow 10YR 6/8, trace silt and gravel, wet, non plastic; Coastal Pln		6	SS	3-4-6-8		(SP-SM) gravel size is 2 to 4 cm. in diameter
		15.0	7	SS	3-4-10-12		
			8	SS	6-12-18-20		
			9	SS	7-11-15-15		
		20.0	10	SS	4-15-16-20		
	Gravely SAND, dense, brownish yellow 10YR 6/8, trace silt, wet non plastic; Coastal Pln		11	SS	3-7-15-37		(SP-GP) gravel size is 3 to 8 cm. in diameter
	SAND, dense, light brown 10YR 8/3 to brownish yellow 10YR 6/8, trace silt, wet, non plastic; Coastal Pln	25.0	12	SS	10-11-18-20		(SP-SM)
	Boring Terminated @ 25 feet	30.0					Notes: Groundwater Data 5/10, 5:15p.m. 24 hrs, 8.16 feet from time of drilling. Borehole caved-in to 11 feet.
		35.0					
		40.0					
		45.0					
		50.0					

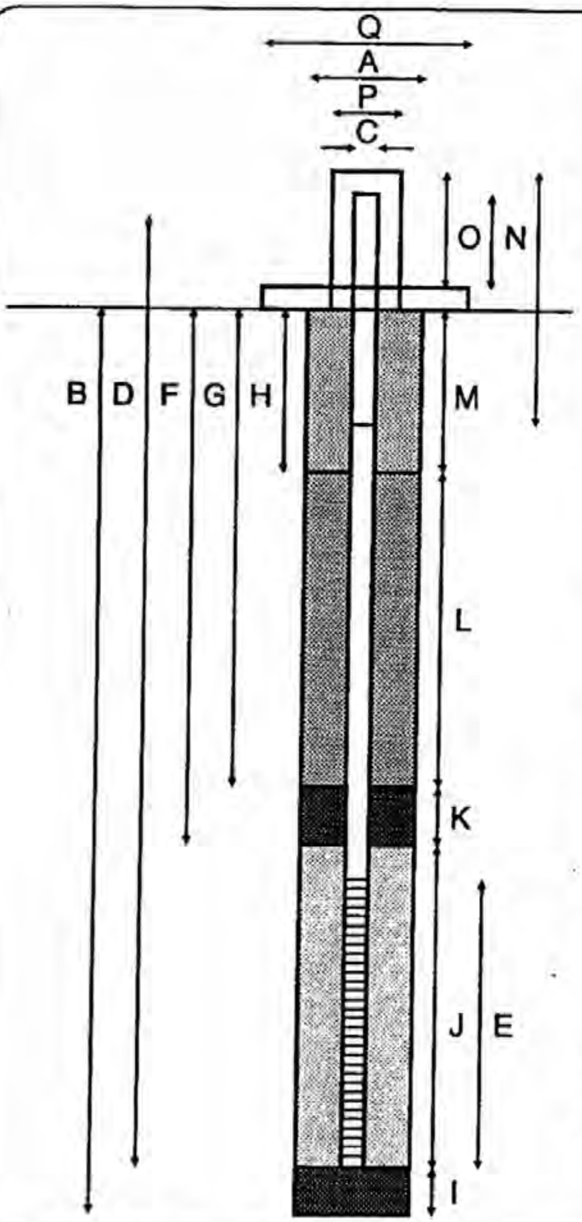
LEGEND

SPT= Standard Penetration Test
SS = Split-Spoon (sample)
UDS= Undisturbed Sample

MONITORING WELL

AS - BUILT

CONSTRUCTION DETAILS



A. Borehole Diameter: 10.25 Inch O.D.
Drilling Method: Hollow Stem
B. Borehole Drilled Depth: 22 ft. below ground surface
C. Casing Inside Diameter: 4 inches
Casing Material: Tri-Loc Flush Thread ASTM 40 PVC
D. Total Casing Length: 14.5 feet
E. Screen Length: 10 feet continuous slot
Screen Type: Tri-Loc Flush Thread PVC 0.010 inch slots
F. Depth to Top of Filter Pack: 9 feet
Type of Filter Pack: 20-40 Mesh Pre-Washed Silica
Placement Method: Tremied Down Slurry
G. Depth to Top of Seal: 5.9 feet
Type of Seal: Sodium Bentonite Medium Chips
Placement Method: Pour, Settle and Tamp
H. Depth to Top of Grout: Approx. 3 feet
Type of Grout: Portland Type 1 with Bentonite
Placement Method: Side Tremie
I. Backfill/Cavings Thickness: None
J. Sand/Gravel Pack Thickness: 13 feet
K. Bentonite Annular Seal: Approx. 3.1 feet
L. Annular Grout: 3 feet
M. Surface Concrete: Approx. 3 feet
N. Casing Rise: 2.5 feet
O. Well Head Protector Rise: 3 feet
P. Protector Diameter: 0.67 feet
Protector Material: steel
Q. Well Pad Diameter: 5' x 5'
Pad Thickness: Approx. 0.67 feet
Driller: Southern Earth Sciences, INC.
Drill Rig: BK-66

WELL CONSTRUCTION DETAIL- MONITORING WELL

SURVEY DATA

Surveyors: McCrory and Williams
Registered [✓ YES] NO (circle one)
Date Surveyed: 9/18/93
Datum: MSL

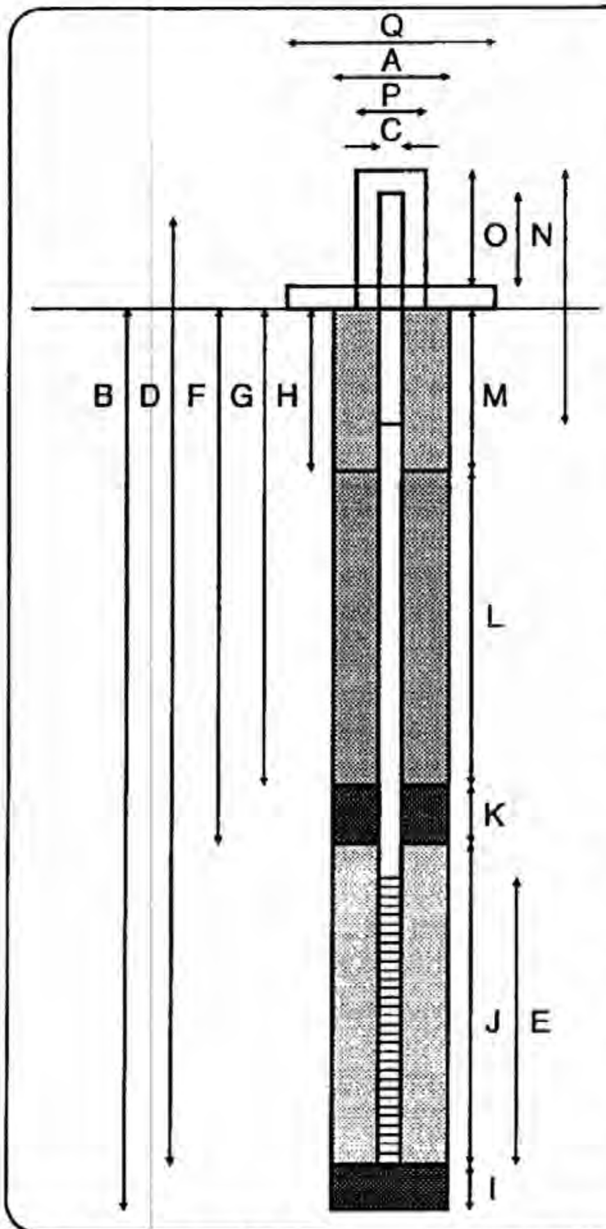
Top of Casing TOC: 234.38
Ground Surface: 231.7
Northing: 9886.8
Easting: 2096.7
Latitude:
Longitude:
Map:
W.L.(0Hr.) 11.8' below ground surface
W.L.(24Hr.)

MATERIALS USED

Casing Type: ASTM 40 PVC 4" ID
Casing Sections: 1x10', 1x3'
Connector Type: Flush Threads
Screen Sections: 1x10' TRI-LOC
Well Point Type: 6 inch sump
Bags Sand: (10) 50 lb. bags
Bags Bentonite: (1) 50 lb. bag
Bags Portland: (3) 94 lb. bags
Bags Concrete: -0.62 cubic yards
Bags Gravel: None
Cap Type:
Lock Type & # Dolphin

Well # **UGW-1**
Client: BFI
Project: Timberlands Landfill
Location: Escambia County, AL
Project # 2055.924.26
Installed By: S. LeRoy, GIT
Title: Hydrogeologist
Date(s): 9/20/93

EMCON
SOUTHEAST



A. Borehole Diameter: 10.25 Inch O.D.

Drilling Method: Hollow Stem

B. Borehole Drilled Depth: 24 ft. below ground surface

C. Casing Inside Diameter: 4 inches

Casing Material: Tri-Loc Flush Thread ASTM 40 PVC

D. Total Casing Length: 16.5 feet

E. Screen Length: 10 feet continuous slot

Screen Type: Tri-Loc Flush Thread PVC 0.010 inch slots

F. Depth to Top of Filter Pack: 11.5 feet

Type of Filter Pack: 20-40 Mesh Pre-Washed Silica

Placement Method: Tremied Down Slurry

G. Depth to Top of Seal: 9 feet

Type of Seal: Sodium Bentonite Medium Chips

Placement Method: Pour, Settle and Tamp

H. Depth to Top of Grout: Approx. 3 feet

Type of Grout: Portland Type 1 with Bentonite

Placement Method: Side Tremie

I. Backfill/Cavings Thickness: None

J. Sand/Gravel Pack Thickness: Approx. 12.5 feet

K. Bentonite Annular Seal: Approx. 2.5 feet

L. Annular Grout: 6 feet

M. Surface Concrete: Approx. 3 feet

N. Casing Rise: 2.5 feet

O. Well Head Protector Rise: 3 feet

P. Protector Diameter: 0.67 feet

Protector Material: steel

Q. Well Pad Diameter: 5' x 5'

Pad Thickness: Approx. 0.67 feet

Driller: Southern Earth Sciences, INC.

Drill Rig: BK-66

WELL CONSTRUCTION DETAIL- MONITORING WELL

SURVEY DATA

Surveyors: McCrory and Williams

Registered [✓ YES] NO (circle one)

Date Surveyed: 9/18/93

Datum: MSL

Top of Casing TOC: 222.00

Ground Surface: 219.7

Northing: 8016.0

Easting: 4474.9

Latitude:

Longitude:

Map:

W.L.(0Hr.) 13.77' below ground

W.L.(24Hr.) 14.16' below ground

MATERIALS USED

Casing Type: ASTM 40 PVC 4" ID

Casing Sections: 1x10', 1x6.5'

Connector Type: Flush Threads

Screen Sections: 1x10' TRI-LOC

Well Point Type: 6 inch sump

Bags Sand: (11) 50 lb. bags

Bags Bentonite: (1) 50 lb. bag

Bags Portland: (6) 94 lb. bags

Bags Concrete: -0.62 cubic yards

Bags Gravel: None

Cap Type:

Lock Type & # Dolphin

Well # **GW-6**

Client: BFI

Project: Timberlands Landfill

Location: Escambia County, AL

Project # 2055.924.26

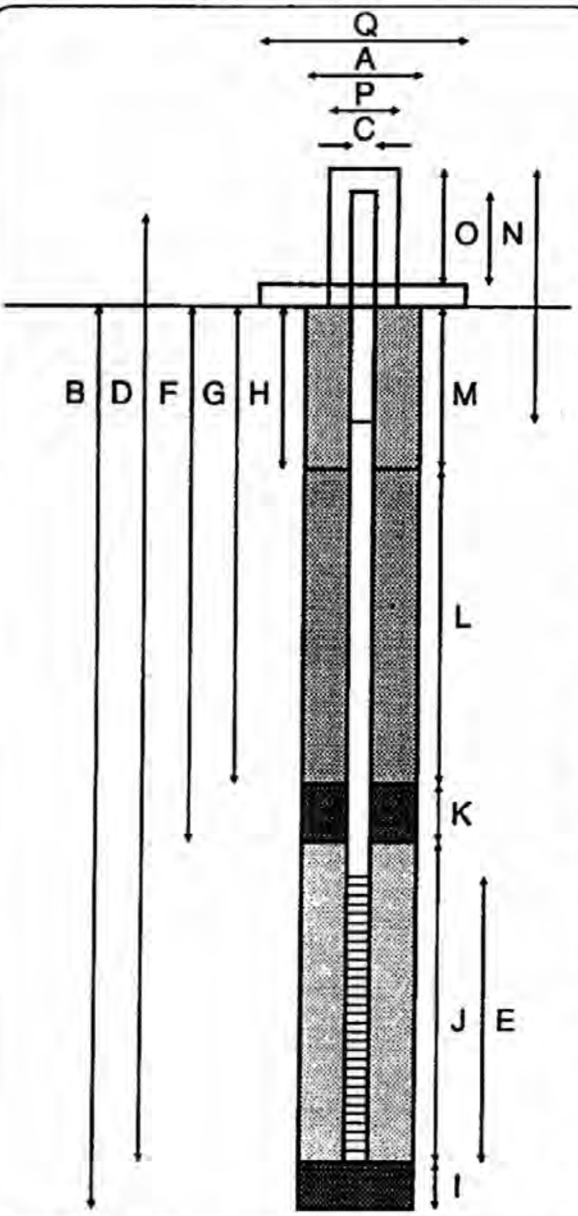
Installed By: S. LeRoy, GIT

Title: Hydrogeologist

Date(s): 9/23/93

EMCON

SOUTHEAST



A. Borehole Diameter: 10.25 Inch O.D.
Drilling Method: Hollow Stem
B. Borehole Drilled Depth: 18 ft. below ground surface
C. Casing Inside Diameter: 4 inches
Casing Material: Tri-Loc Flush Thread ASTM 40 PVC
D. Total Casing Length: 15.5 feet
E. Screen Length: 5 feet continuous slot
Screen Type: Tri-Loc Flush Thread PVC 0.010 inch slots
F. Depth to Top of Filter Pack: 10.75 feet
Type of Filter Pack: 20-40 Mesh Pre-Washed Silica
Placement Method: Tremied Down Slurry
G. Depth to Top of Seal: 8 feet
Type of Seal: Sodium Bentonite Medium Chips
Placement Method: Pour, Settle and Tamp
H. Depth to Top of Grout: Approx. 3 feet
Type of Grout: Portland Type 1 with Bentonite
Placement Method: Side Tremie
I. Backfill/Cavings Thickness: None
J. Sand/Gravel Pack Thickness: 7.25 feet
K. Bentonite Annular Seal: Approx. 2.75 feet
L. Annular Grout: 5 feet
M. Surface Concrete: Approx. 3 feet
N. Casing Rise: 2.5 feet
O. Well Head Protector Rise: 3 feet
P. Protector Diameter: 0.67 feet
Protector Material: steel
Q. Well Pad Diameter: 5' x 5'
Pad Thickness: Approx. 0.67 feet
Driller: Southern Earth Sciences, INC.
Drill Rig: BK-66

WELL CONSTRUCTION DETAIL- MONITORING WELL

SURVEY DATA

Surveyors: McCrory and Williams
Registered [✓ YES] NO (circle one)
Date Surveyed: 9/18/93
Datum: MSL

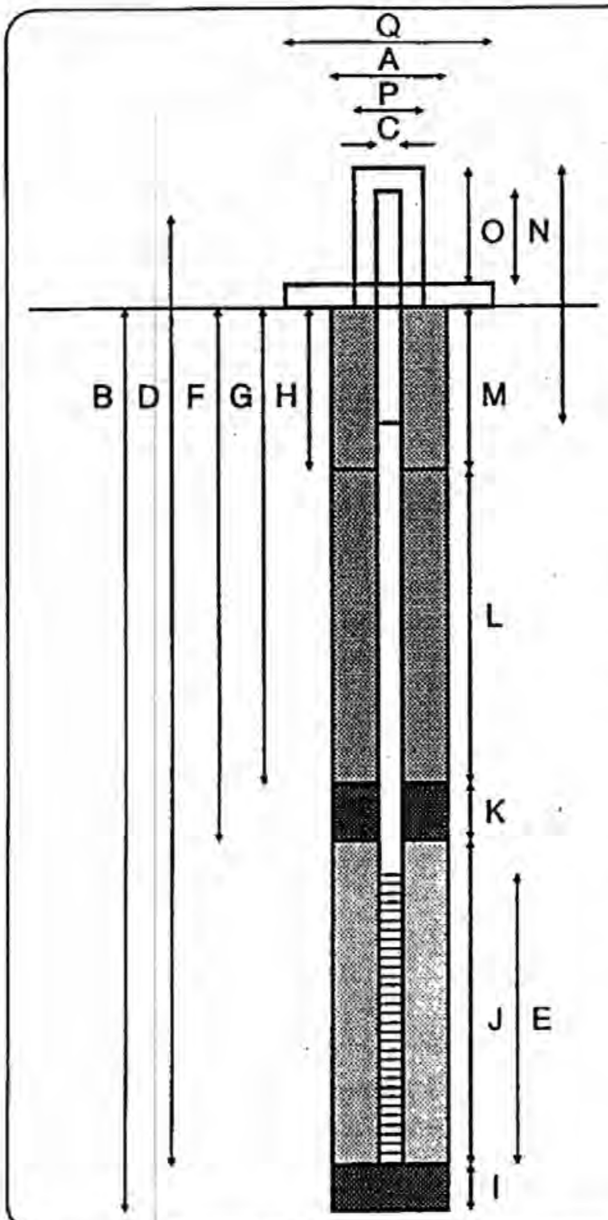
Top of Casing TOC: 214.6
Ground Surface: 212.2
Northing: 7492.5
Easting: 4050.4
Latitude:
Longitude:
Map:
W.L.(0Hr.) Approx. 7 feet bgs
W.L.(24Hr.)

MATERIALS USED

Casing Type: ASTM 40 PVC 4" ID
Casing Sections: 1x10', 1x5.5'
Connector Type: Flush Threads
Screen Sections: 1x5' TRI-LOC
Well Point Type: 6 inch sump
Bags Sand: (5) 50 lb. bags
Bags Bentonite: (1) 50 lb. bag
Bags Portland: (5) 94 lb. bags
Bags Concrete: -0.62 cubic yards
Bags Gravel: None
Cap Type:
Lock Type & # Dolphin

Well # **GW-7**
Client: BFI
Project: Timberlands Landfill
Location: Escambia County, AL
Project # 2055.924.26
Installed By: S. LeRoy, GIT
Title: Hydrogeologist
Date(s): 9/22/93

EMCON
SOUTHEAST



A. Borehole Diameter 0.83
Drilling Method Hollow stem auger
B. Borehole Drilled Depth 23.42
C. Casing Inside Diameter 0.33
Casing Material Trilok Sched. 40 PVC
D. Total Casing Length 27.75
E. Screen Lenght 10.0
Screen Type Trilok Continuous Slot 0.010
F. Depth to Top of Filter Pack 10.0
Type of Filter Pack 20/40 Pearl James Silica Sand
Placement Method Side Discharge Tremmie
G. Depth to Top of Seal 7.0
Type of Seal Hole plug Baroid Bentonite Chips
Placement Method Poured and Tamped
H. Depth to Top of Grout 1.5
Type of Grout Bentonite/Cement
Placement Method Tremmied
I. Backfill/Cavings Thickness 0.0
J. Sand/Gravel Pack Thickness 13.42
K. Bentonite Annular Seal 3.0
L. Annular Grout 5.5
M. Surface Concrete 1.5
N. Casing Rise 2.5
O. Well Head Protector Rise 2.66
P. Protector Diameter 0.66 Square
Protector Material Steel
Q. Well Pad Diameter 5.5
Pad Thickness 0.5
Driller Southern Earth Sciences
Drill Rig BK-66
All Measurements in Feet

WELL CONSTRUCTION DETAIL TYPE II WELL

GEODASICS

Surveyors: McCullers-Caps&Assoc.
Registered [✓ YES] / NO (circle one)
Date Surveyed: 6-9-94
Datum: MSL

Top of Casing TOC: 215.76
Ground Surface: 212.7
Northing: 7499.506
Easting: 3073.174
Latitude: N.A.
Longitude: N.A.
Map: N.A.
W.L.(0min) 10.0 from TOC
W.L.(10min) 8.16 from TOC

MATERIALS USED

Casing Type: Trilok Shed. 40 PVC
Casing Sections: 2X10 foot
Connector Type: Flush joint Threaded
Screen Sections: 1X10 foot
Well Point Type: Flat Surface PVC
Bags Sand: 11
Bags Bentonite: 1
Bags Portland: 2
Bags Concrete: 0.5 yd 3
Bags Gravel: N.A.
Cap Type: Expanding Environmental
Lock Type & # Dolphin #16

Well# GW-8
Client BFI
Project Timberlands L.F.
Location: Escambia Co. Ala.
Project # 2055.012.94
Installed By: Mitch Guthrie
Title: Senior Geologist P.G.
Date(s): 5-10-94

EMCON
SOUTHEAST

WL (static) 8.16 from Toc
Elev. 207.6 ft, MSL on

PRODUCTION WELL LOG

NOVEMBER 1993

W M Blair 120 103 salter 36401 10/15/93
DRILLING CONTRACTOR License Number Address Zip Code Date

Advance Cont Brewton Ala 36426
PROPERTY OWNER Address (mailing) Zip Code

Escambia 5 NW 3N 9E
WELL LOCATION County Section ¼ Section Township Range

Distance and direction from nearest town, community, road junction or other reference point

WELL WILL BE USED FOR: ☐ Private supply ☐ Public supply ☑ Industrial supply ☐ Test well
☐ Irrigation Other:

10/20/93
Estimated starting date

Drilling method: (check) Cable tool [✓ Rotary] Jetted Bored Other:

4
Diameter of well

400
Estimated depth

Wayne M Blair
SIGNATURE of Drilling Contractor

For Steve Kennedy

Total Depth 410

Completion Date Nov 1/94

Interval	Description of cuttings	Interval	Description of cuttings
			Thickness
0	Clay	20	-20'
20	Sand & gravel	70	- 50'
1	Clay Yellow	120	-50'
120	Sand Brown	210	- 90'
210	Clay Blue	280	-70'
280	Limestone	390	-110'
390	Limestone Sandy	410	-20'
			120

Completion data: report depths below ground level

Pump
Type: ☐ Turb. ☑ Subm. ☐ Jet ☐ Cyl.; Other:
Intake depth 120 H.P. 5 Yield 100 gpm

Capacity
Tested by: ☑ pumping ☐ air lift ☐ bailer ☐ bail
Measured Static Water Level 62 ft.
Measured pumping level 100 ft. after
24 hrs. pumping 100 gpm Just Pumping
Development time prior to testing 2 hrs.

Finish
☑ Open hole ☑ Screened ☐ Slotted pipe [✓ ☐ Gravel]
Interval(s) screened: ~~410~~ to 410
to 370 to
Packer(s) set at 370 and
Screens: diam. 2"; Size openings .08 ?

Casing

Interval cased	Diam. (inches)	*Type pipe	*Type couplings	[✓ Interval grouted]
0-320	4	Pvc		

*Couplings: Threaded & Coupled (T&C) Welded (W)
Threaded & coupled & welded (TC&W)

Other:

*Pipe: Black; PVC; Galv.; Other:

Quality
Water analysis obtained? (check) ☐ No ☑ Bacteriological ☐ Chemical

Analysis by: ☐ Ala Geol. Surv. ☑ Ala Health Dept. ☐ U.S. Geol. Surv. ☐ Private lab.

Signed: Wayne M Blair

*For deeper well please attach continuation sheet.

205-578-2352

1) 2" csg on pkr inside 4" pvc ?
2) Type grout and interval if any
3) filter pack design specs (20-40 sand)
4) Rotary - air - water?
5) Interpret what has happened - filter pack collapse etc

ADEM Form 60 1/83

Herst & Associates, Inc.

Mr. John Poole
Chief of Land Division
Alabama Department of Environmental Management
1400 Coliseum Boulevard
Montgomery, AL 36110

April 5, 2001

Dear Mr. Poole:

Groundwater Statistical Analysis Report, Groundwater Sampling & Analysis Plan, and Statistical Analysis Plan, Timberlands Landfill, Brewton, Alabama

Herst & Associates, Inc. is submitting a copy of the groundwater statistical analysis report (See Attachment 1) for the February 2001 groundwater sampling event at the Timberlands Landfill.

Also, on behalf of Timberlands Landfill, Herst & Associates, Inc. is submitting update copies of the following two plans:

(1) Groundwater Sampling & Analysis Plan (GWSAP), and
(2) Groundwater Statistical Analysis Plan (SAP).

The GWSAP and SAP are intended to update and supersede the current groundwater sampling and statistical evaluation procedures at the site.

In response to the statistical exceedances of mercury at GW-5, the site conducted a barhole gas investigation in attempt to identify the source of the mercury concentrations at GW-5. The purpose of the barhole gas sampling was to provide analytical information related to potential mercury migration in the vapor phase through the unsaturated zone near groundwater monitoring well GW-5. The results of the barhole gas monitoring near GW-5 indicated that methane gas and volatile organic compounds in air samples are detectable near monitoring well GW-5, however mercury was not detected in the gas samples collected during the investigation. It is apparent that the potential for mercury migration in the vapor phase through the unsaturated zone near GW-5 is low, however the presence of methane and VOCs in the air and/or gas is high. The site intends to review and update the landfill gas control system in an effort to minimize the affects of landfill gas on groundwater quality.

5988 Mid Rivers Mall Drive, Suite 136
St. Charles, Missouri 63304, USA

Telephone (636) 939-9111
Fax (636) 939-9757

During the February 2001 groundwater detection monitoring event, dissolved mercury at GW-5 was also analyzed to compare to the total mercury that has historically been analyzed at the site. The total mercury concentration at GW-5 was 0.00364 mg/L and the dissolved mercury concentration at GW-5 was 0.00119 mg/L. The presence of higher concentrations of total mercury than dissolved mercury is an indication that sediment was suspended in the sample. The dissolved mercury results are considered more representative of groundwater quality at GW-5. The site proposes to continue monitoring for dissolved mercury at GW-5 in conjunction with total mercury to determine if trends are apparent for dissolved mercury.

Should you have any questions or concerns, please contact us at your earliest convenience.

Sincerely,

HERST & ASSOCIATES, INC.

COPY

Steve Jett
Senior Hydrogeologist

Ward Herst
Managing Director

Attachments: *Attachment 1 - February 2001 Groundwater Statistical Analysis Report*
Attachment 2 – Groundwater Sampling & Analysis Plan
Attachment 3 – Groundwater Statistical Analysis Plan

cc: *Pat Manderscheid, Timberlands Landfill*
Ed Hood, AWI
Gordon Spradley, BFI
Beverly Biagg, ADEM

Statistical Analysis Plan

Timberlands Landfill
Brewton, Alabama

April 2001

Herst & Associates, Inc.

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TABLES

APPENDICES

1.0 INTRODUCTION

The following is an updated Statistical Analysis Plan (SAP) for the Timberlands Landfill, Brewton, Alabama. The purpose of the SAP is to provide guidance and methods of statistically evaluating groundwater monitoring data collected at the facility. This SAP is intended to update and supersede the current statistical evaluation procedures at the site. The proposed statistical approach has been developed to comply with Alabama Department of Environmental Management (ADEM) regulation 335-13-4-.27 and the facility's permit.

2.0 GROUNDWATER QUALITY MONITORING NETWORK

The groundwater monitoring network at the site consists of 5 wells. The current monitoring program is identified on Table 1.

TABLE 1
GROUNDWATER MONITORING PROGRAM

UPGRADIENT WELLS	DOWNGRADIENT WELLS
UGW-1	GW-4, GW-5, GW-6, GW-7, GW-8

3.0 PARAMETERS

The parameters subject to statistical evaluation during detection monitoring are noted in Appendix I of ADEM 335-13-4-.27. These parameters (Numbered 1 through 63) are also listed in Appendix A of this report and are to be sampled and analyzed on a semi-annual basis.

4.0 STATISTICAL APPROACH

The statistical analysis software program, *Sanitas*™ *for Ground Water v7.5*, is licensed to the Timberlands Landfill. *Sanitas™ for Ground Water* will be utilized to evaluate the groundwater data during detection monitoring. An equivalent software package may be utilized if it complies with the statistical procedures allowed under EPA and ADEM regulations. *Sanitas™ for Ground Water* follows a documented decision logic that incorporates the following applicable regulations: EPA "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Interim Final Guidance," April 1989 and the July 1992 "Addendum." Current regulations and acceptable industry standards for statistical analysis will be utilized to provide the most appropriate statistical analyses in consideration of the site's groundwater monitoring data.

4.1 Background Data

Intra-well analysis will be used at the site.

The background data set to be used for comparisons will consist of all available data from September 1993 up to the most current sampling event for each respective monitoring well. Background will be updated for each event. A summary of the background data is contained in Appendix B. New wells that are installed to supplement the monitoring system or replace a monitoring well will require eight rounds of background prior to performing statistical analysis on detection monitoring events.

For this SAP, background data was evaluated to determine the number of events used in calculating prediction intervals. The higher the number of background events, the lower the false positive and negative rates and higher the statistical power. Data was screened for historical trends using the Mann-Kendall trend test and the Sen's Slope estimate for trend. When used in conjunction with one another, the Mann-Kendall test for temporal trend and the Sen's slope estimate are two types of evaluation monitoring statistics useful in determining the significance of an apparent trend and to estimate the magnitude of that trend. Positive and negative values of Mann-Kendall statistics and critical values, respectively, relate to increasing and decreasing trends. The Sen's Slope/Mann-Kendall test was performed for each constituent from each well on data from September 1993 through February 2001.

No upward statistical trends existed for the parameters statistically evaluated, with the exception of mercury at GW-5. However, mercury at GW-5 is currently in an assessment monitoring program. Although cadmium and chromium trend tests indicated a significant trend, this result is a function of the statistics due to a laboratory change of the method detection limit. In reality, cadmium and chromium have been reported as non-detect historically.

Included in Appendix C is a summary of the Sen's Slope/Mann-Kendall trend analyses and applicable plots. Included in Appendix D are time series plots for each constituent sampled to date.

4.2 Expanding Groundwater Database

The dataset will be reevaluated every subsequent event to determine if background can be updated to include more recent results. Trend analysis and outlier evaluations will be performed to verify the appropriateness of updating background. Background will be updated every event provided no previous results were confirmed as a significant statistical increase or are trending upward.

Volatile organic compounds (VOCs) have been sporadically detected during past monitoring events, however no VOCs have been detected since 1997, which comprises the last six monitoring events.

4.3 Statistical Tests

Future sampling event data will be compared to the intra-well prediction intervals calculated during each sampling event. The data will be evaluated based on the percent of non-detections and distributional properties of the background. Parameters will be pooled by well by parameter over the background time interval. The background data will be screened for outliers prior to calculation of prediction intervals. All statistical formulas used by *Sanitas™* follow EPA Guidance to calculate outliers, distribution, and prediction intervals.

Outliers

The background data will be evaluated for the presence of statistical outliers. Methodologies for determining a statistical outlier are defined in the EPA "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Interim Final Guidance," April 1989 and the July 1992 "Addendum." Any statistical outliers that are determined will be removed from the background data set prior to performing prediction interval statistical analysis.

Non-Detects

The percentage of non-detects for a sample parameter will be assessed during the statistical evaluation. The following approach will be used for non-detects.

- If non-detects are ≤ 15 percent then non-detects will be replaced with one-half of the method detection limit (MDL) prior to running the analysis.

- If non-detects are > 15 percent and ≤ 50 percent then the data's sample mean and standard deviation will be adjusted according to the Cohen's adjustment method.

- If non-detects are > 50 percent, a non-parametric prediction interval test will be used.

Distribution

Tests of normality will be conducted to assess the data distribution of groundwater concentrations. Shapiro-Wilks normality testing will be used for sample datasets with fifty or less samples. Shapiro Francia normality testing will be used for sample datasets with greater than fifty samples. Original or transformed data (via ladder of powers) that are not normally distributed will be analyzed using non-parametric methods.

Prediction Interval

The prediction interval is a statistical method used to compare a single observation to a group of observations. The prediction interval is calculated to include observations from the same population with a specified confidence. In groundwater monitoring, a prediction interval approach may be used to make comparisons between background and compliance data. The interval is developed to contain all future observations, within a certain probability. For the Timberlands Landfill, intra-well prediction intervals have been developed based on a 99% confidence that future observations will fall within the range. If any future observation exceeds this interval, this is considered potentially statistically significant evidence that the observation is not representative of the background group. Statistical calculations are based on the EPA "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Interim Final Guidance," April 1989 and the July 1992 "Addendum."

During parametric prediction interval analysis, the mean and the standard deviation are calculated for the raw or transformed background data. The number of comparison observations, *K*, is defined to be included in the interval. If less than 15% of the background observations are nondetects, the nondetects are replaced with one half of the MDL prior to performing the analysis. If more than 15% but less than 50% of the background data are below the MDL, the data's sample mean and standard deviation are adjusted according to the Cohen's Adjustment. However, when the background data are not transformed-normal or contain greater than 50% observations below the MDL, *Sanitas*^{TM} automatically constructs a nonparametric prediction interval. During nonparametric analysis, the highest value from the background data is used to set the upper limit of the prediction interval.

Included in each statistical analysis report will be a summary of the prediction intervals calculated from the background data. The summary tables define the background distribution for each parameter, identify any transformations applied to specific parameters, and the proportion of non-detects.

In the event an inorganic parameter is determined to be a statistically significant increase (i.e. exceeds the calculated prediction limits and is statistically trending upward), the site has three options:

(1) Conduct a verification resample,
(2) Submit an alternate source demonstration that the statistically significant increase (SSI) was caused by a source other than the landfill, or
(3) Begin an assessment monitoring program.

If the site chooses to conduct a verification resample, the following procedures will be utilized.

4.4 Verification Resampling

A single resample will be used for verification. Passing one of one verification resampling protocol is very conservative and yet yields increased statistical power. The next semi-annual sampling event will constitute the verification resampling event. If verification resampling confirms that a SSI over background did not occur, the site will continue with the detection monitoring program. If verification resampling confirms a SSI over background did occur, the site will either submit an alternate source demonstration or initiate an assessment monitoring program. Following the completion of verification resampling, a report will be submitted to the ADEM no later than 44 days following receipt of the analytical results. The 44 days allows 30 days from receiving the analytical results to determine if an SSI exists, plus 14 days to notify the department of the SSI.

4.5 Volatile Organic Compounds

The strategy for establishing a volatile organic compound (VOC) in a downgradient monitoring well as an SSI will be based on the following procedural steps:

A. The laboratory analytical report of the groundwater sample results will undergo a cursory data validation. The validation will include checking holding times and evaluating laboratory, equipment, trip, and field blanks for the presence of contaminants. A list will be made of any VOCs with a detectable concentration.

B. These detectable concentrations will be evaluated to determine if there is a "quantifiable detection." Quantifiable detections will be any detection that is reported at a concentration above the practical quantitation limit (PQL) for the parameter.

C. Any detections that remain from the above steps will be considered a potential SSI. Monitoring wells with any potential VOC SSIs will be resampled in accordance with verification resampling protocol in Section 4.4 to determine a "confirmed presence" of the SSI. If a confirmed presence of a VOC SSI occurs, the site will either submit an alternate source demonstration or proceed into an assessment monitoring program. If the VOC is not confirmed during the resampling event, then the site will continue with the detection monitoring program.

5.0 RESPONSE TO STATISTICAL ANALYSIS

To comply with 335-13-4-.27, a statistical analysis report will be submitted to the ADEM within 44 days following receipt of the analytical results. The 44 days allows 30 days from receiving the analytical results to determine if an SSI exists, plus 14 days to notify the department of the SSI.

If verification resampling is performed, a report will be submitted to the ADEM no later than 44 days following receipt of the resampling analytical data.

If a statistically significant increase is identified, the following steps will be conducted:

- If the SSI is suspected to be due to sampling or laboratory error then the affected well(s) will be resampled. Sample data will be evaluated to assess the source of the SSI.
- If the SSI is indicated to be a source other than the landfill, then an alternate source demonstration will be presented to the ADEM within 90 days after notification of the SSI.
- If an alternative source demonstration is not ADEM approved and/or landfill impacts cannot be eliminated as a potential source of an SSI, then an assessment monitoring program will be implemented within 90 days after notification of the SSI.

Appendices

Appendix A
Statistical Evaluation Parameters

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
LAND DIVISION - SOLID WASTE PROGRAM

335-13-4-APPENDIX I CONSTITUENTS FOR DETECTION MONITORING

	Common Name[2]	CAS Number[3]
	pH[4]	N/A
	Specific Conductance[4]	N/A
	Inorganic Constituents	
1.	Antimony	Total
2.	Arsenic	Total
3.	Barium	Total
4.	Beryllium	Total
5.	Cadmium	Total
6.	Chromium	Total
7.	Cobalt	Total
8.	Copper	Total
9.	Lead	Total
10.	Mercury	Total
11.	Nickel	Total
12.	Selenium	Total
13.	Silver	Total
14.	Thallium	Total
15.	Vanadium	Total
16.	Zinc	Total
	Organic Constituents	
17.	Acetone	67-64-1
18.	Acrylonitrile	107-13-1
19.	Benzene	71-43-2
20.	Bromochloromethane	74-97-5
21.	Bromodichloromethane	75-27-4
22.	Bromoform; Tribromomethane	75-25-2
23.	Carbon disulfide	75-15-0
24.	Carbon tetrachloride	56-23-5
25.	Chlorobenzene	108-90-7
26.	Chloroethane; Ethyl chloride	75-00-3
27.	Chloroform; Trichloromethane	67-66-3
28.	Dibromochloromethane; Chlorodibromomethane	124-48-1
29.	1,2-Dibromo-3-chloropropane (DBCP)	96-12-8
30.	1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4
31.	o-Dichlorobenzene; 1,2-Dichlorobenzene	95-50-1
32.	p-Dichlorobenzene; 1,4-Dichlorobenzene	106-46-7
33.	trans-1,4-Dichloro-2-butene	110-57-6
34.	1,1-Dichloroethane; Ethylidene chloride	75-34-3
35.	1,2-Dichloroethane; Ethylene dichloride	107-06-2
36.	1,1-Dichloroethylene; 1,1-dichloroethene; Vinylidene chloride	75-35-4

	Common Name[2]	CAS Number[3]
37.	cis-1,2-Dichloroethylene; cis-1,2Dichloroethene	156-59-2
38.	trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5
39.	1,2-Dichloropropane; Propylene dichloride	78-87-5
40.	cis-1,3-Dichloropropene	10061-01-5
41.	trans-1,3-Dichloropropene	10061-02-6
42.	Ethylbenzene	100-41-4
43.	2-Hexanone; Methyl butyl ketone	591-78-6
44.	Methyl bromide; Bromomethane	74-83-9
45.	Methyl chloride; Chloromethane	74-87-3
46.	Methylene bromide; Dibromomethane	74-95-3
47.	Methylene chloride; Dichloromethane	75-09-2
48.	Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
49.	Methyl iodide; Iodomethane	74-88-4
50.	4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
51.	Styrene	100-42-5
52.	1,1,1,2-Tetrachloroethane	630-20-6
53.	1,1,2,2-Tetrachloroethane	79-34-5
54.	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
55.	Toluene	108-88-3
56.	1,1,1-Trichloroethane; Methylchloroform	71-55-6
57.	1,1,2-Trichloroethane	79-00-5
58.	Trichloroethylene; Trichloroethene	79-01-6
59.	Trichlorofluoromethane; CFC-11	75-69-4
60.	1,2,3-Trichloropropane	96-18-4
61.	Vinyl acetate	108-05-4
62.	Vinyl chloride	75-01-4
63.	Xylenes	1330-20-7

Notes

[1] This list contains 47 volatile organics for which possible analytical procedure provided in EPA Report SW-846, "Test Methods for Evaluating Solid Waste," Third Edition, November 1986, as revised December 1987, includes Method 8260; and 15 metals for which SW-846 provides either Method 6010 or a method from the 7000 series of methods.

[2] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

[3] Chemical Abstracts Service registry number. Where "Total" is entered, all species in the groundwater that contain this element are included.

[4] State specific requirements.

Author: Russell A. Kelly.
Statutory Authority: Code of Alabama 1975, §§ 22-27-4, 22-27-7.
History: November 2, 1993.
Amended: July 26, 1996.

Appendix B
Background Data Summary

TIME SERIES (data)

Constituent: 1112-Tetrachloroethane (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 9:58 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 111-Trichloroethane (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 4/5/01. 9:58 AM Client: Timberlands LF View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 1122-Tetrachloroethane (ug/L) | Facility: Timberlands LF | Data File: TIMBER

Date: 4/5/01, 9:59 AM | Client: Timberlands LF | View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 112-Trichloroethane (ug/L)

Date: 4/5/01, 9:59 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 11-Dichloroethane (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 11-Dichloroethylene (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 123-Trichloropropane (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data

TIME SERIES (data)

Constituent: 12-Dibromo-3-chloropropane (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 9:59 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	CGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<10	<10	<10	<10
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 12-Dibromoethane (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 12-Dichlorobenzene (ug/L)
Date: 4/5/01, 9:59 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10 D	<10 D		<10 D
09/30/93			<10 D	<10 D		<10 D
10/01/93			<10 D	<10 D		<10 D
10/02/93			<10 D	<10 D		<10 D
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

D = Average of Duplicate or Split observations. Asterisk indicates background data.

TIME SERIES (data)

Constituent: 12-Dichloroethane (ug/L)

Date: 4/5/01, 9:59 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 12-Dichloropropane (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 9:59 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: 14-Dichlorobenzene (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10 D	<10 D		<10 D
09/30/93			<10 D	<10 D		<10 D
10/01/93			<10 D	<10 D		<10 D
10/02/93			<10 D	<10 D		<10 D
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

D = Average of Duplicate or Split observations. Asterisk indicates background data.

TIME SERIES (data)

Constituent: 2-Hexanone (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.
v.7.561 CAS# n/a

TIME SERIES (data)

Constituent: Acetone (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			2	2	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	6	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	3
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Acrylonitrile (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 9:59 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<100	<100		<100
09/30/93			<100	<100		<100
10/01/93			<100	<100		<100
10/02/93			<100	<100		<100
03/30/94			<100	<100		<100
06/16/94					<100	
09/28/94			<100	<100	<100	<100
03/16/95			<100	<100	<100	<100
09/07/95			<100	<100	<100	<100
03/14/96			<100	<100	<100	<100
09/12/96	<100	<100	<100	<100	<100	<100
10/03/96	<100	<100				
11/05/96	<100	<100				
12/10/96	<100	<100				
03/06/97	<100	<100	<100	<100	<100	<100
09/03/97				<100	<100	<100
09/04/97	<100	<100	<100			
03/18/98				<100	<100	
03/19/98	<100	<100	<100			<100
09/18/98	<100	<100	<100	<100	<100	<100
03/02/99				<100	<100	
03/03/99	<100	<100	<100			<100
09/08/99		<100	<100	<100	<100	
09/09/99	<100					<100
03/20/00	<100	<100	<100	<100	<100	<100
09/12/00	<100	<100	<100	<100	<100	<100
02/07/01	<100	<100	<100	<100	<100	<100

Asterisk indicates background data

TIME SERIES (data)

Constituent: Antimony Total (ug/L)

Date: 4/5/01, 9:59 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<2	<2		<2
09/30/93			<2	<2		<2
10/01/93			<2	<2		<2
10/02/93			<2	<2		2
03/30/94			<2	<2		<2
06/16/94					<2	
09/28/94			2	<2	<2	<2
03/16/95			<2	<2	<2	<2
09/07/95			<2	<2	<2	<2
03/14/96			<2	<2	3	<2
09/12/96	<2	<2	<2	<2	<2	<2
10/03/96	<2	<2				
11/05/96	<2	<2				
12/10/96	<2	<2				
03/06/97	<2	<2	<2	<2	<2	<2
09/03/97				<2	<2	<2
09/04/97	<2	<2	<2			
03/18/98				<2	<2	
03/19/98	<2	<2	<2			<2
09/18/98	<2	<2	<2	<2	<2	<2
03/02/99				<2	<0.333	
03/03/99	<0.333	<2	<2			<2
09/08/99		<2	<2	<2	<2	
09/09/99	<2					<2
03/20/00	<2	<2	<2	<2	<2	<2
09/12/00	<2	<2	<2	<2	<2	<2
02/07/01	<2	<2	<2	<2	<2	<2

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Arsenic Total (ug/L)

Date: 4/5/01, 10:00 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	CW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<2	<2		<2
09/30/93			3	<2		<2
10/01/93			<2	<2		<2
10/02/93			2	2		<2
03/30/94			<2	<2		<2
06/16/94					<2	
09/28/94			<2	<2	<2	<2
03/16/95			<2	<2	<2	<2
09/07/95			<2	<2	2	<2
03/14/96			<2	<2	<2	<2
09/12/96	<2	<2	<2	<2	<2	<2
10/03/96	<2	<2				
11/05/96	<2	<2				
12/10/96	<2	<2				
03/06/97	<2	<2	<2	<2	<2	<2
09/03/97				2	<2	<2
09/04/97	3	<2	<2			
03/18/98				<2	<2	
03/19/98	<2	<2	<2			<2
09/18/98	<2	<2	<2	4.39	<2	<2
03/02/99				<2	<2	
03/03/99	<2	3.83	<2			<2
09/08/99		<2	<2	<2	<2	
09/09/99	<2					<2
03/20/00	<2	<2	<2	<2	<2	<2
09/12/00	<2	<2	<2	<2	<2	<2
02/07/01	<2	<2	2.81	<2	<2	<2

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Barium Total (mg/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:00 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			0.021	0.012		0.017
09/30/93			0.022	0.013		0.032
10/01/93			0.023	0.016		0.038
10/02/93			0.025	0.019		0.042
03/30/94			0.018	0.015		0.012
06/16/94					0.009	
09/28/94			0.02	0.018	0.016	0.012
03/16/95			0.019	0.018	0.02	0.015
09/07/95			0.018	0.018	0.02	0.013
03/14/96			0.019	0.019	0.018	0.018
09/12/96	0.006	0.02	0.019	0.016	0.015	0.013
10/03/96	<0.005	0.019				
11/05/96	<0.005	0.018				
12/10/96	<0.005	0.017				
03/06/97	<0.005	0.016	0.018	0.019	0.014	0.018
09/03/97				0.018	0.014	0.013
09/04/97	<0.005	0.018	0.02			
03/18/98				0.0166	0.0117	
03/19/98	<0.005	0.0174	0.0162			0.0156
09/18/98	0.00594	0.0208	0.018	0.0156	0.0121	0.0192
03/02/99				<0.005	0.0114	
03/03/99	<0.005	<0.005	0.0173			0.0211
09/08/99		0.022	0.0171	0.0183	0.0127	
09/09/99	<0.005					0.0206
03/20/00	<0.005	0.0408	0.0185	0.0192	0.0123	0.0199
09/12/00	<0.005	0.0278	0.0171	0.017	0.0129	0.0191
03/07/01	0.00595	0.032	0.0156	0.0165	0.0183	0.0152

Asterisk indicates background data

TIME SERIES (data)

Constituent: Beryllium Total (mg/L)

Date: 4/5/01, 10:00 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.01	<0.01		<0.01
09/30/93			<0.01	<0.01		<0.01
10/01/93			<0.01	<0.01		<0.01
10/02/93			<0.01	<0.01		<0.01
03/30/94			<0.01	<0.01		<0.01
06/16/94					<0.01	
09/28/94			<0.01	<0.01	<0.01	<0.01
03/16/95			<0.002	<0.002	<0.002	<0.002
09/07/95			<0.002	<0.002	<0.002	<0.002
03/14/96			<0.002	<0.002	<0.002	<0.002
09/12/96	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
10/03/96	<0.002	<0.002				
11/05/96	<0.002	<0.002				
12/10/96	<0.002	<0.002				
03/06/97	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
09/03/97				<0.002	<0.002	<0.002
09/04/97	<0.002	<0.002	<0.002			
03/18/98				<0.002	<0.002	
03/19/98	<0.002	<0.002	<0.002			<0.002
09/18/98	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
03/02/99				<0.002	<0.002	
03/03/99	<0.002	<0.002	<0.002			<0.002
09/08/99		<0.002	<0.002	<0.002	<0.002	
09/09/99	<0.002					<0.002
03/20/00	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
09/12/00	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
02/07/01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Bromochloromethane (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:00 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data

TIME SERIES (data)

Constituent: Bromoform (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01. 10:00 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Cadmium Total (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:00 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			0.3	0.1		0.4
09/30/93			0.2	<0.1		0.2
10/01/93			0.1	<0.1		<0.1
10/02/93			0.1	<0.1		0.1
03/30/94			0.1	0.1		<0.1
06/16/94					<0.1	
09/28/94			<0.1	<0.1	<0.1	<0.1
03/16/95			<0.1	0.2	<0.1	<0.1
09/07/95			<0.1	<0.1	<0.1	<0.1
03/14/96			<0.1	<0.1	<0.1	<0.1
09/12/96	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
10/03/96	<0.1	<0.1				
11/05/96	<0.1	<0.1				
12/10/96	<0.1	<0.1				
03/06/97	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
09/03/97				<0.1	<0.1	<0.1
09/04/97	<0.1	<0.1	<0.1			
03/18/98				<1	<1	
03/19/98	<1	<1	<1			<1
09/18/98	<1 D	<1 D	<1 D	<1 D	<1 D	<1 D
03/02/99				<1	<1	
03/03/99	<1	<1	<1			<1
09/08/99		<1	<1	<1	<1	
09/09/99	<1					<1
03/20/00	<1	<1	<1	<1	<1	<1
09/12/00	<1	<1	<1	<1	<1	<1
02/07/01	<1	<1	<1	<1	<1	<1

D = Average of Duplicate or Split observations. Asterisk indicates background data.

TIME SERIES (data)

Constituent: Carbon disulfide (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:00 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	2
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.
v.7.501 CA58 [illegible]

TIME SERIES (data)

Constituent: Carbon tetrachloride (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:00 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Chlorobenzene (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:00 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.
r.7.301. CAS# n/a

TIME SERIES (data)

Constituent: Chloroethane (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:00 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Chloroform (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:00 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Chromium Total (mg/L)

Date: 4/5/01, 10:00 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.005	<0.005		<0.005
09/30/93			<0.005	<0.005		<0.005
10/01/93			<0.005	<0.005		<0.005
10/02/93			<0.005	<0.005		<0.005
03/30/94			<0.005	<0.005		<0.005
06/16/94					<0.005	
09/28/94			<0.008	<0.008	<0.008	<0.008
03/16/95			<0.008	<0.008	<0.008	<0.008
09/07/95			<0.008	<0.008	<0.008	<0.008
03/14/96			<0.008	<0.008	<0.008	<0.008
09/12/96	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
10/03/96	<0.008	<0.008				
11/05/96	<0.008	<0.008				
12/10/96	<0.008	<0.008				
03/06/97	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
09/03/97				<0.008	<0.008	<0.008
09/04/97	<0.008	<0.008	<0.008			
03/18/98				<0.008	<0.008	
03/19/98	<0.008	<0.008	<0.008			<0.008
09/18/98	0.00915	<0.008	<0.008	<0.008	<0.008	<0.008
03/02/99				<0.008	<0.008	
03/03/99	<0.008	<0.008	<0.008			<0.008
09/08/99		<0.008	<0.008	<0.008	<0.008	
09/09/99	<0.008					<0.008
03/20/00	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
09/12/00	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
02/07/01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008

Asterisk indicates background data.

TIME SERIES (data)

Constituent: cis-12-Dichloroethylene (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:00 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: cis-13-Dichloropropylene (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:00 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Cobalt Total (mg/L) Facility: Timberlands LF Data File: TIMBER

Date: 4/5/01, 10:00 AM Client: Timberlands LF View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.02	<0.02		<0.02
09/30/93			<0.02	<0.02		<0.02
10/01/93			<0.02	<0.02		<0.02
10/02/93			<0.02	<0.02		<0.02
03/30/94			<0.02	<0.02		<0.02
06/16/94					<0.02	
09/28/94			<0.02	<0.02	<0.02	<0.02
03/16/95			<0.02	<0.02	<0.02	<0.02
09/07/95			<0.02	<0.02	<0.02	<0.02
03/14/96			<0.02	<0.02	<0.02	<0.02
09/12/96	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
10/03/96	<0.02	<0.02				
11/05/96	<0.02	<0.02				
12/10/96	<0.02	<0.02				
03/06/97	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
09/03/97				<0.02	<0.02	<0.02
09/04/97	<0.02	<0.02	<0.02			
03/18/98				<0.02	<0.025	
03/19/98	<0.02	<0.025	<0.02			<0.02
09/18/98	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
03/02/99				<0.02	<0.02	
03/03/99	<0.02	<0.02	<0.02			<0.02
09/08/99		<0.02	<0.02	<0.02	<0.02	
09/09/99	<0.02					<0.02
03/20/00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
09/12/00	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
02/07/01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Asterisk indicates background data

TIME SERIES (data)

Constituent: Copper Total (mg/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:01 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.025	<0.025		<0.025
09/30/93			<0.025	<0.025		<0.025
10/01/93			<0.025	<0.025		<0.025
10/02/93			<0.025	<0.025		<0.025
03/30/94			<0.025	<0.025		<0.025
06/16/94					<0.025	
09/28/94			<0.025	<0.025	<0.025	<0.025
03/16/95			<0.025	<0.025	<0.025	<0.025
09/07/95			<0.025	<0.025	<0.025	<0.025
03/14/96			<0.025	<0.025	<0.025	<0.025
09/12/96	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
10/03/96	<0.025	<0.025				
11/05/96	<0.025	<0.025				
12/10/96	<0.025	<0.025				
03/06/97	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
09/03/97				<0.025	<0.025	<0.025
09/04/97	<0.025	<0.025	<0.025			
03/18/98				<0.025	<0.01	
03/19/98	<0.025	<0.01	<0.025			<0.025
09/18/98	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
03/02/99				<0.025	<0.025	
03/03/99	<0.025	<0.025	<0.025			<0.025
09/08/99		<0.025	<0.025	<0.025	<0.025	
09/09/99	<0.025					<0.025
03/20/00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
09/12/00	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
02/07/01	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Dibromochloromethane (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:01 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data

TIME SERIES (data)

Constituent: Dibromomethane (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:01 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/15/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Dichlorobromomethane (ug/L)　　Facility: Timberlands LF　　Data File: TIMBER

Date: 4/5/01, 10:01 AM　　Client: Timberlands LF　　View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Ethylbenzene (ug/l.)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:01 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Iodomethane (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:01 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Lead Total (ug/L)

Date: 4/5/01, 10:01 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<2	<2		<2
09/30/93			<2	<2		4
10/01/93			5.3	<2		<2
10/02/93			<2	<2		2.6
03/30/94			<2	<2		<2
06/16/94					<2	
09/28/94			<2	<2	<2	<2
03/16/95			<2	<2	<2	<2
09/07/95			<2	3	<2	<2
03/14/96			<2	<2	<2	<2
09/12/96	<2	<2	<2	<2	<2	<2
10/03/96	<2	<2				
11/05/96	<2	<2				
12/10/96	<2	<2				
03/06/97	<2	<2	<2	<2	<2	<2
09/03/97				<2	<2	<2
09/04/97	<2	<2	<2			
03/18/98				<2	<2	
03/19/98	<2	<2	<2			<2
09/18/98	<2	<2	<2	<2	<2	<2
03/02/99				<2	<2	
03/03/99	<2	<2	<2			<2
09/08/99		<2	<2	<2	<2	
09/09/99	3.33					<2
03/20/00	<2	<2	<2	<2	<2	<2
09/12/00	<2	<2	<2	<2	<2	<2
02/07/01	<2	<2	<2	<2	<2	<2

Asterisk indicates background data

TIME SERIES (data)

Constituent: Mercury Total (ug/L) | Facility: Timberlands LF | Data File: TIMBER

Date: 4/5/01, 10:01 AM | Client: Timberlands LF | View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.2	<0.2		<0.2
09/30/93			<0.2	<0.2		<0.2
10/01/93			<0.2	<0.2		<0.2
10/02/93			<0.2	<0.2		<0.2
03/30/94			<0.2	<0.2		<0.2
06/16/94					<0.2	
09/28/94			<0.2	<0.2	<0.2	<0.2
03/16/95			<0.2	<0.2	<0.2	<0.2
09/07/95			<0.2	<0.2	<0.2	<0.2
03/14/96			<0.2	<0.2	<0.2	<0.2
09/12/96	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
10/03/96	<0.2	<0.2				
11/05/96	<0.2	<0.2				
12/10/96	<0.2	<0.2				
03/06/97	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
09/03/97				<0.2	<0.2	<0.2
09/04/97	<0.2	<0.2	<0.2			
03/18/98				<0.2	<0.2	
03/19/98	<0.2	<0.2	<0.2			<0.2
09/18/98	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
03/02/99				<0.2	<0.2	
03/03/99	<0.2	0.319	<0.2			<0.2
09/08/99		1.32	<0.2	<0.2	<0.2	
09/09/99	<0.2					<0.2
03/20/00	<0.2	2.5	<0.2	<0.2	<0.2	<0.2
09/12/00	<0.2	3.2	<0.2	<0.2	<0.2	<0.2
02/07/01	<0.2	3.74	<0.2	<0.2	<0.2	<0.2

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Methyl bromide (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:01 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data

TIME SERIES (data)

Constituent: Methyl chloride (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01. 10:01 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Methyl ethyl ketone (ug/L) | Facility: Timberlands LF | Data File: TIMBER

Date: 4/5/01, 10:01 AM | Client: Timberlands LF | View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					4	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Methyl-iso-butyl ketone (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:01 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Nickel Total (mg/L)

Date: 4/5/01, 10:01 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.04	<0.04		<0.04
09/30/93			<0.04	<0.04		<0.04
10/01/93			<0.04	<0.04		<0.04
10/02/93			<0.04	<0.04		<0.04
03/30/94			<0.04	<0.04		<0.04
06/16/94					<0.04	
09/28/94			<0.04	<0.04	<0.04	<0.04
03/16/95			<0.04	<0.04	<0.04	<0.04
09/07/95			<0.04	<0.04	<0.04	<0.04
03/14/96			<0.04	<0.04	<0.04	<0.04
09/12/96	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
10/03/96	<0.04	<0.04				
11/05/96	<0.04	<0.04				
12/10/96	<0.04	<0.04				
03/06/97	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
09/03/97				<0.04	<0.04	<0.04
09/04/97	<0.04	<0.04	<0.04			
03/18/98				<0.04	<0.04	
03/19/98	<0.04	<0.04	<0.04			<0.04
09/18/98	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
03/02/99				<0.04	<0.04	
03/03/99	<0.04	<0.04	<0.04			<0.04
09/08/99		<0.04	<0.04	<0.04	<0.04	
09/09/99	<0.04					<0.04
03/20/00	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
09/12/00	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
02/07/01	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Selenium Total (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:01 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<2	<2		<2
09/30/93			<2	<2		<2
10/01/93			<2	<2		<2
10/02/93			<2	<2		<2
03/30/94			<2	<2		<2
06/15/94					<2	
09/28/94			<2	<2	<2	<2
03/16/95			<2	<2	<2	<2
09/07/95			<2	<2	<2	<2
03/14/96			<2	<2	<2	<2
09/12/96	<2	<2	<2	<2	<2	<2
10/03/96	<2	<2				
11/05/96	<2	<2				
12/10/96	<2	<2				
03/06/97	<2	<2	<2	<2	<2	<2
09/03/97				<2	<2	<2
09/04/97	<2	<2	<2			
03/18/98				<2	<2	
03/19/98	3.96	<2	<2			<2
09/18/98	<2	<2	<2	<2	<2	<2
03/02/99				<2	<2	
03/03/99	<2	<2	<2			<2
09/08/99		<2	<2	<2	<2	
09/09/99	<2					<2
03/20/00	3.34	<2	5.04	4.76	<2	<2
09/12/00	<2	<2	<2	<2	<2	<2
02/07/01	<2	<2	<2	<2	<2	<2

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Silver Total (mg/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:02 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.015	<0.015		<0.015
09/30/93			<0.015	<0.015		<0.015
10/01/93			<0.015	<0.015		<0.015
10/02/93			<0.015	<0.015		<0.015
03/30/94			<0.015	<0.015		<0.015
06/16/94					<0.015	
09/28/94			<0.015	<0.015	<0.015	<0.015
03/16/95			<0.015	<0.015	<0.015	<0.015
09/07/95			<0.015	<0.015	<0.015	<0.015
03/14/96			<0.015	<0.015	<0.015	<0.015
09/12/96	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
10/03/96	<0.015	<0.015				
11/05/96	<0.015	<0.015				
12/10/96	<0.015	<0.015				
03/06/97	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
09/03/97				<0.015	<0.015	<0.015
09/04/97	<0.015	<0.015	<0.015			
03/18/98				<0.015	<0.015	
03/19/98	<0.015	<0.015	<0.015			<0.015
09/18/98	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
03/02/99				<0.015	<0.015	
03/03/99	<0.015	<0.015	0.0154			<0.015
09/08/99		<0.015	<0.015	<0.015	<0.015	
09/09/99	<0.015					<0.015
03/20/00	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
09/12/00	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
02/07/01	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Styrene (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:02 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Tetrachloroethylene (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:02 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Thallium Total (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:02 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<2	<2		<2
09/30/93			<2	<2		<2
10/01/93			<2	<2		<2
10/02/93			<2	<2		<2
03/30/94			<2	<2		<2
06/16/94					<2	
09/28/94			<2	<2	<2	<2
03/16/95			<2	<2	<2	<2
09/07/95			<2	<2	<2	<2
03/14/96			<2	<2	<2	<2
09/12/96	<2	<2	<2	<2	<2	<2
10/03/96	<2	<2				
11/05/96	<2	<2				
12/10/96	<2	<2				
03/06/97	<2	<2	<2	<2	<2	<2
09/03/97				<2	<2	<2
09/04/97	<2	<2	<2			
03/18/98				<2	<2	
03/19/98	<2	<2	<2			<2
09/18/98	<2	<2	<2	<2	<2	<2
03/02/99				<2	<2	
03/03/99	<2	<2	<2			<2
09/08/99		<2	<2	<2	<2	
09/09/99	<2					<2
03/20/00	<2	<2	<2	<2	<2	<2
09/12/00	<2	<2	<2	<2	<2	<2
02/07/01	<2	<2	<2	<2	<2	<2

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Toluene (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:02 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<2
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: trans-12-Dichloroethylene (ug/L) | Facility: Timberlands LF | Data File: TIMBER

Date: 4/5/01, 10:02 AM | Client: Timberlands LF | View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: trans-13-Dichloropropylene (ug/L)
Facility: Timberlands LF
Data File: TIMBER
Date: 4/5/01, 10:02 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UOW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data

TIME SERIES (data)

Constituent: trans-14-Dichloro-2-butene (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:02 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data

TIME SERIES (data)

Constituent: Trichloroethylene (ug/L)

Facility: Timberlands LF

Data File: TIMBER

Date: 4/5/01, 10:02 AM

Client: Timberlands LF

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<5	<5		<5
09/30/93			<5	<5		<5
10/01/93			<5	<5		<5
10/02/93			<5	<5		<5
03/30/94			<5	<5		<5
06/16/94					<5	
09/28/94			<5	<5	<5	<5
03/16/95			<5	<5	<5	<5
09/07/95			<5	<5	<5	<5
03/14/96			<5	<5	<5	<5
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data

TIME SERIES (data)

Constituent: Trichlorofluoromethane (ug/L.)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:02 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Vanadium Total (mg/L) | Facility: Timberlands LF | Data File: TIMBER

Date: 4/5/01, 10:02 AM | Client: Timberlands LF | View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.01	<0.01		<0.01
09/30/93			<0.01	<0.01		0.02
10/01/93			<0.01	<0.01		<0.01
10/02/93			<0.01	<0.01		<0.01
03/30/94			<0.01	<0.01		<0.01
06/16/94					<0.01	
09/28/94			<0.01	<0.01	<0.01	<0.01
03/16/95			<0.01	<0.01	<0.01	<0.01
09/07/95			<0.01	<0.01	<0.01	<0.01
03/14/96			<0.01	<0.01	<0.01	<0.01
09/12/96	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
10/03/96	<0.01	<0.01				
11/05/96	<0.01	<0.01				
12/10/96	<0.01	<0.01				
03/06/97	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
09/03/97				<0.01	<0.01	<0.01
09/04/97	<0.01	<0.01	<0.01			
03/18/98				<0.01	<0.01	
03/19/98	<0.01	<0.01	<0.01			<0.01
09/18/98	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
03/02/99				<0.01	<0.01	
03/03/99	<0.01	<0.01	<0.01			<0.01
09/08/99		<0.01	<0.01	<0.01	<0.01	
09/09/99	<0.01					<0.01
03/20/00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
09/12/00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
02/07/01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Vinyl acetate (ug/L)

Date: 4/5/01, 10:02 AM

Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Vinyl chloride (ug/L)
Facility: Timberlands LF
Data File: TIMBER

Date: 4/5/01, 10:02 AM
Client: Timberlands LF
View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<10	<10		<10
09/30/93			<10	<10		<10
10/01/93			<10	<10		<10
10/02/93			<10	<10		<10
03/30/94			<10	<10		<10
06/16/94					<10	
09/28/94			<10	<10	<10	<10
03/16/95			<10	<10	<10	<10
09/07/95			<10	<10	<10	<10
03/14/96			<10	<10	<10	<10
09/12/96	<10	<10	<10	<10	<10	<10
10/03/96	<10	<10				
11/05/96	<10	<10				
12/10/96	<10	<10				
03/06/97	<10	<10	<10	<10	<10	<10
09/03/97				<10	<10	<10
09/04/97	<10	<10	<10			
03/18/98				<10	<10	
03/19/98	<10	<10	<10			<10
09/18/98	<10	<10	<10	<10	<10	<10
03/02/99				<10	<10	
03/03/99	<10	<10	<10			<10
09/08/99		<10	<10	<10	<10	
09/09/99	<10					<10
03/20/00	<10	<10	<10	<10	<10	<10
09/12/00	<10	<10	<10	<10	<10	<10
02/07/01	<10	<10	<10	<10	<10	<10

Asterisk indicates background data

TIME SERIES (data)

Constituent: Xylenes [Total] (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 4/5/01, 10:02 AM Client: Timberlands LF View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/12/96	<5	<5	<5	<5	<5	<5
10/03/96	<5	<5				
11/05/96	<5	<5				
12/10/96	<5	<5				
03/06/97	<5	<5	<5	<5	<5	<5
09/03/97				<5	<5	<5
09/04/97	<5	<5	<5			
03/18/98				<5	<5	
03/19/98	<5	<5	<5			<5
09/18/98	<5	<5	<5	<5	<5	<5
03/02/99				<5	<5	
03/03/99	<5	<5	<5			<5
09/08/99		<5	<5	<5	<5	
09/09/99	<5					<5
03/20/00	<5	<5	<5	<5	<5	<5
09/12/00	<5	<5	<5	<5	<5	<5
02/07/01	<5	<5	<5	<5	<5	<5

Asterisk indicates background data.

TIME SERIES (data)

Constituent: Zinc Total (mg/L) Facility: Timberlands LF Data File: TIMBER

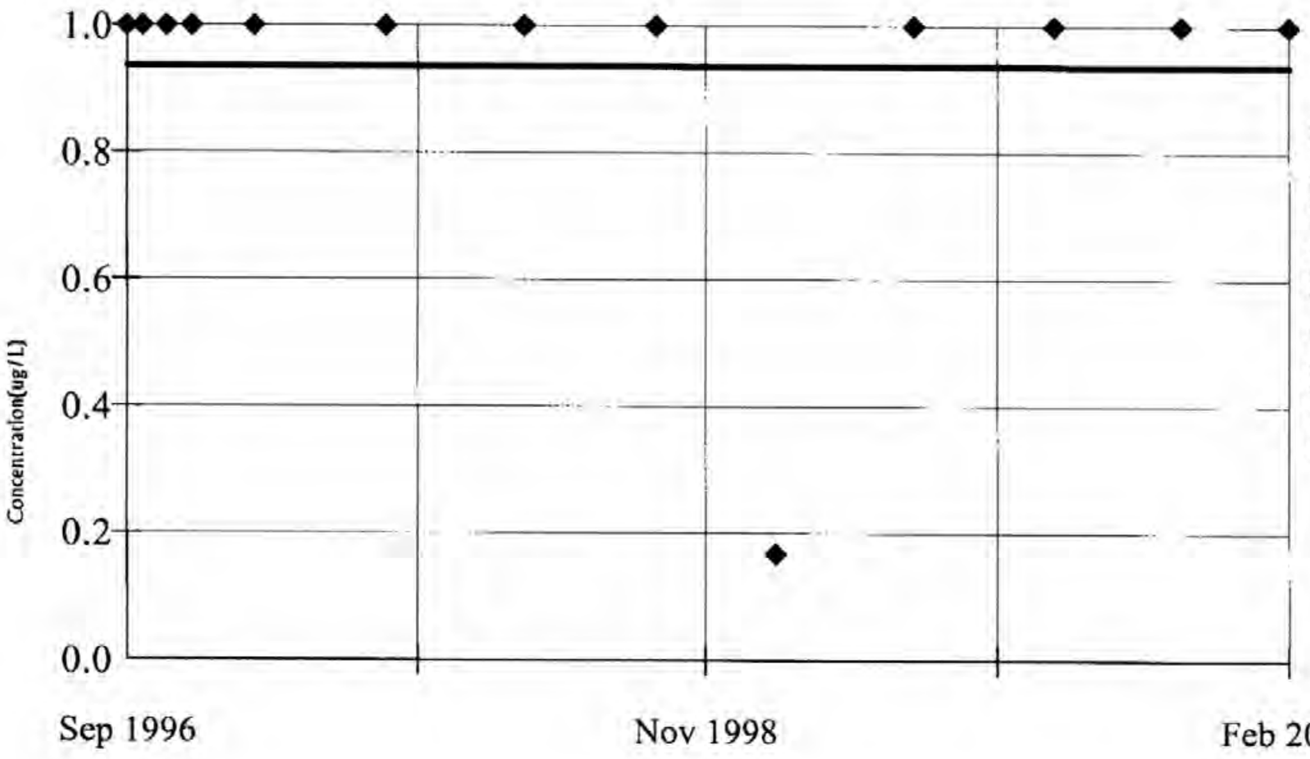
Date: 4/5/01, 10:02 AM Client: Timberlands LF View: _Batch_

Date	GW-4	GW-5	GW-6	GW-7	GW-8	UGW-1*
09/29/93			<0.03	<0.03		<0.03
09/30/93			<0.03	<0.03		<0.03
10/01/93			<0.03	<0.03		<0.03
10/02/93			0.05	<0.03		<0.03
03/30/94			<0.03	<0.03		<0.03
06/16/94					0.05	
09/28/94			<0.03	<0.03	<0.03	<0.03
03/16/95			<0.03	<0.03	<0.03	<0.03
09/07/95			<0.03	<0.03	0.03	<0.03
03/14/96			<0.03	<0.03	<0.03	<0.03
09/12/96	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
10/03/96	<0.03	<0.03				
11/05/96	<0.03	<0.03				
12/10/96	<0.03	<0.03				
03/06/97	0.17	<0.03	<0.03	0.15	<0.03	<0.03
09/03/97				<0.03	<0.03	<0.03
09/04/97	<0.03	<0.03	<0.03			
03/18/98				0.0322	<0.03	
03/19/98	<0.03	0.0338	<0.03			<0.03
09/18/98	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
03/02/99				<0.03	<0.03	
03/03/99	<0.03	<0.03	<0.03			<0.03
09/08/99		<0.03	<0.03	<0.03	<0.03	
09/09/99	<0.03					<0.03
03/20/00	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
09/12/00	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
02/07/01	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03

Asterisk indicates background data.

Appendix C
Sen's Slope/Mann-Kendall Plots

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = -4.

Trend not significant at 95% confidence level (two tailed). Critical value = -34.

Constituent: Antimony Total (ug/L)

Date: 3/27/01, 10:20 AM

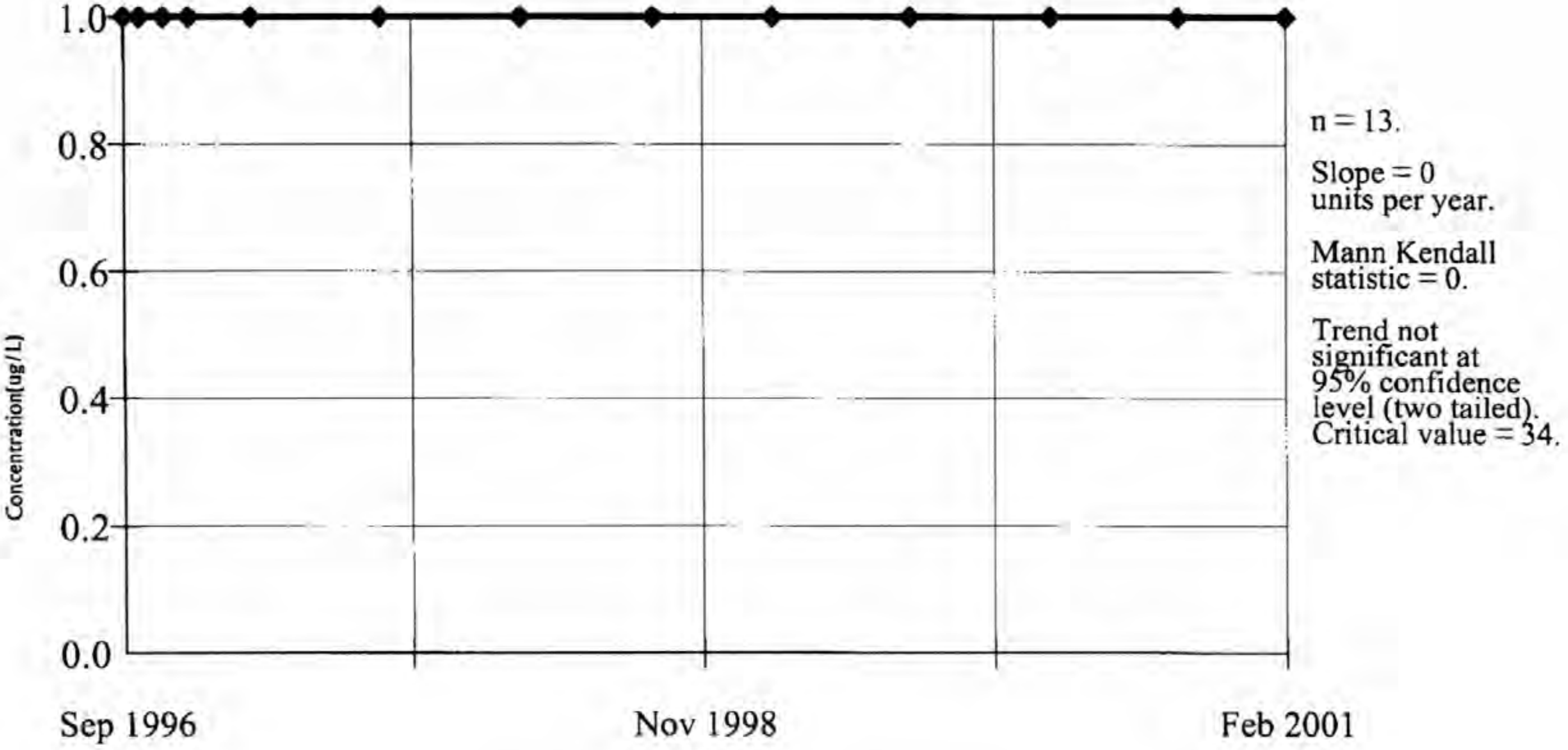
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5

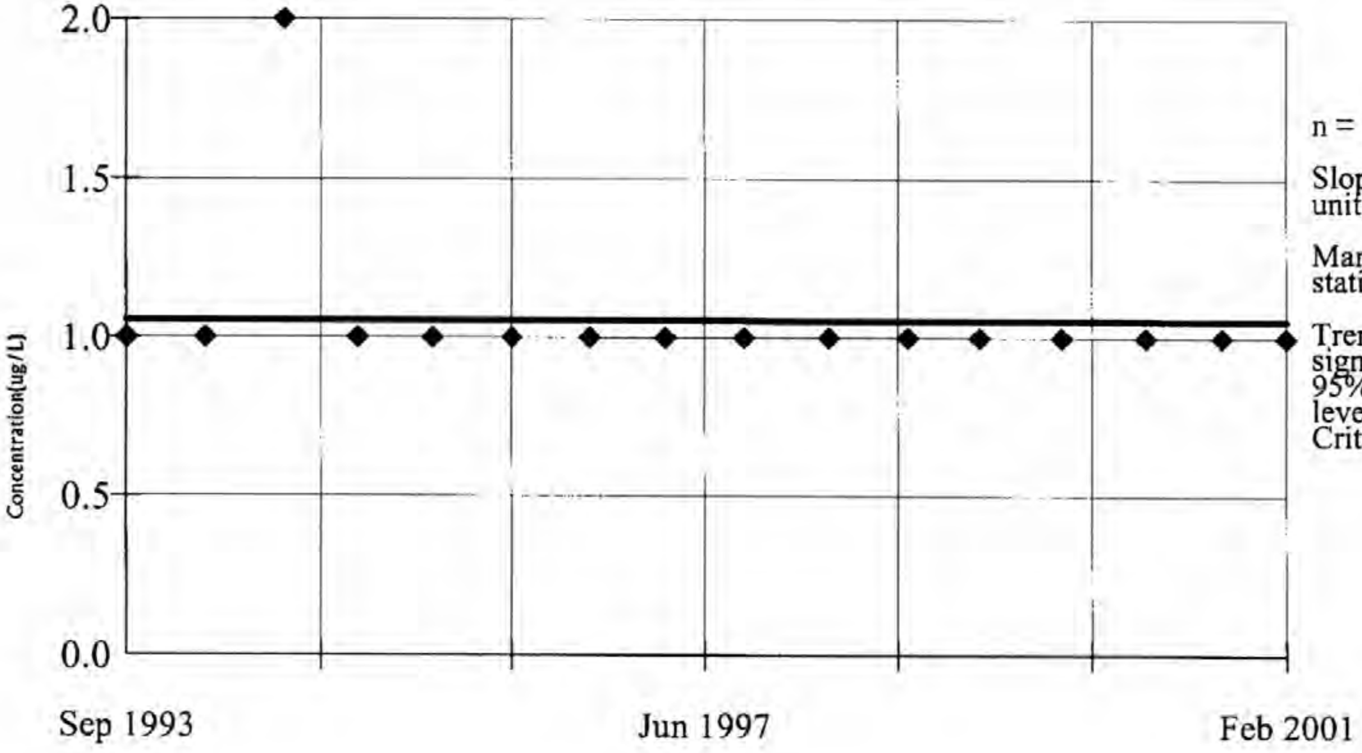


Constituent: Antimony Total (ug/L)
Date: 3/27/01, 10:20 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = -8.

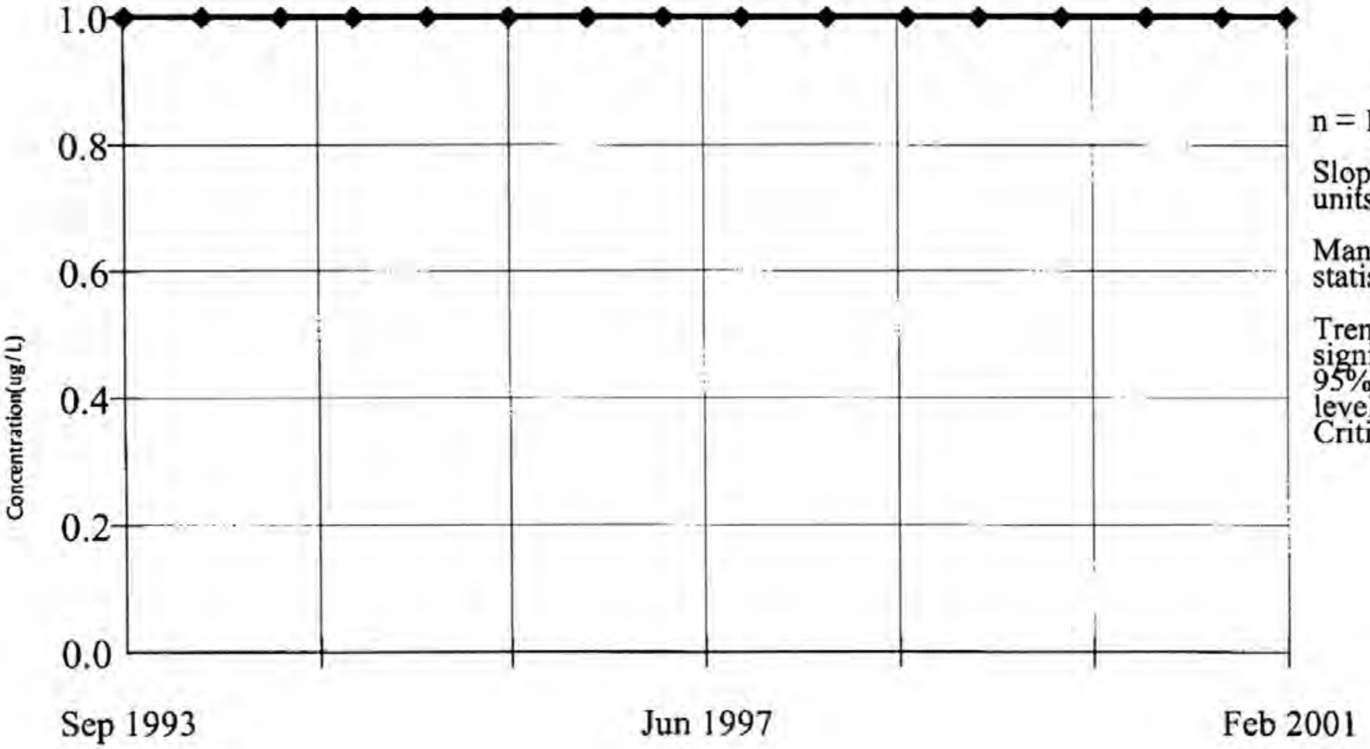
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -58.

Constituent: Antimony Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 0.

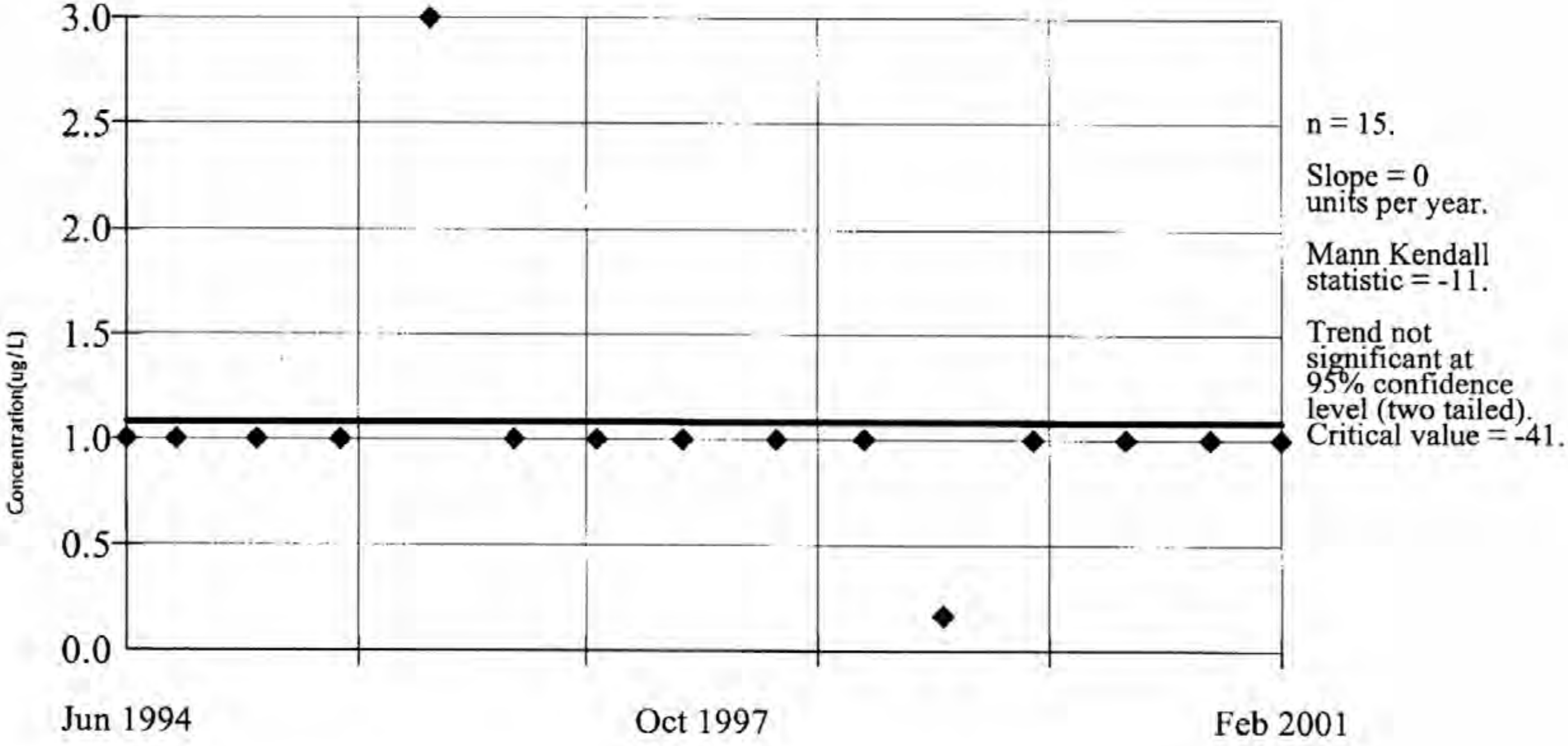
Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Antimony Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0 units per year.

Mann Kendall statistic = -11.

Trend not significant at 95% confidence level (two tailed). Critical value = -41.

Constituent: Antimony Total (ug/L)

Date: 3/27/01, 10:21 AM

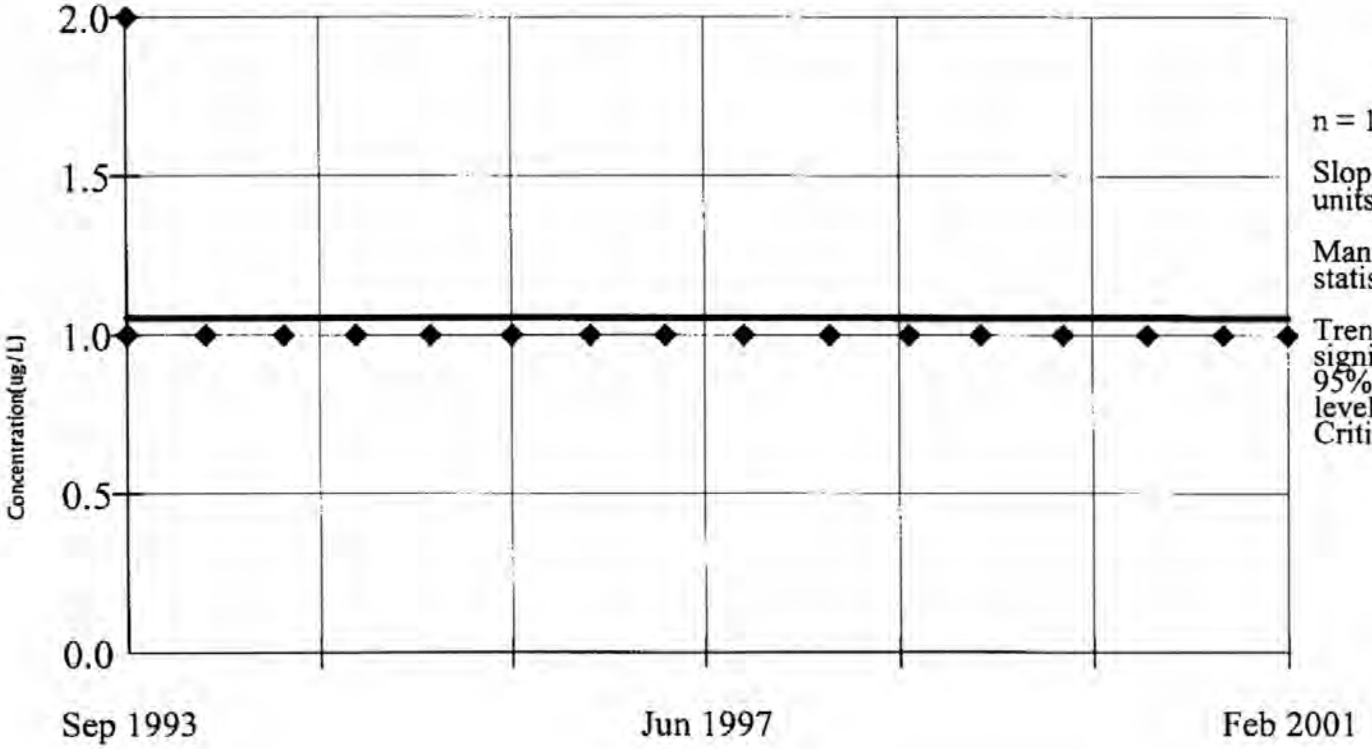
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = -12.

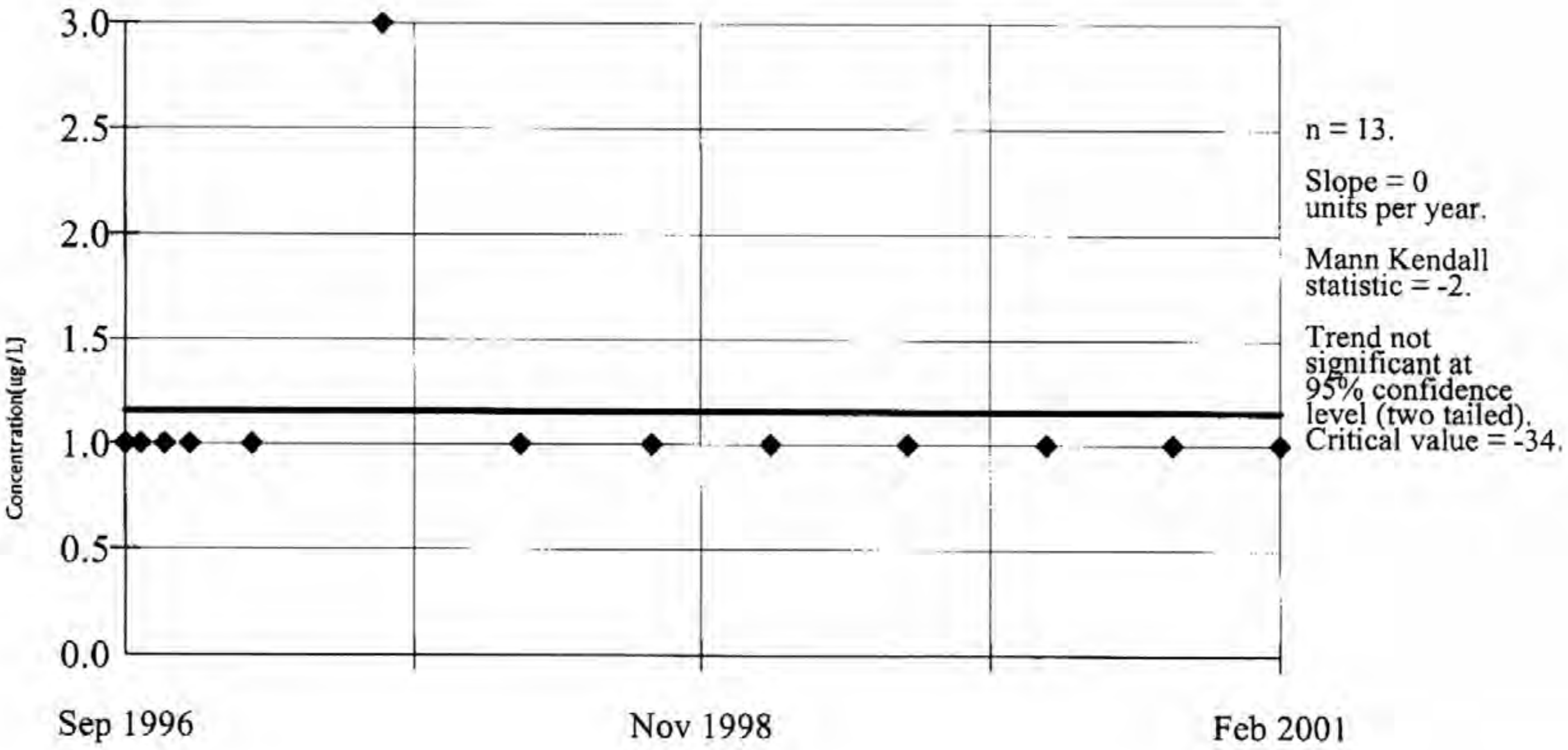
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -58.

Constituent: Antimony Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



Constituent: Arsenic Total (ug/L)

Date: 3/27/01, 10:21 AM

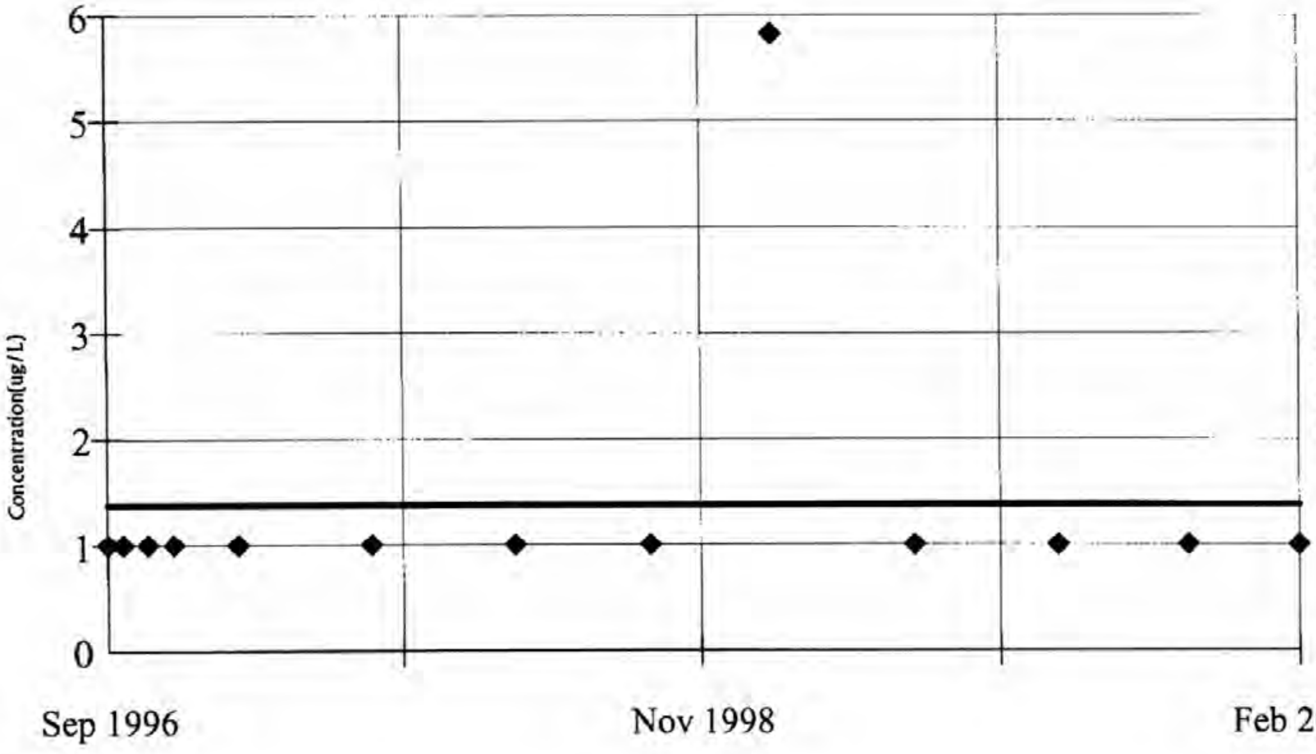
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 4.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Arsenic Total (ug/L)

Date: 3/27/01, 10:21 AM

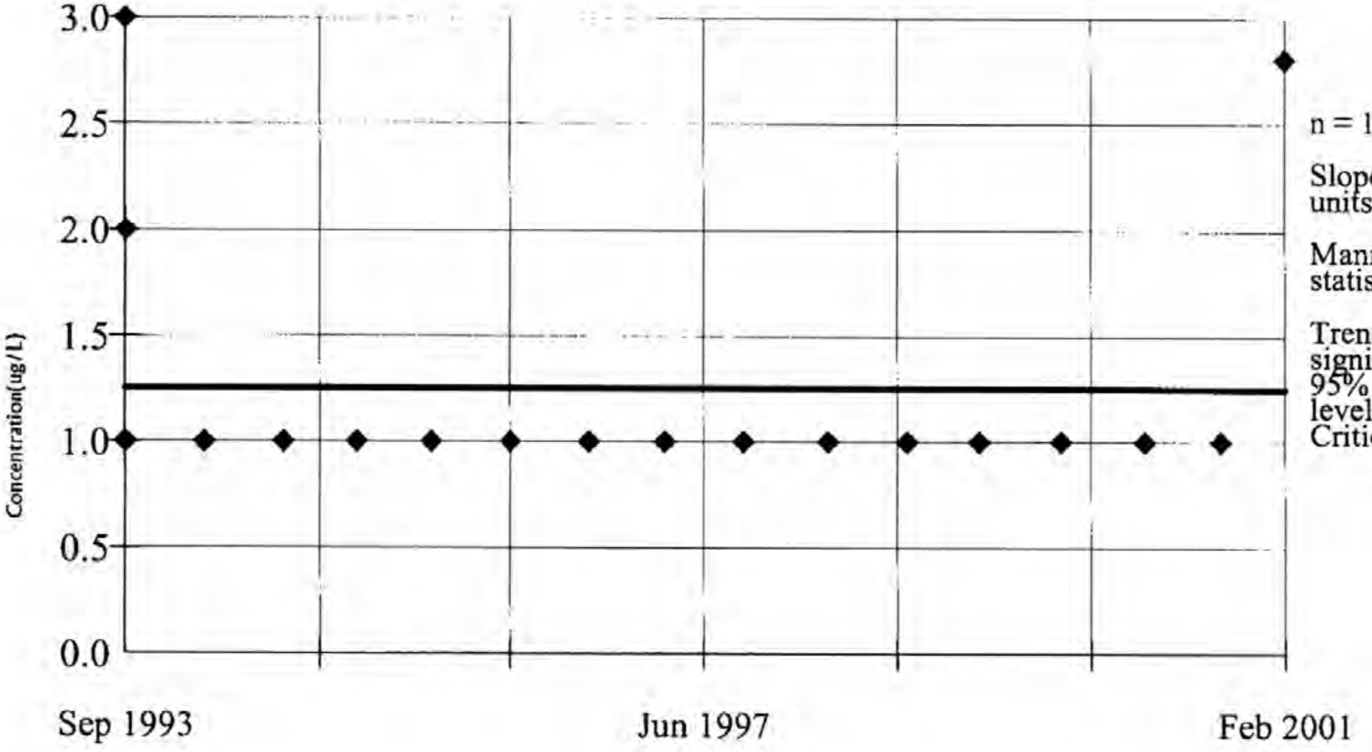
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = -11.

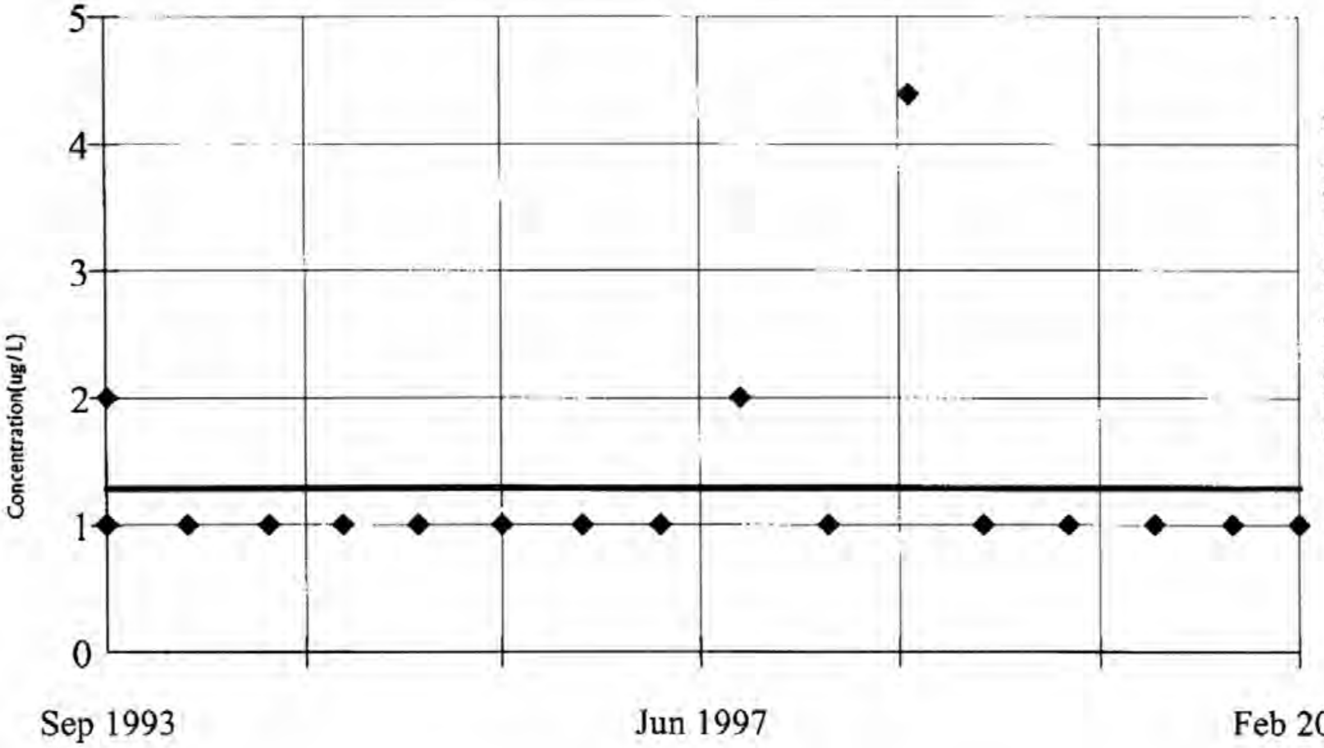
Trend not significant at 95% confidence level (two tailed). Critical value = -58.

Constituent: Arsenic Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 2.

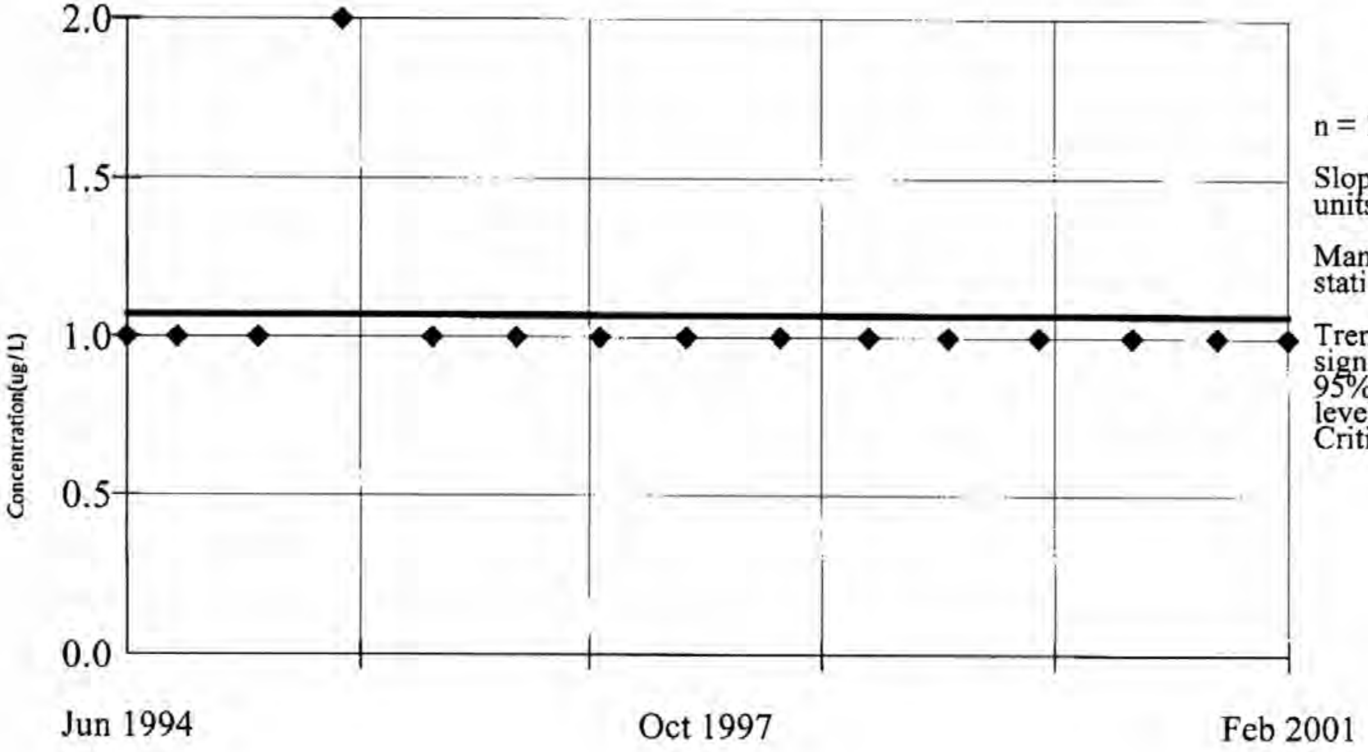
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Arsenic Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0
units per year.

Mann Kendall
statistic = -8.

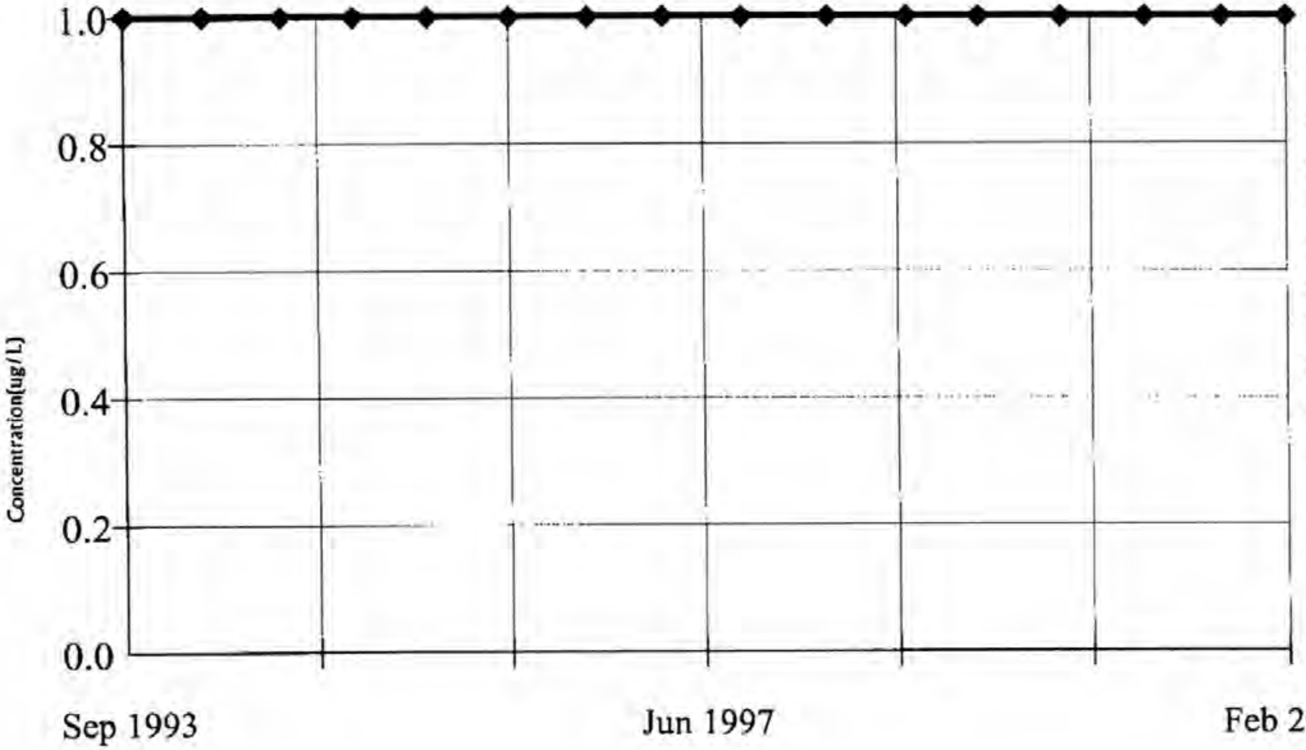
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -41.

Constituent: Arsenic Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 0.

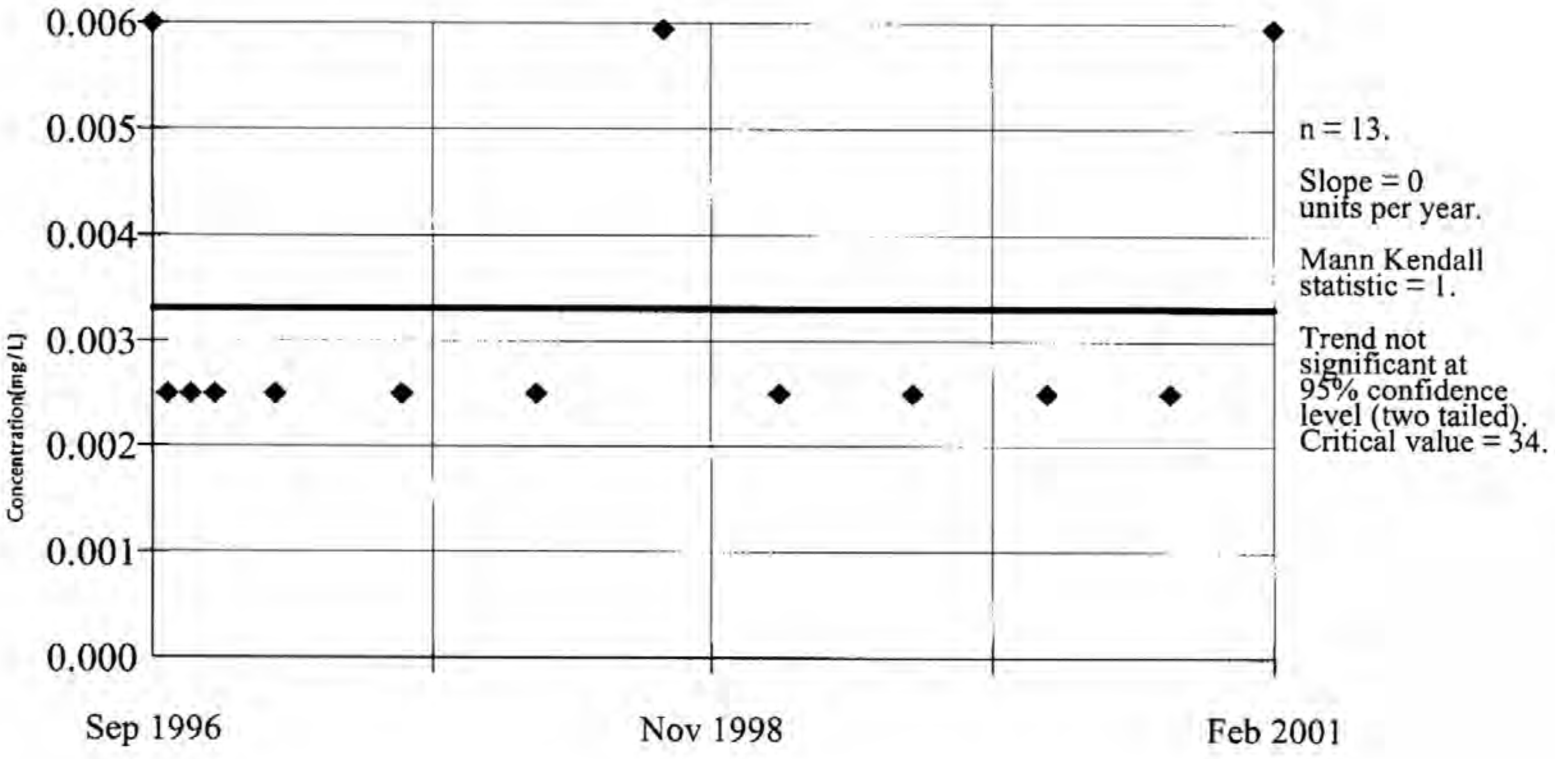
Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Arsenic Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4

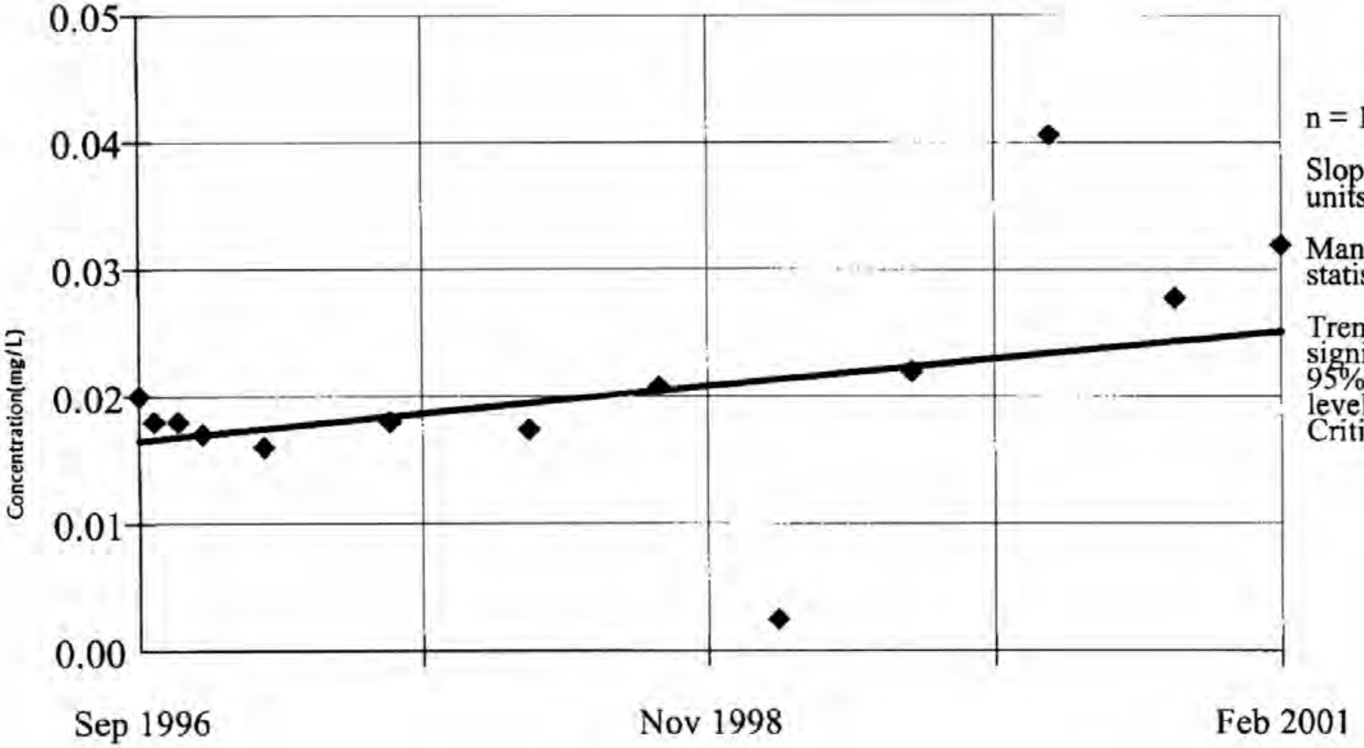


Constituent: Barium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0.002 units per year.

Mann Kendall statistic = 27.

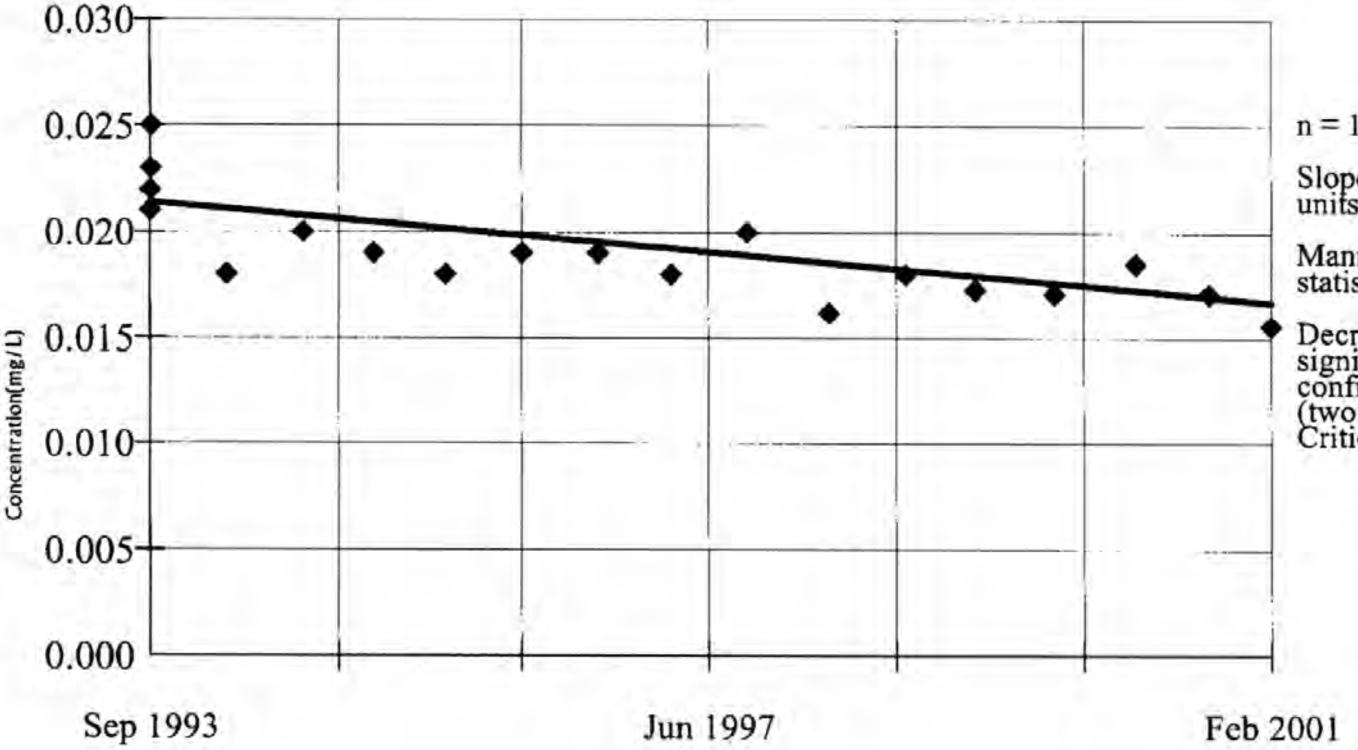
Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Barium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = -0.001 units per year.

Mann Kendall statistic = -102.

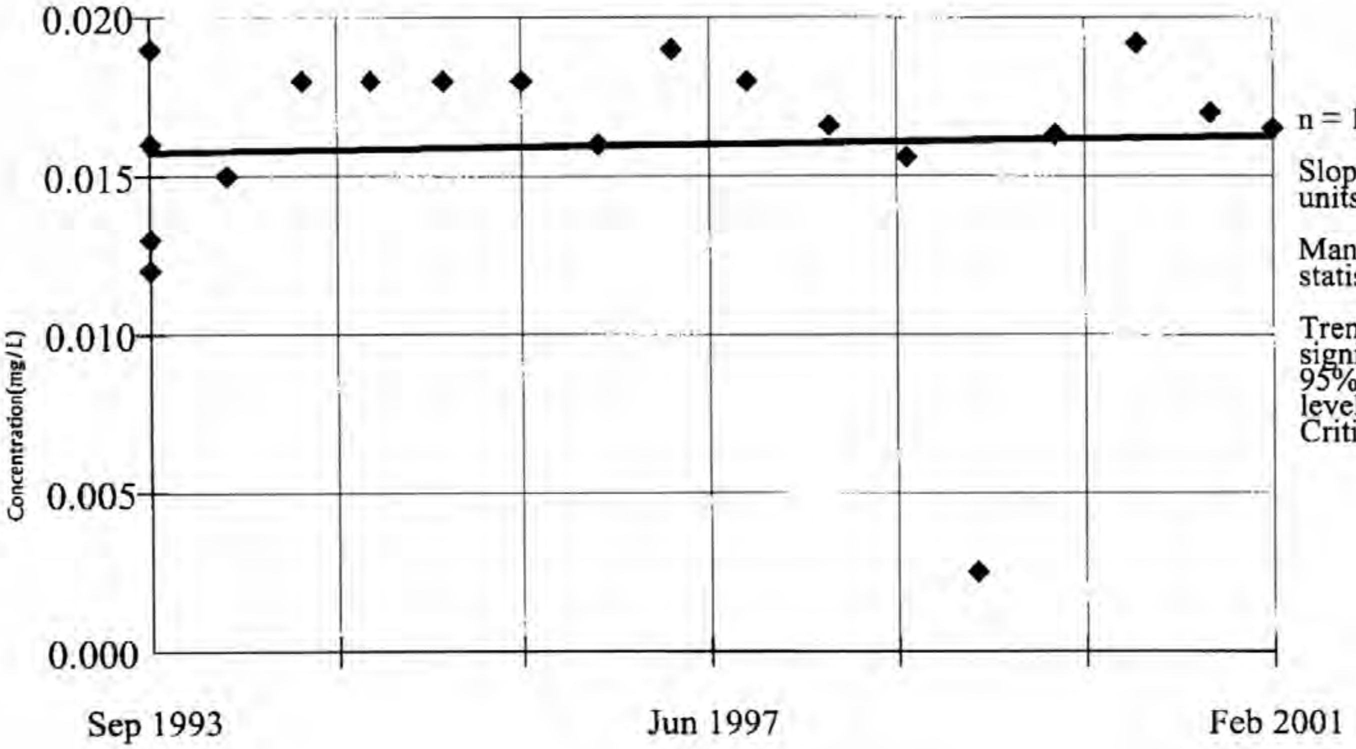
Decreasing trend significant at 95% confidence level (two tailed). Critical value = -58.

Constituent: Barium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0.000 units per year.

Mann Kendall statistic = 19.

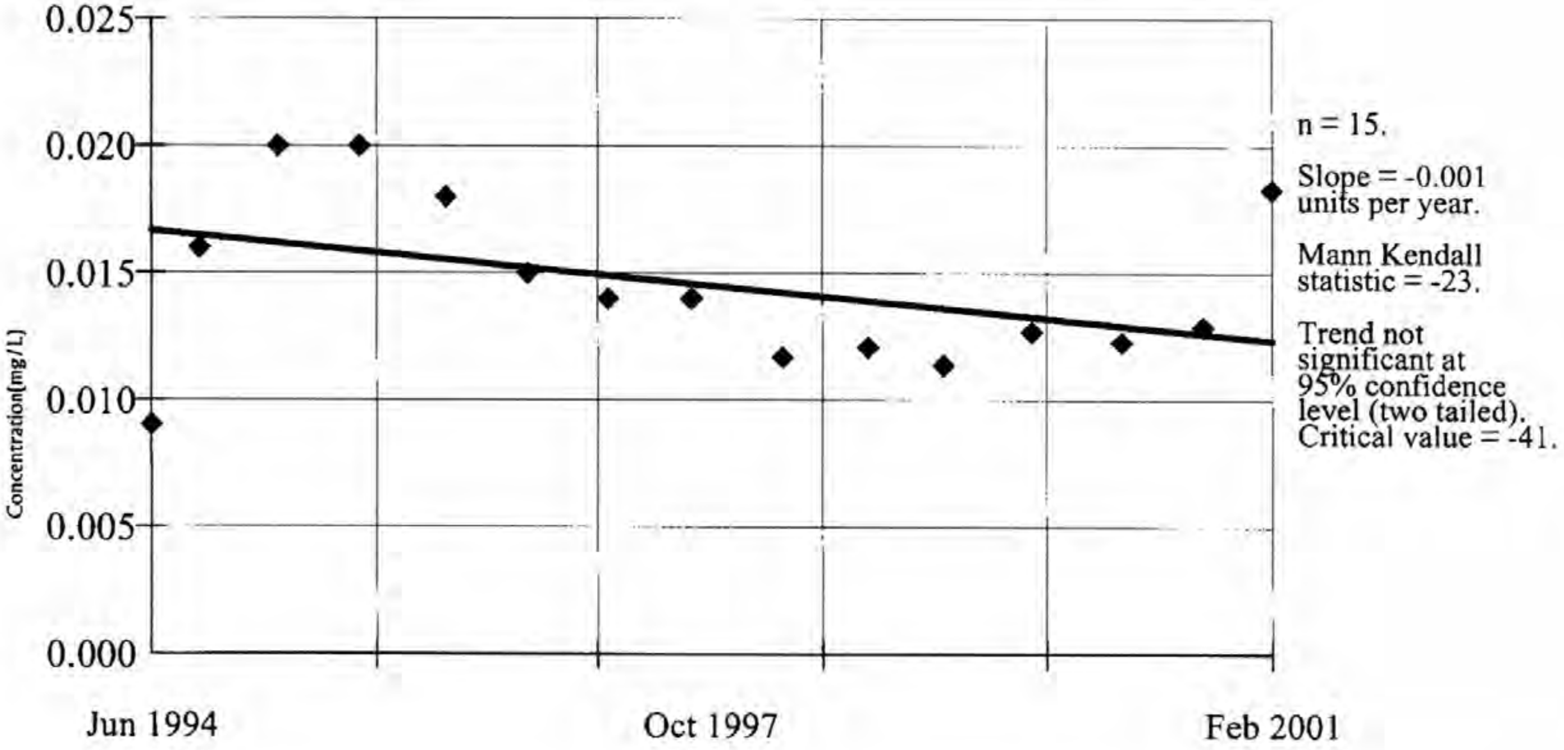
Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Barium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8

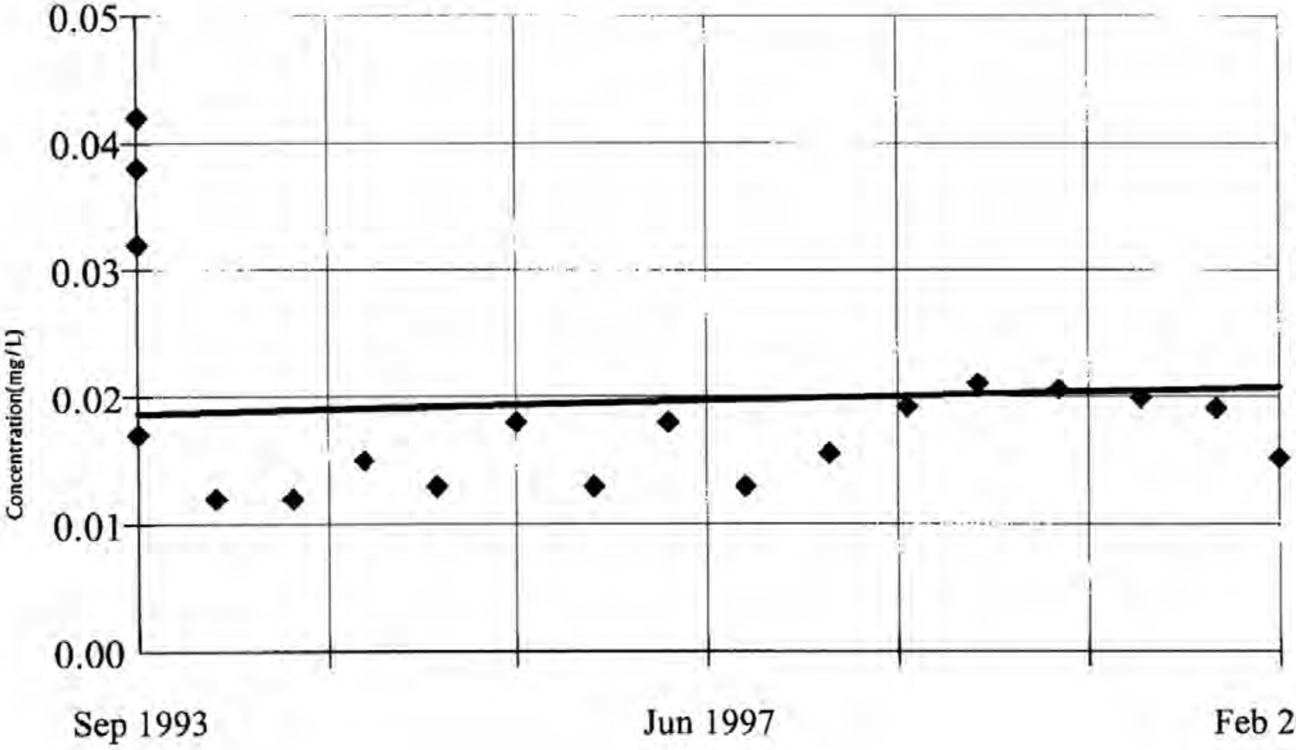


Constituent: Barium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0.000 units per year.

Mann Kendall statistic = 14.

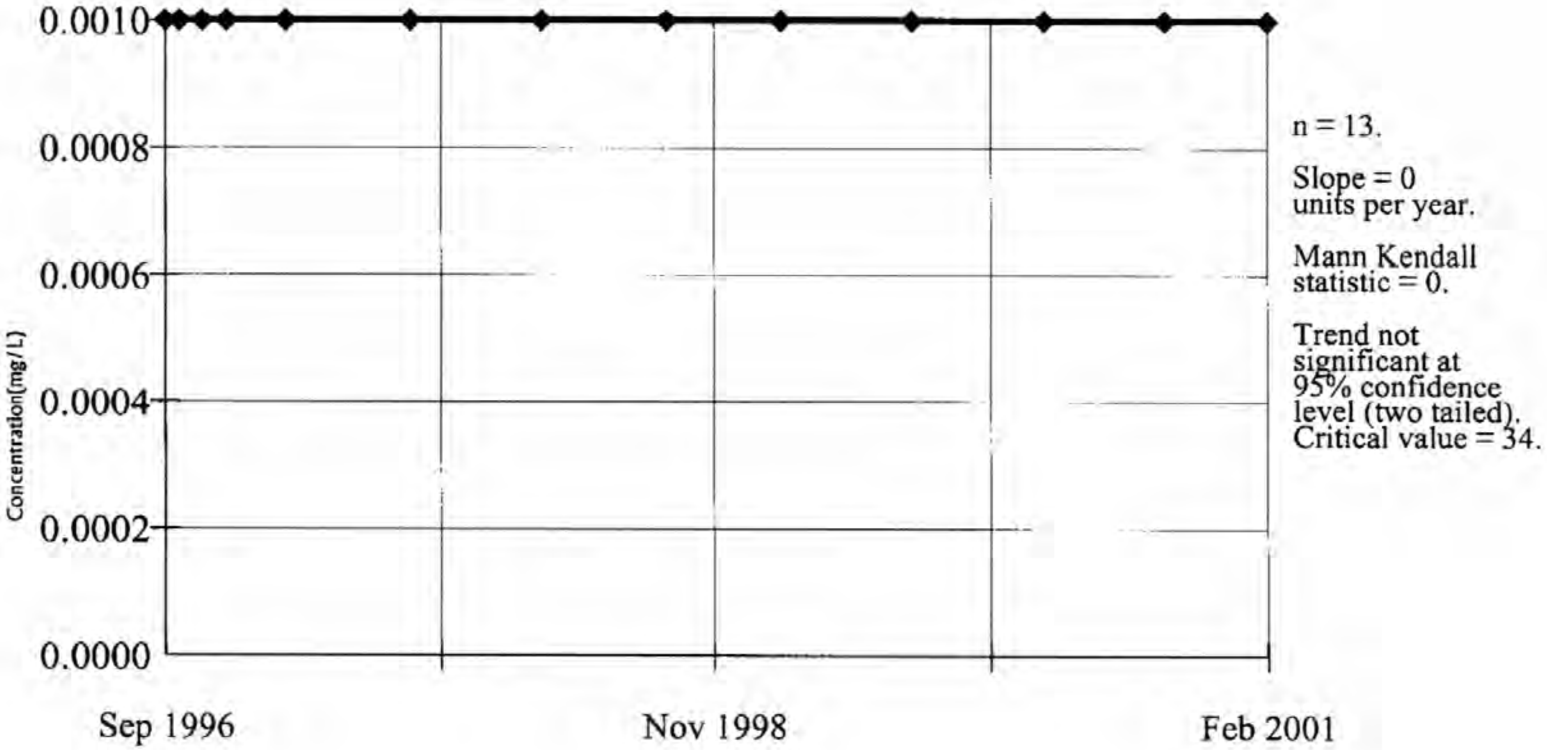
Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Barium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

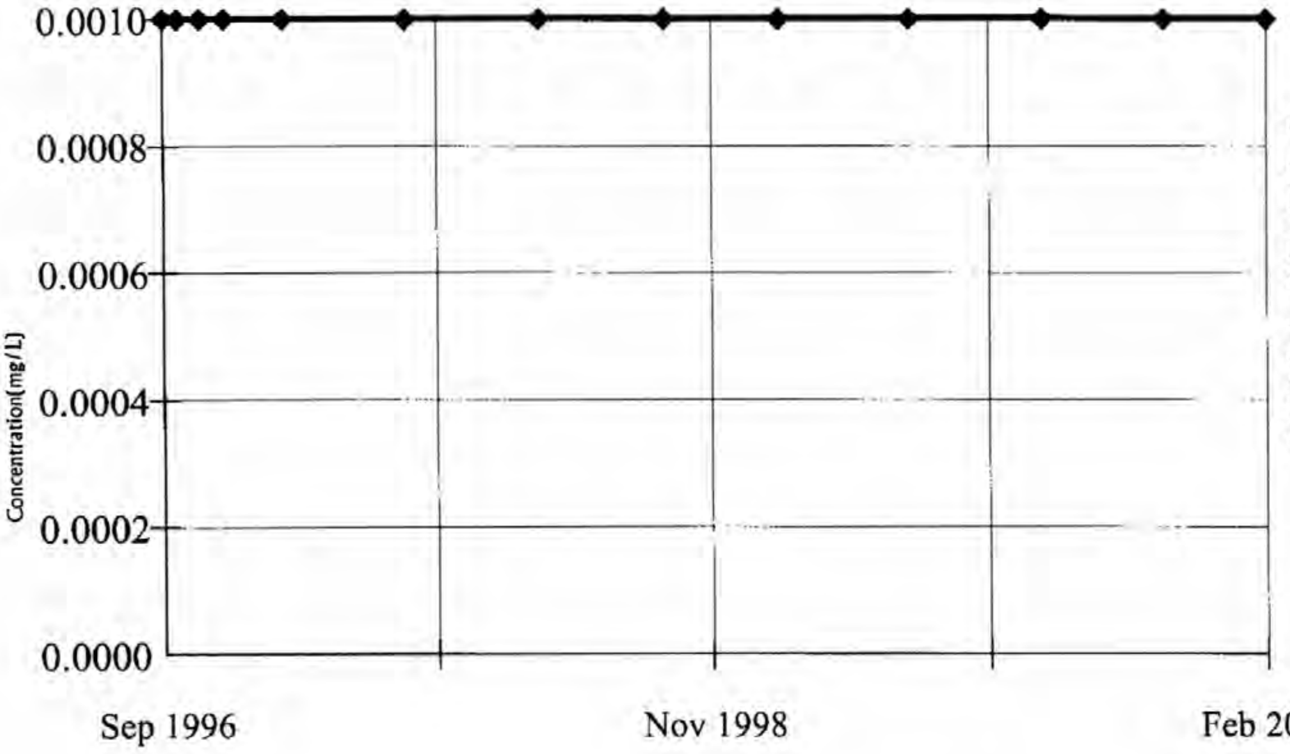
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Beryllium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

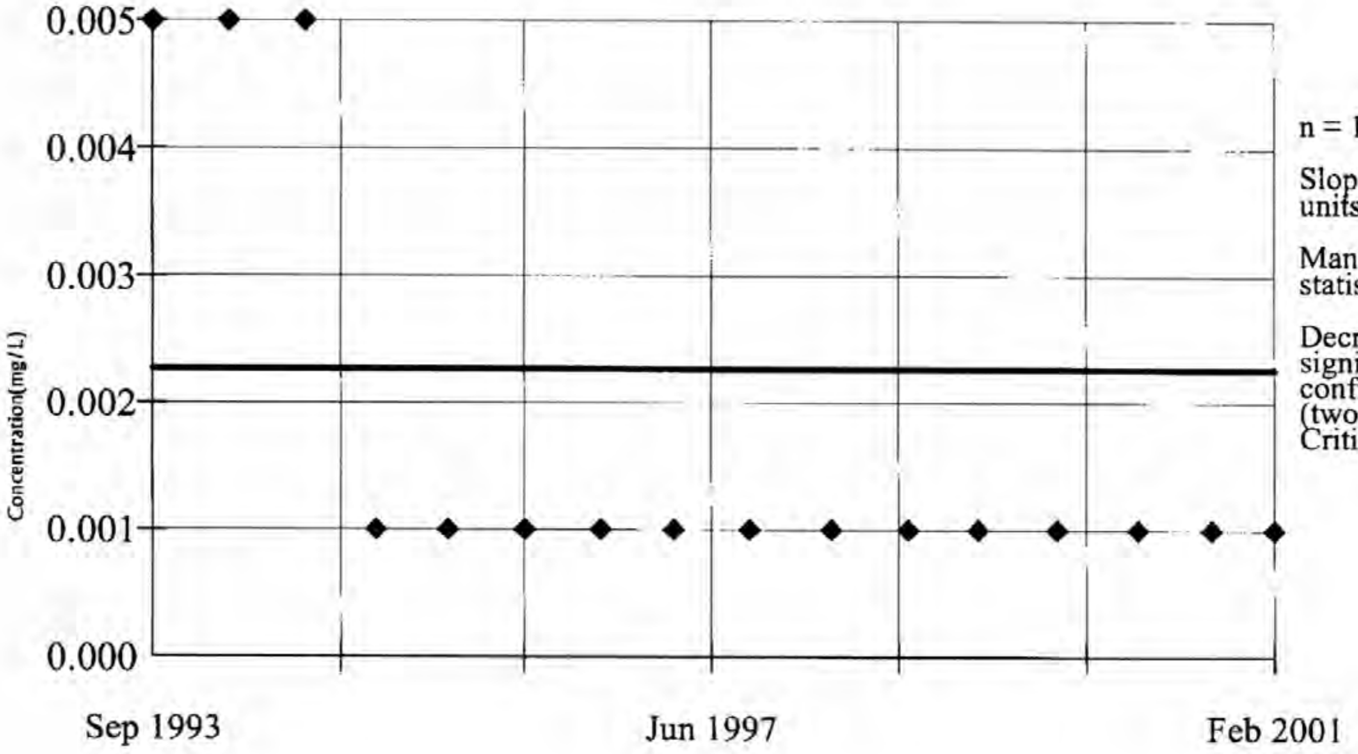
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Beryllium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = -78.

Decreasing trend significant at 95% confidence level (two tailed). Critical value = -58.

Constituent: Beryllium Total (mg/L)

Date: 3/27/01, 10:21 AM

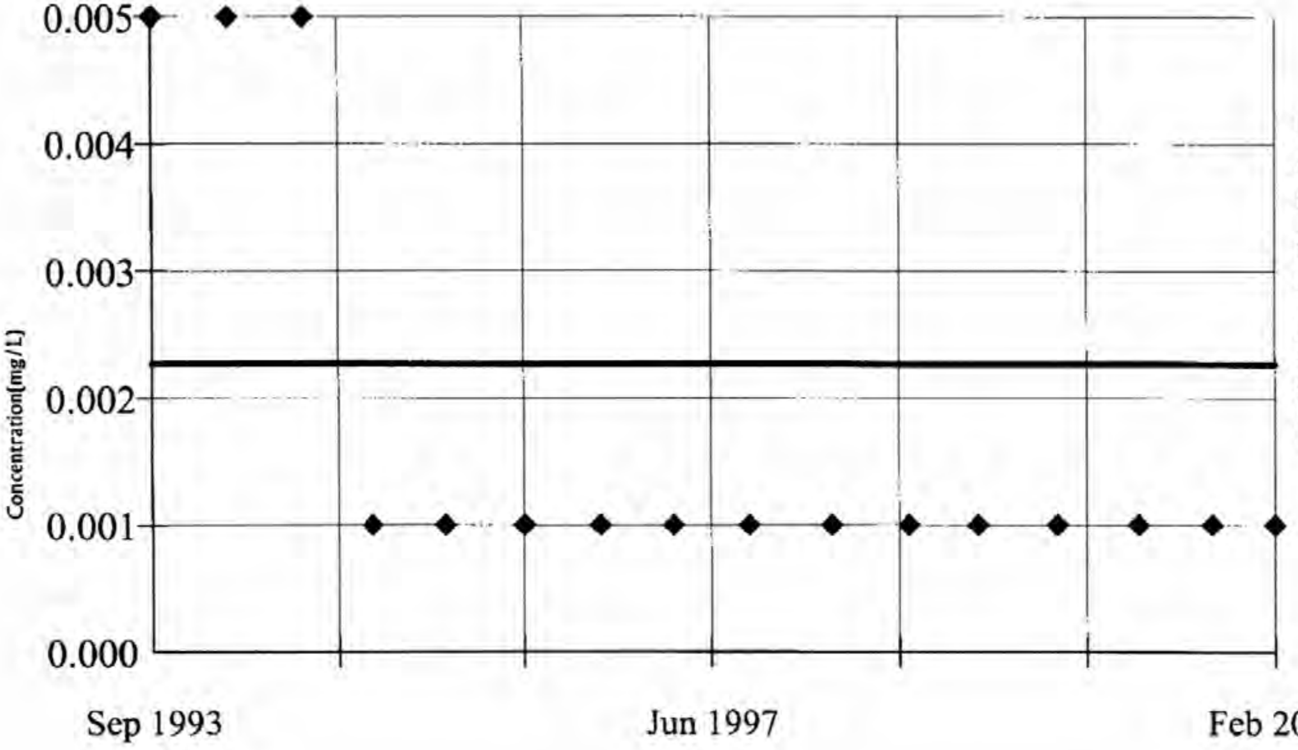
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = -78.

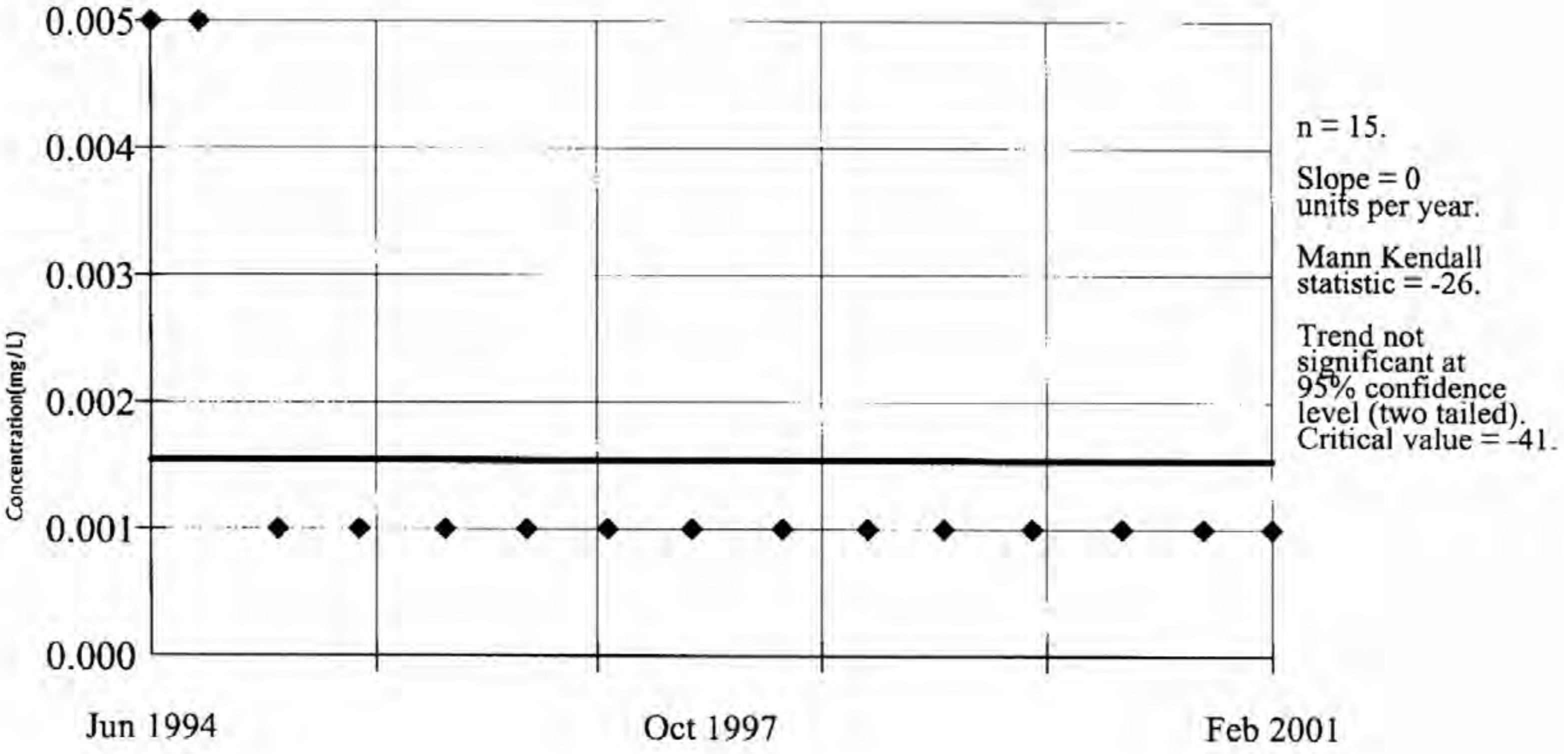
Decreasing trend
significant at 95%
confidence level
(two tailed).
Critical value = -58.

Constituent: Beryllium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

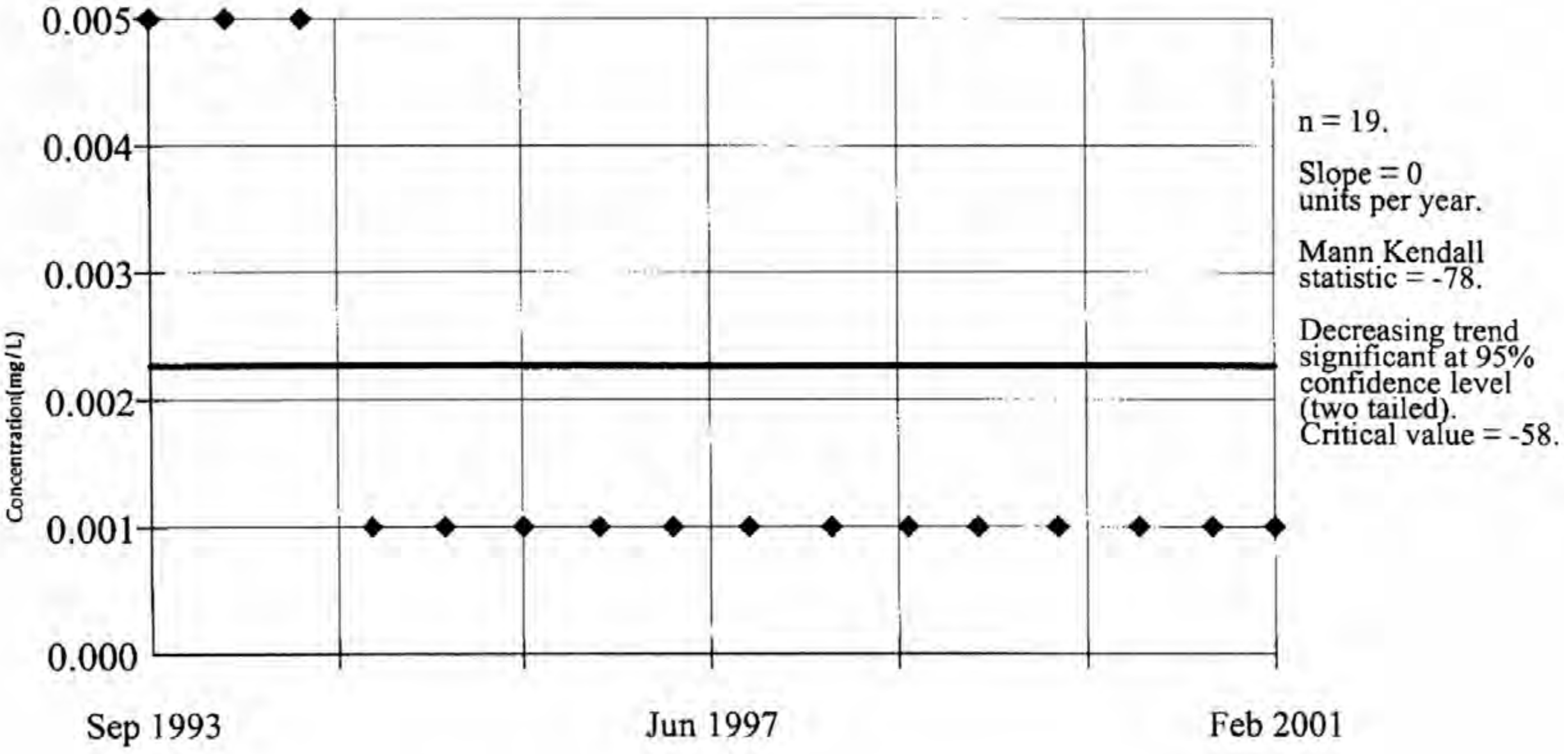
SEN'S SLOPE ESTIMATOR
GW-8



Constituent: Beryllium Total (mg/L) Facility: Timberlands LF Data File: TIMBER

Date: 3/27/01, 10:21 AM Client: Timberlands LF View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1

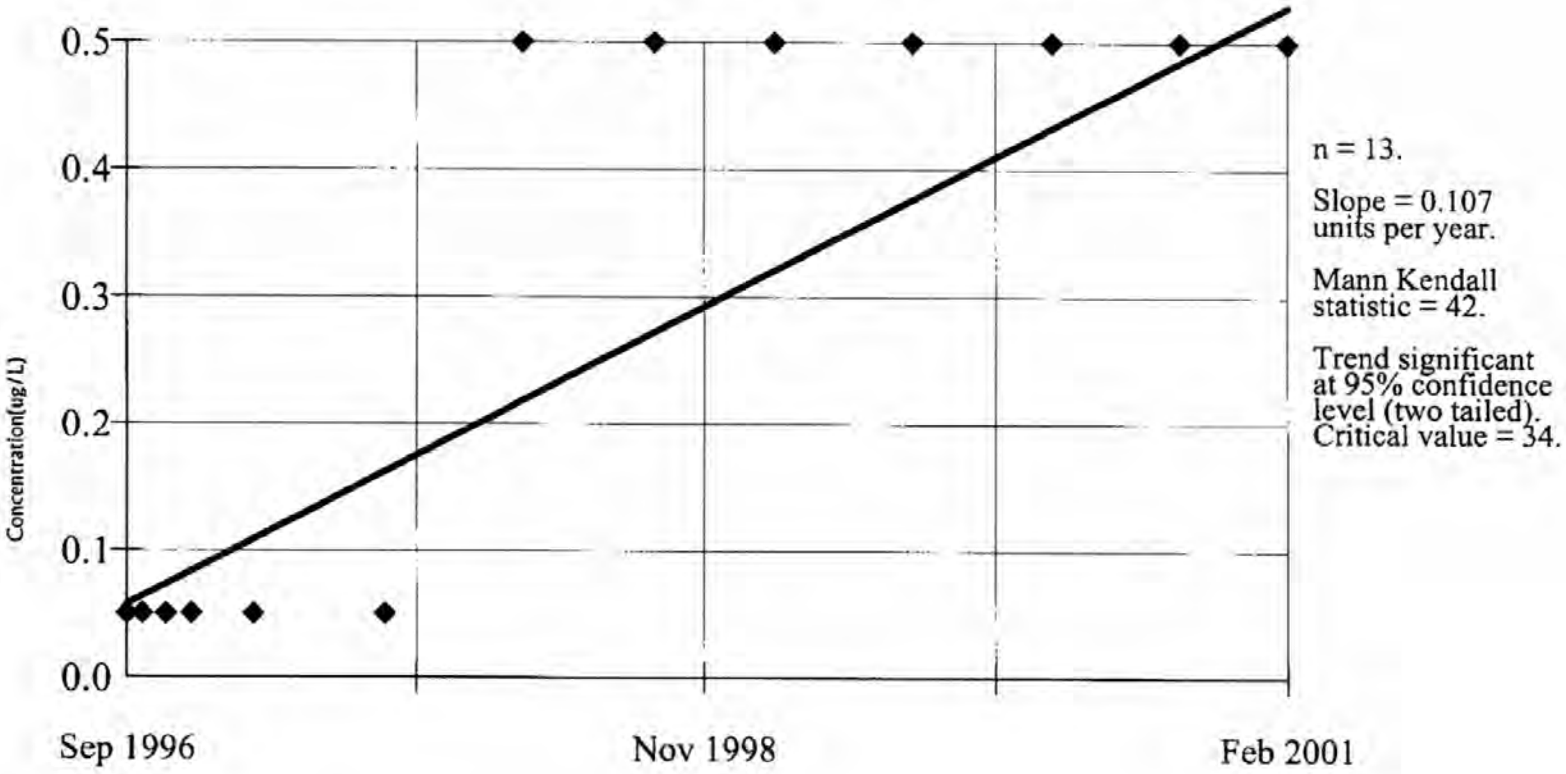


Constituent: Beryllium Total (mg/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0.107 units per year.

Mann Kendall statistic = 42.

Trend significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Cadmium Total (ug/L)

Date: 3/27/01, 10:21 AM

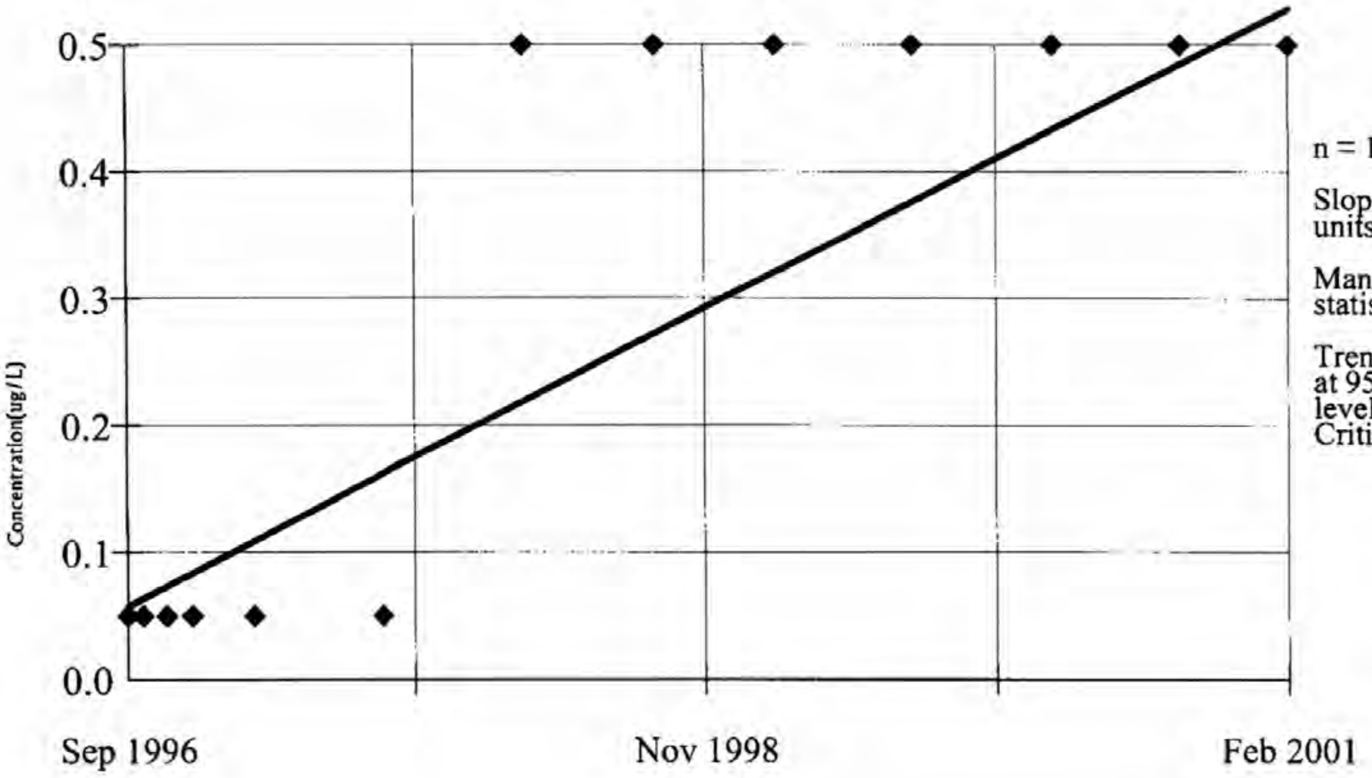
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0.107 units per year.

Mann Kendall statistic = 42.

Trend significant at 95% confidence level (two tailed). Critical value = 34.

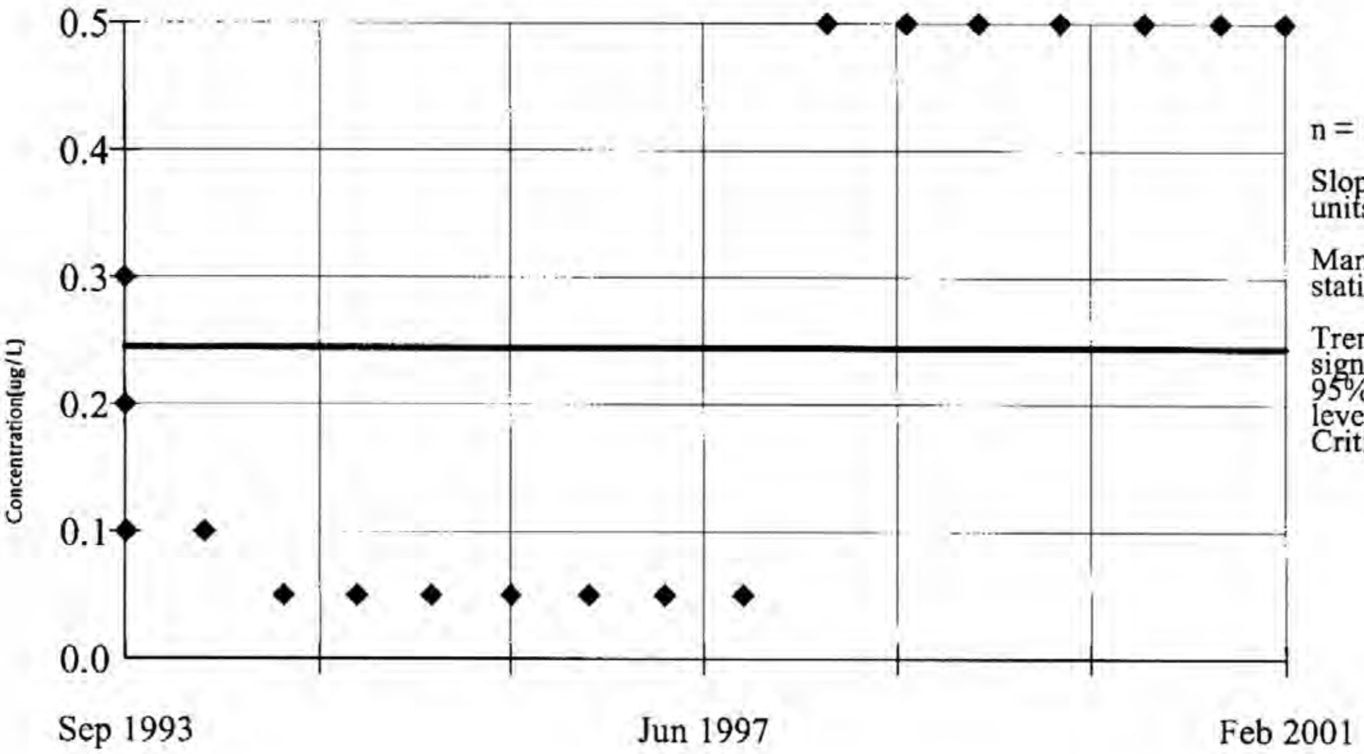
Constituent: Cadmium Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR

GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 42.

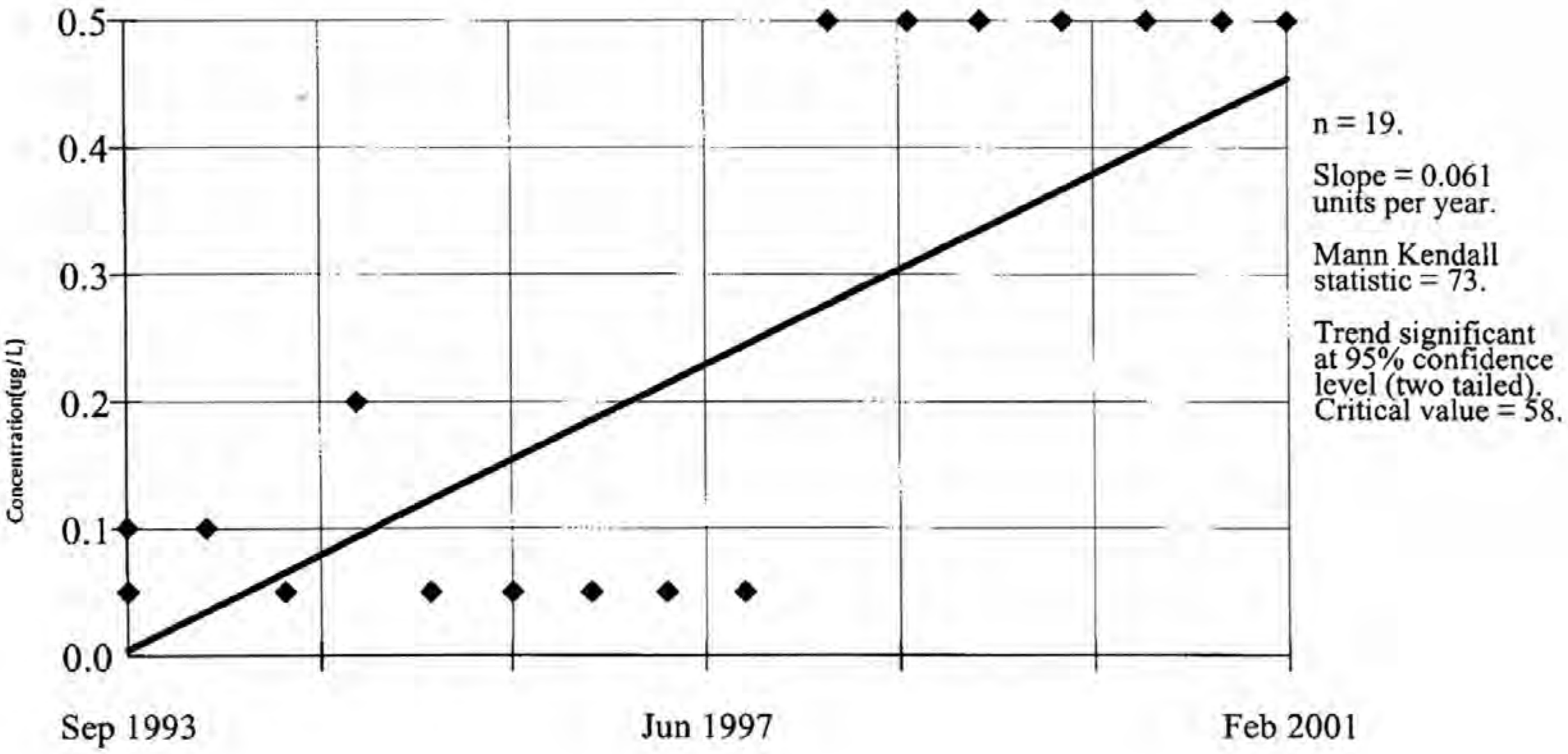
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Cadmium Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0.061 units per year.

Mann Kendall statistic = 73.

Trend significant at 95% confidence level (two tailed). Critical value = 58.

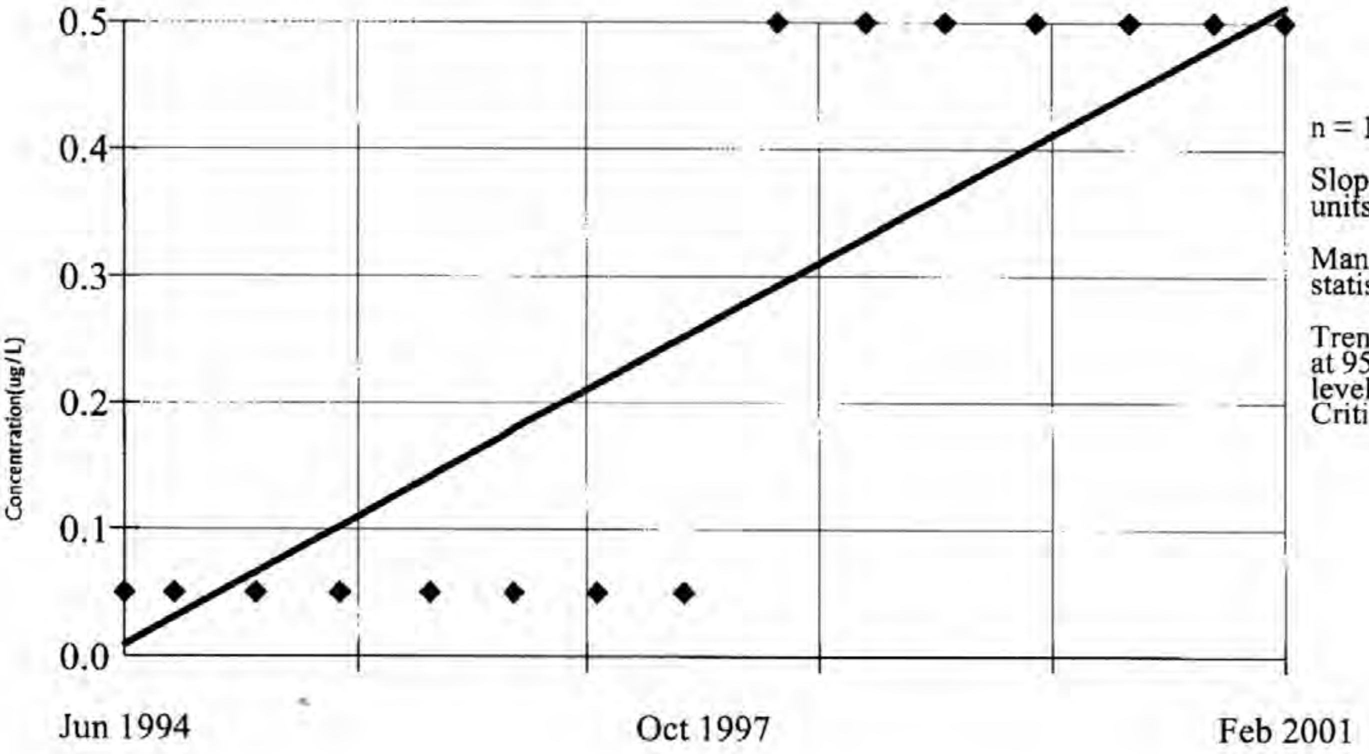
Constituent: Cadmium Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR

GW-8



n = 15.

Slope = 0.075 units per year.

Mann Kendall statistic = 56.

Trend significant at 95% confidence level (two tailed). Critical value = 41.

Constituent: Cadmium Total (ug/L)

Date: 3/27/01, 10:21 AM

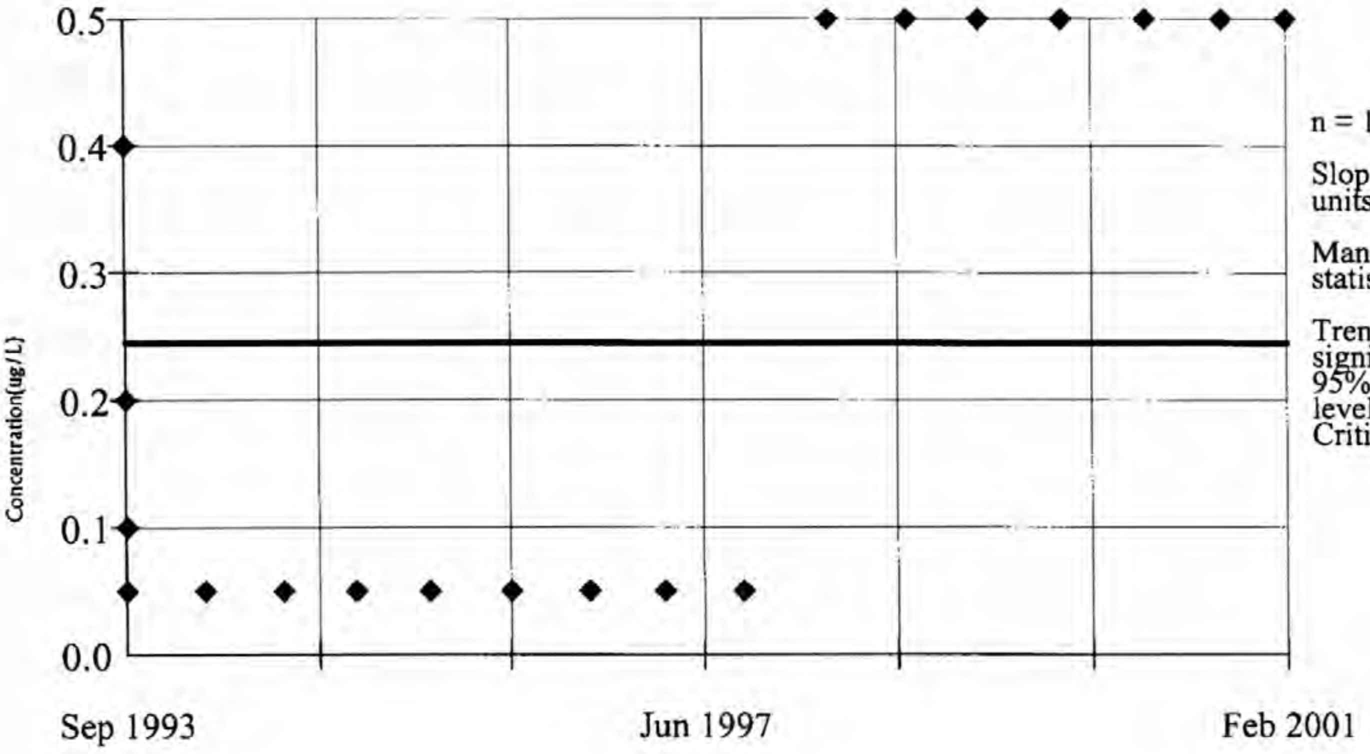
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 56.

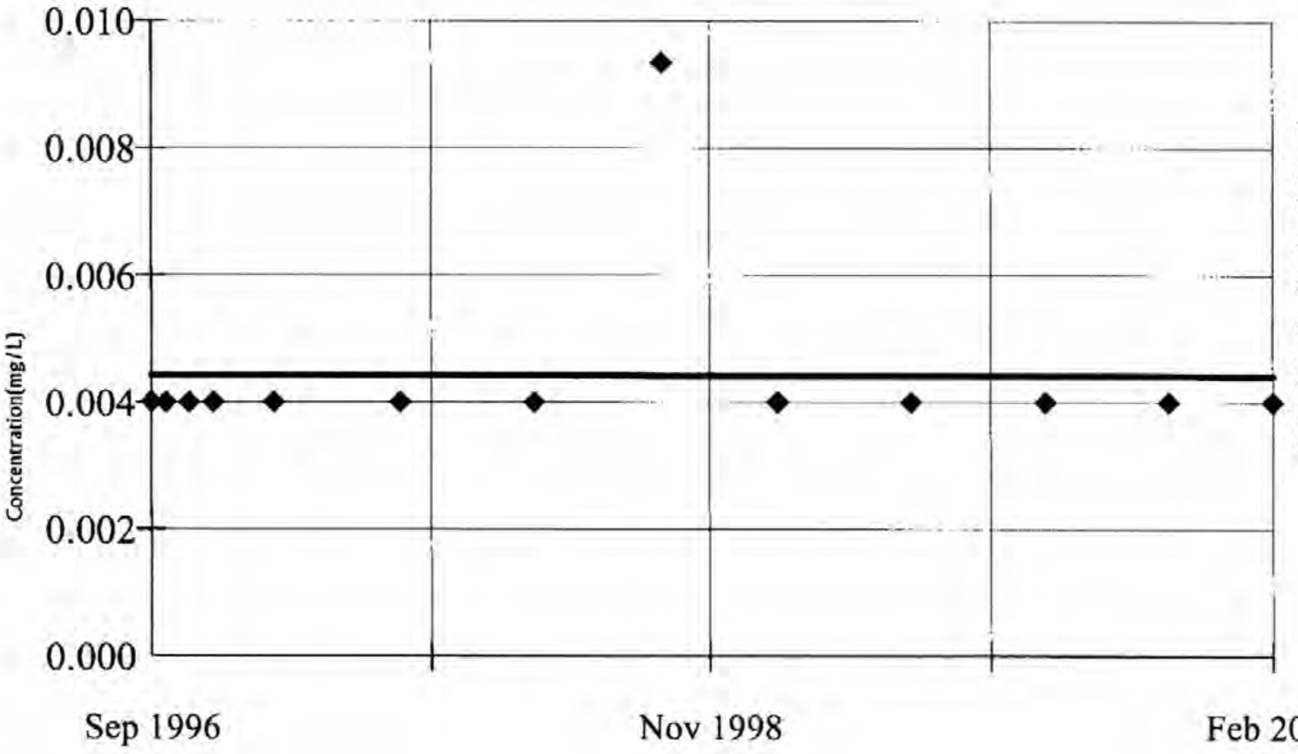
Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Cadmium Total (ug/L)
Date: 3/27/01, 10:21 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 2.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

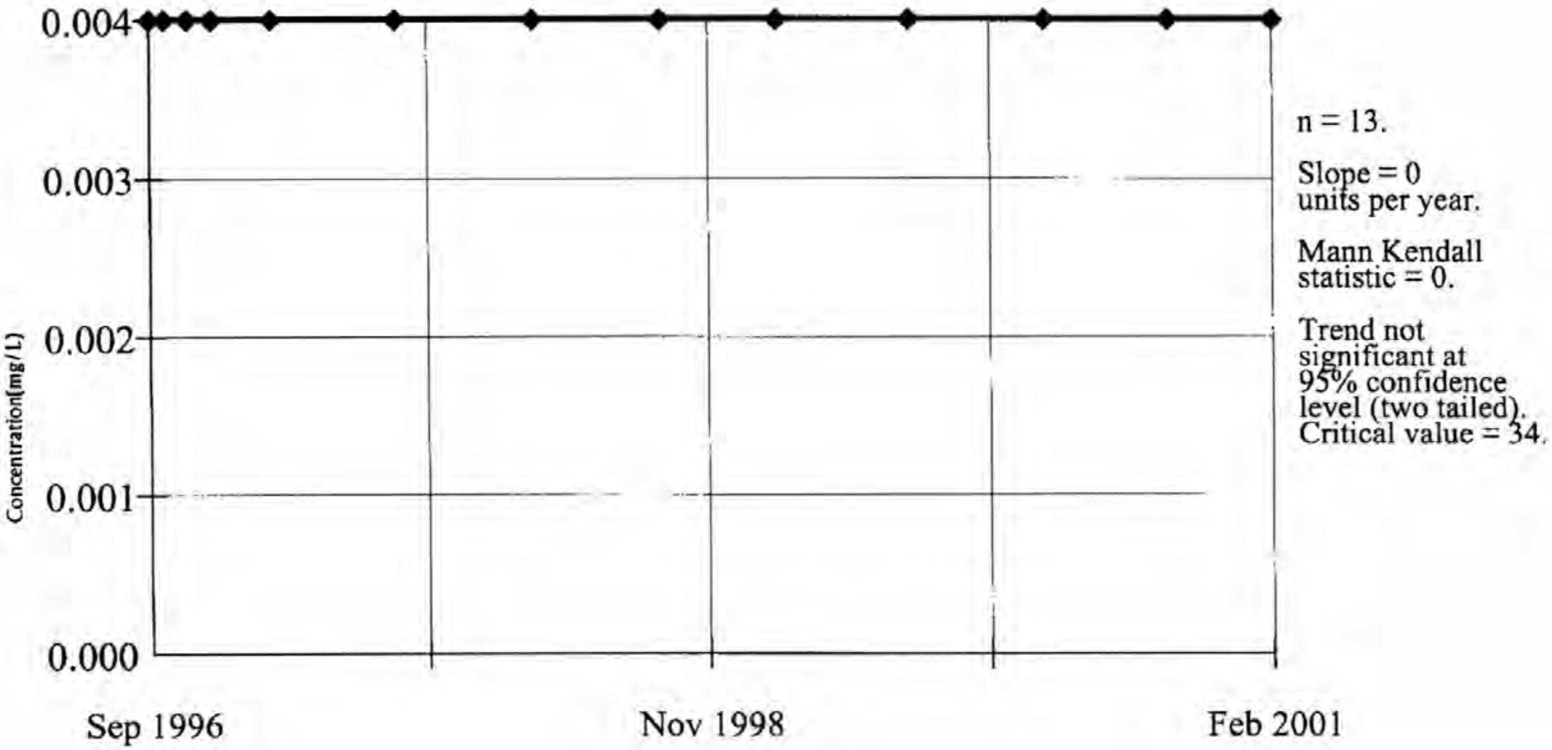
Constituent: Chromium Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

v.7.501. CAS# n/a EPA Sanitas™

SEN'S SLOPE ESTIMATOR
GW-5

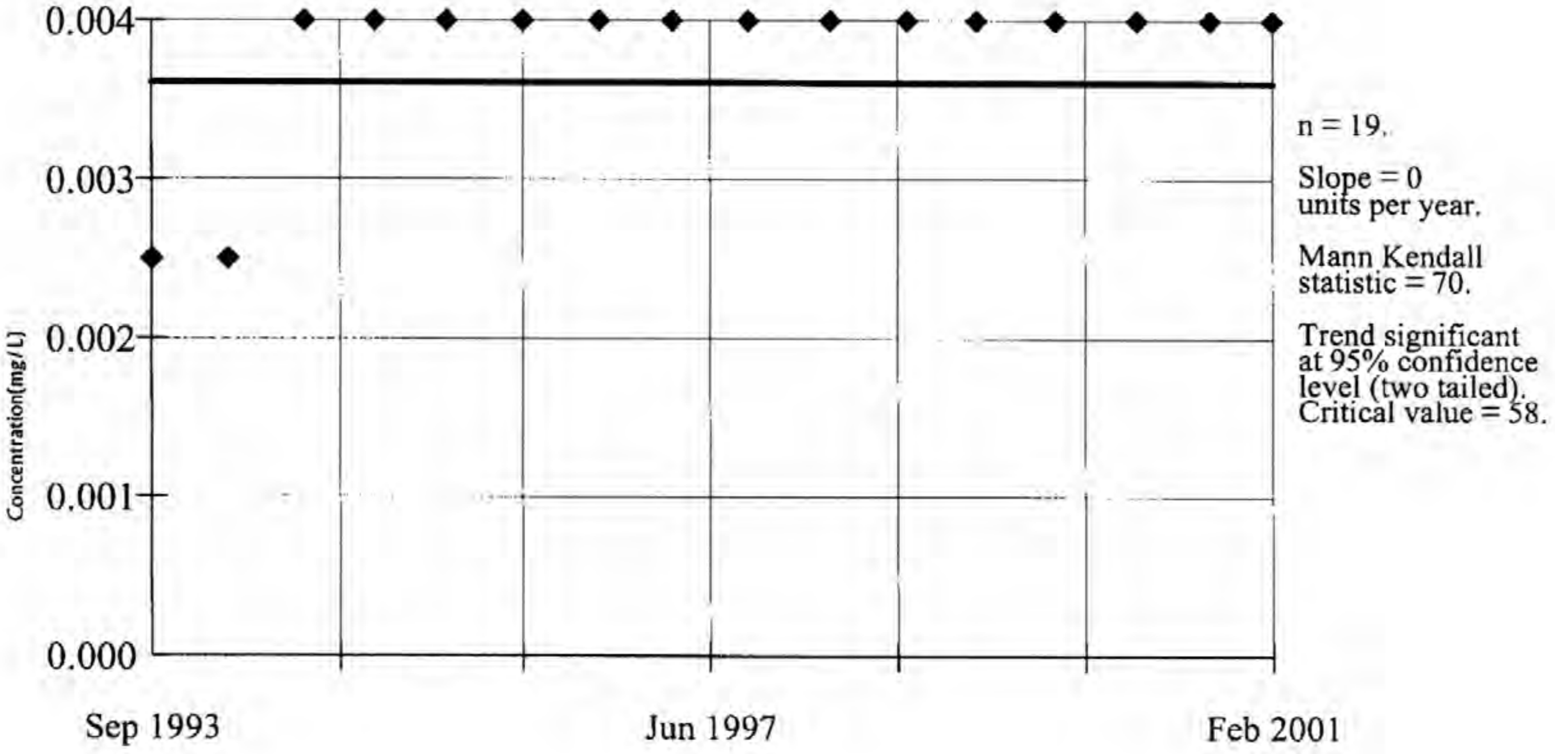


Constituent: Chromium Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6

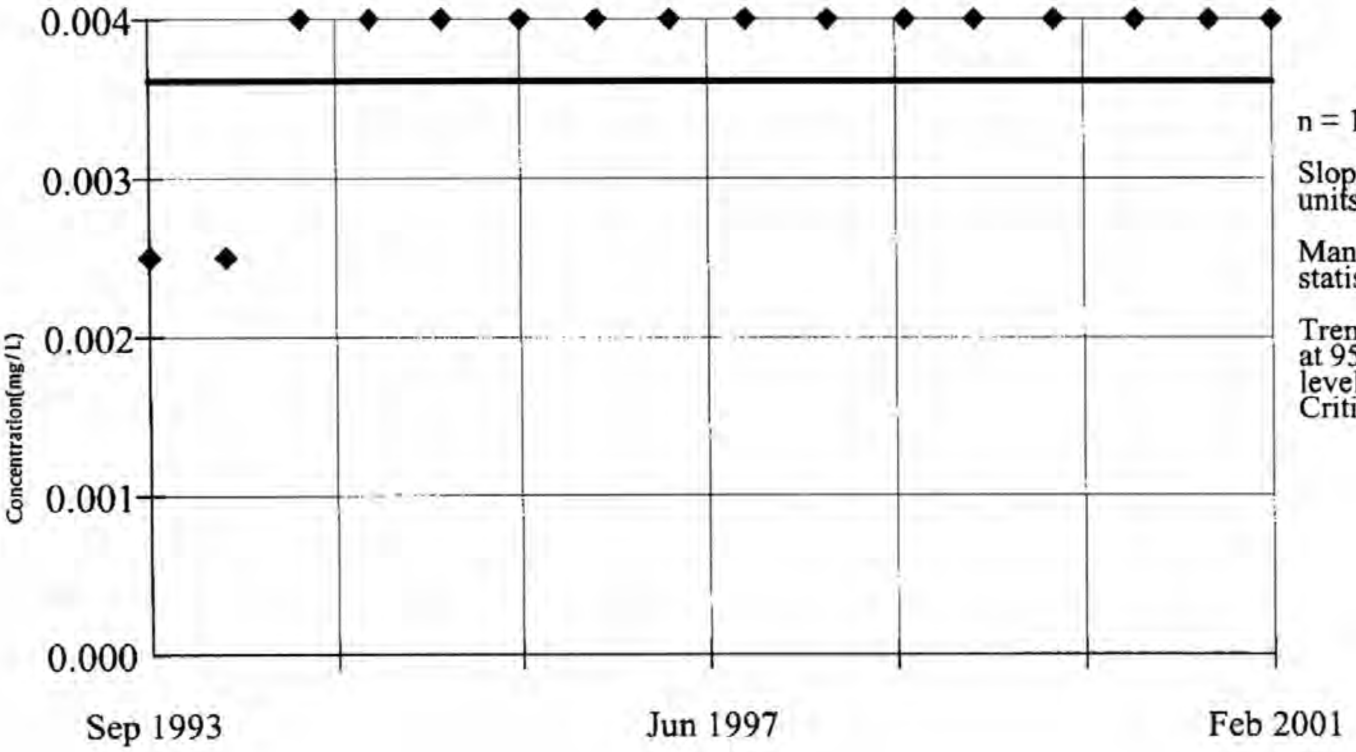


Constituent: Chromium Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 70.

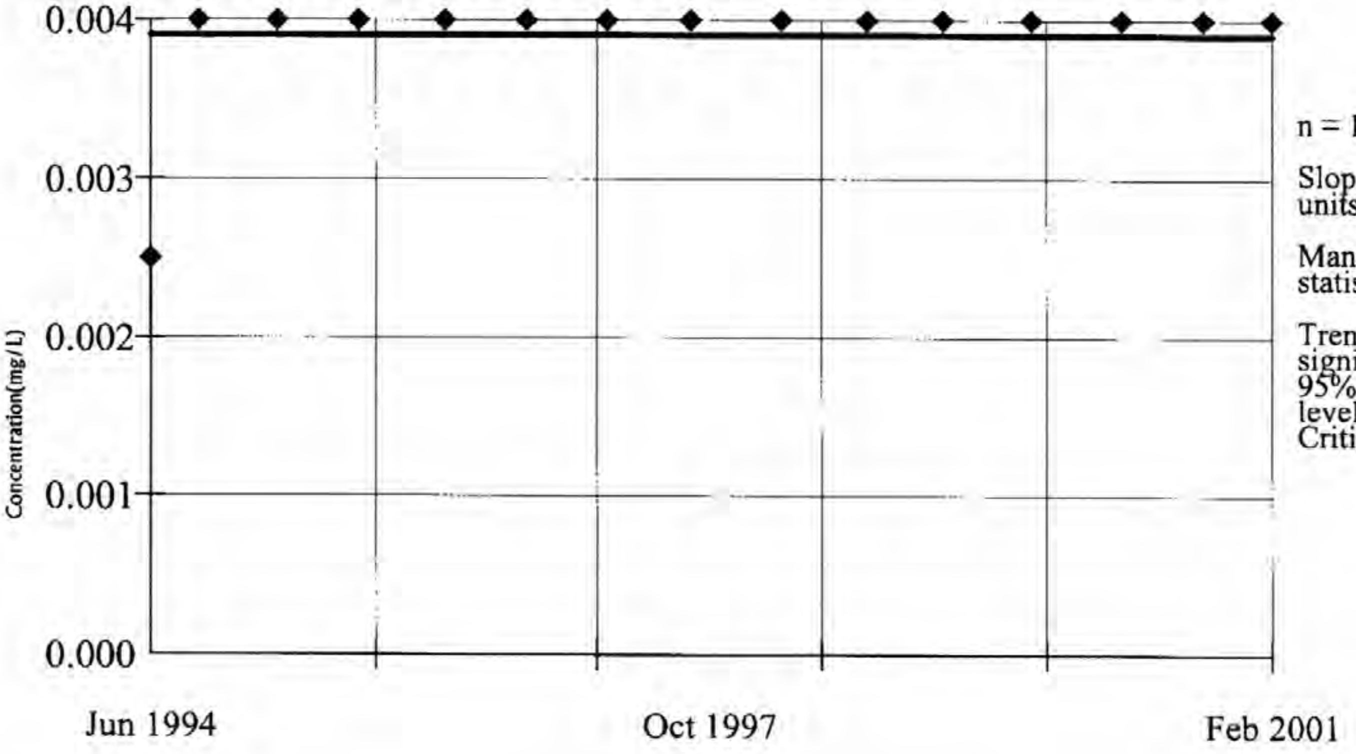
Trend significant
at 95% confidence
level (two tailed).
Critical value = 58.

Constituent: Chromium Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0 units per year.

Mann Kendall statistic = 14.

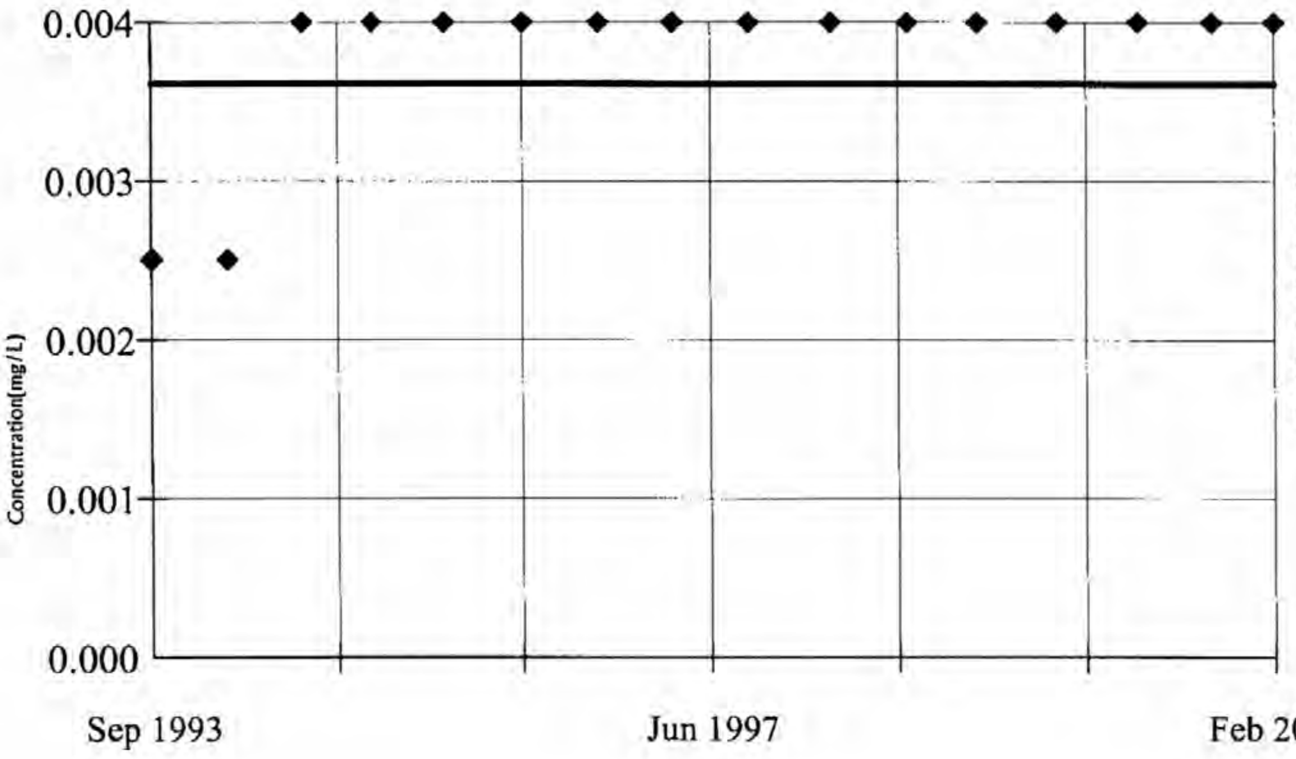
Trend not significant at 95% confidence level (two tailed). Critical value = 41.

Constituent: Chromium Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 70.

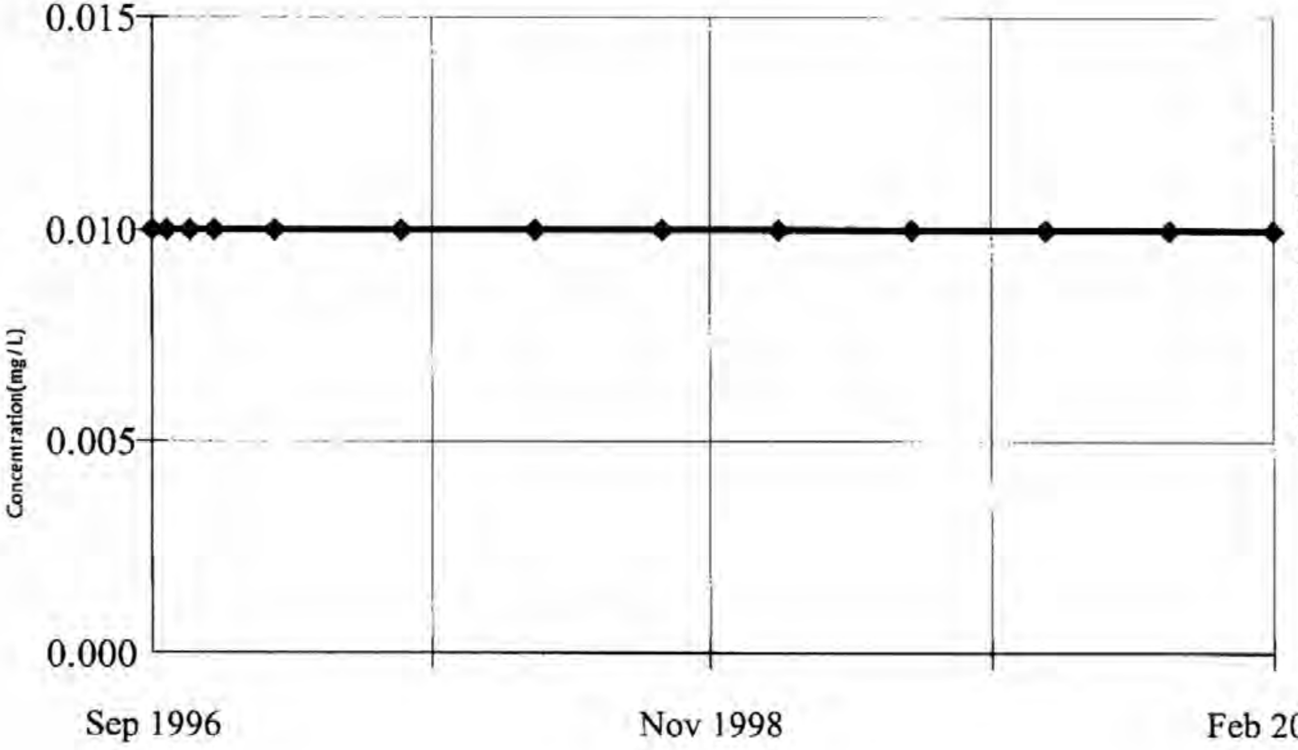
Trend significant
at 95% confidence
level (two tailed).
Critical value = 58.

Constituent: Chromium Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = 0.

Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Cobalt Total (mg/L)

Date: 3/27/01, 10:22 AM

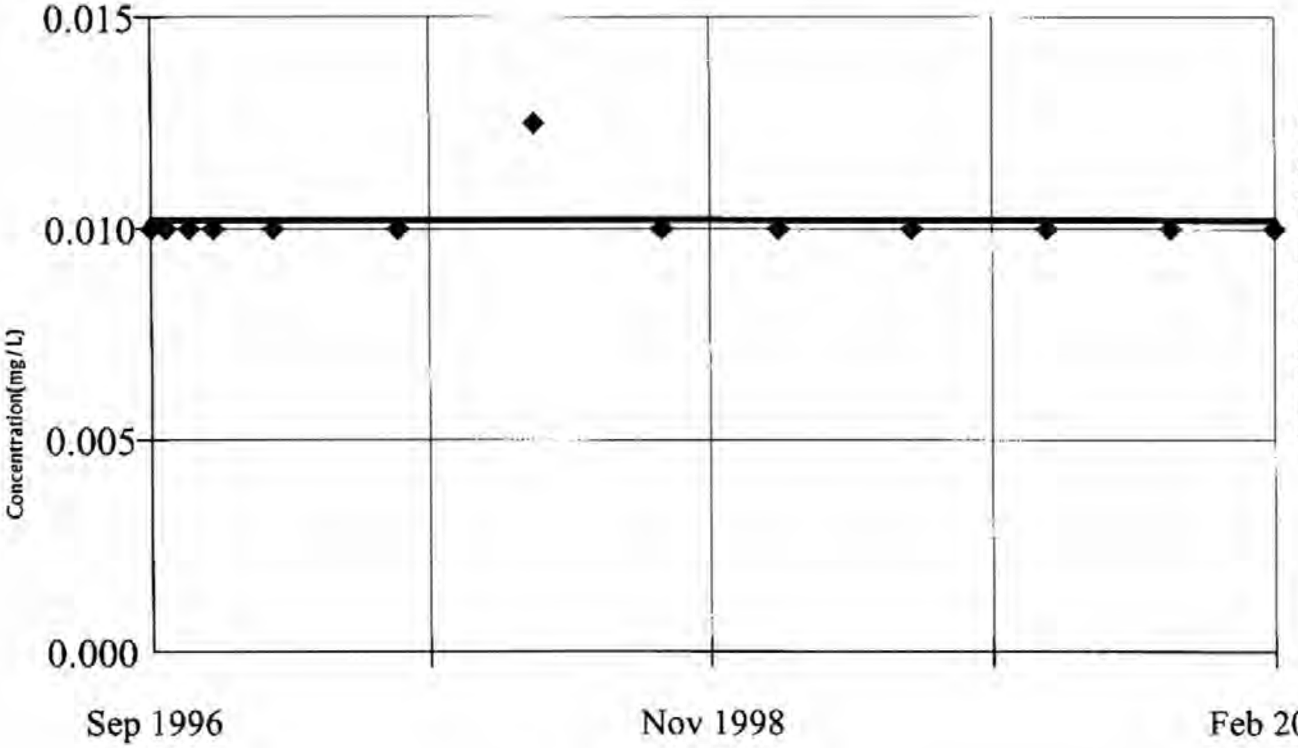
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

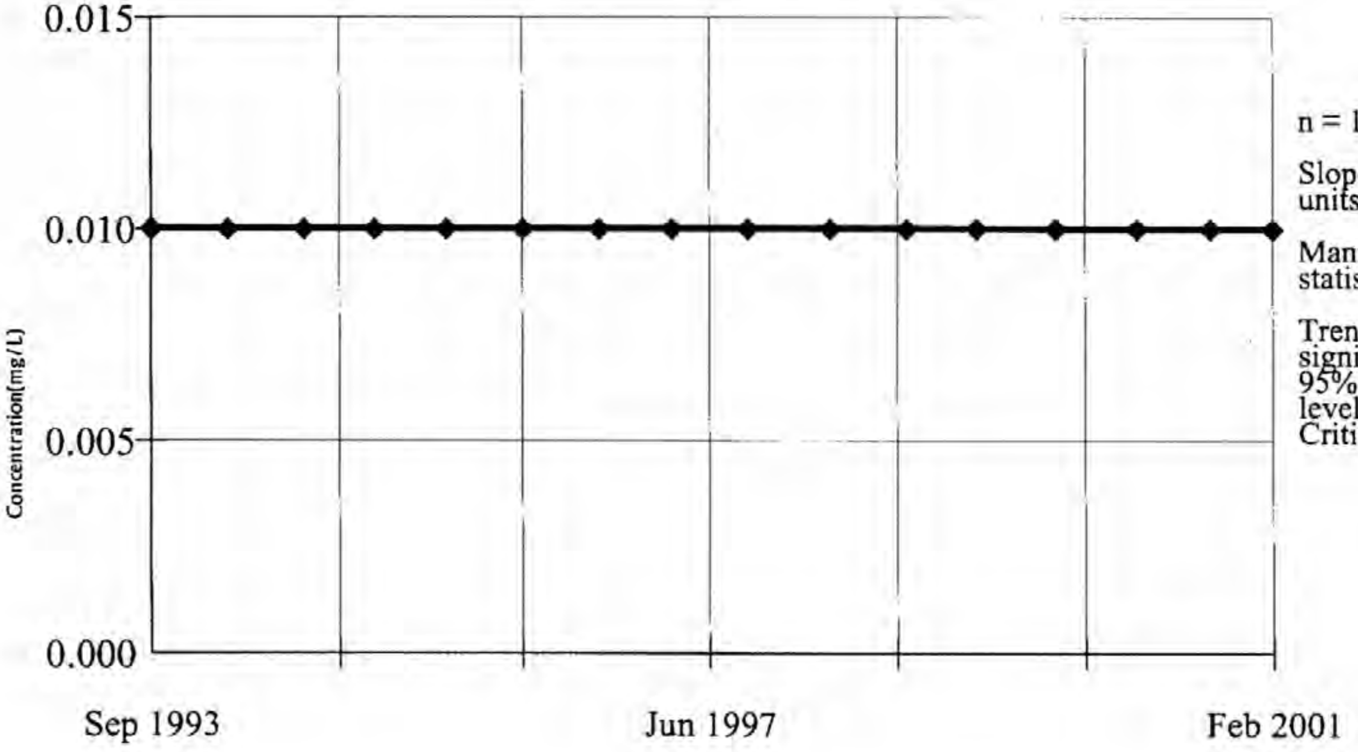
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Cobalt Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 0.

Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Cobalt Total (mg/L)

Date: 3/27/01, 10:22 AM

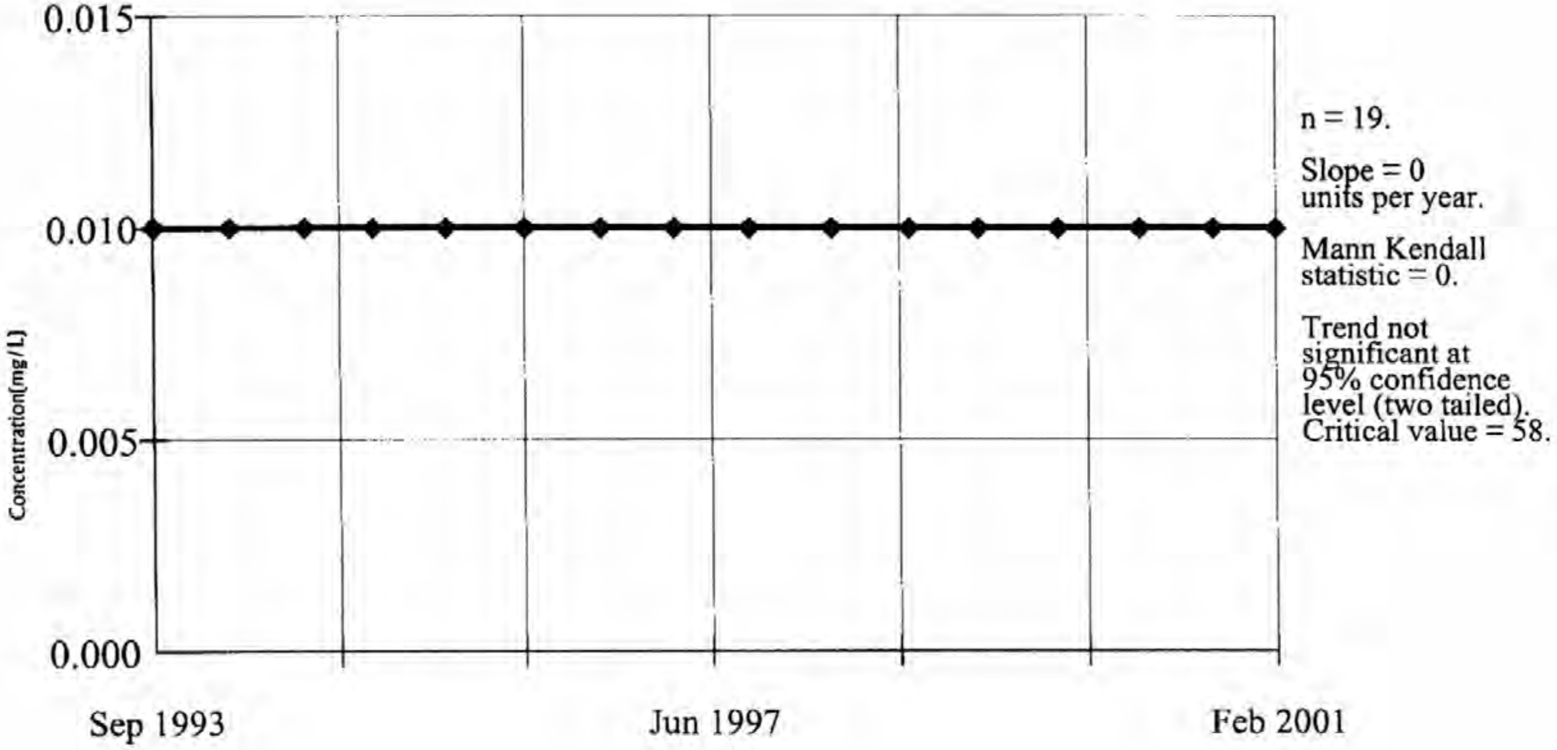
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7

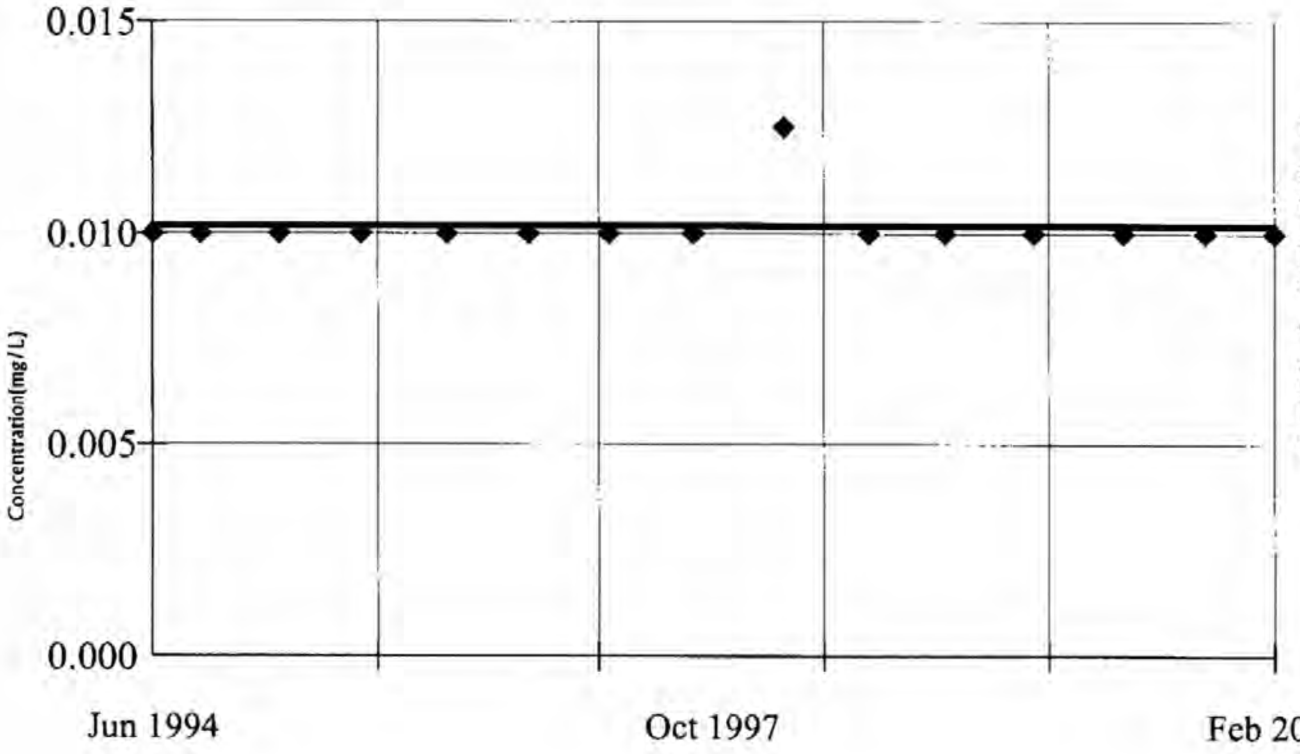


Constituent: Cobalt Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0
units per year.

Mann Kendall
statistic = 2.

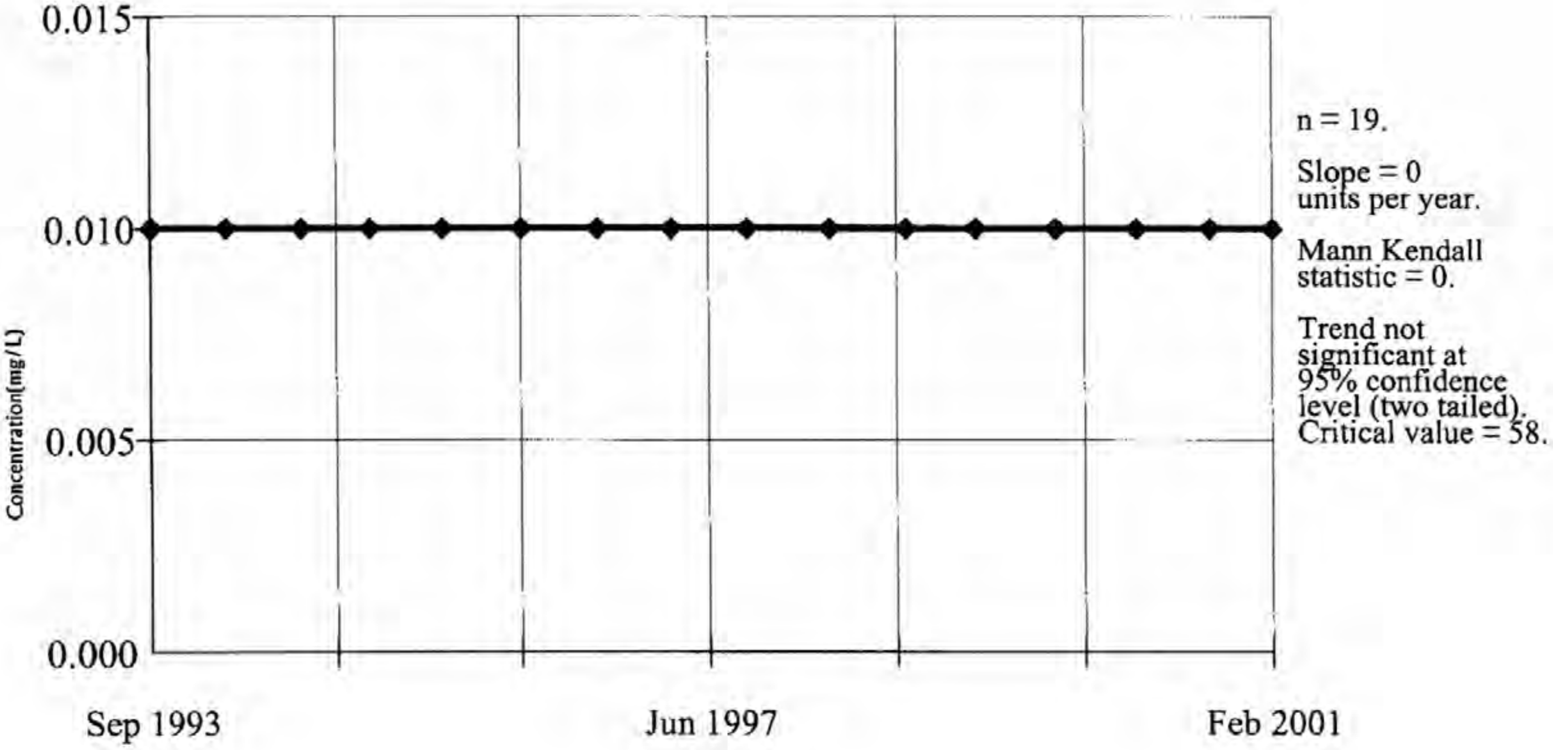
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 41.

Constituent: Cobalt Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 0.

Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Cobalt Total (mg/L)

Date: 3/27/01, 10:22 AM

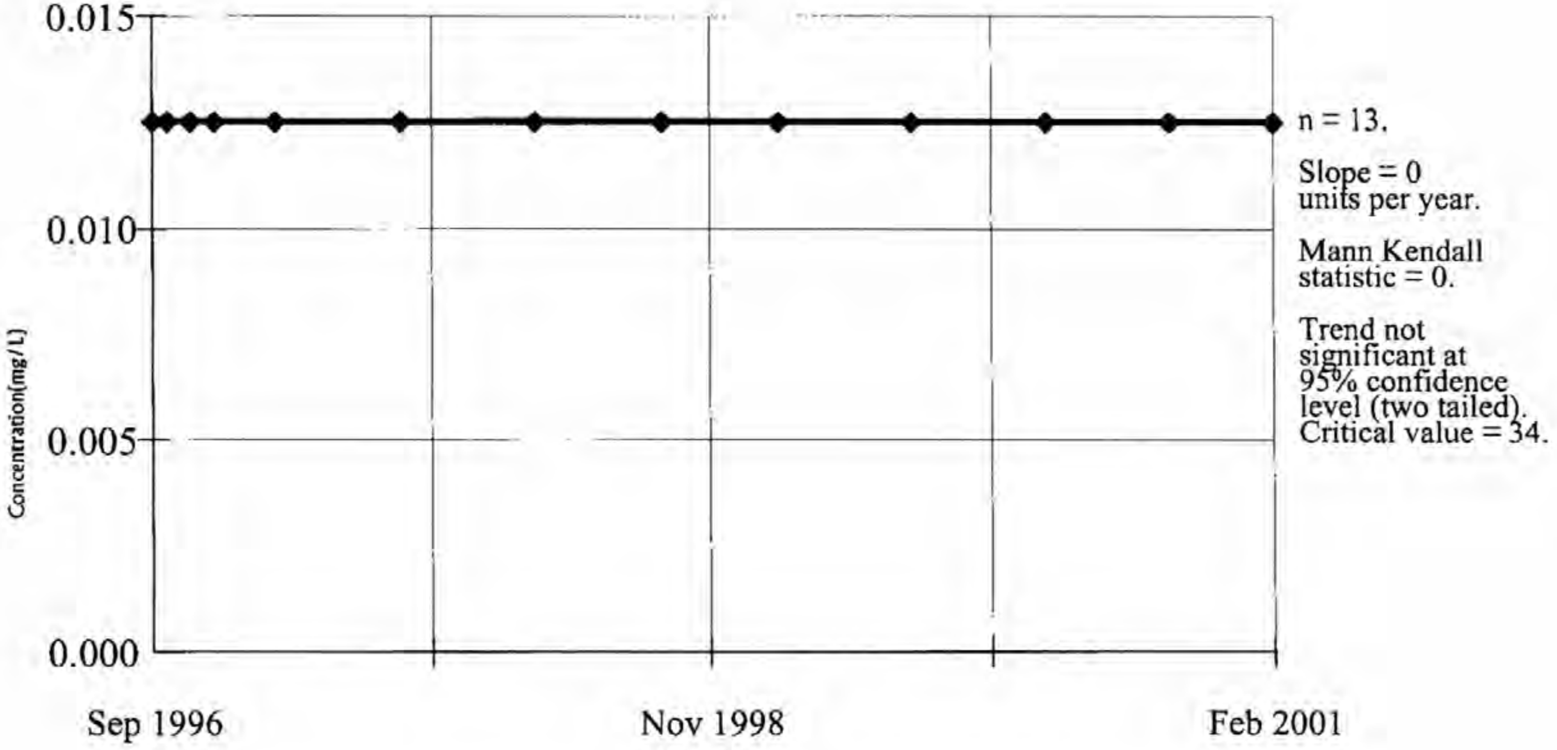
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4

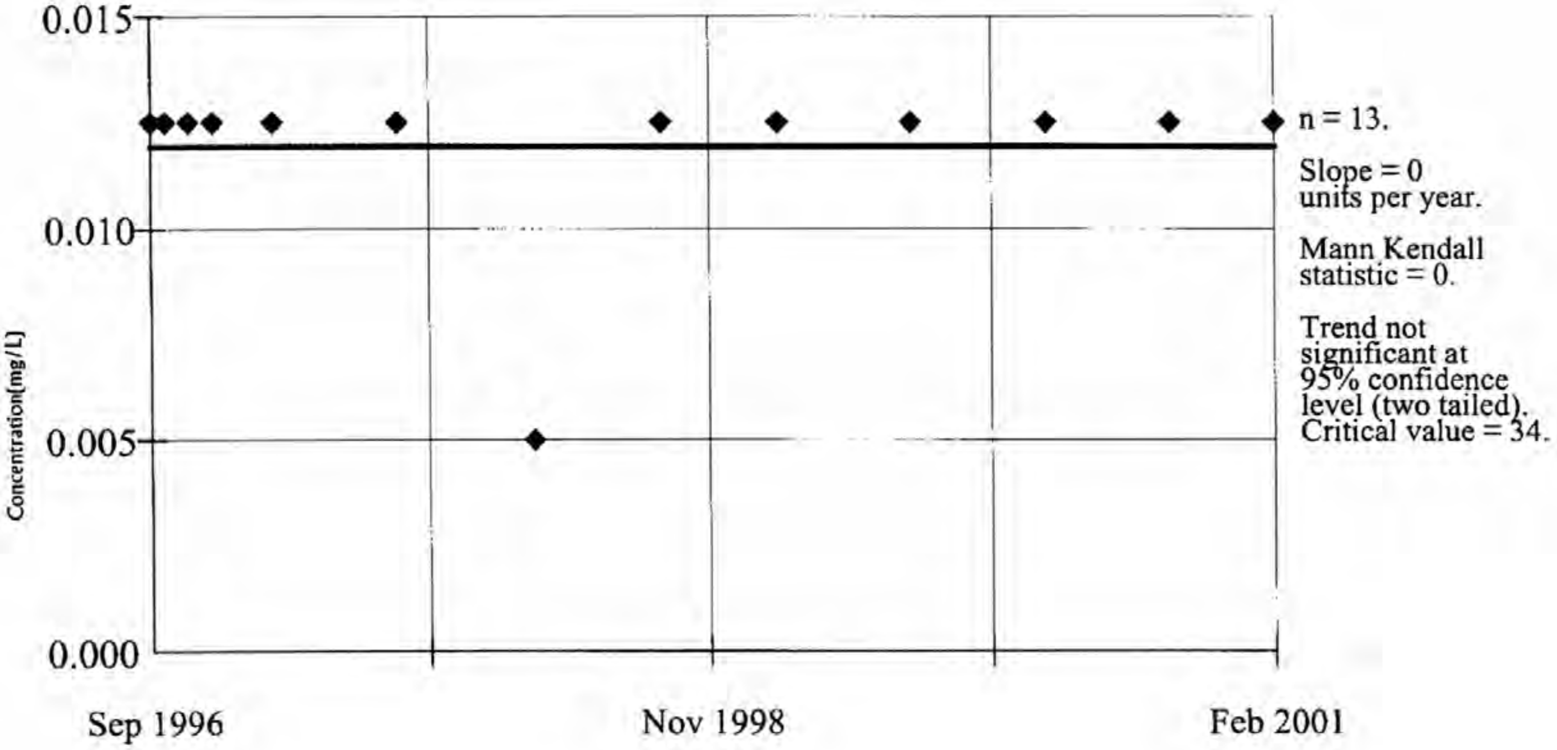


Constituent: Copper Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5

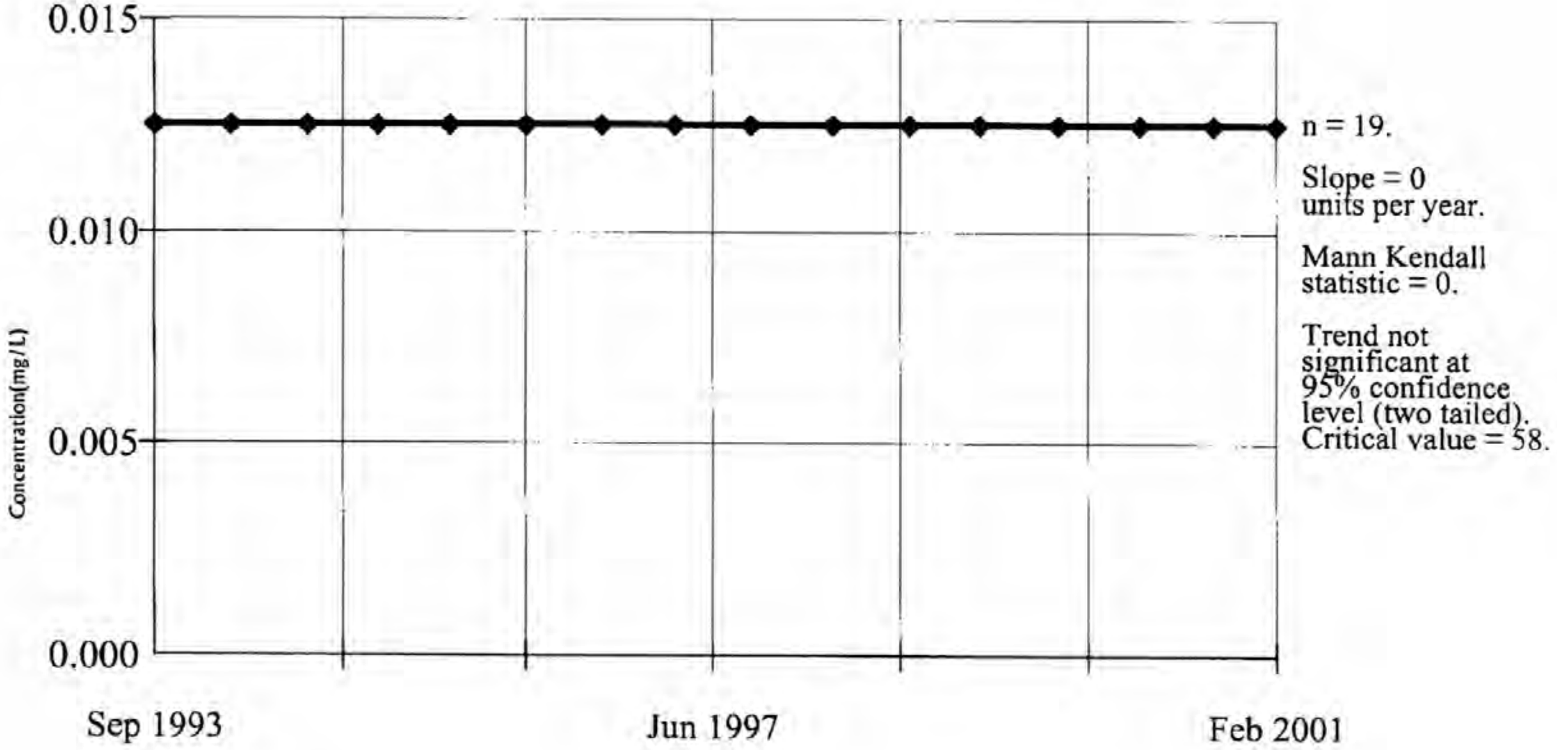


Constituent: Copper Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6

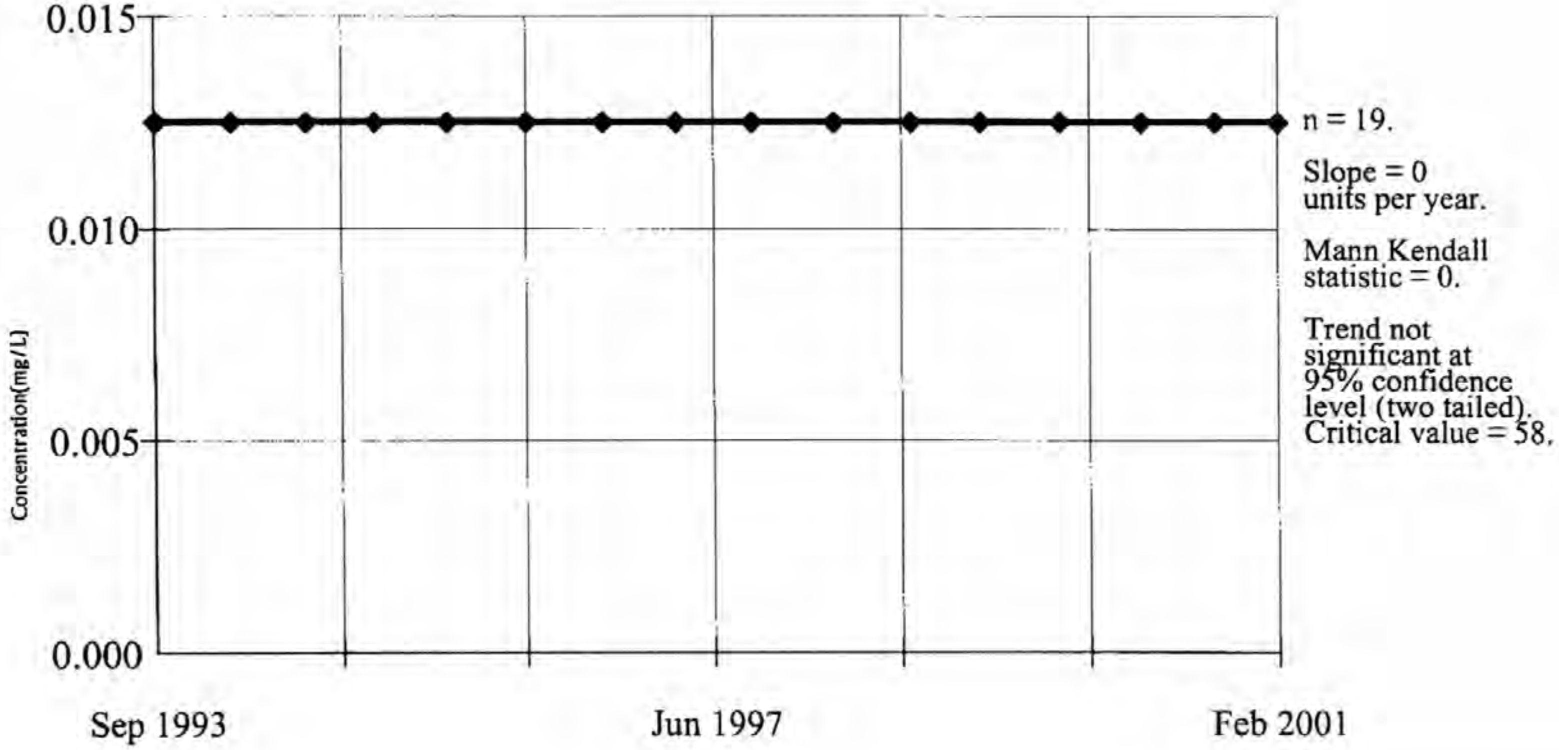


Constituent: Copper Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7

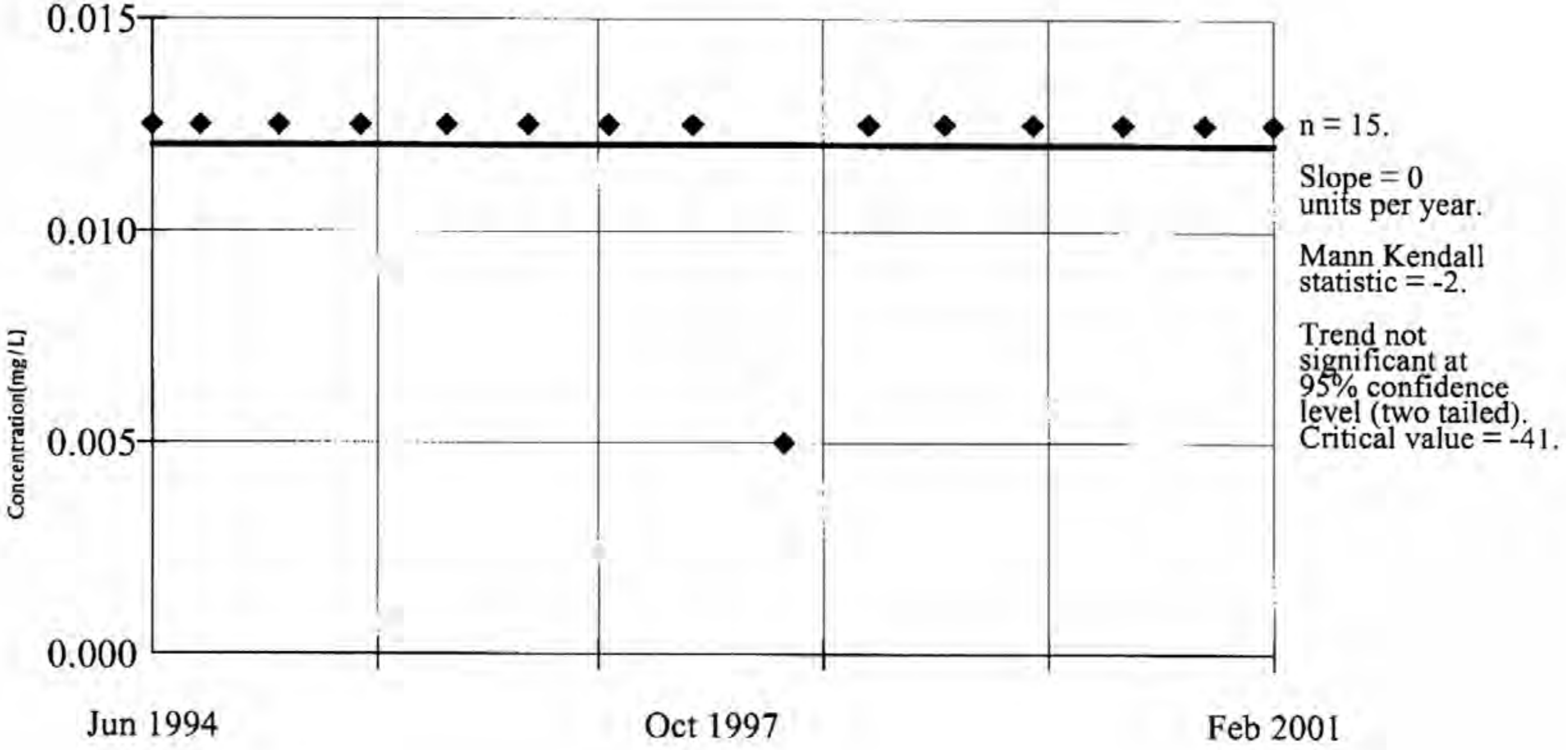


Constituent: Copper Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



Constituent: Copper Total (mg/L)

Date: 3/27/01, 10:22 AM

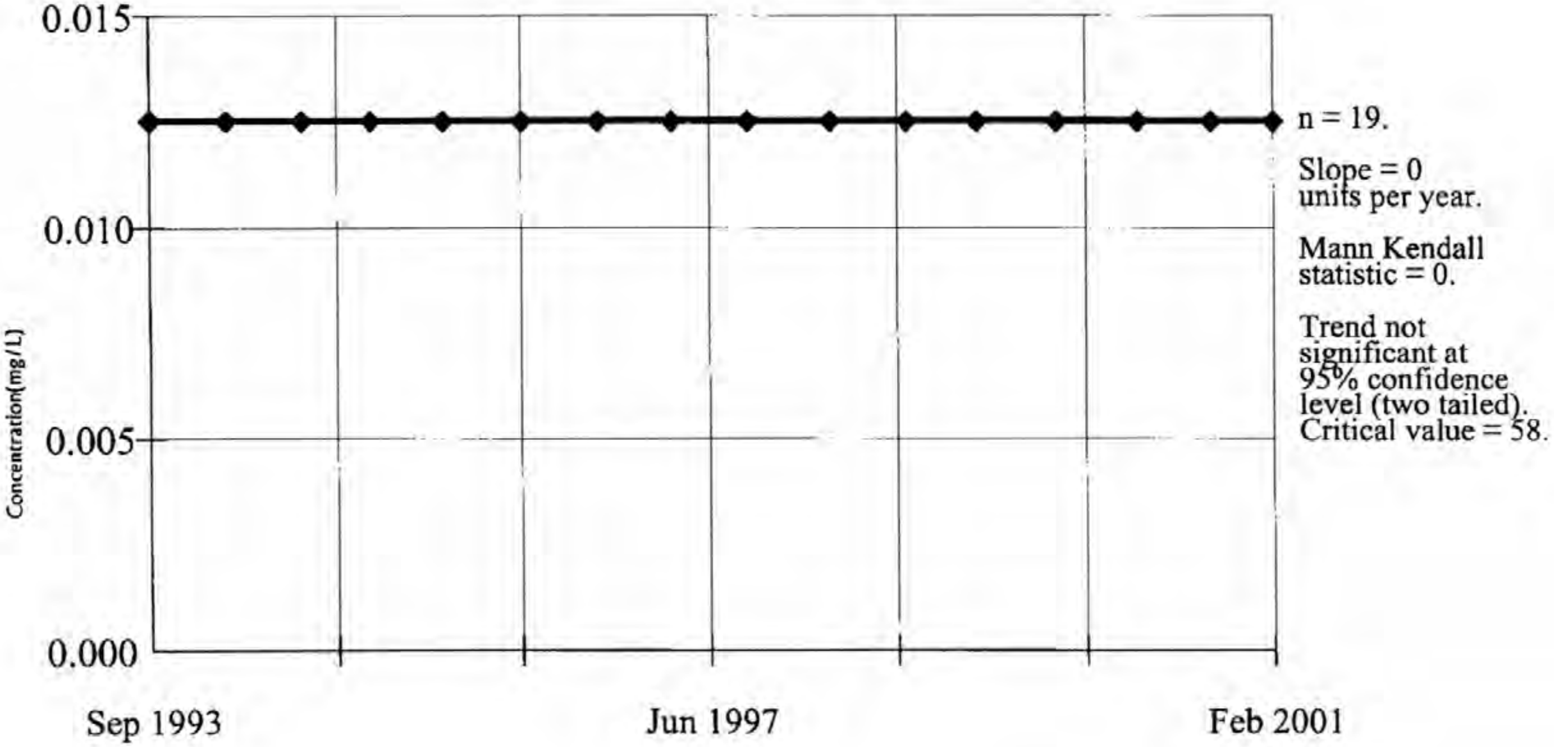
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1

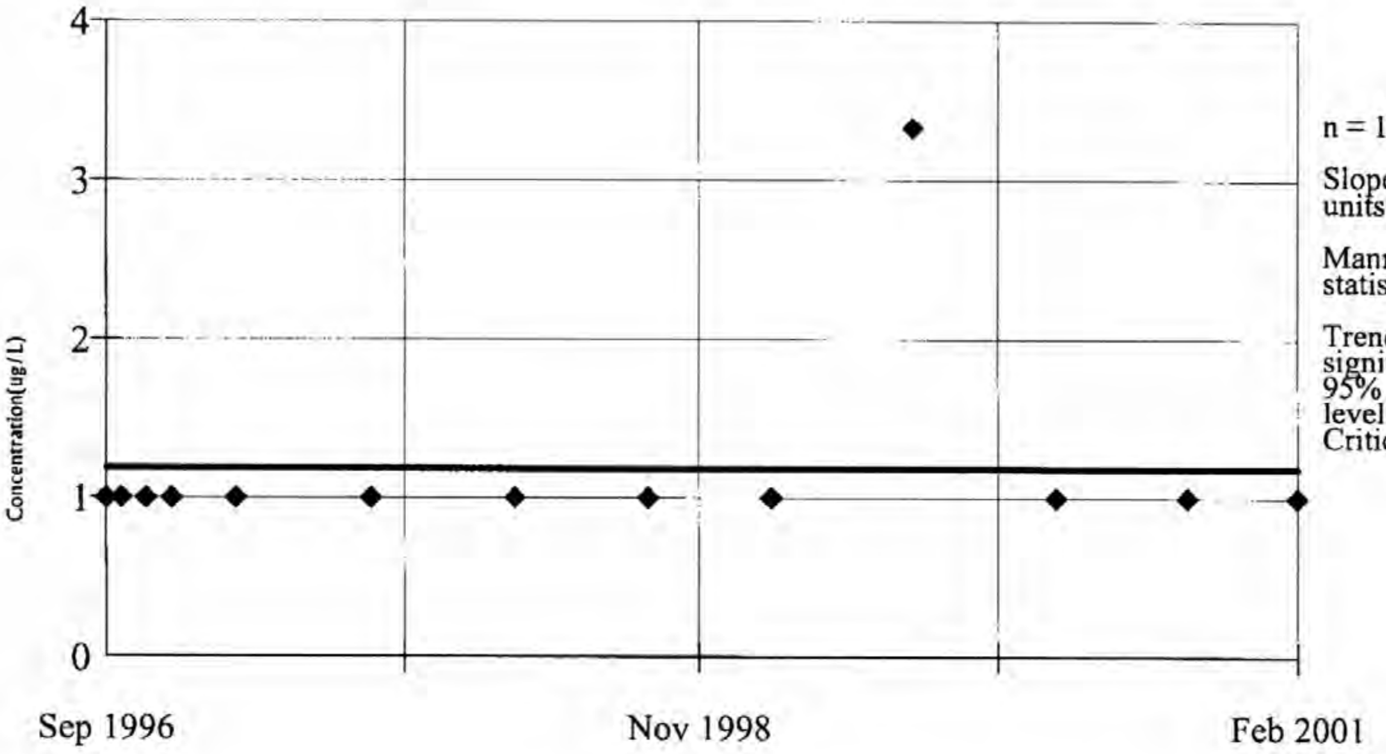


Constituent: Copper Total (mg/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 6.

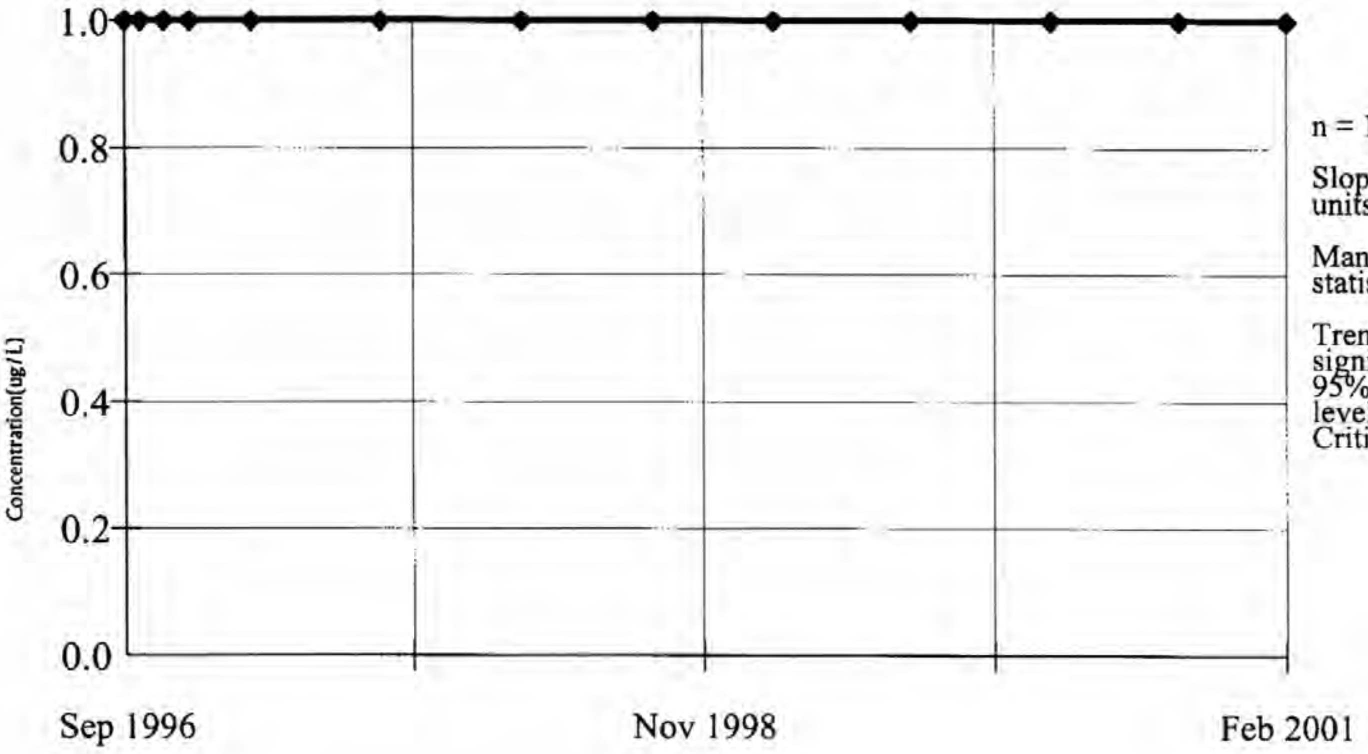
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Lead Total (ug/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

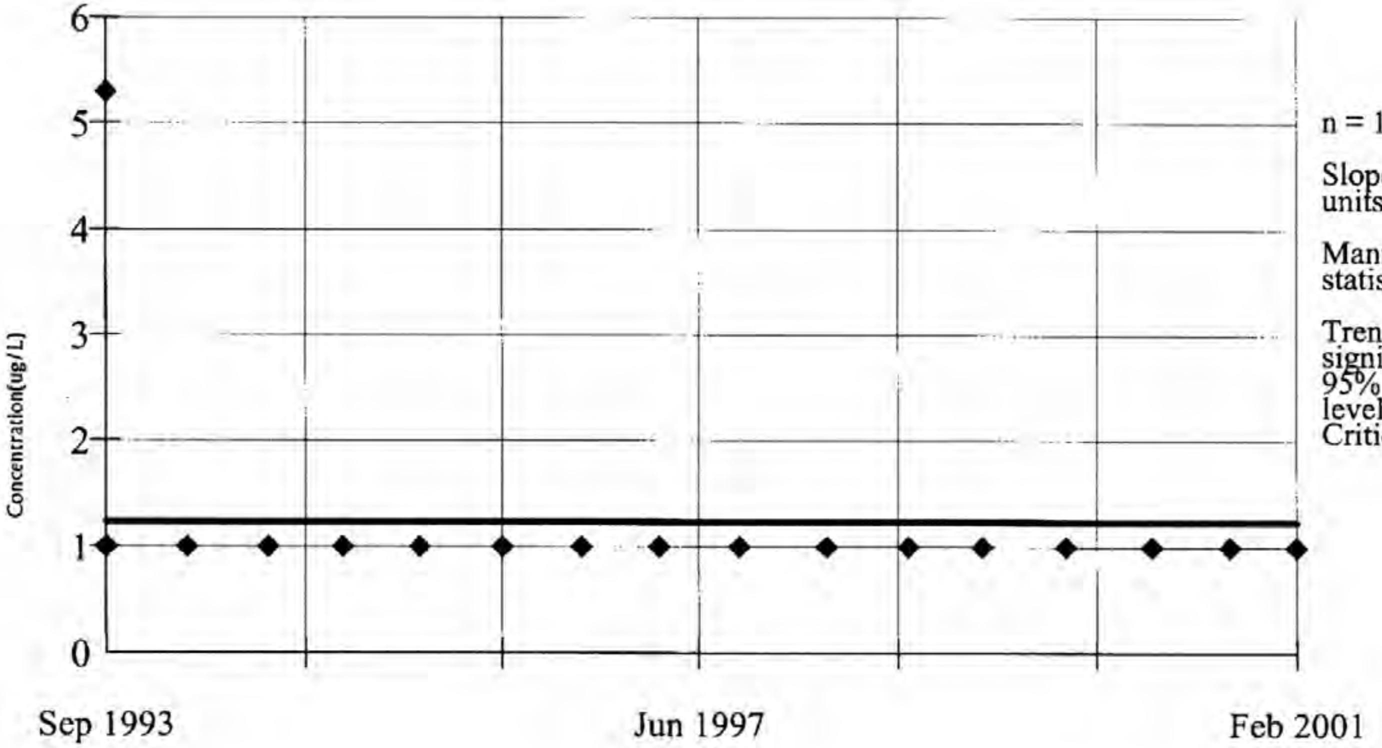
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Lead Total (ug/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0
units per year.

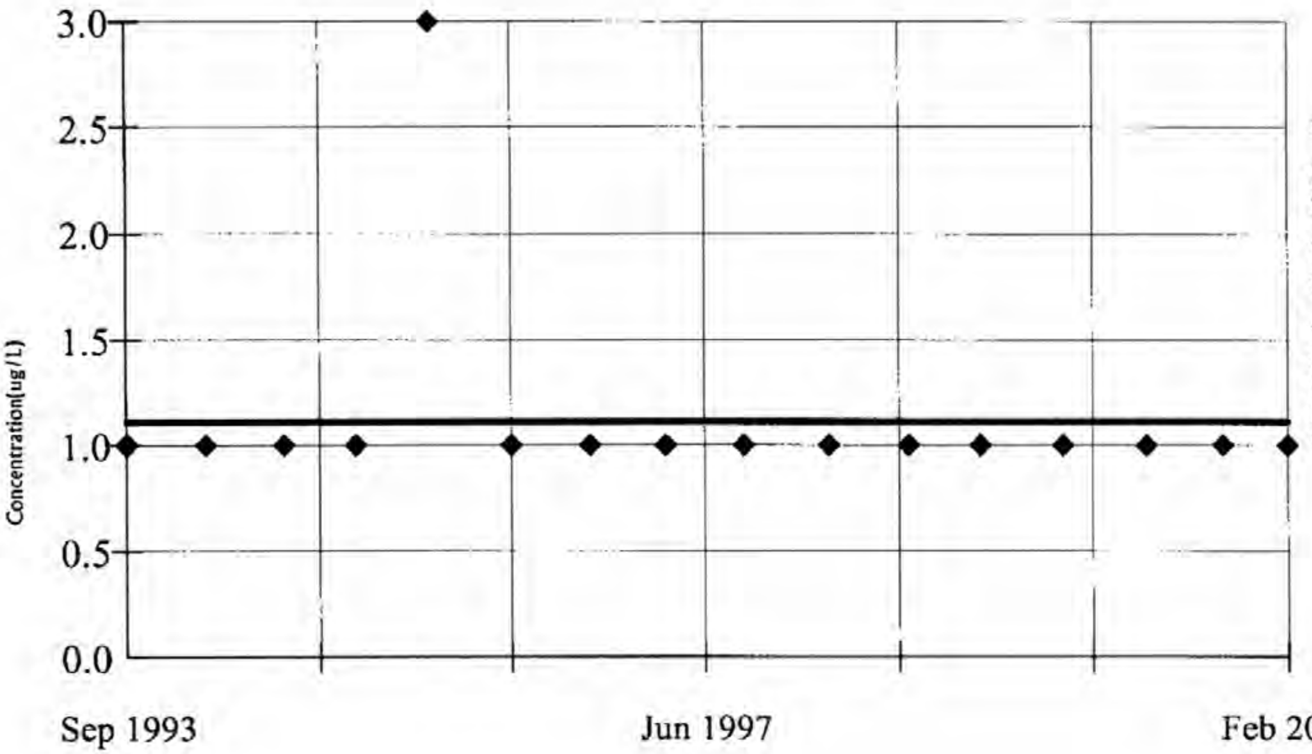
Mann Kendall
statistic = -14.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = -58.

Constituent: Lead Total (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 3/27/01, 10:22 AM Client: Timberlands LF View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

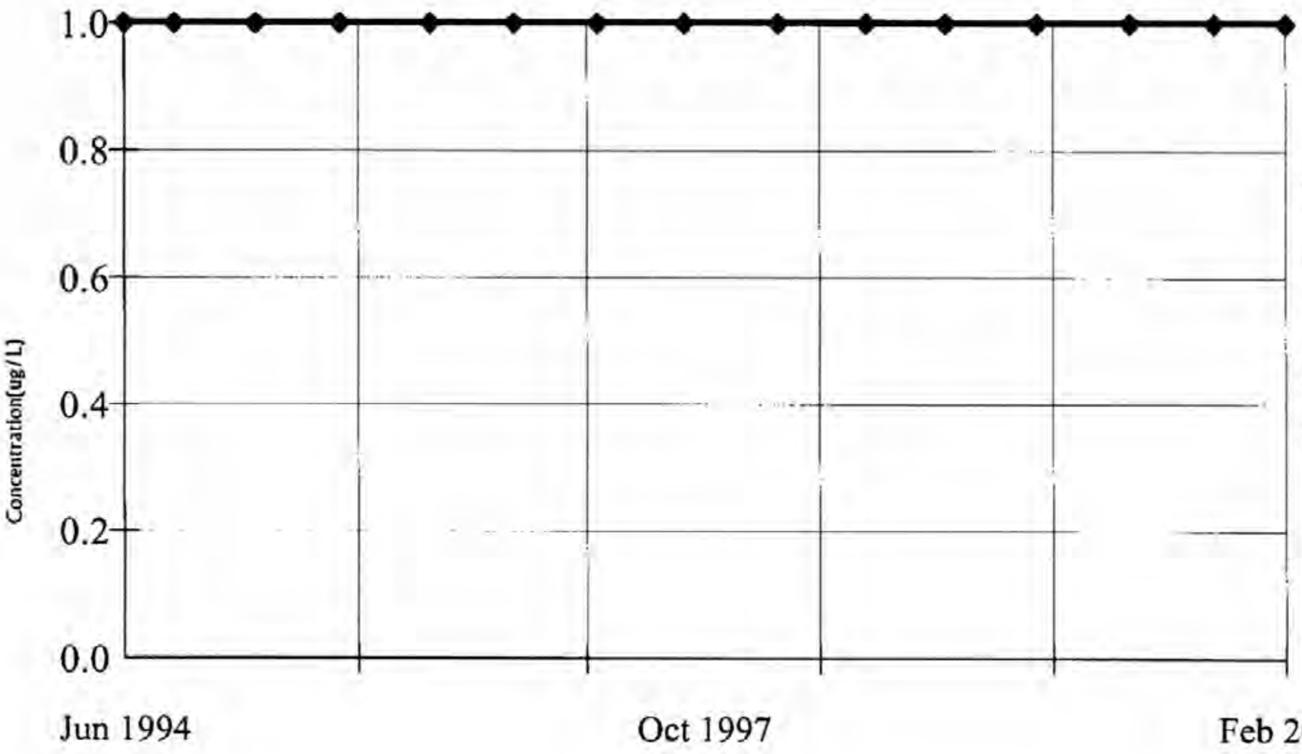
Mann Kendall
statistic = -4.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = -58.

Constituent: Lead Total (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 3/27/01, 10:22 AM Client: Timberlands LF View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

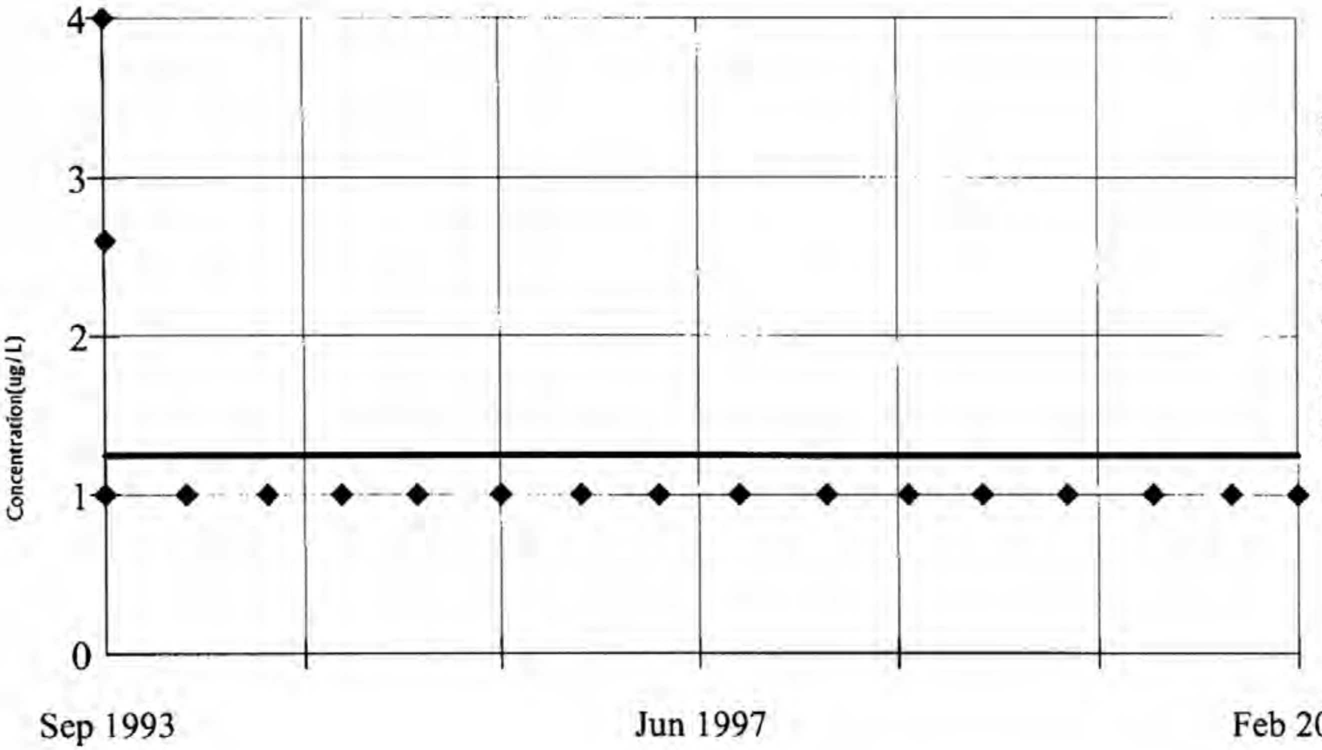
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 41.

Constituent: Lead Total (ug/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = -29.

Trend not significant at 95% confidence level (two tailed). Critical value = -58.

Constituent: Lead Total (ug/L)

Date: 3/27/01, 10:22 AM

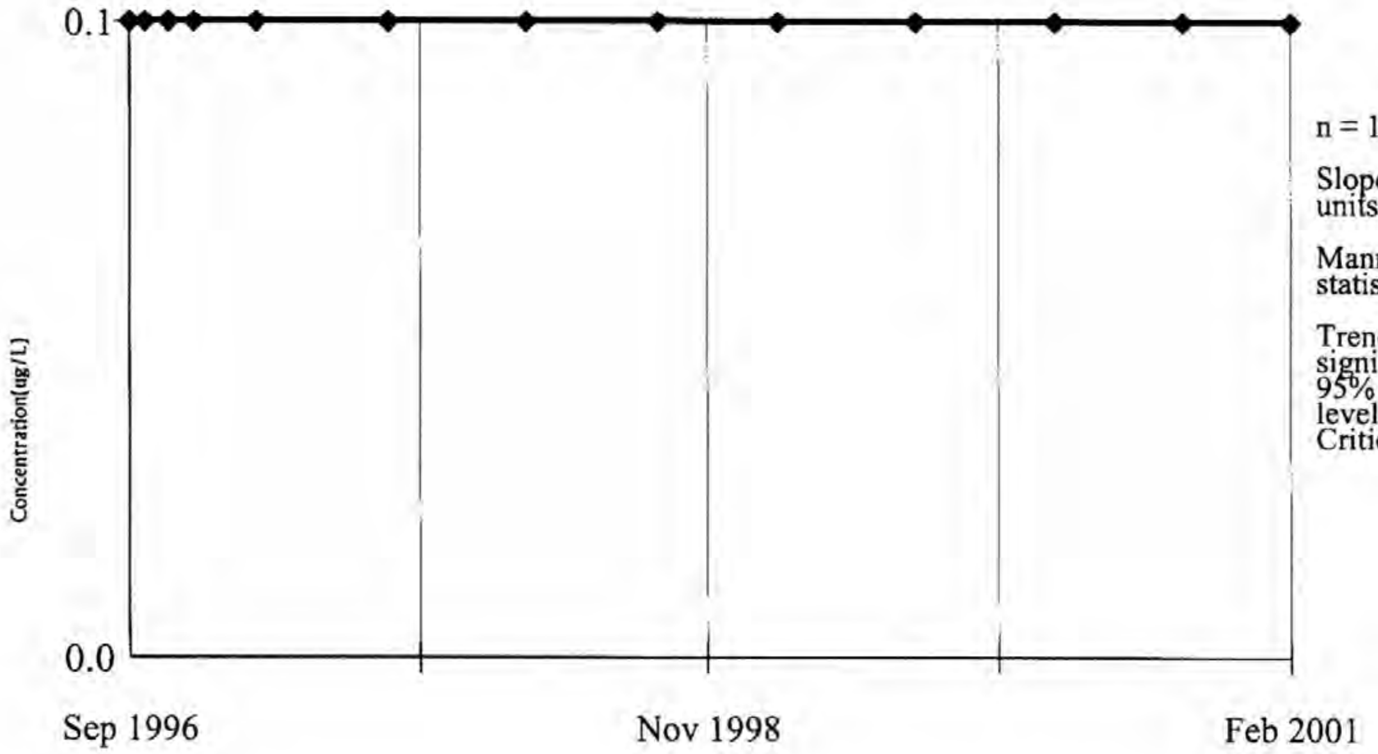
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = 0.

Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Mercury Total (ug/L)

Date: 3/27/01, 10:22 AM

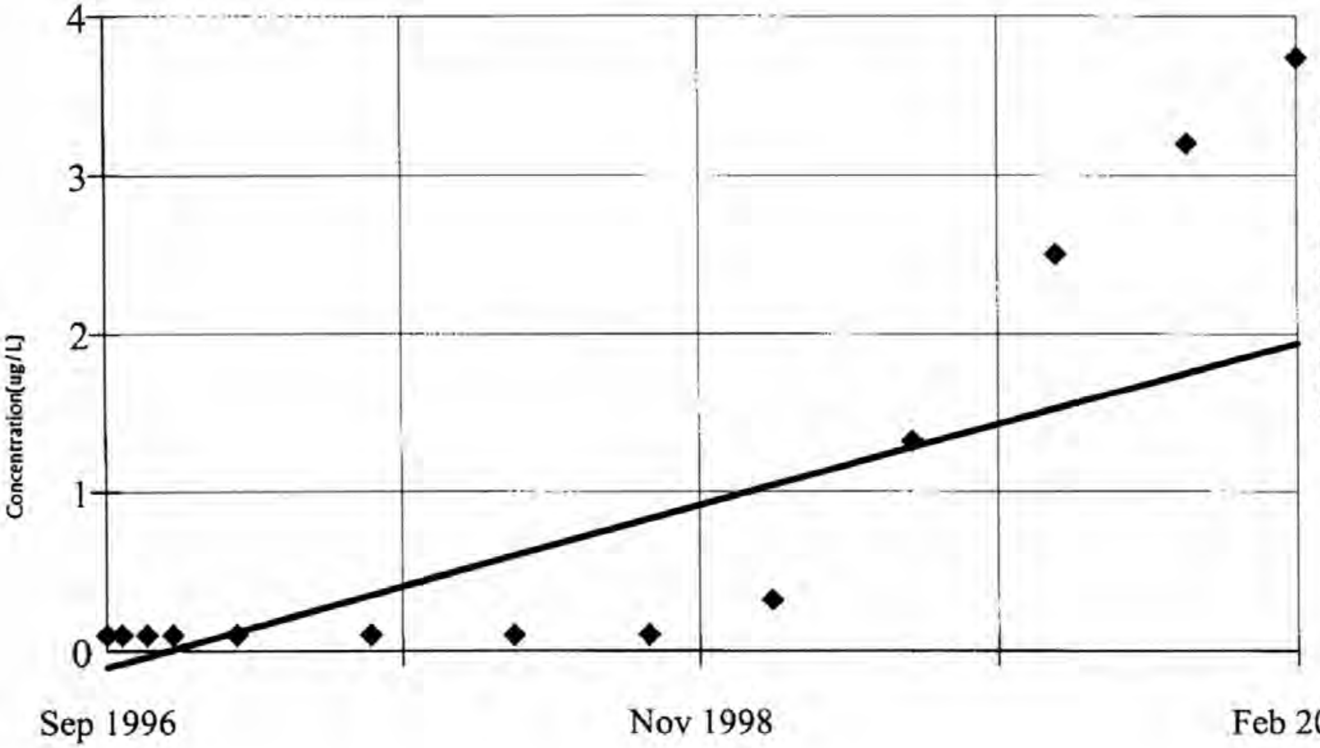
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0.463 units per year.

Mann Kendall statistic = 50.

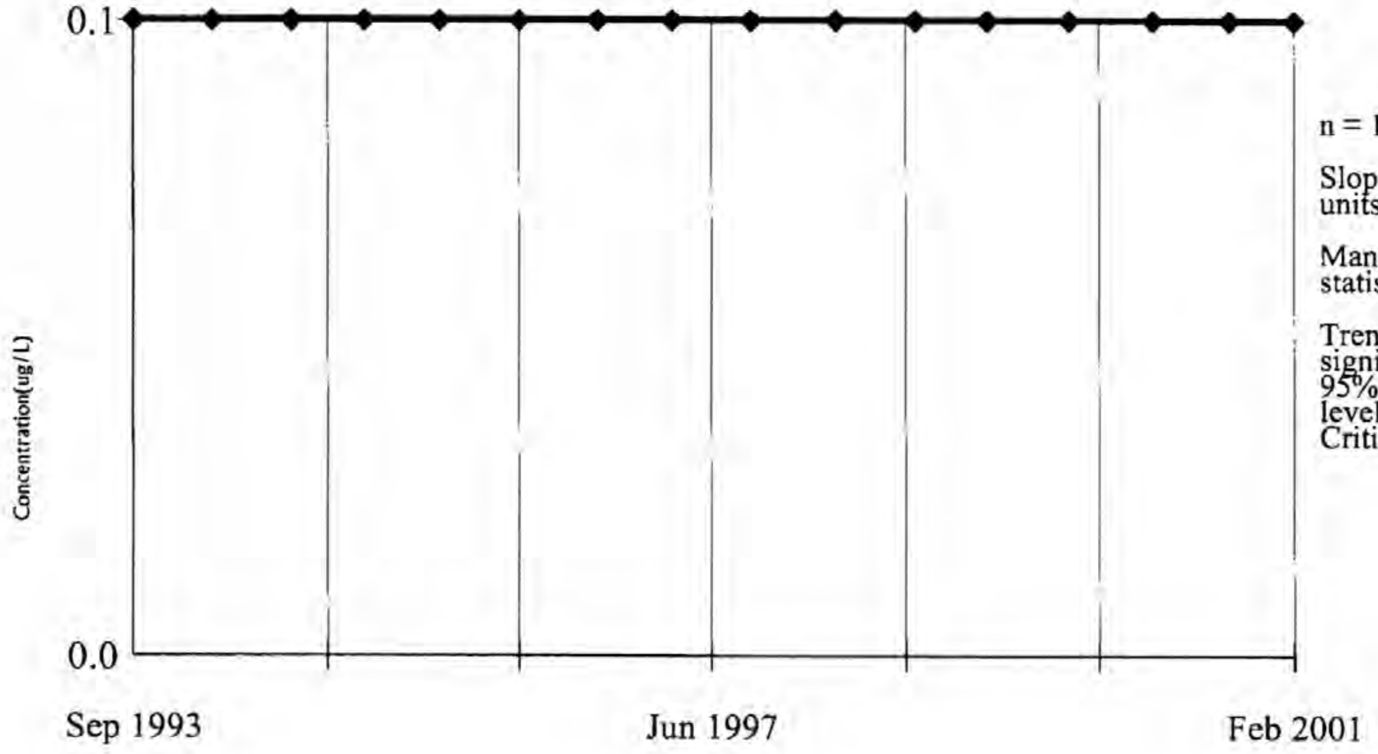
Trend significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Mercury Total (ug/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

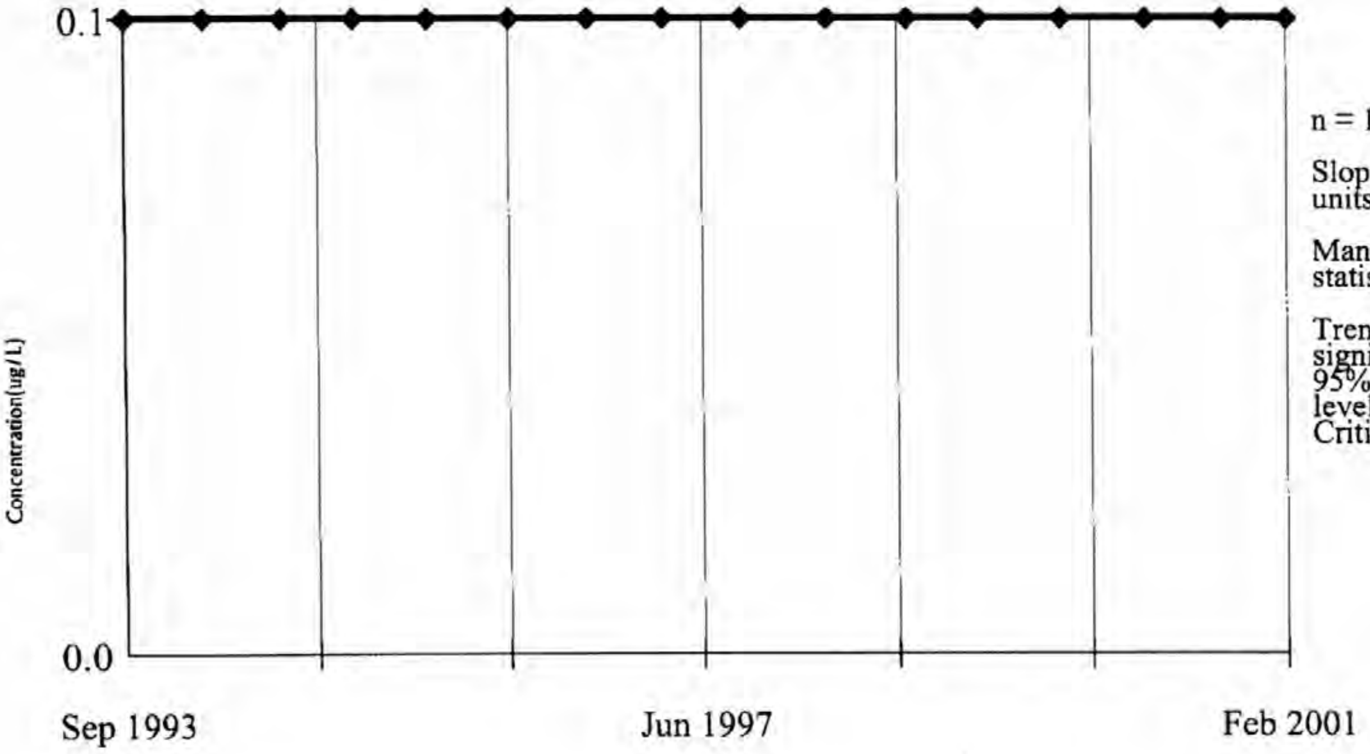
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Mercury Total (ug/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

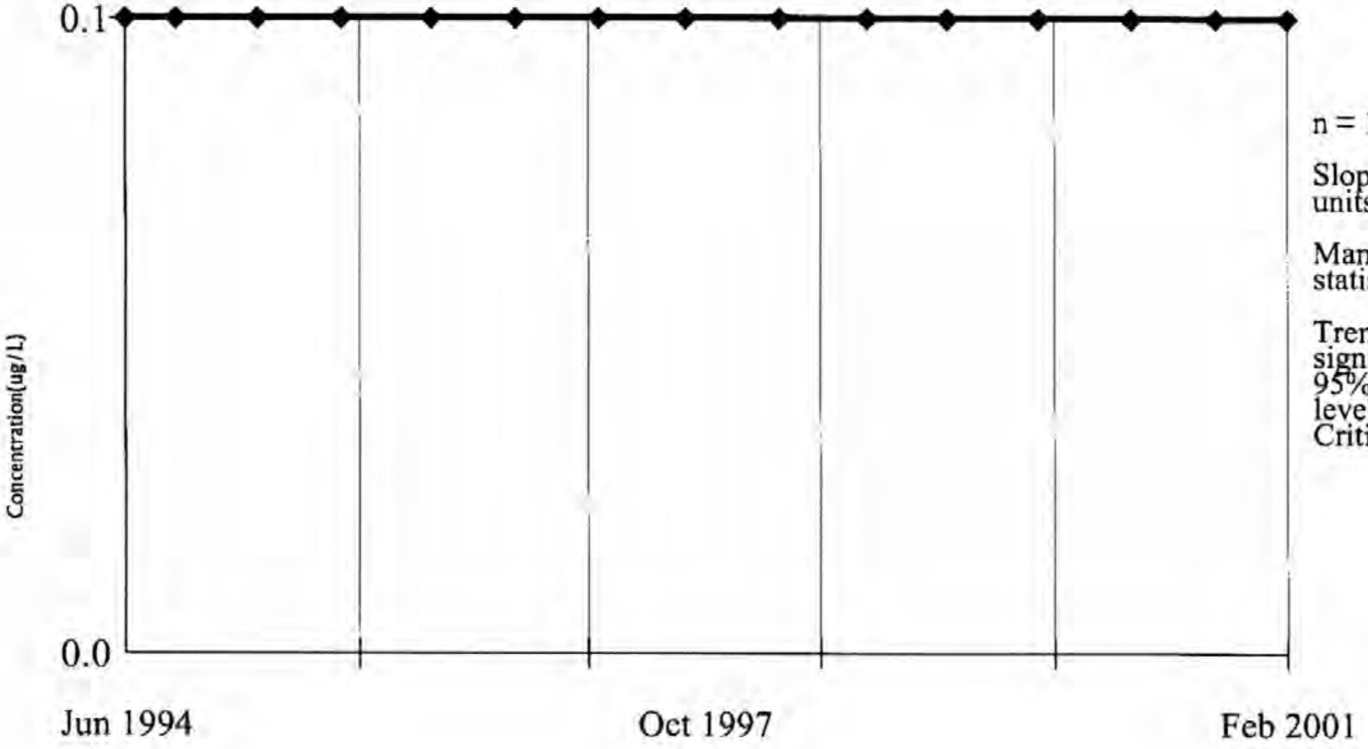
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Mercury Total (ug/L)
Date: 3/27/01, 10:22 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

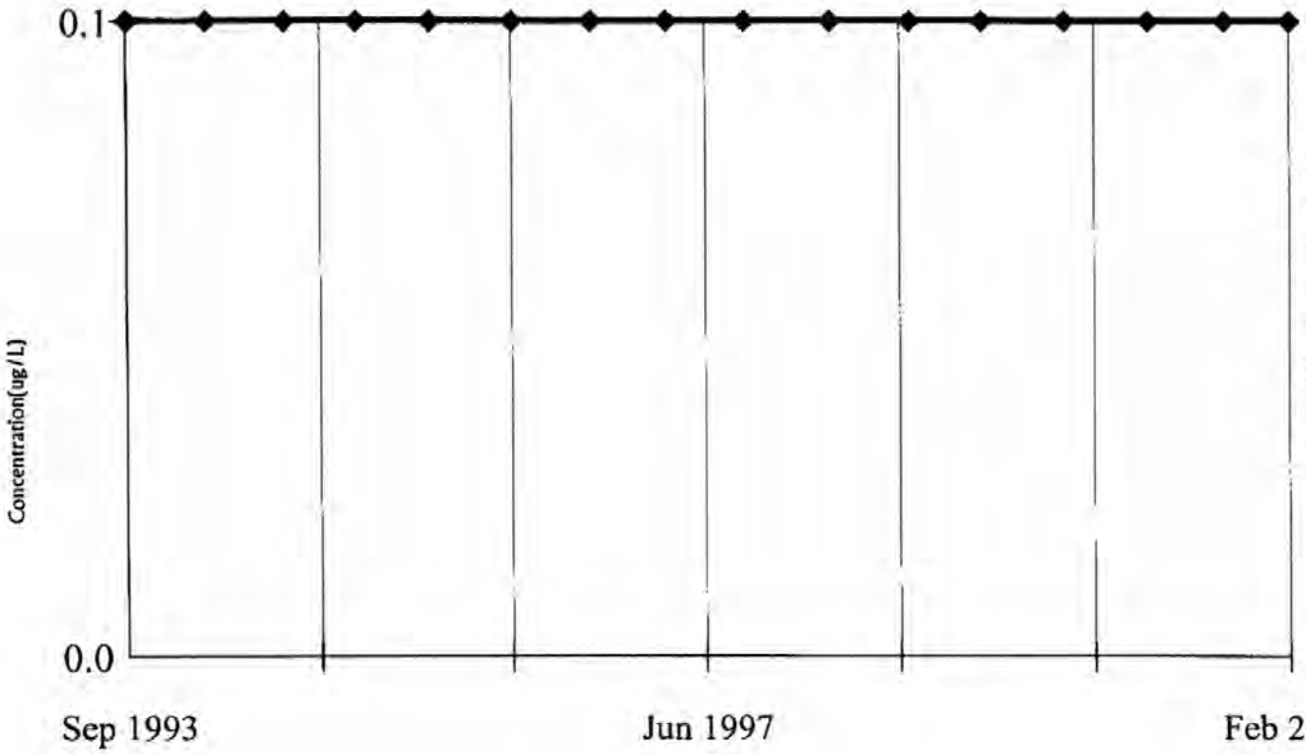
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 41.

Constituent: Mercury Total (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 3/27/01, 10:23 AM Client: Timberlands LF View: _Batch_

v.7.501. CAS# n/a EPA Sanitas™

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

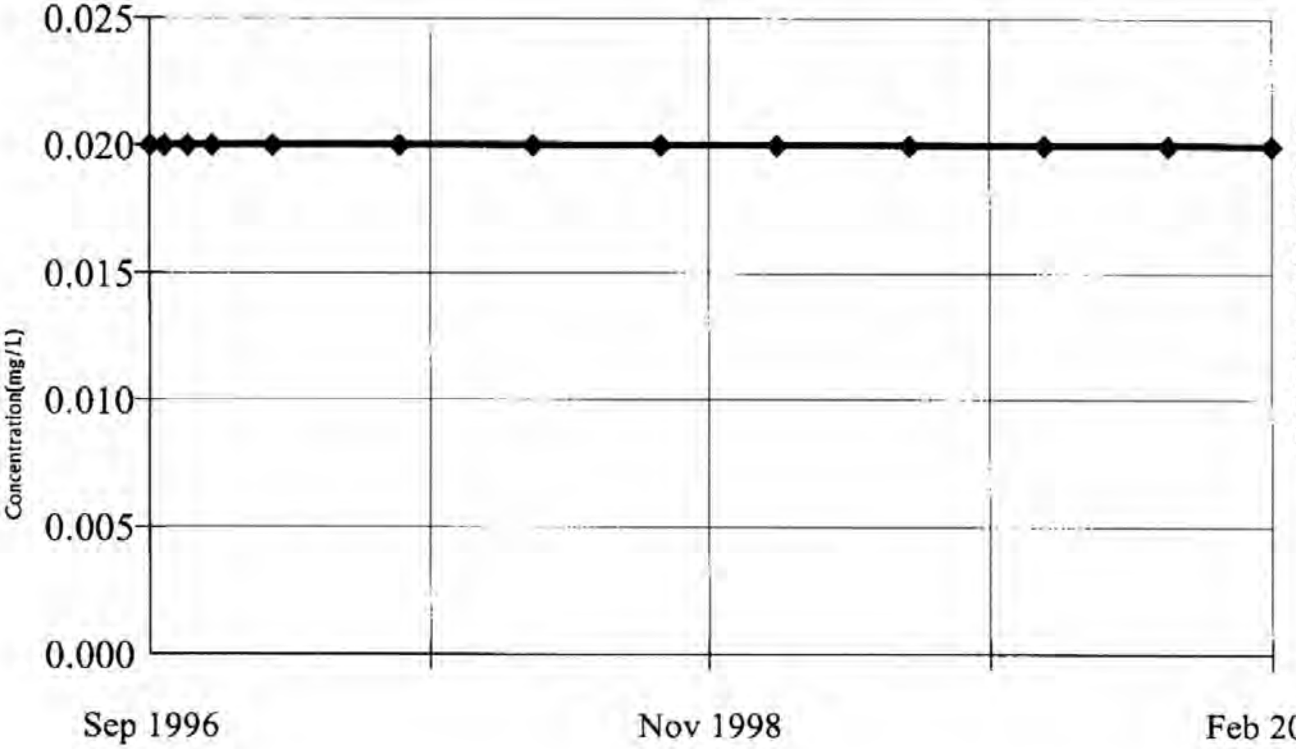
Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Mercury Total (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 3/27/01, 10:23 AM Client: Timberlands LF View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = 0.

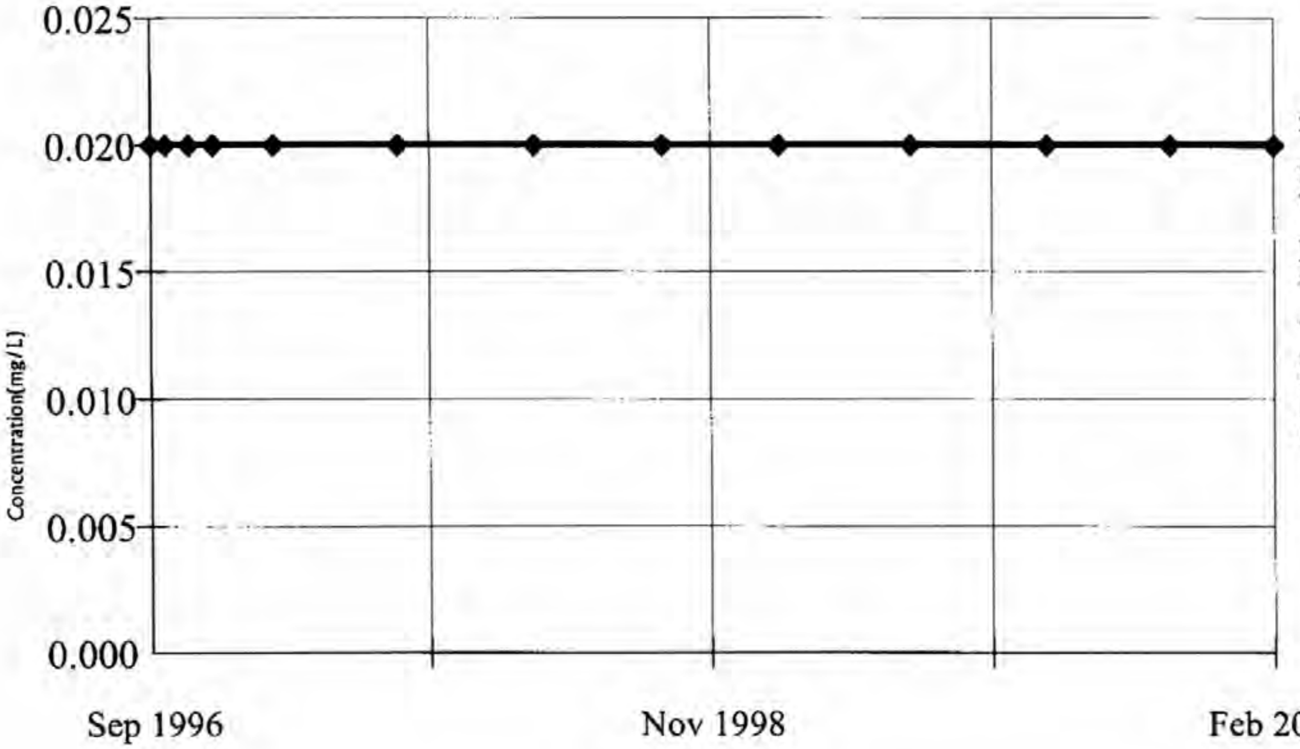
Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Nickel Total (mg/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Nickel Total (mg/L)

Date: 3/27/01, 10:23 AM

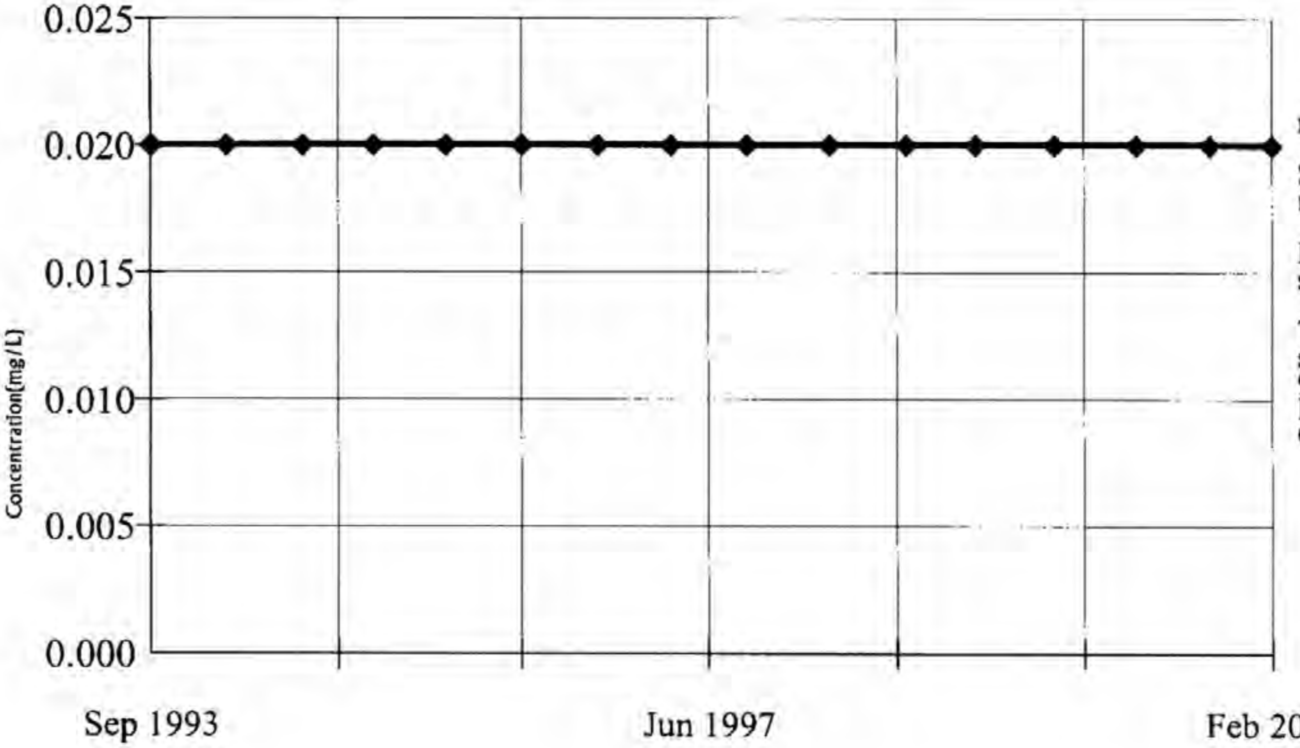
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

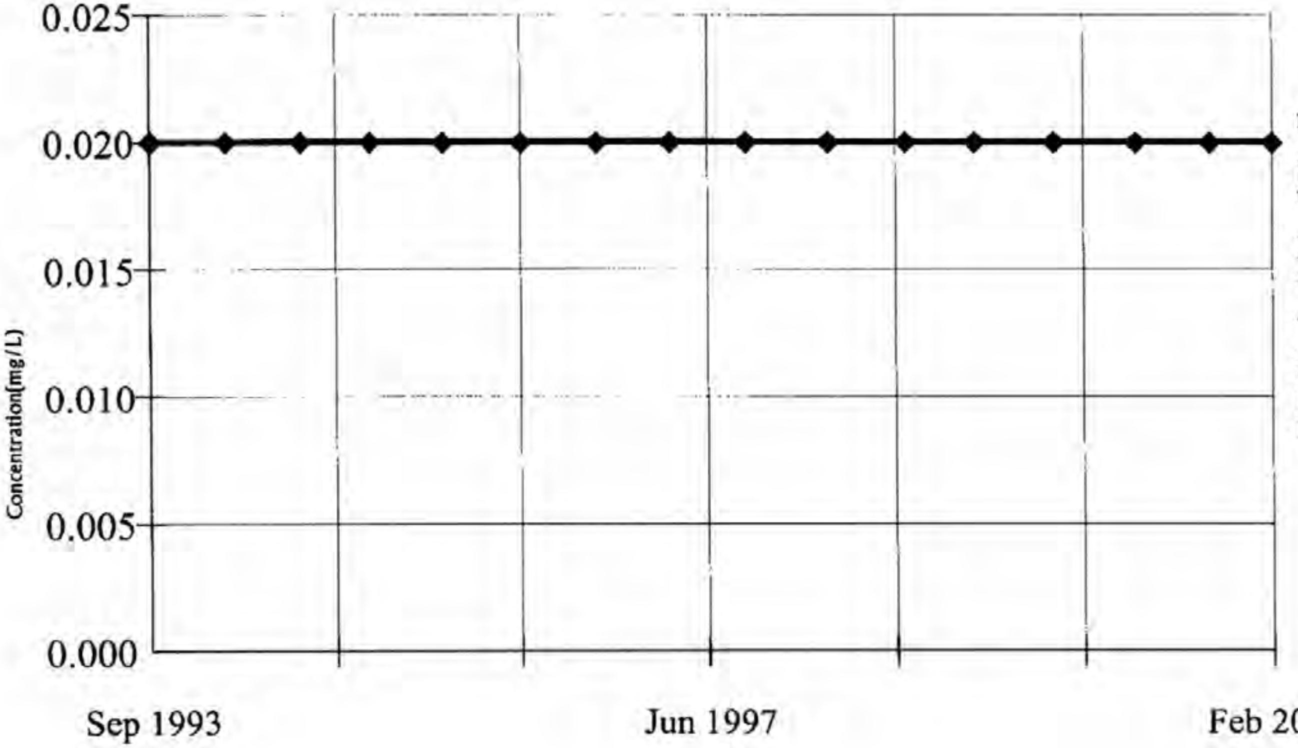
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Nickel Total (mg/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

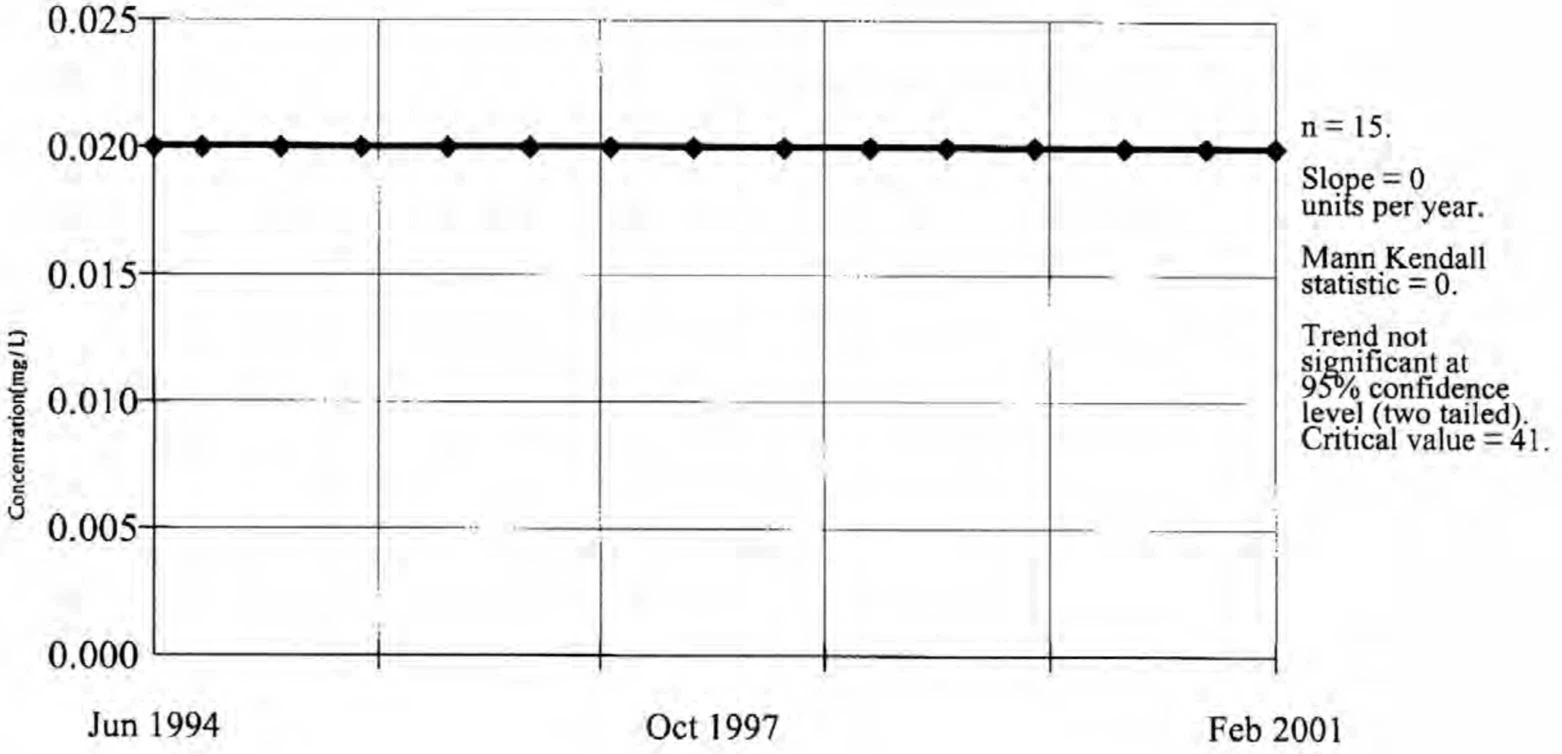
Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Nickel Total (mg/L)   Facility: Timberlands LF   Data File: TIMBER

Date: 3/27/01, 10:23 AM   Client: Timberlands LF   View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8

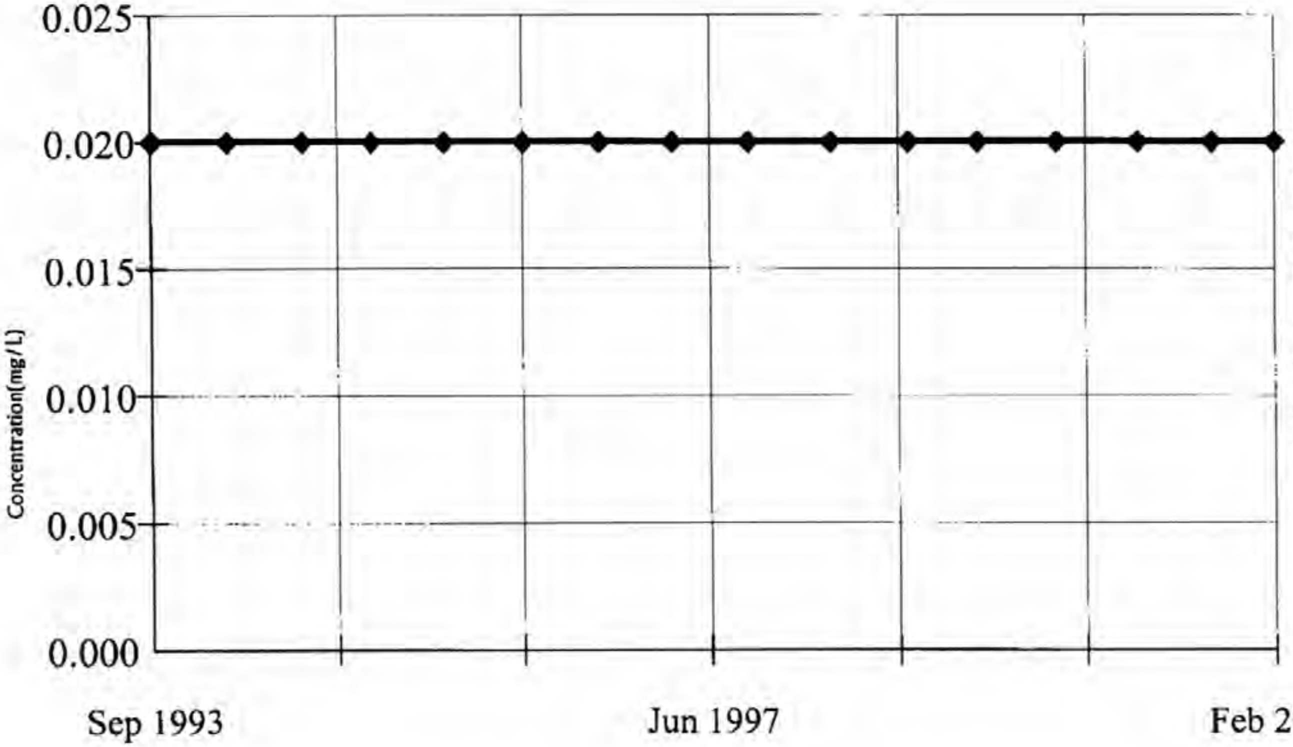


Constituent: Nickel Total (mg/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Nickel Total (mg/L)

Date: 3/27/01, 10:23 AM

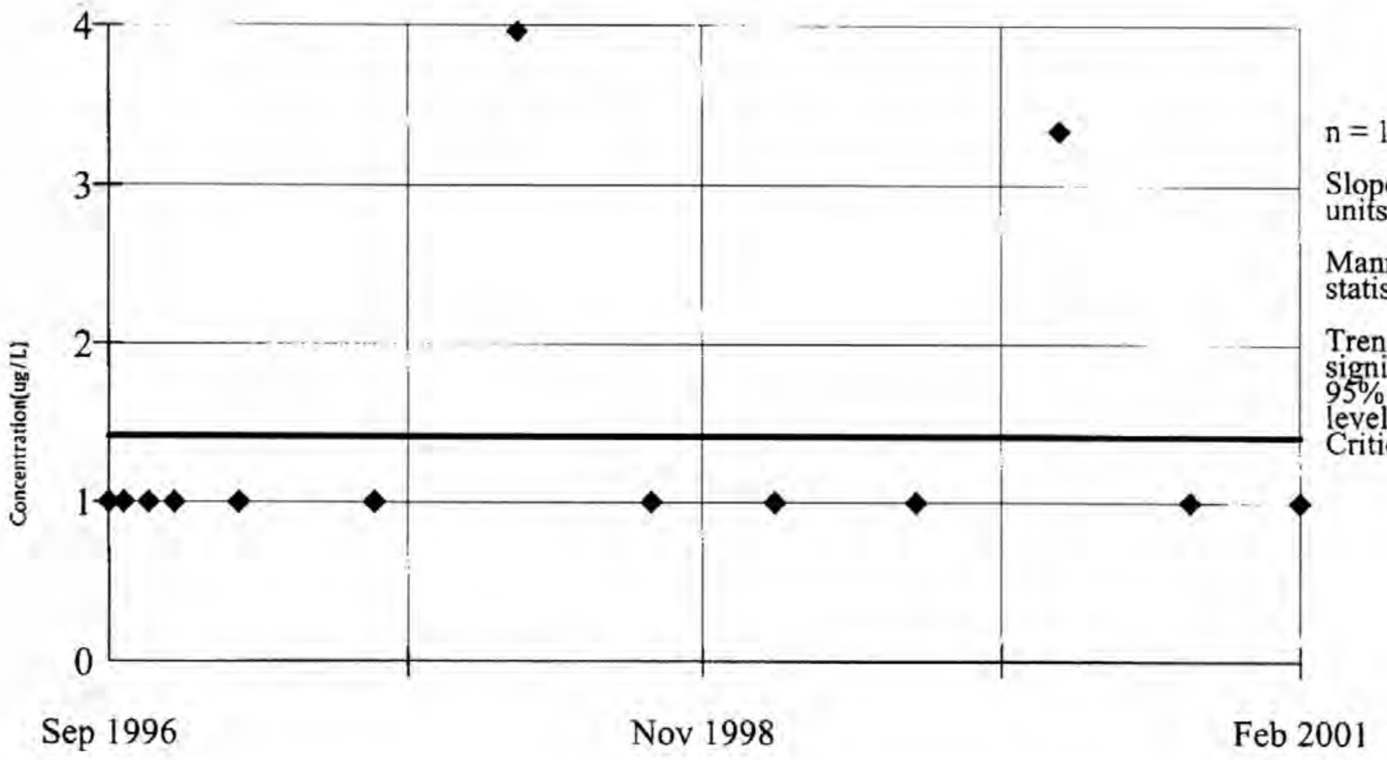
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 7.

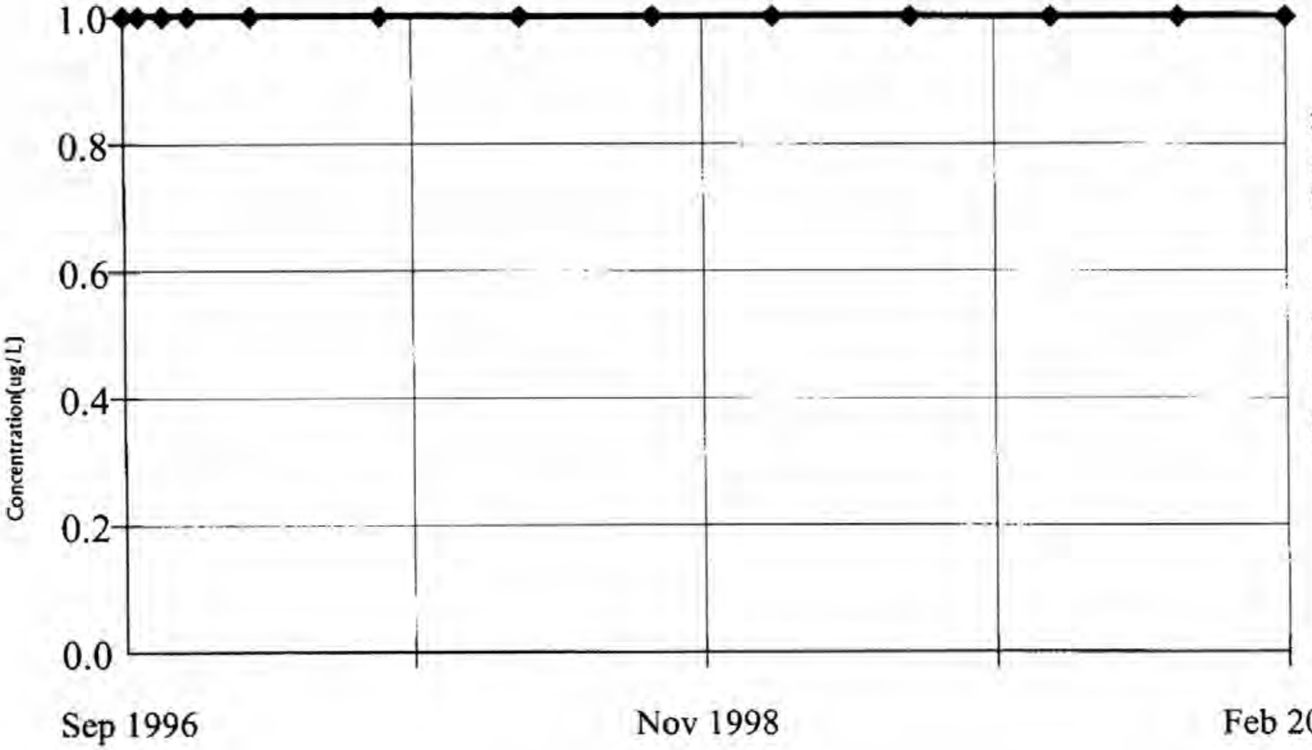
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Selenium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = 0.

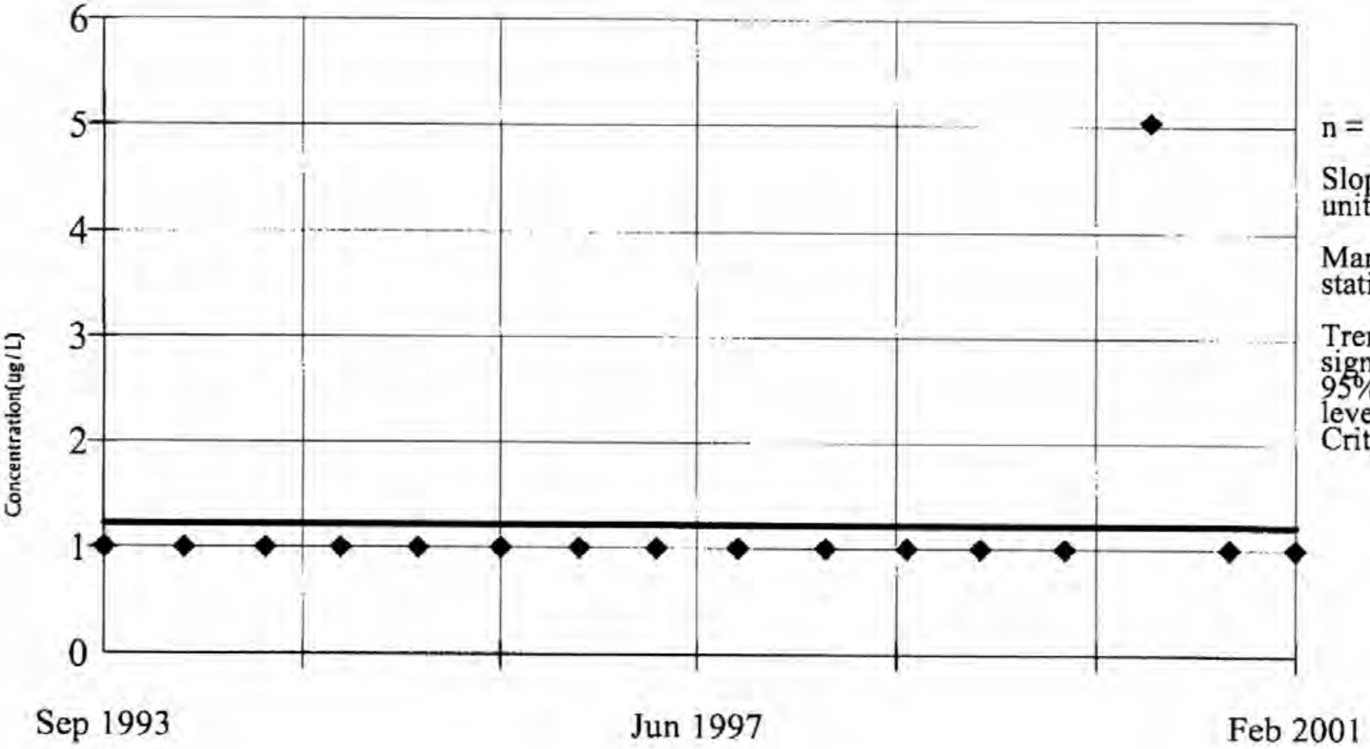
Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Selenium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 14.

Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Selenium Total (ug/L)

Date: 3/27/01, 10:23 AM

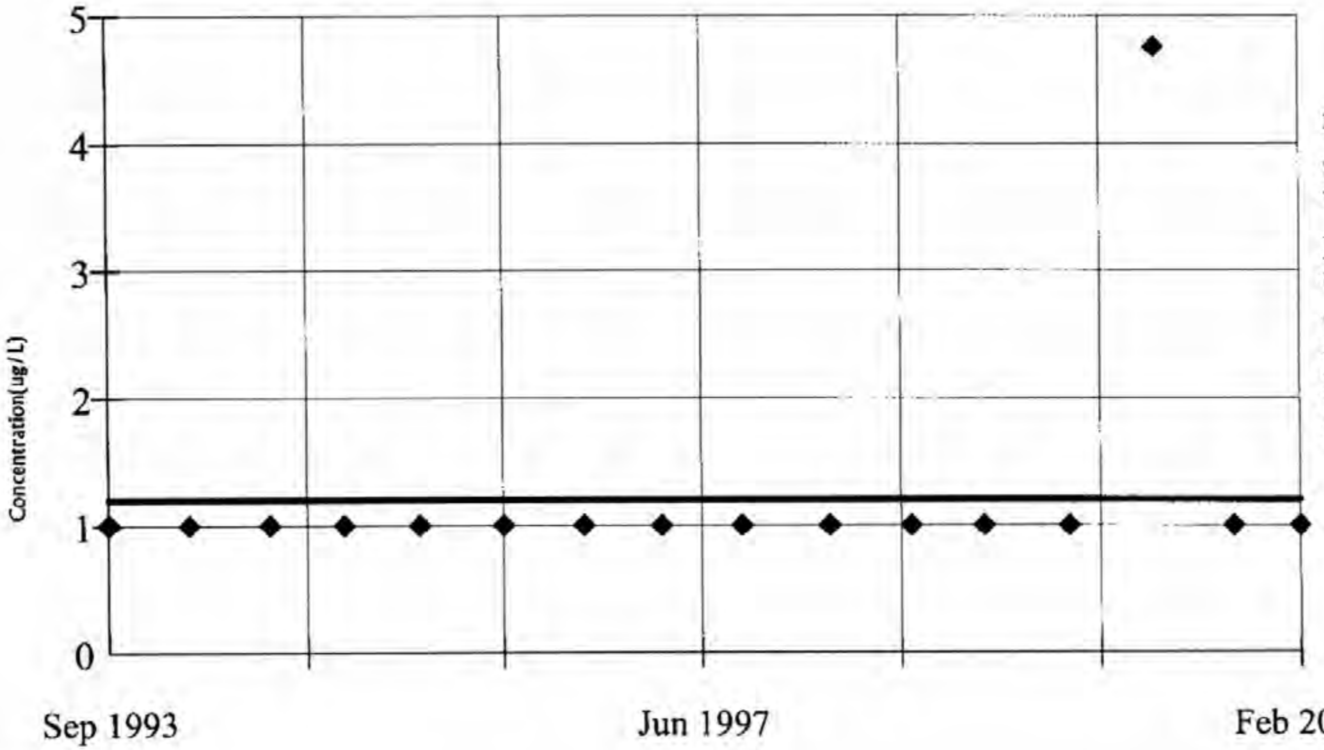
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 14.

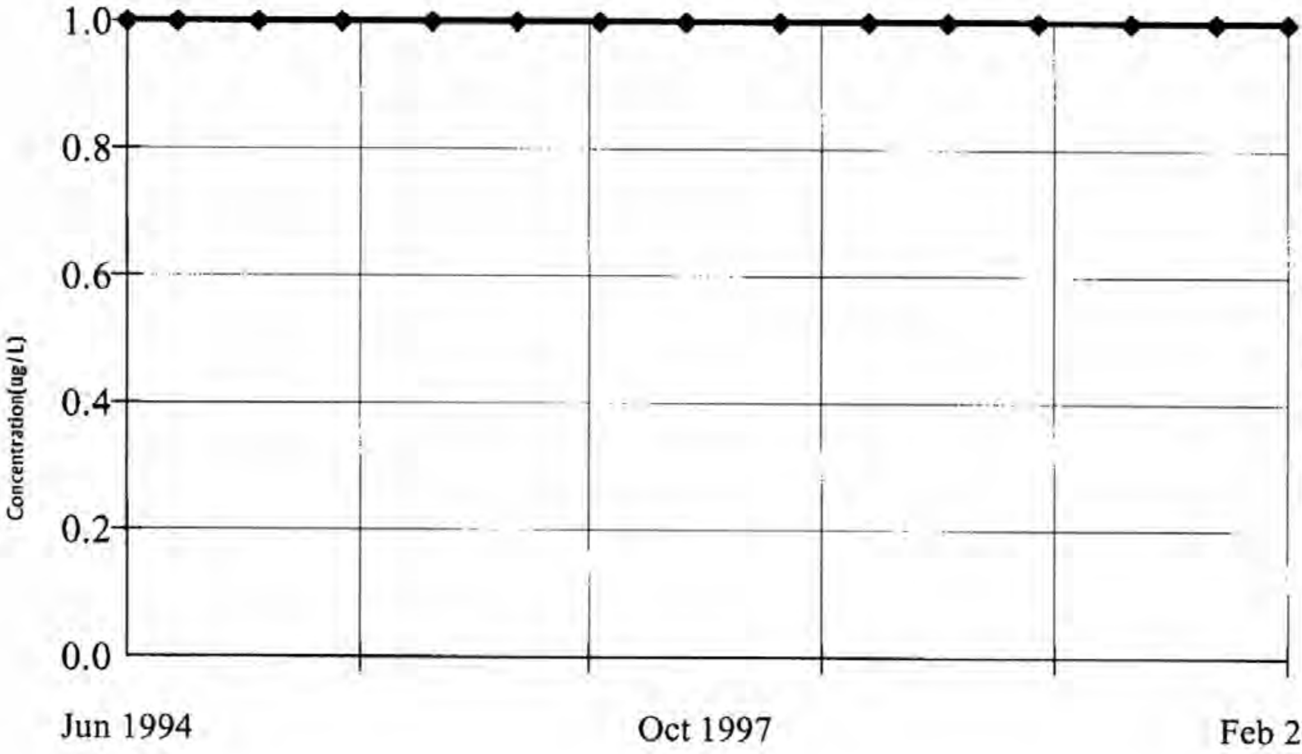
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Selenium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

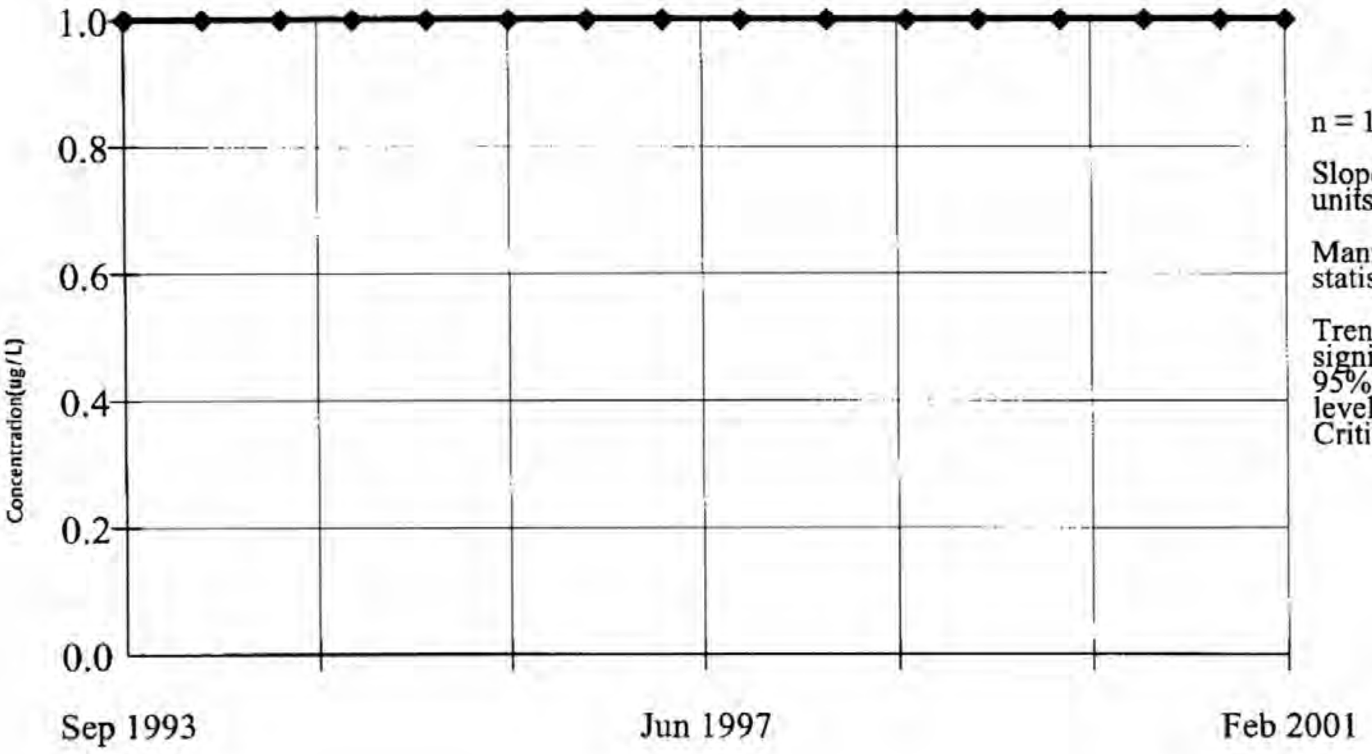
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 41.

Constituent: Selenium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 0.

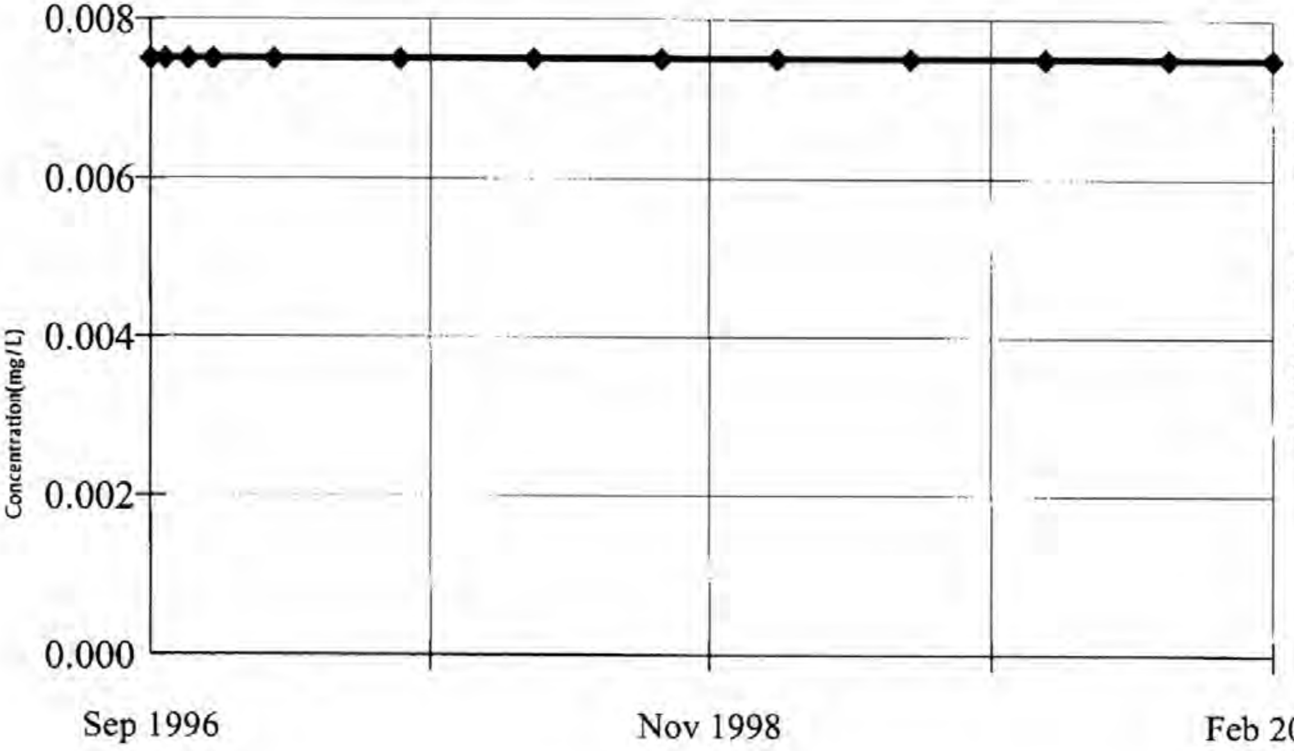
Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Selenium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = 0.

Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Silver Total (mg/L)

Date: 3/27/01, 10:23 AM

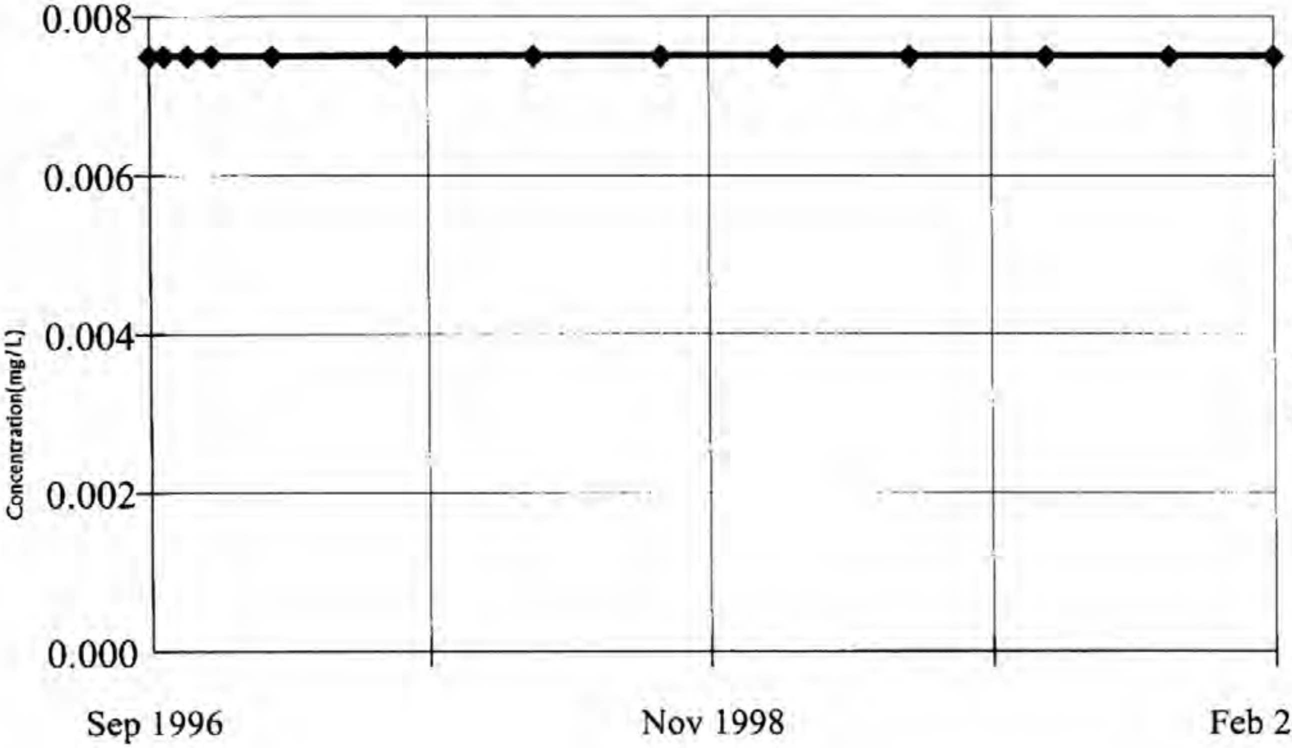
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

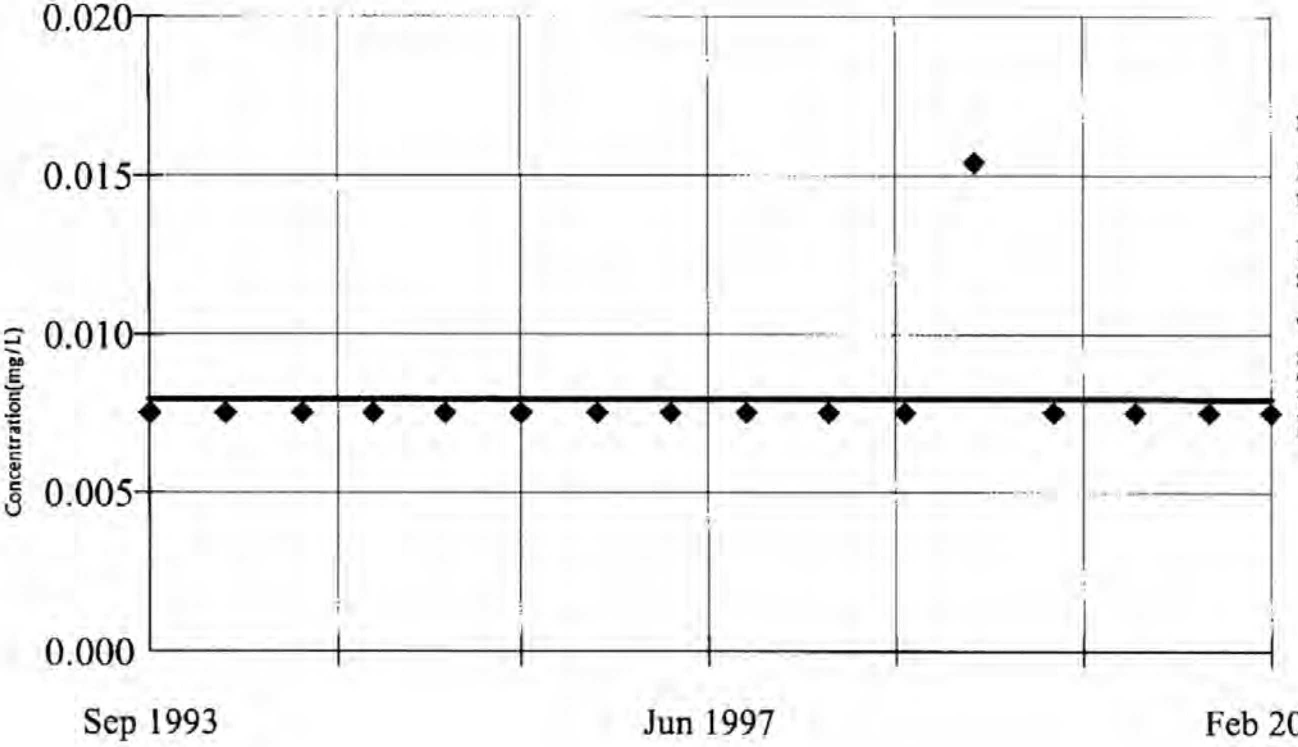
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Silver Total (mg/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 10.

Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Silver Total (mg/L)

Date: 3/27/01, 10:23 AM

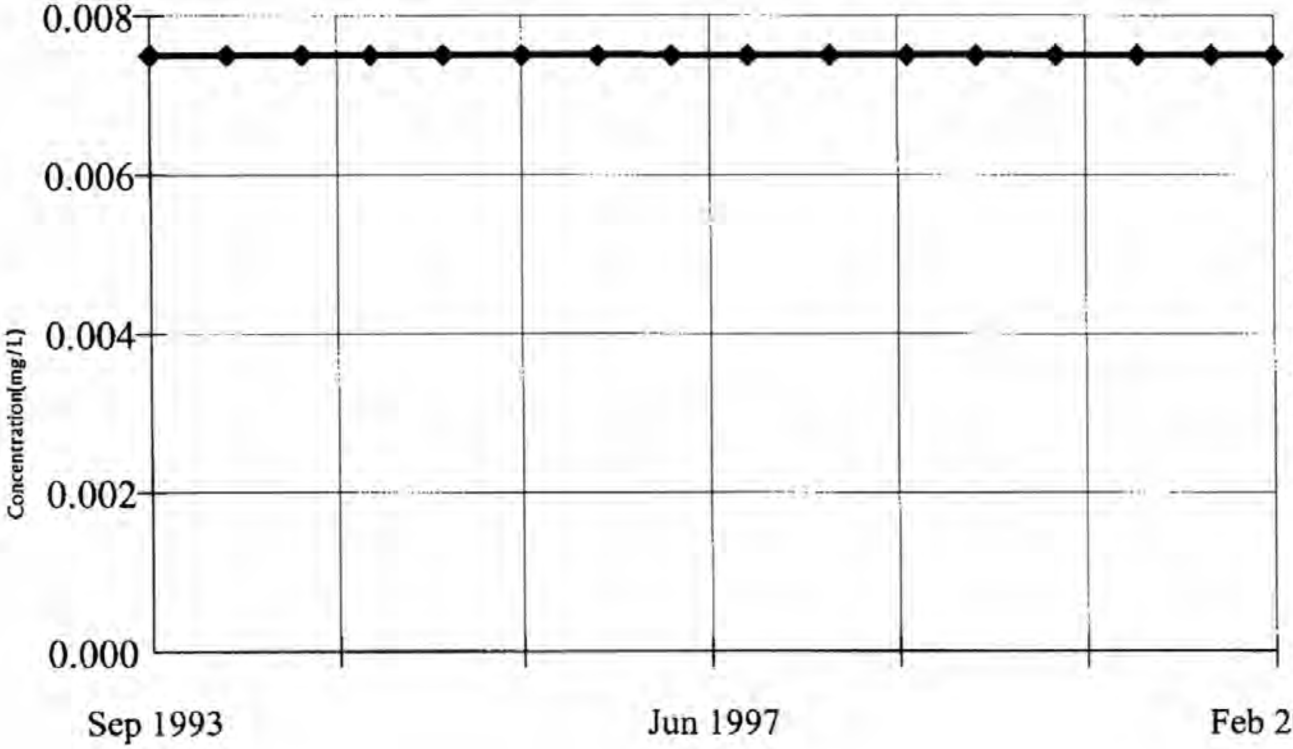
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Silver Total (mg/L)

Date: 3/27/01, 10:23 AM

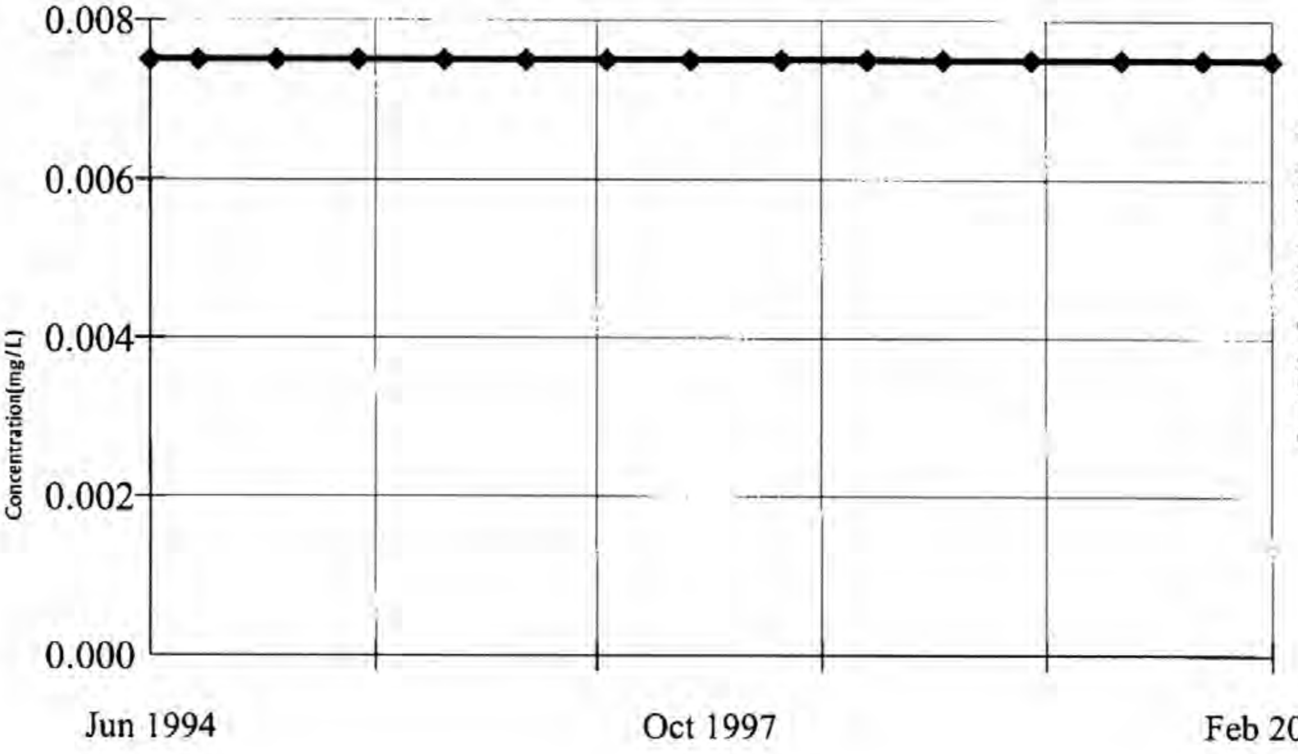
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0 units per year.

Mann Kendall statistic = 0.

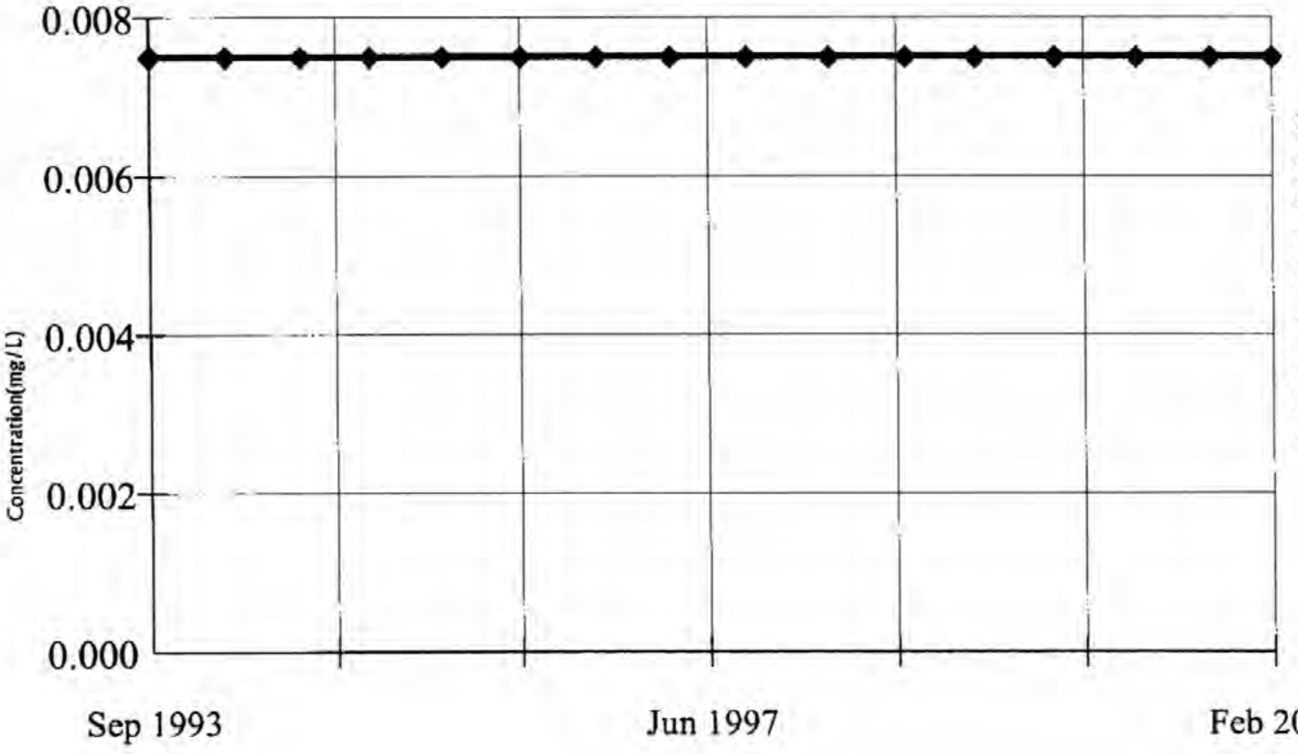
Trend not significant at 95% confidence level (two tailed). Critical value = 41.

Constituent: Silver Total (mg/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Silver Total (mg/L)

Date: 3/27/01, 10:23 AM

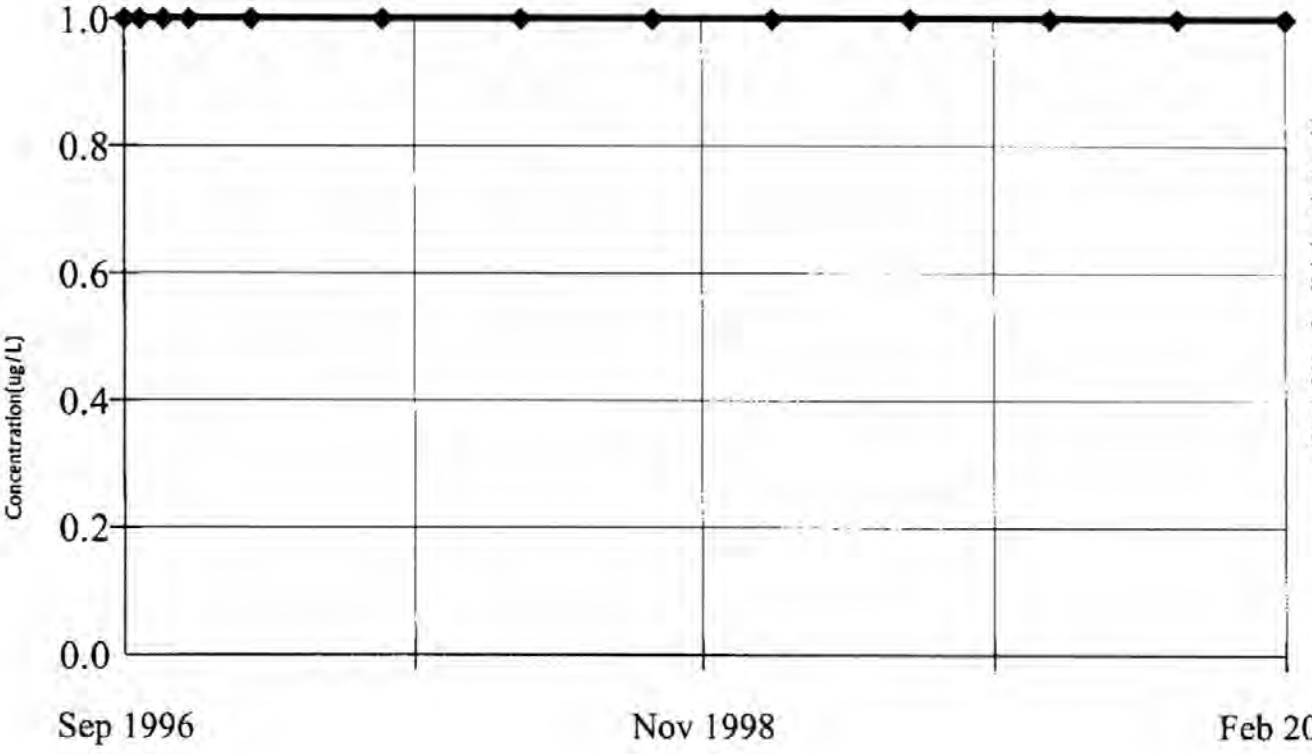
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

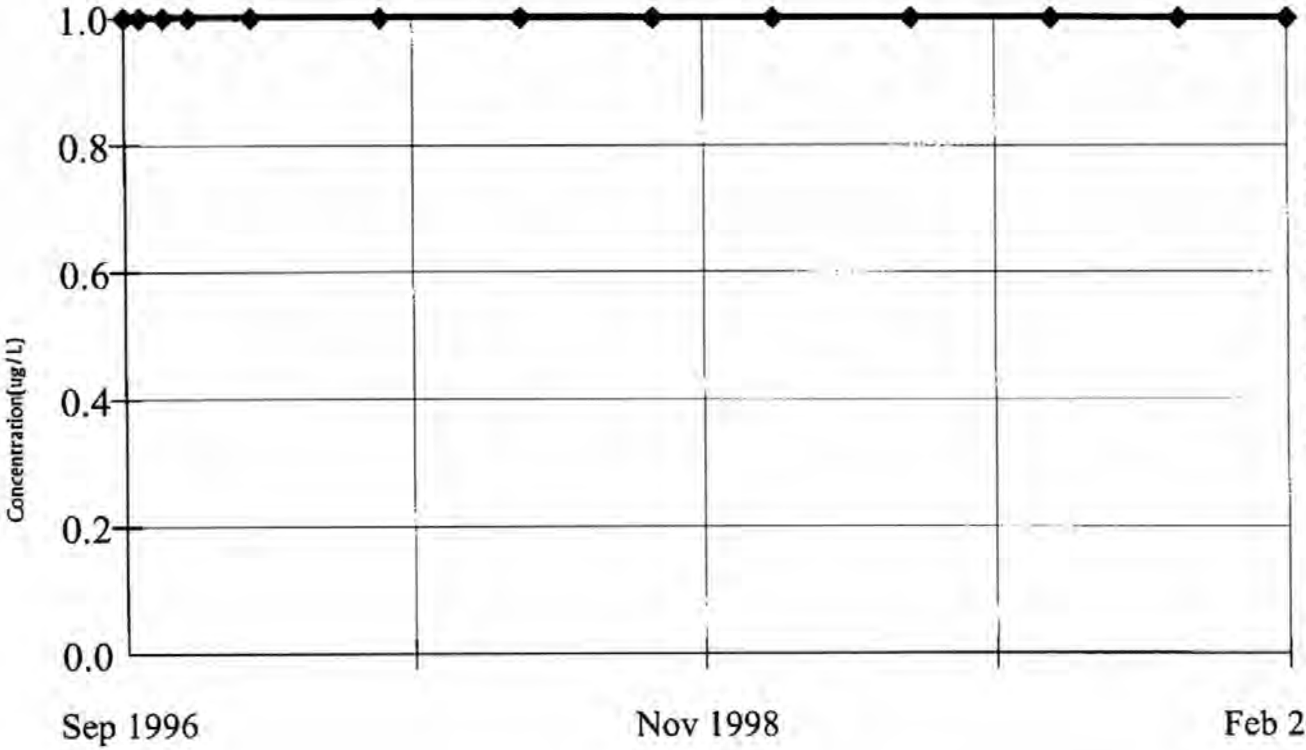
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Thallium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

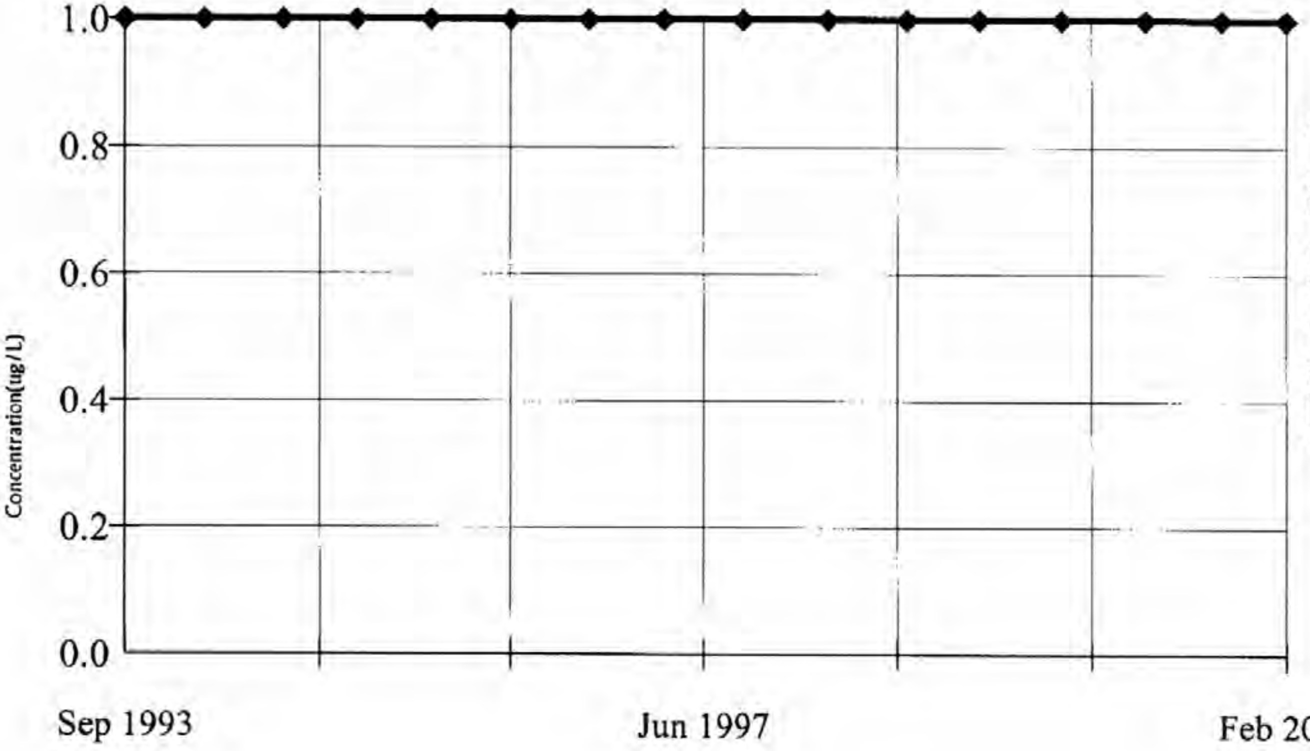
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Thallium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Thallium Total (ug/L)

Date: 3/27/01, 10:23 AM

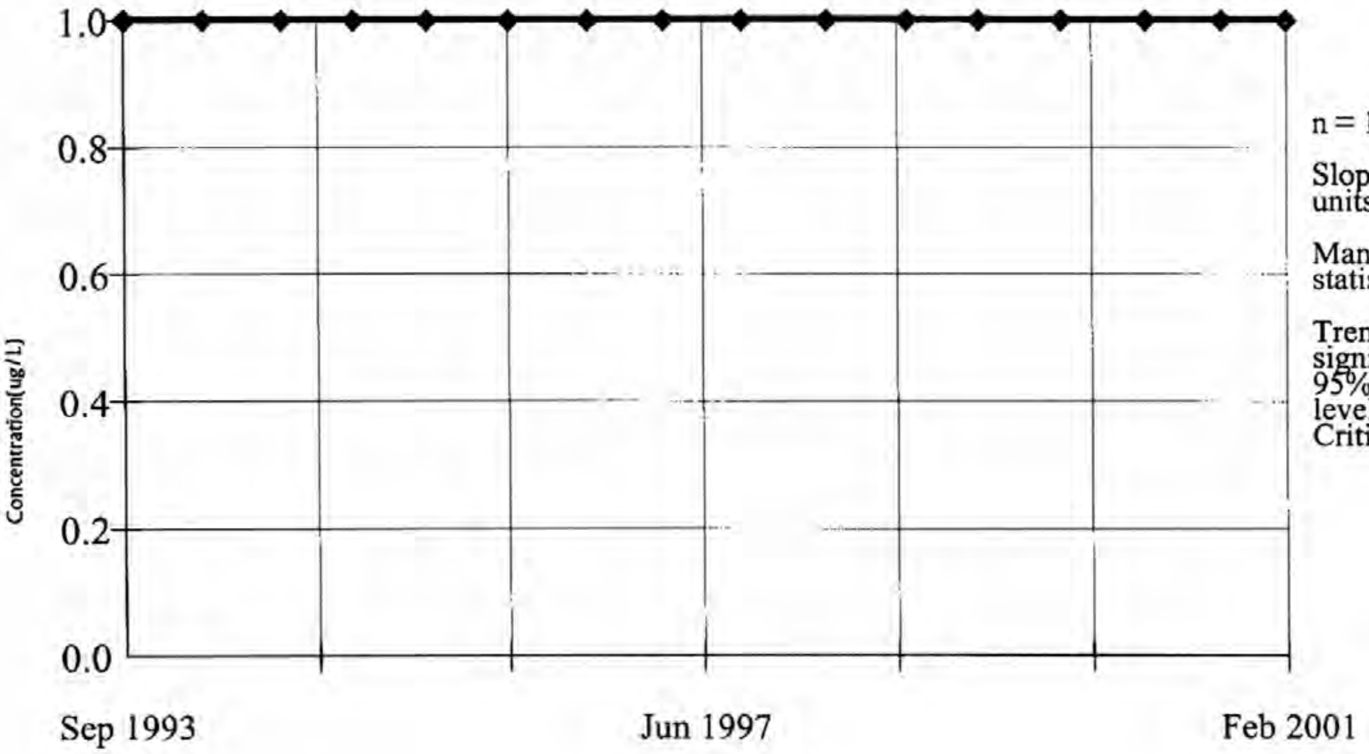
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

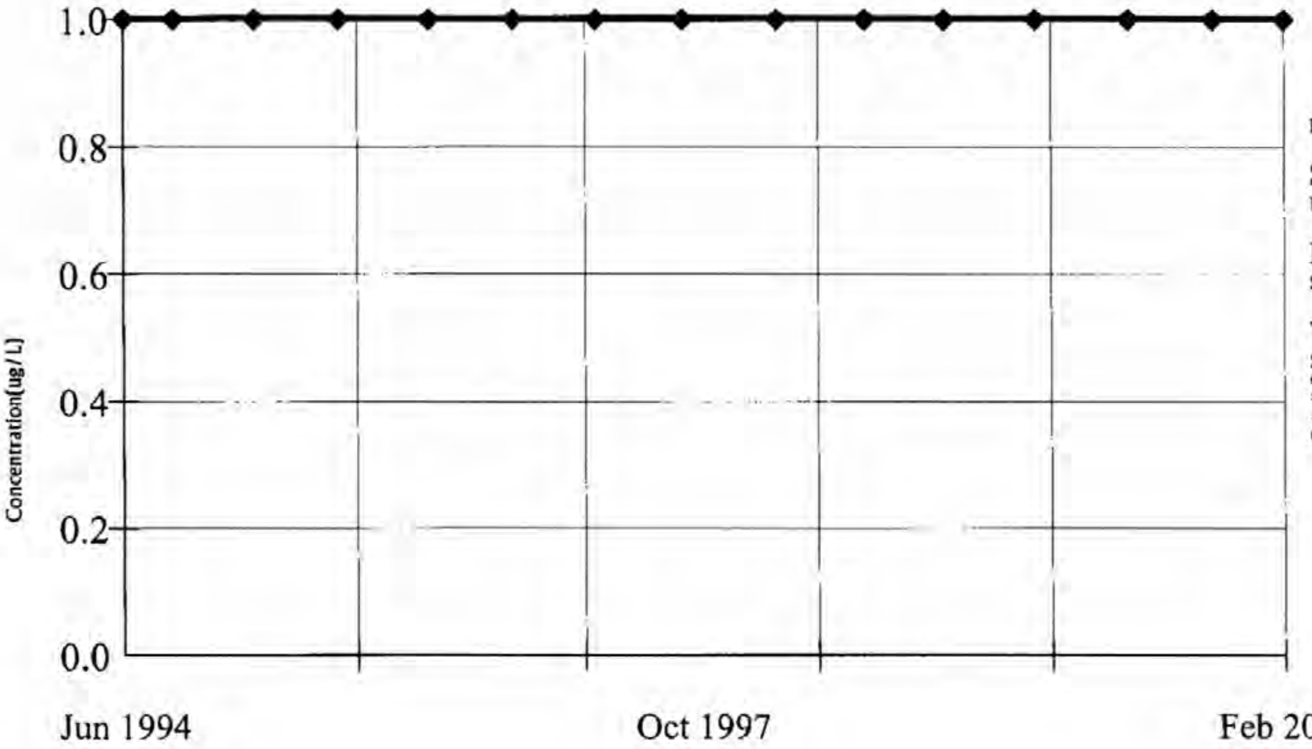
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Thallium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0 units per year.

Mann Kendall statistic = 0.

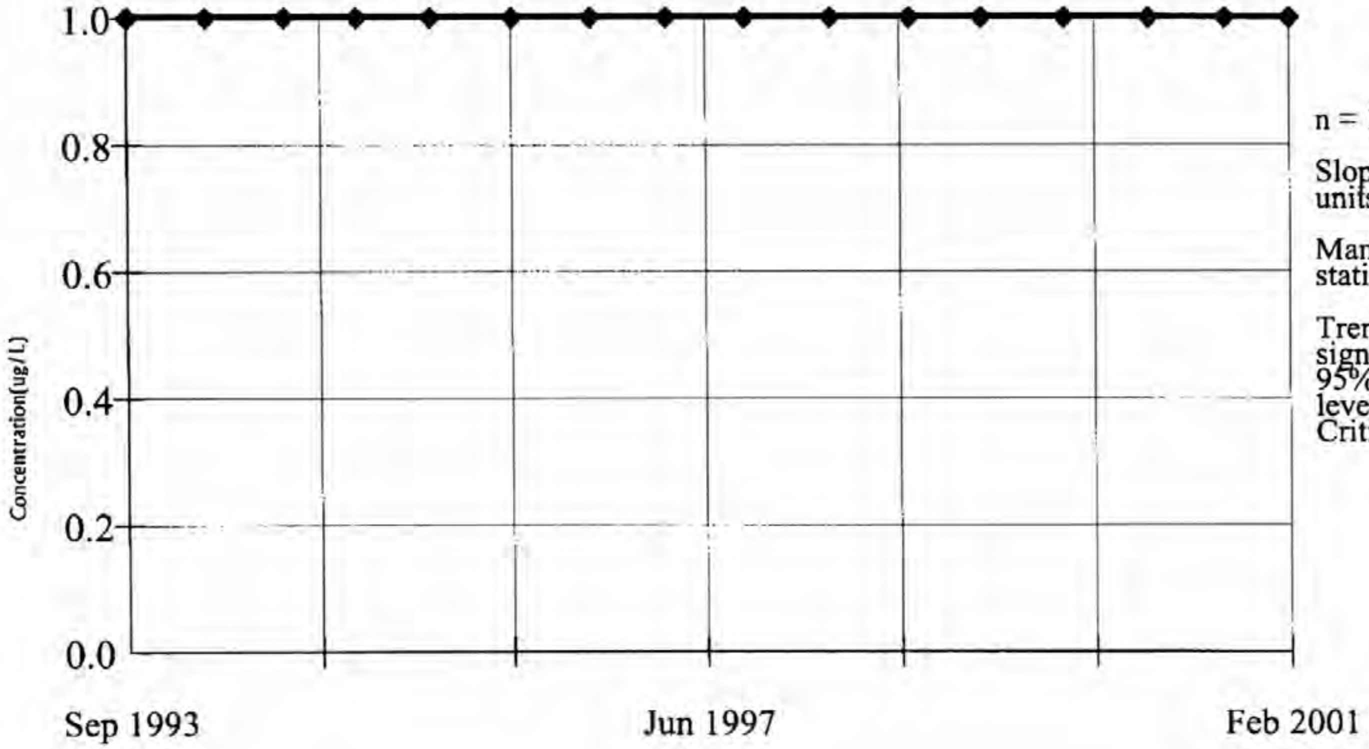
Trend not significant at 95% confidence level (two tailed). Critical value = 41.

Constituent: Thallium Total (ug/L) Facility: Timberlands LF Data File: TIMBER

Date: 3/27/01, 10:23 AM Client: Timberlands LF View: _Batch_

v.7.501. CAS# n/a EPA Sanitas™

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

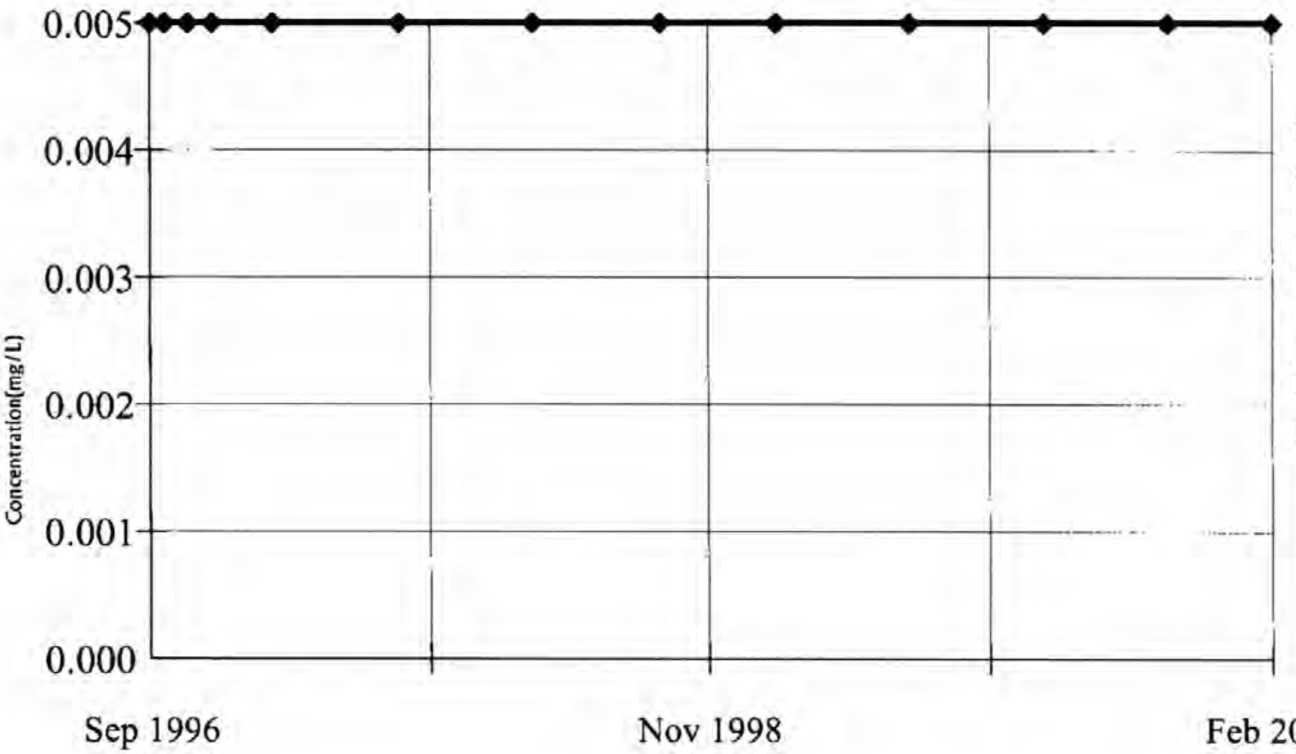
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Thallium Total (ug/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0 units per year.

Mann Kendall statistic = 0.

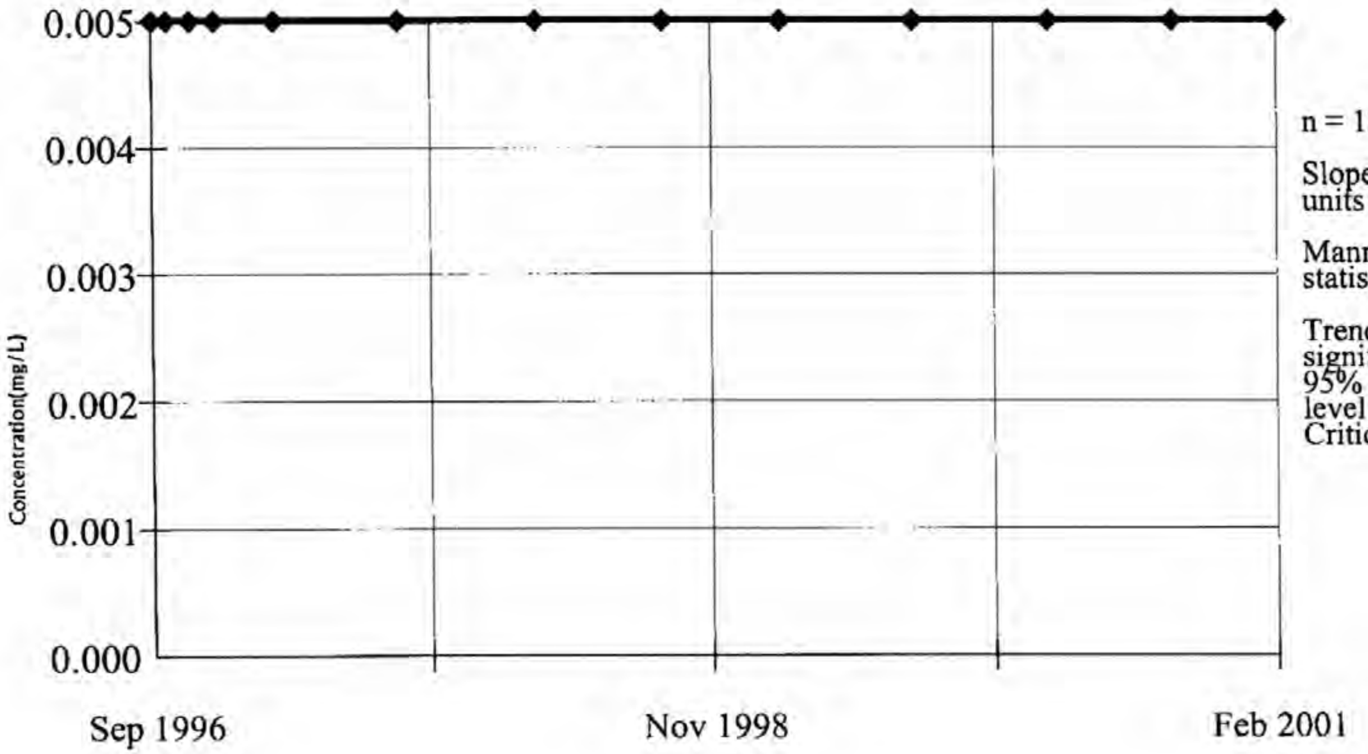
Trend not significant at 95% confidence level (two tailed). Critical value = 34.

Constituent: Vanadium Total (mg/L)
Date: 3/27/01, 10:23 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 34.

Constituent: Vanadium Total (mg/L)

Date: 3/27/01, 10:24 AM

Facility: Timberlands LF

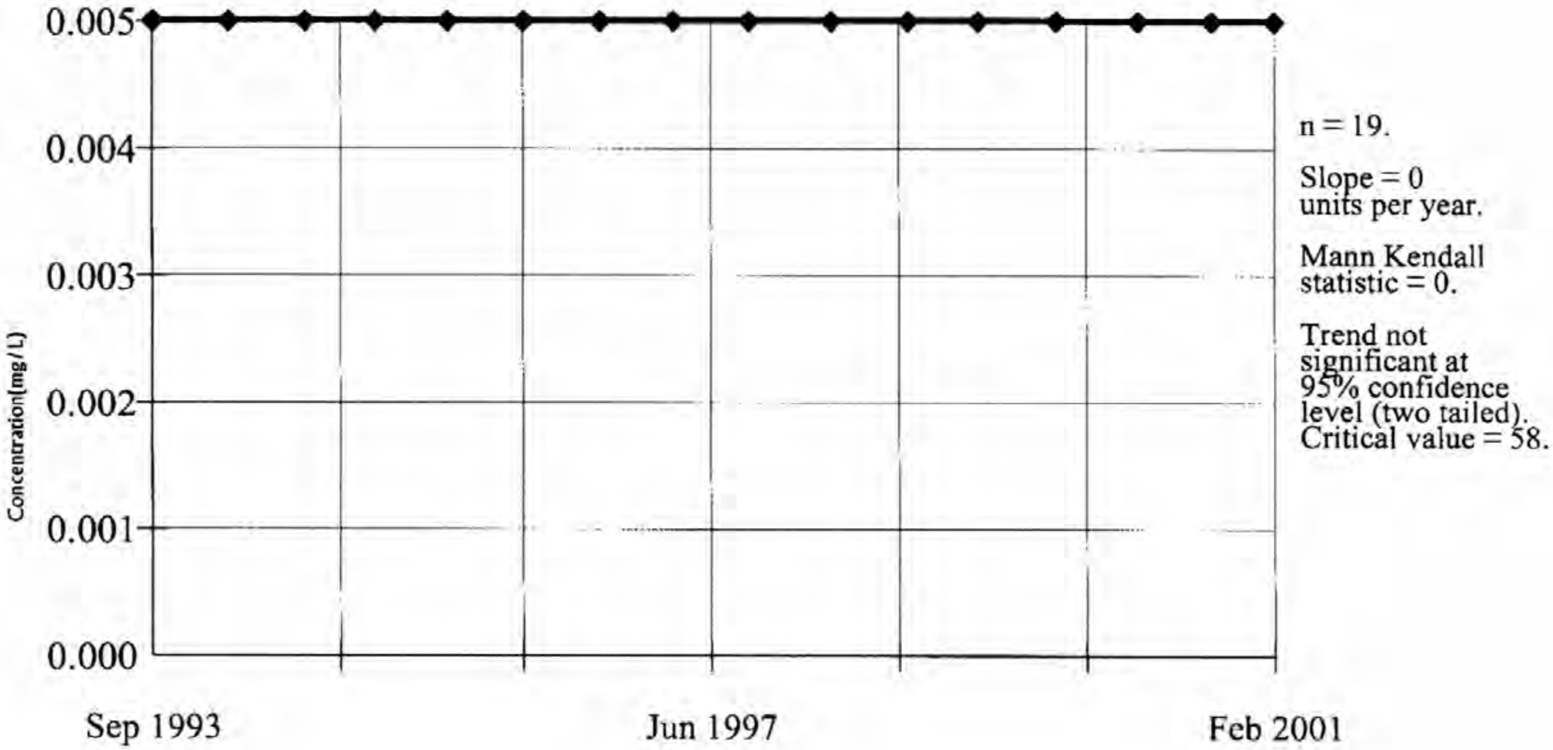
Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR

GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Vanadium Total (mg/L)

Date: 3/27/01, 10:24 AM

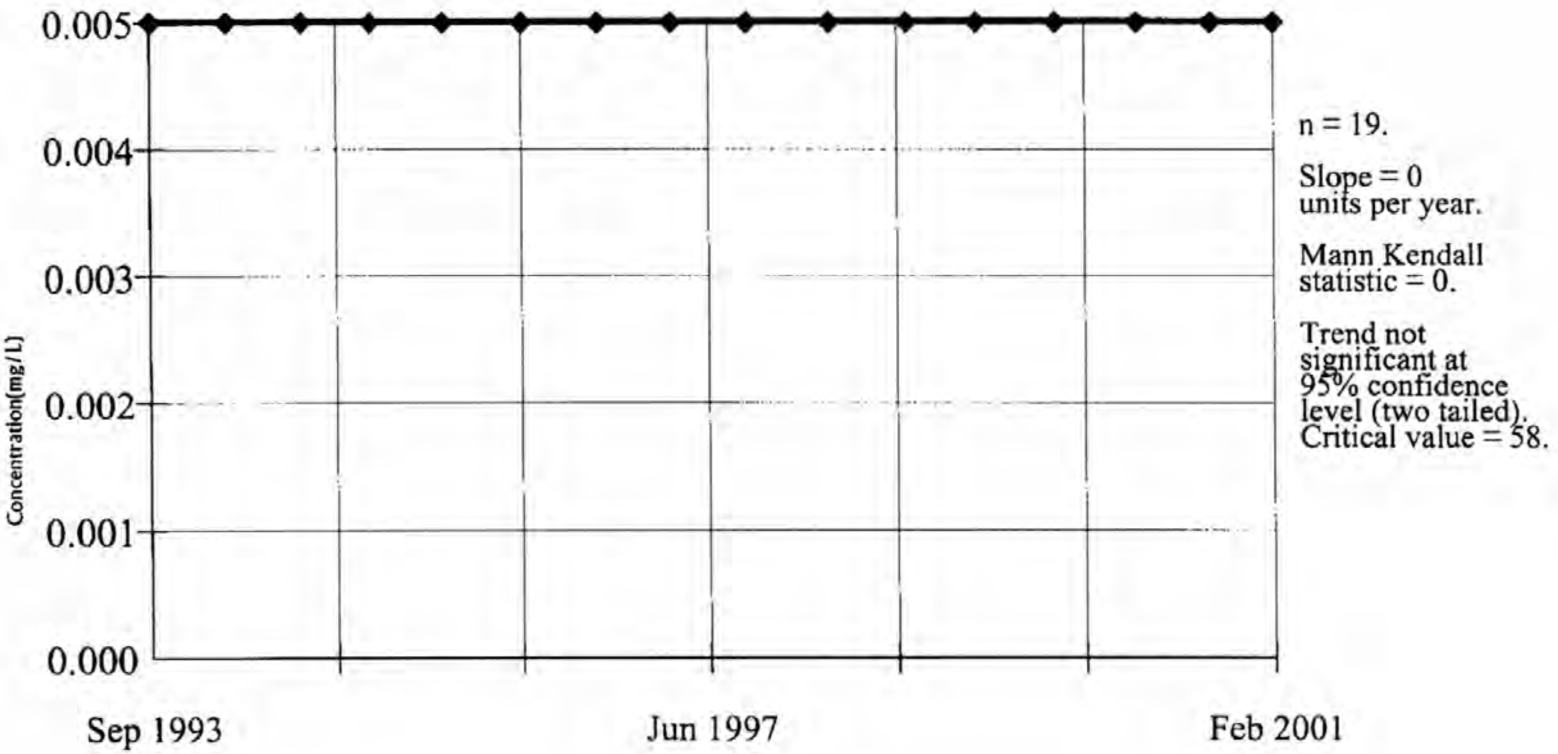
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



Constituent: Vanadium Total (mg/L)

Date: 3/27/01, 10:24 AM

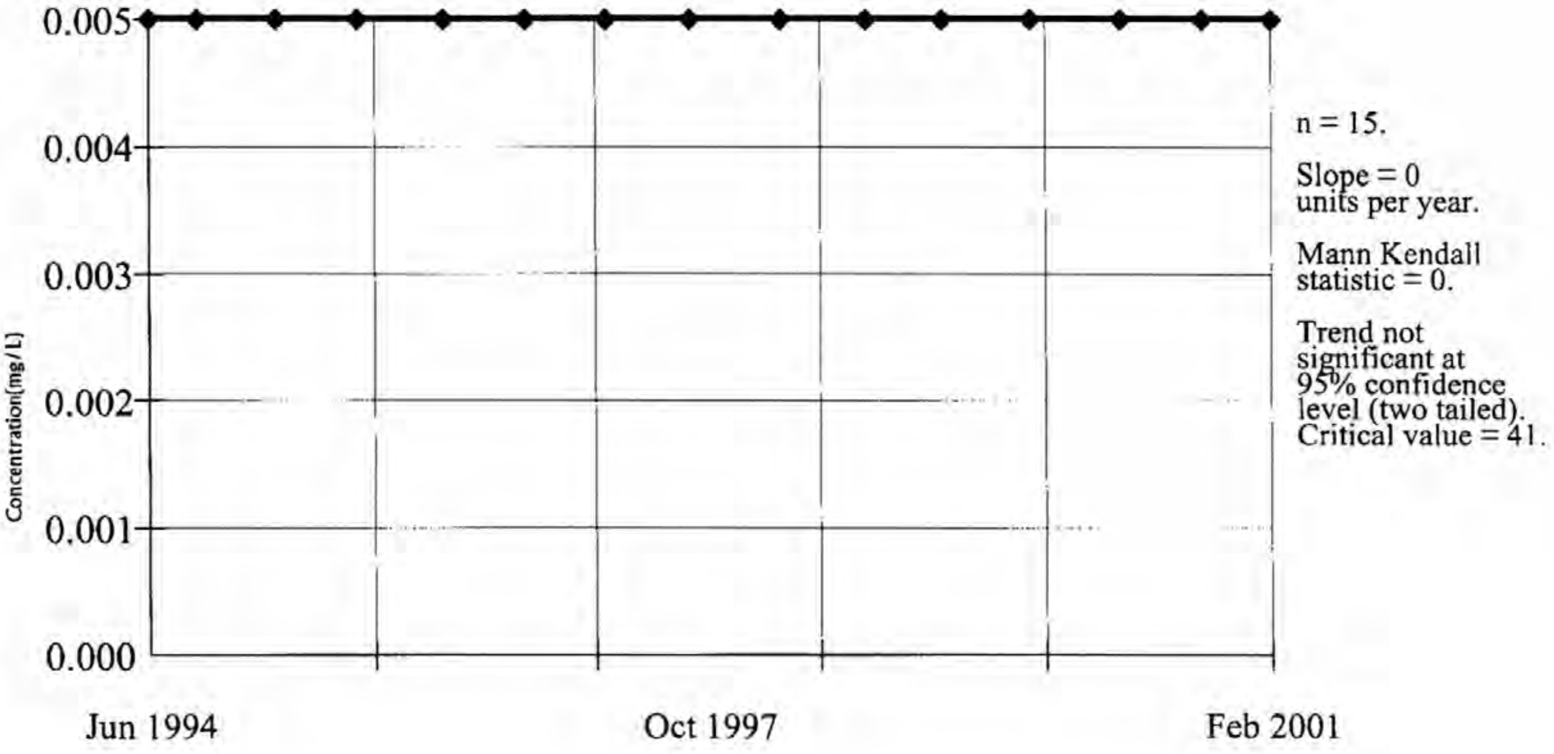
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0 units per year.

Mann Kendall statistic = 0.

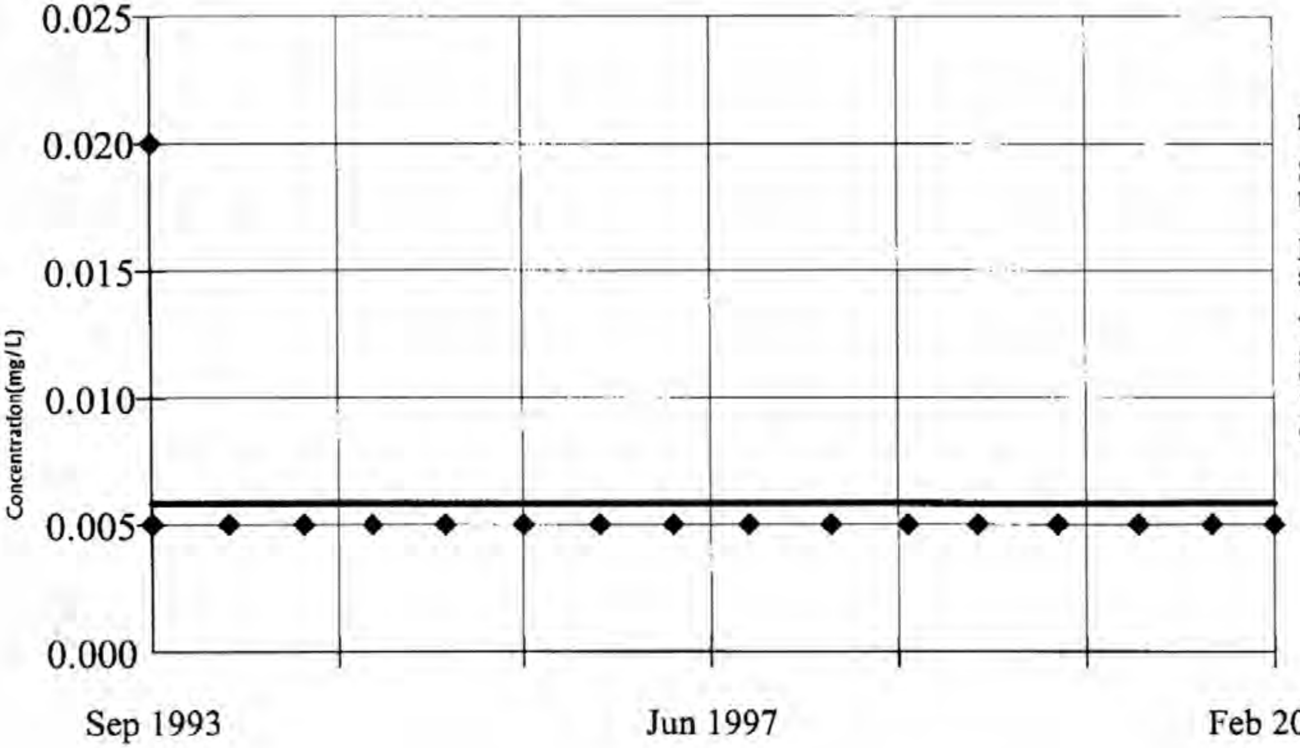
Trend not significant at 95% confidence level (two tailed). Critical value = 41.

Constituent: Vanadium Total (mg/L)
Date: 3/27/01, 10:24 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = -16.

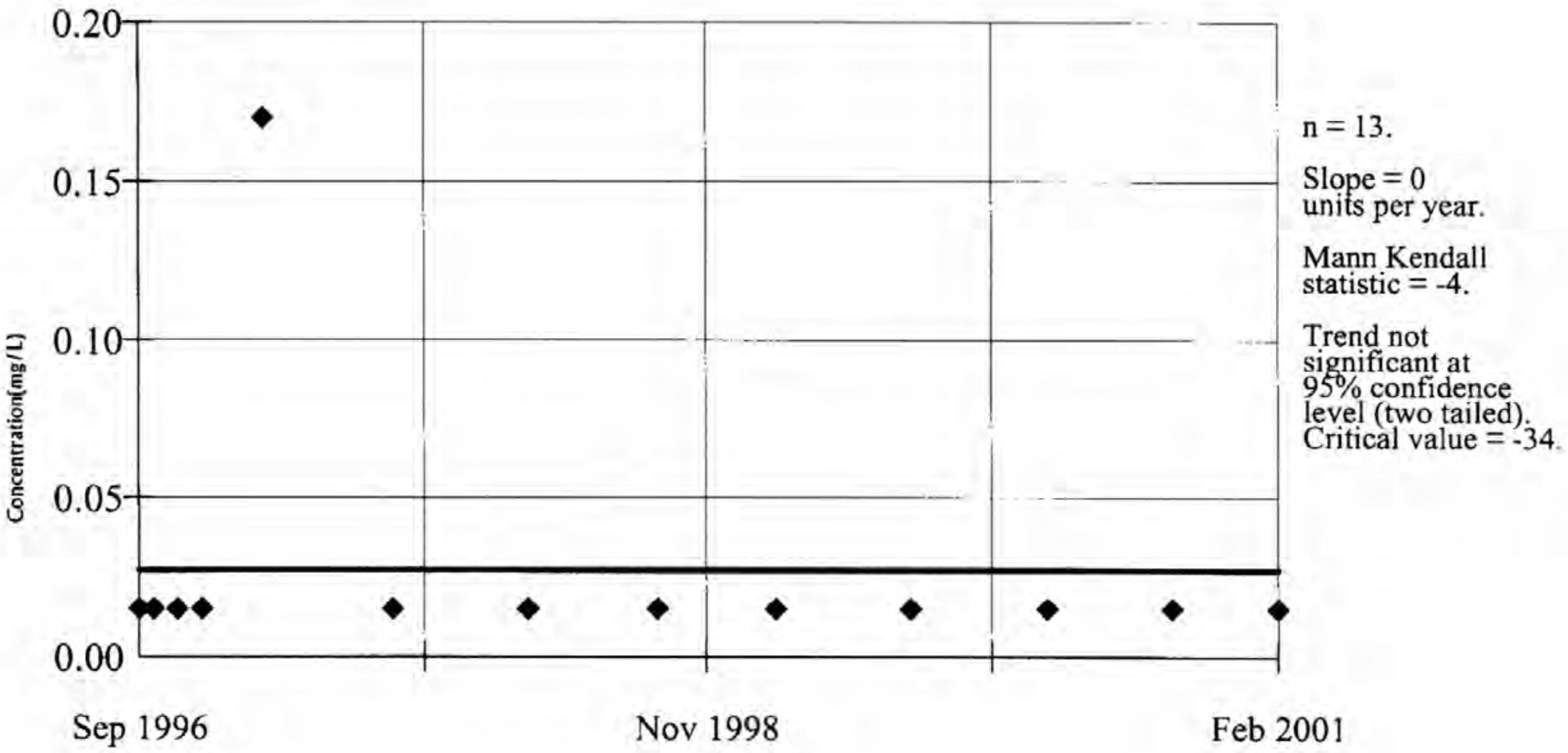
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -58.

Constituent: Vanadium Total (mg/L)
Date: 3/27/01, 10:24 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-4



n = 13.

Slope = 0
units per year.

Mann Kendall
statistic = -4.

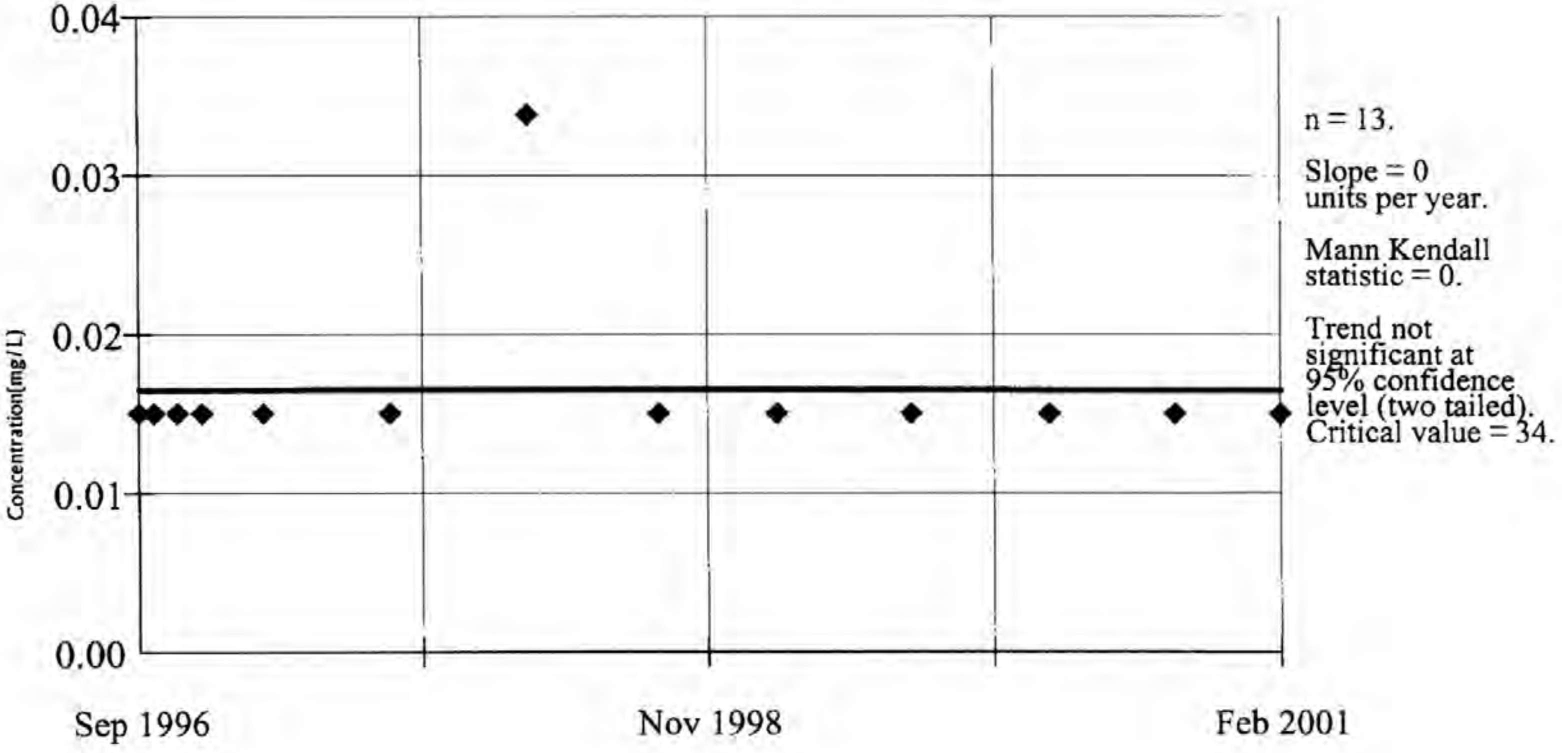
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -34.

Constituent: Zinc Total (mg/L)
Date: 3/27/01, 10:24 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-5

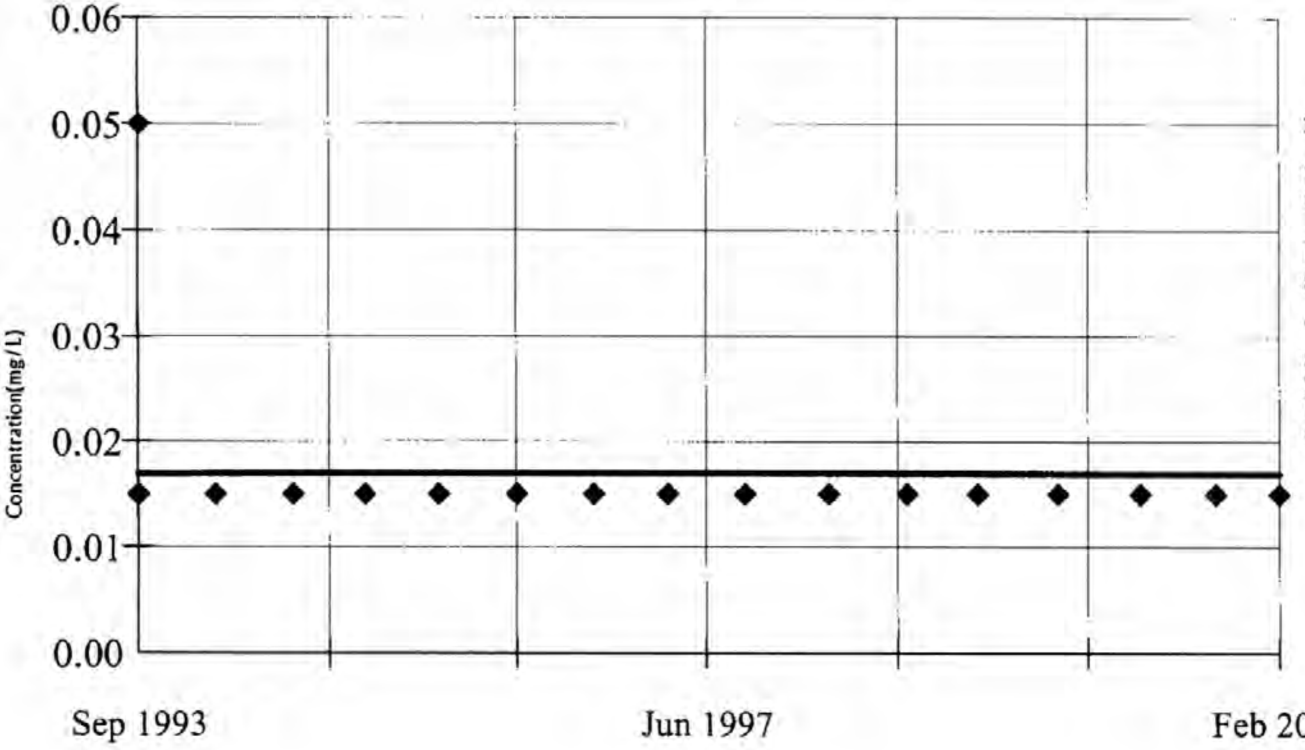


Constituent: Zinc Total (mg/L)
Date: 3/27/01, 10:24 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-6



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = -12.

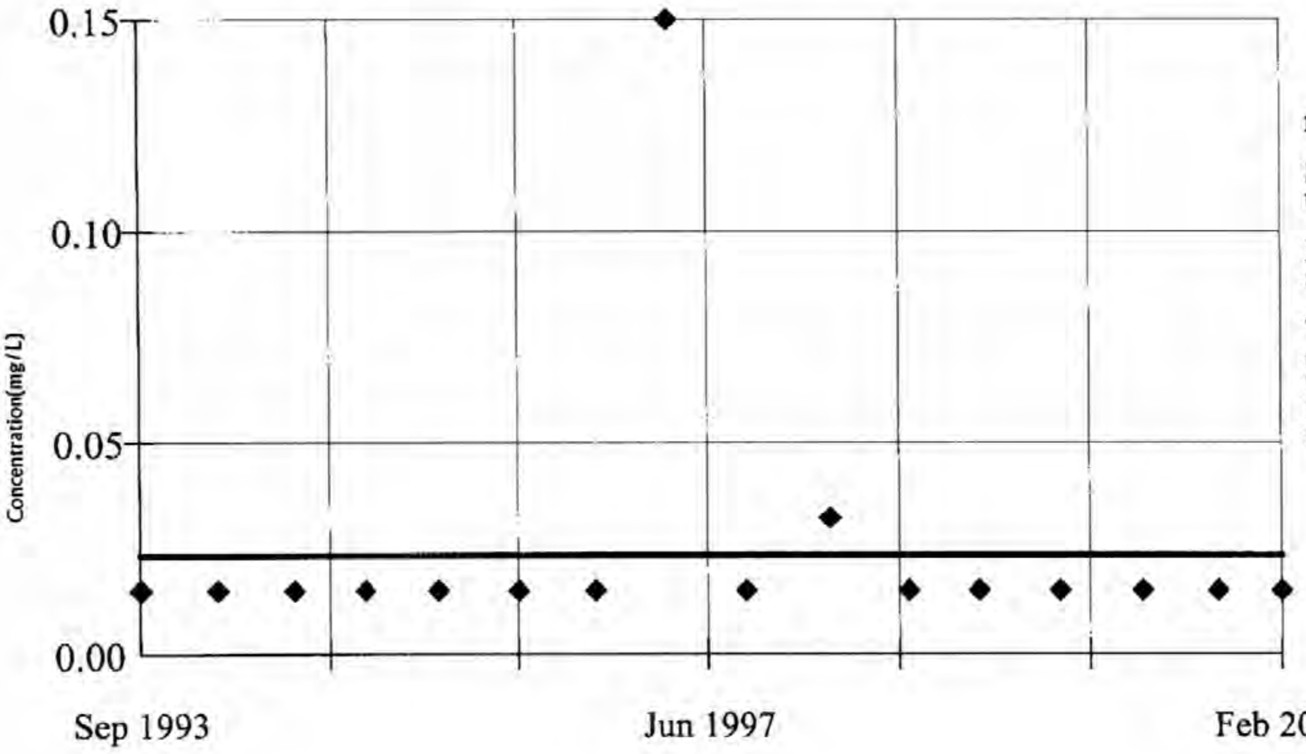
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -58.

Constituent: Zinc Total (mg/L)
Date: 3/27/01, 10:24 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-7



n = 19.

Slope = 0 units per year.

Mann Kendall statistic = 7.

Trend not significant at 95% confidence level (two tailed). Critical value = 58.

Constituent: Zinc Total (mg/L)

Date: 3/27/01, 10:24 AM

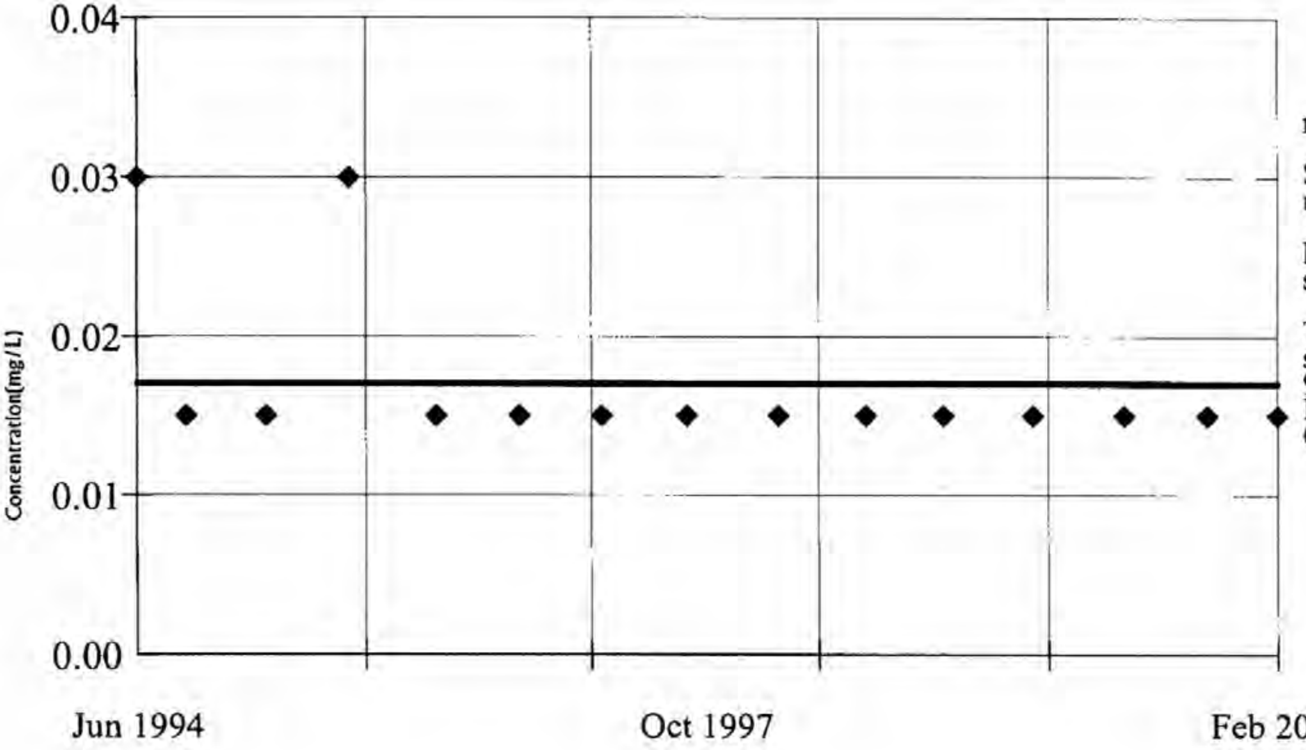
Facility: Timberlands LF

Client: Timberlands LF

Data File: TIMBER

View: _Batch_

SEN'S SLOPE ESTIMATOR
GW-8



n = 15.

Slope = 0
units per year.

Mann Kendall
statistic = -22.

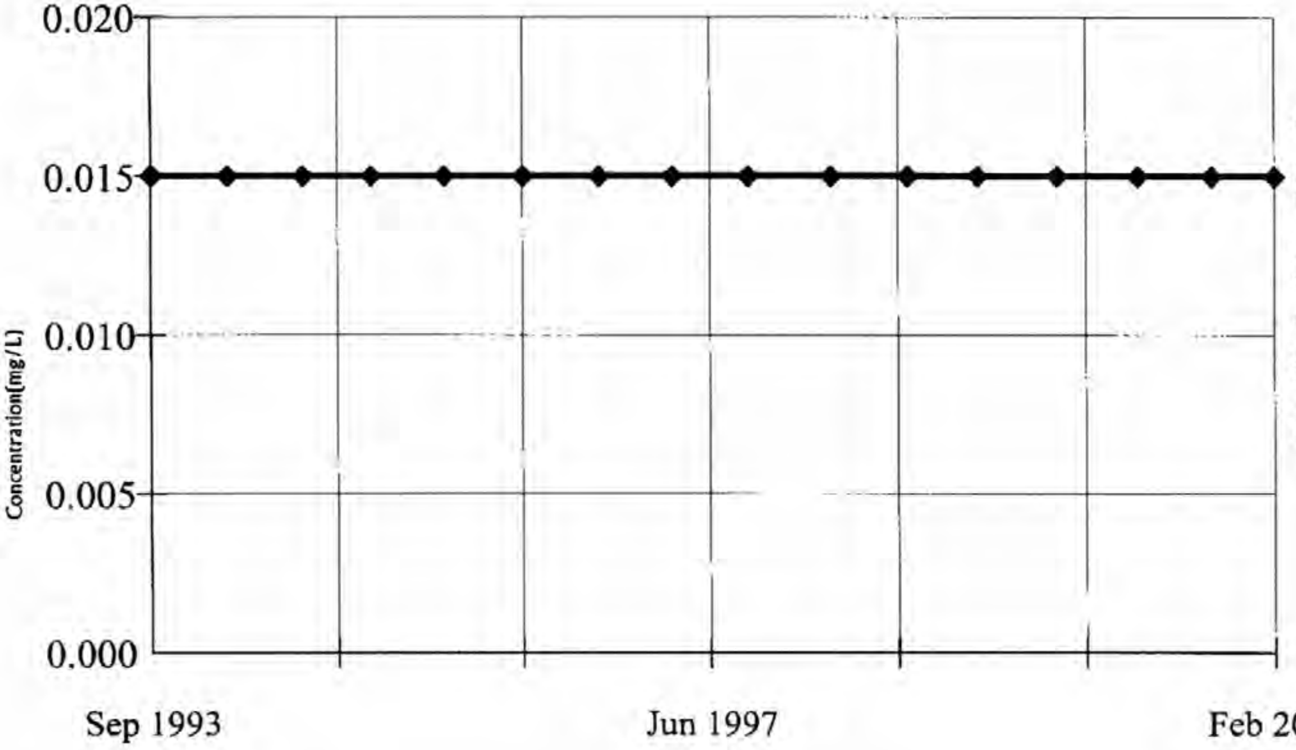
Trend not
significant at
95% confidence
level (two tailed).
Critical value = -41.

Constituent: Zinc Total (mg/L)
Date: 3/27/01, 10:24 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

SEN'S SLOPE ESTIMATOR
UGW-1



n = 19.

Slope = 0
units per year.

Mann Kendall
statistic = 0.

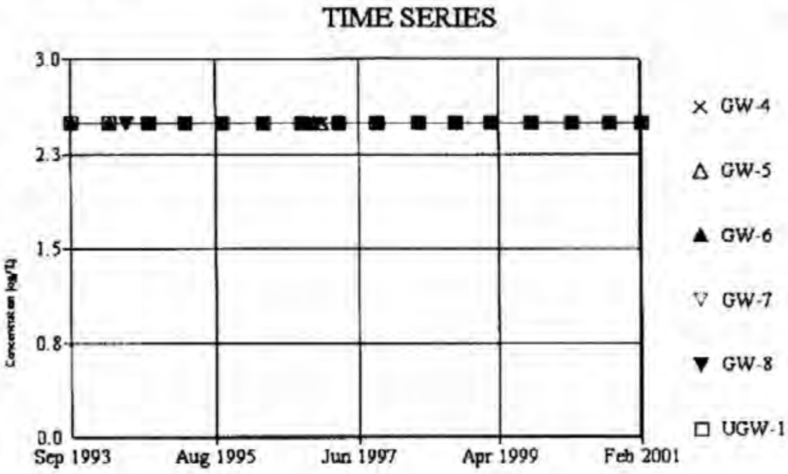
Trend not
significant at
95% confidence
level (two tailed).
Critical value = 58.

Constituent: Zinc Total (mg/L)
Date: 3/27/01, 10:24 AM

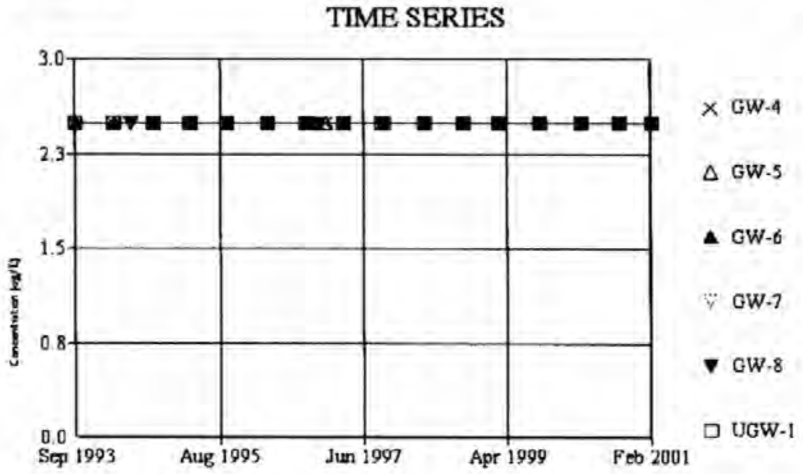
Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

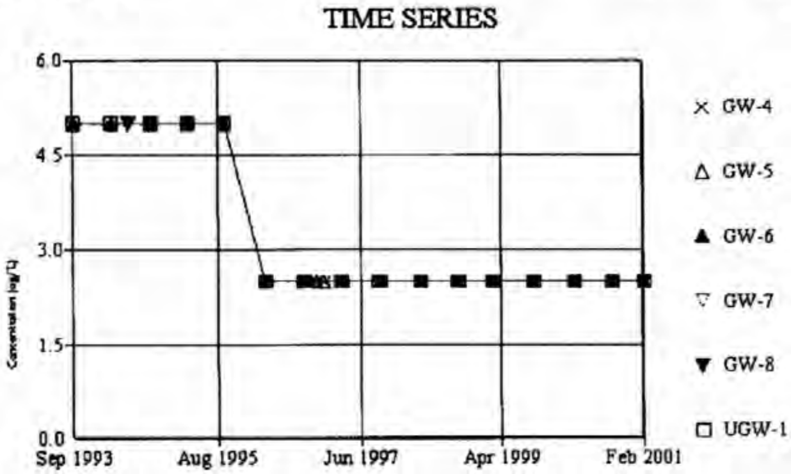
Appendix D
Background Time Series Plots



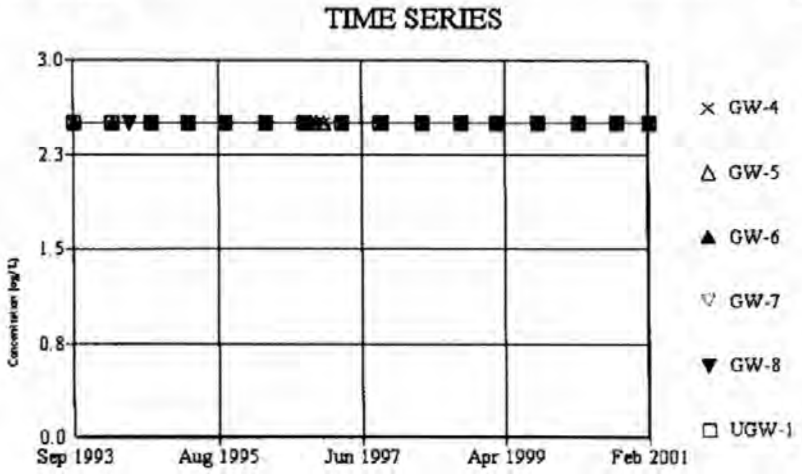
Constituent: 1112-Tetrachloroethane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:03 AM Client: Timberlands LF View: _Batch_



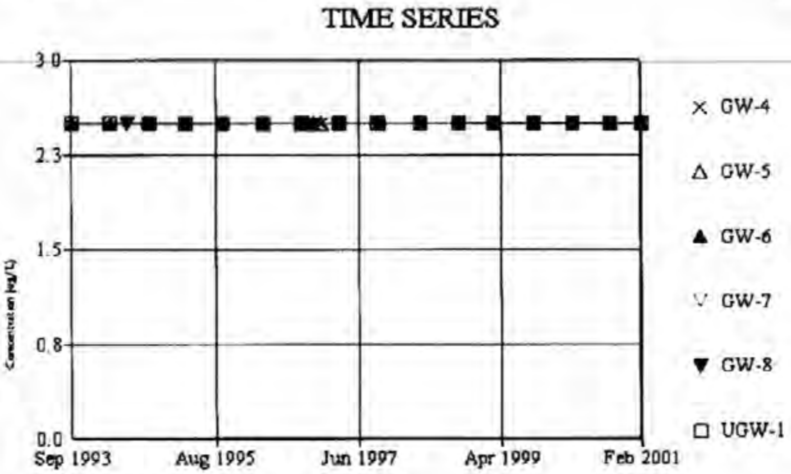
Constituent: 111-Trichloroethane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_



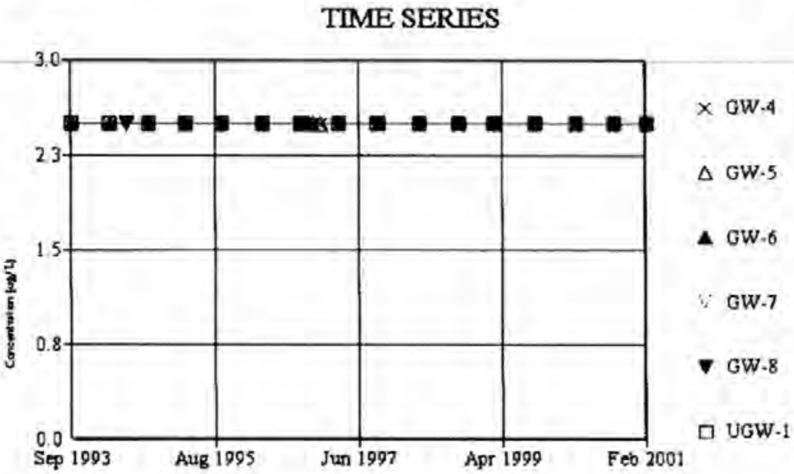
Constituent: 1122-Tetrachloroethane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_



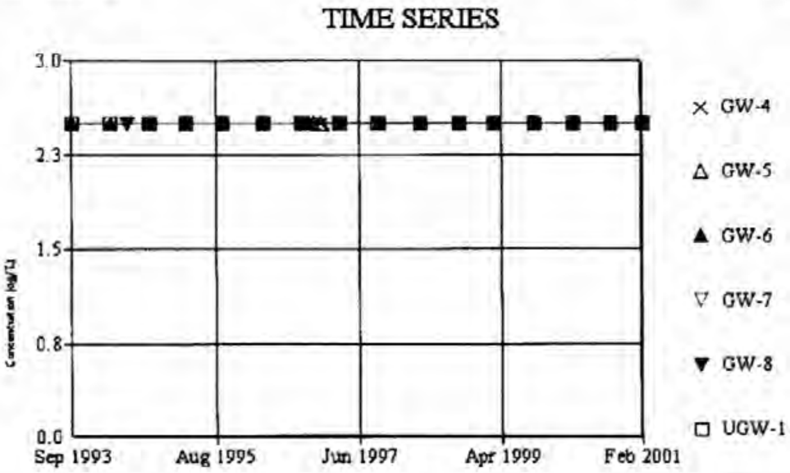
Constituent: 112-Trichloroethane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_



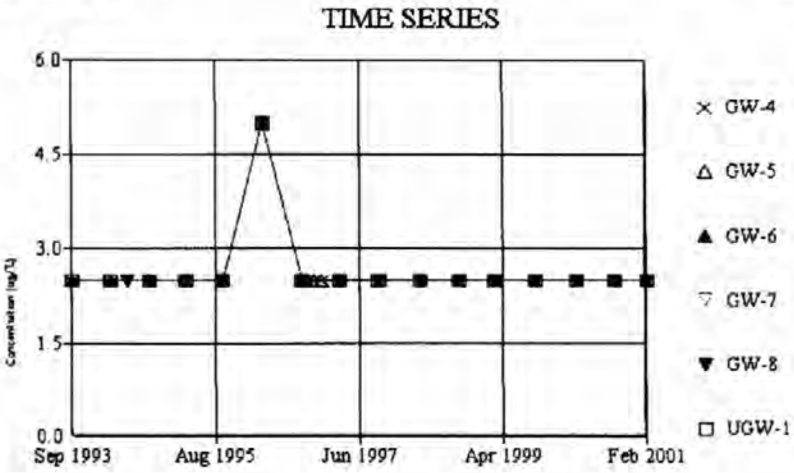
Constituent: 11-Dichloroethane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_



Constituent: 11-Dichloroethylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_

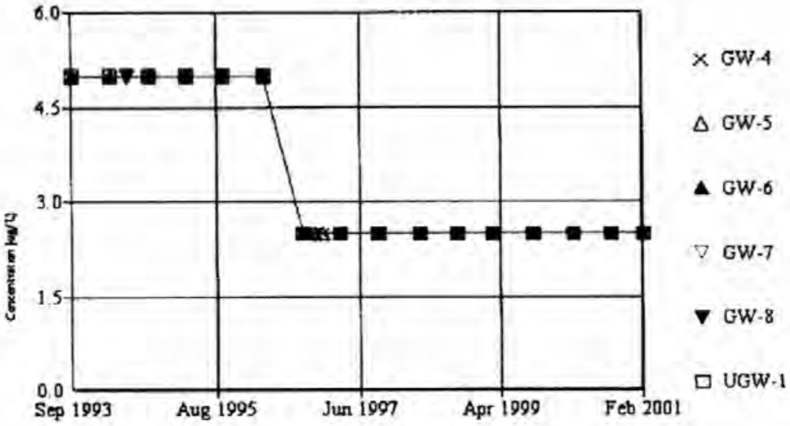


Constituent: 123-Trichloropropane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_



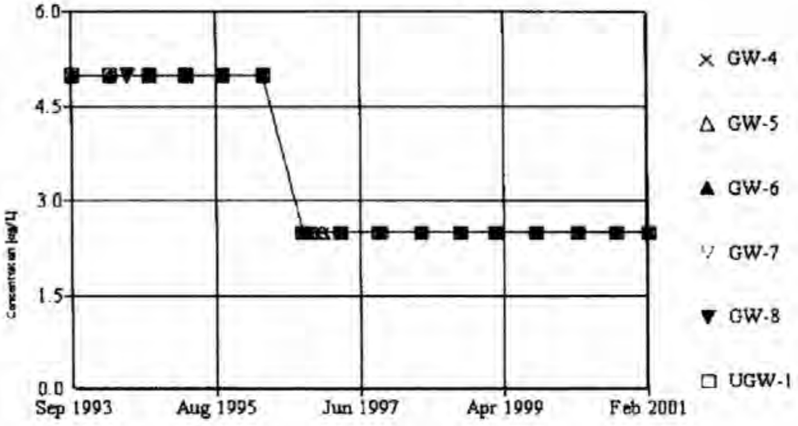
Constituent: 12-Dibromo-3-chloropropane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:04 AM Client: Timberlands LF View: _Batch_

TIME SERIES



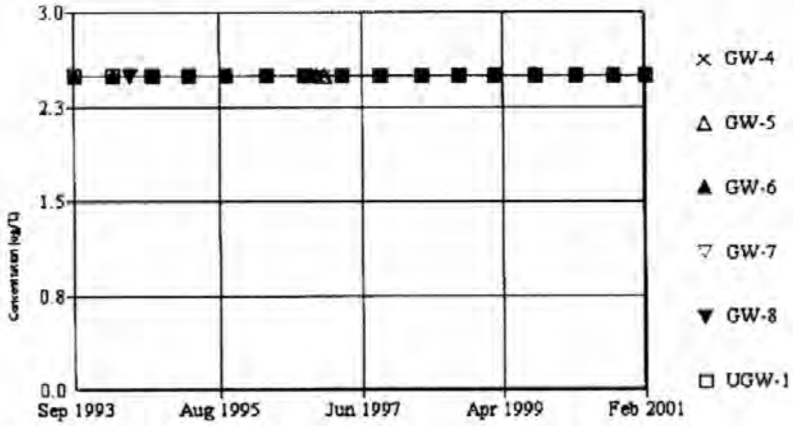
Constituent: 12-Dibromoethane (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:04 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



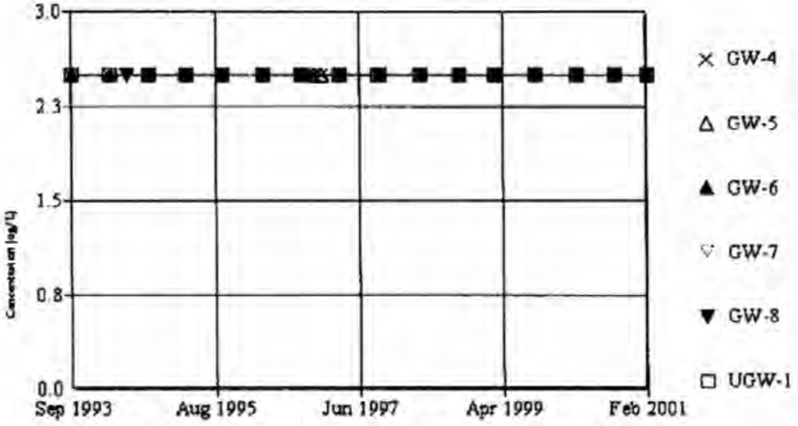
Constituent: 12-Dichlorobenzene (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:04 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



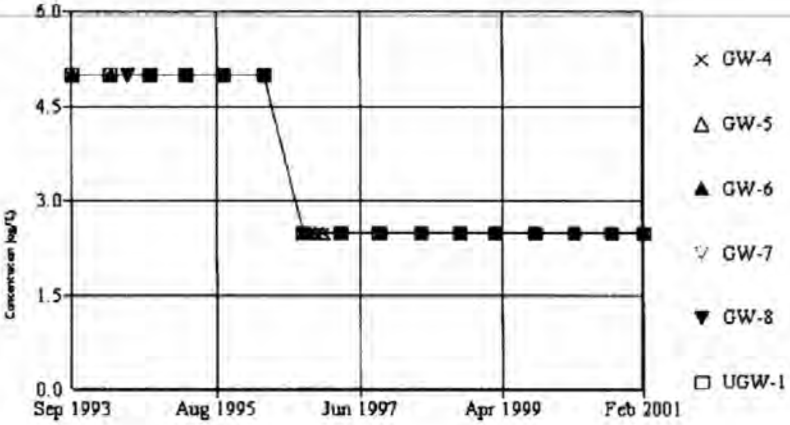
Constituent: 12-Dichloroethane (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:04 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



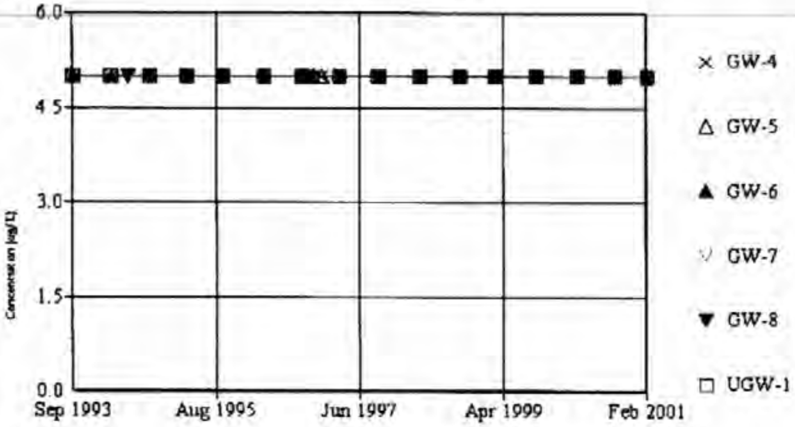
Constituent: 12-Dichloropropane (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:04 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



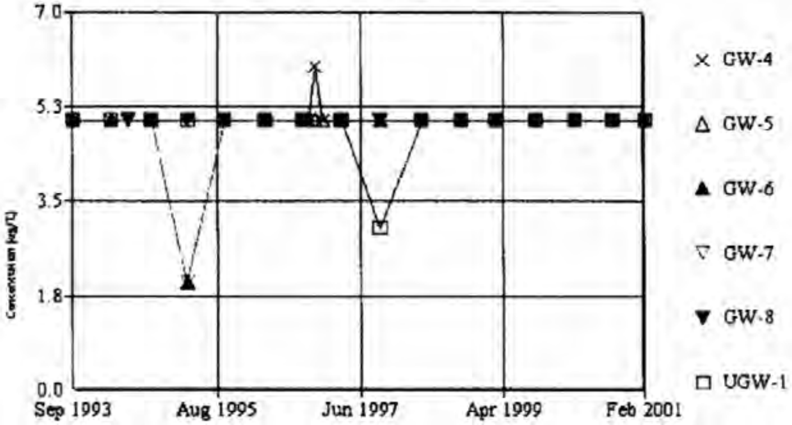
Constituent: 14-Dichlorobenzene (ug/L)
Date: 4/5/01, 10:04 AM
Facility: Timberlands LF
Client: Timberlands LF
Data File: TIMBER
View: _Batch_

TIME SERIES



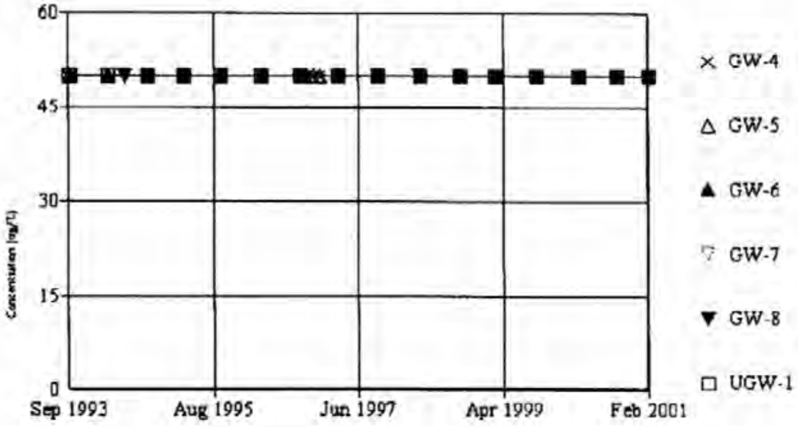
Constituent: 2-Hexanone (ug/L)
Date: 4/5/01, 10:04 AM
Facility: Timberlands LF
Client: Timberlands LF
Data File: TIMBER
View: _Batch_

TIME SERIES

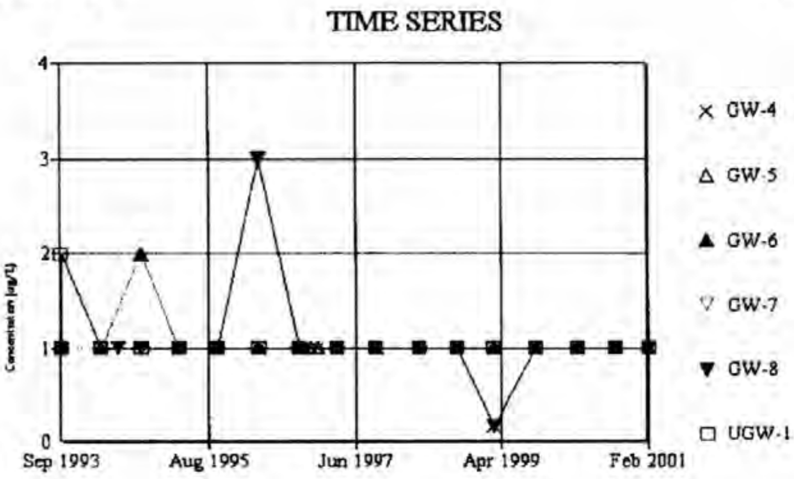


Constituent: Acetone (ug/L)
Date: 4/5/01, 10:04 AM
Facility: Timberlands LF
Client: Timberlands LF
Data File: TIMBER
View: _Batch_

TIME SERIES



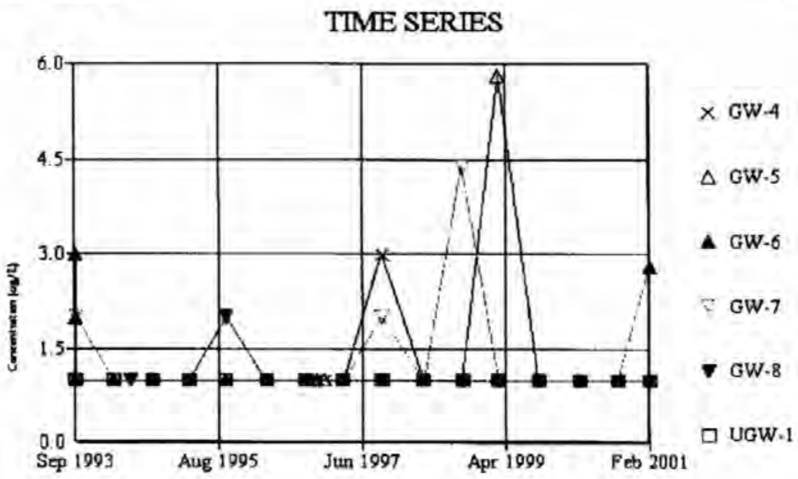
Constituent: Acrylonitrile (ug/L)
Date: 4/5/01, 10:04 AM
Facility: Timberlands LF
Client: Timberlands LF
Data File: TIMBER
View: _Batch_



Constituent: Antimony Total (ug/L)
Date: 4/5/01, 10:04 AM

Facility: Timberlands LF
Client: Timberlands LF

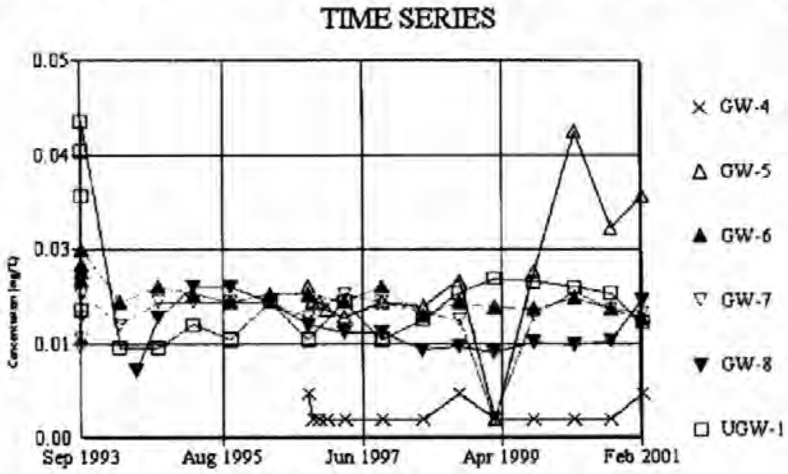
Data File: TIMBER
View: _Batch_



Constituent: Arsenic Total (ug/L)
Date: 4/5/01, 10:04 AM

Facility: Timberlands LF
Client: Timberlands LF

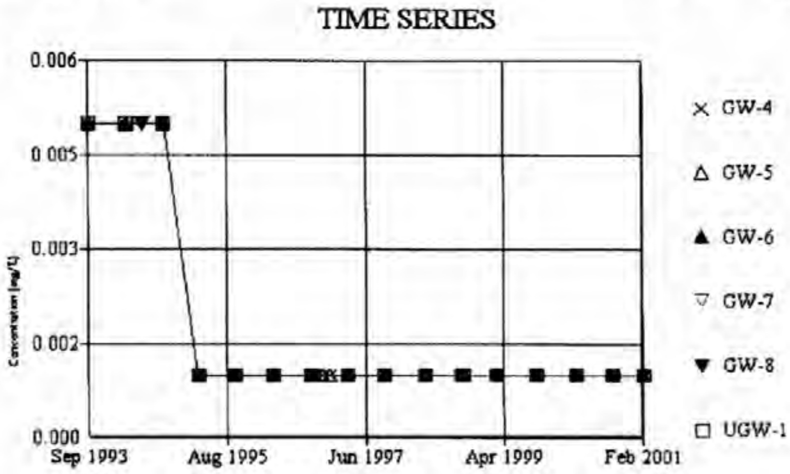
Data File: TIMBER
View: _Batch_



Constituent: Barium Total (mg/L)
Date: 4/5/01, 10:04 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

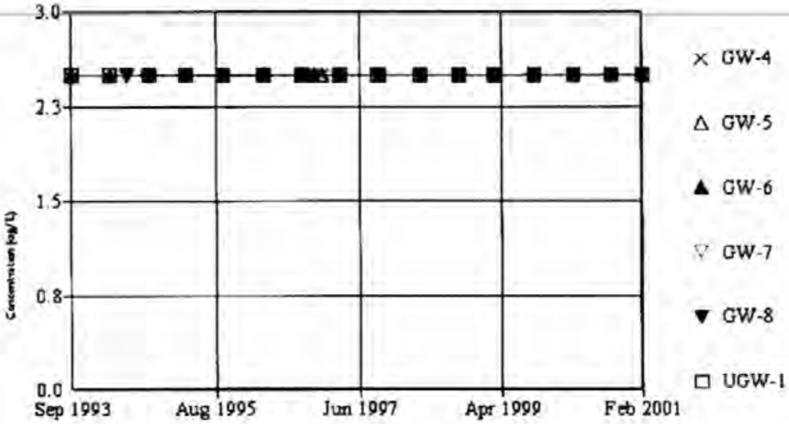


Constituent: Beryllium Total (mg/L)
Date: 4/5/01, 10:04 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

TIME SERIES

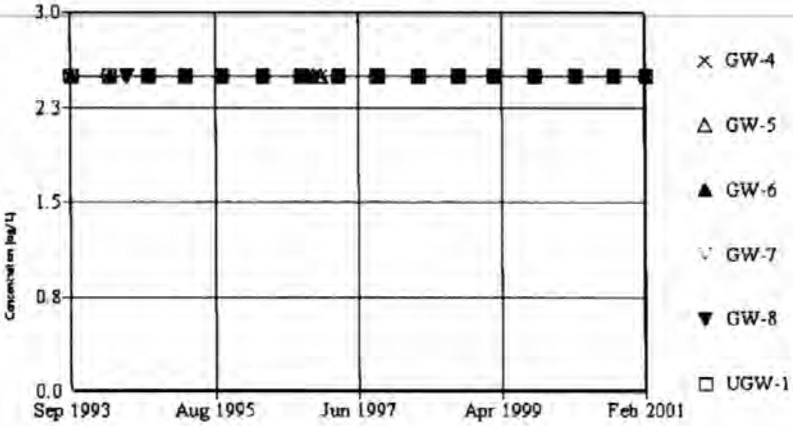


Constituent: Bromochloromethane (ug/L) Date: 4/5/01, 10:05 AM

Facility: Timberlands LF Client: Timberlands LF

Data File: TIMBER View: _Batch_

TIME SERIES

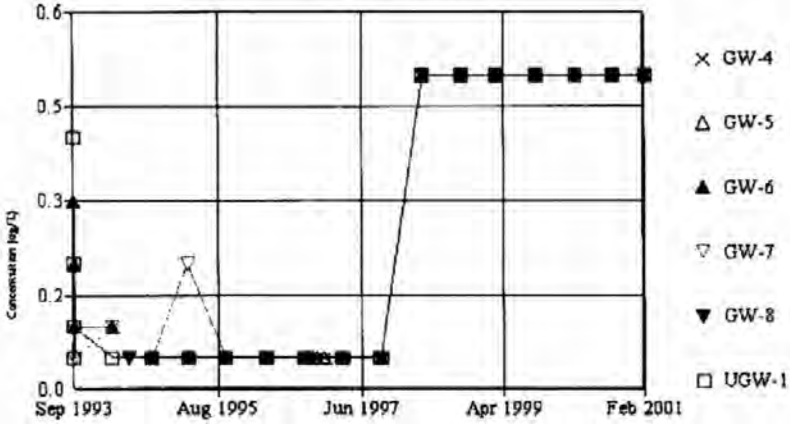


Constituent: Bromoform (ug/L) Date: 4/5/01, 10:05 AM

Facility: Timberlands LF Client: Timberlands LF

Data File: TIMBER View: _Batch_

TIME SERIES

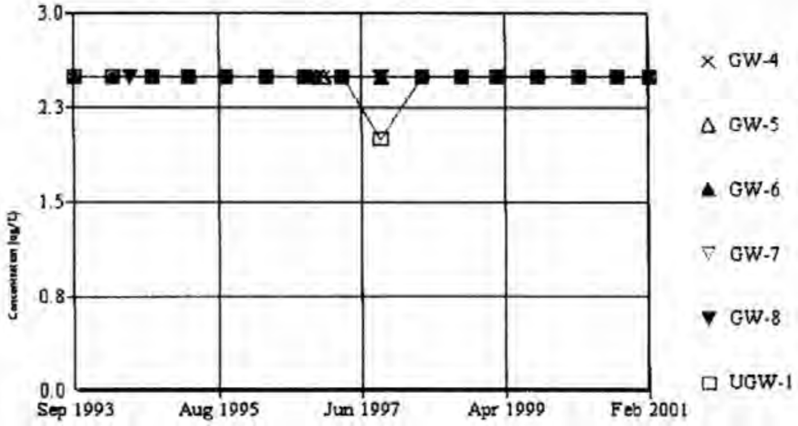


Constituent: Cadmium Total (ug/L) Date: 4/5/01, 10:05 AM

Facility: Timberlands LF Client: Timberlands LF

Data File: TIMBER View: _Batch_

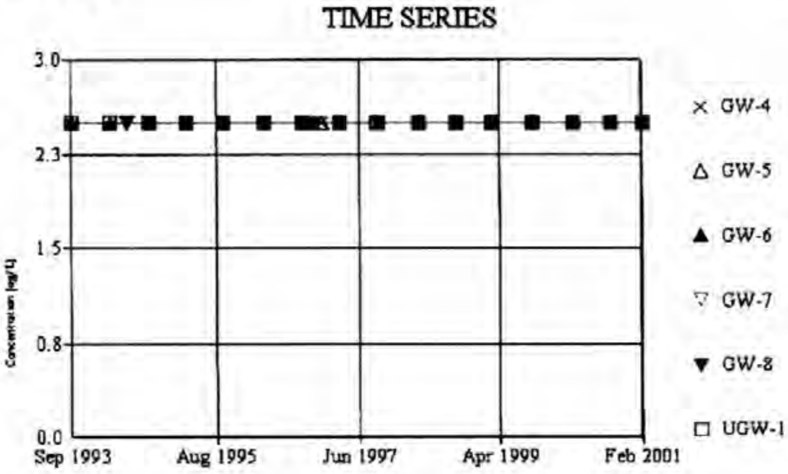
TIME SERIES



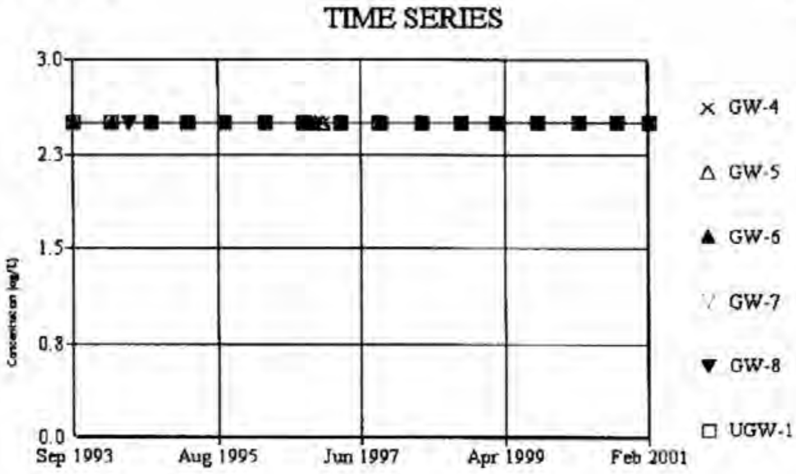
Constituent: Carbon disulfide (ug/L) Date: 4/5/01, 10:05 AM

Facility: Timberlands LF Client: Timberlands LF

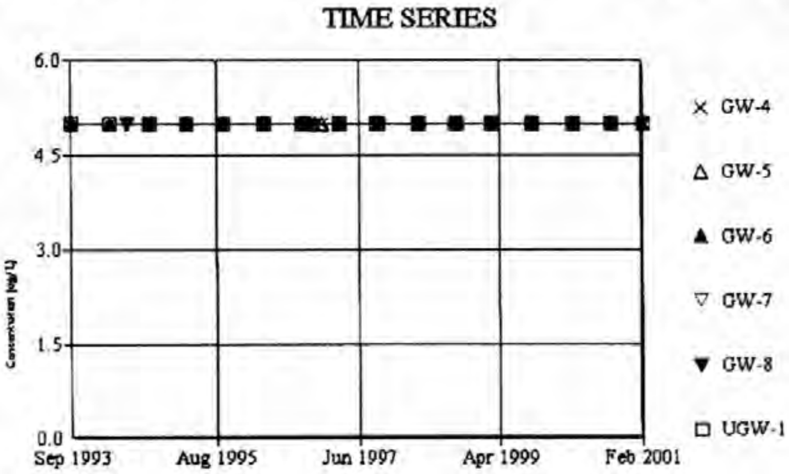
Data File: TIMBER View: _Batch_



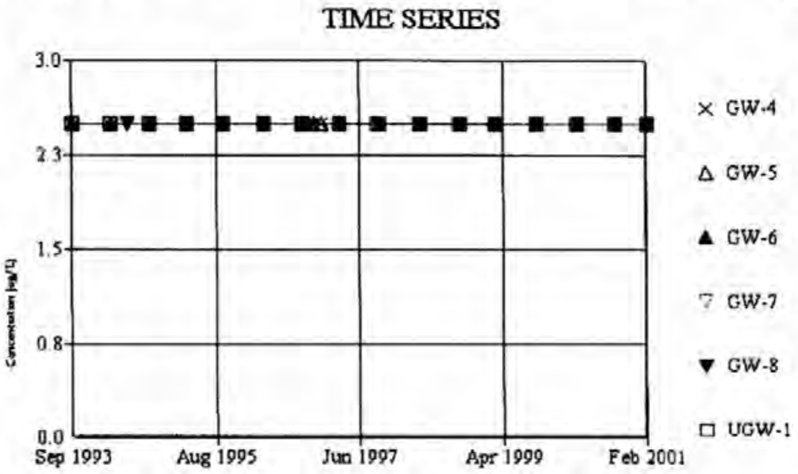
Constituent: Carbon tetrachloride (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**



Constituent: Chlorobenzene (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**

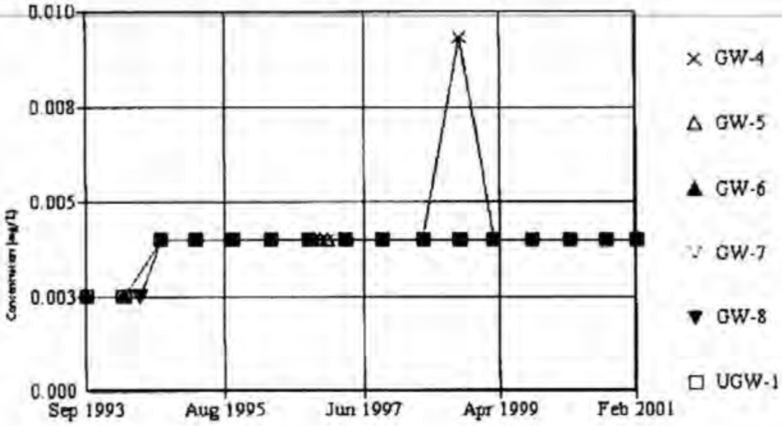


Constituent: Chloroethane (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**



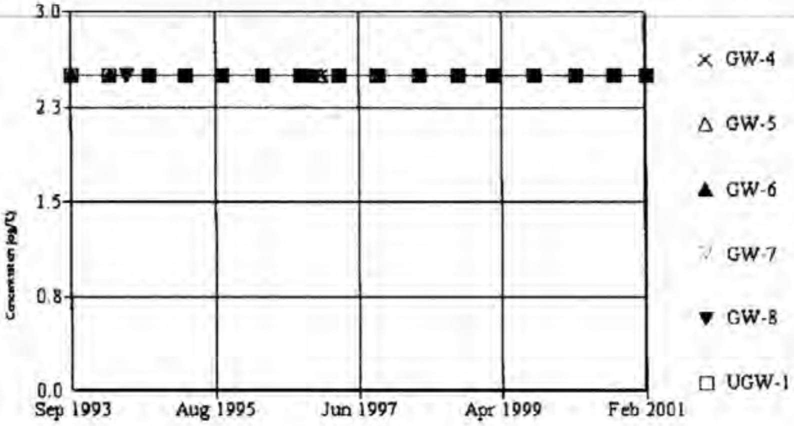
Constituent: Chloroform (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



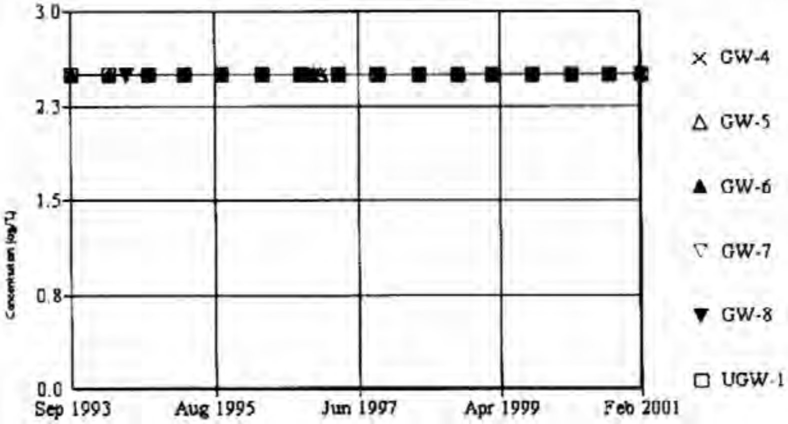
Constituent: Chromium Total (mg/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:05 AM Client: Timberlands LF View: _Batch_

TIME SERIES



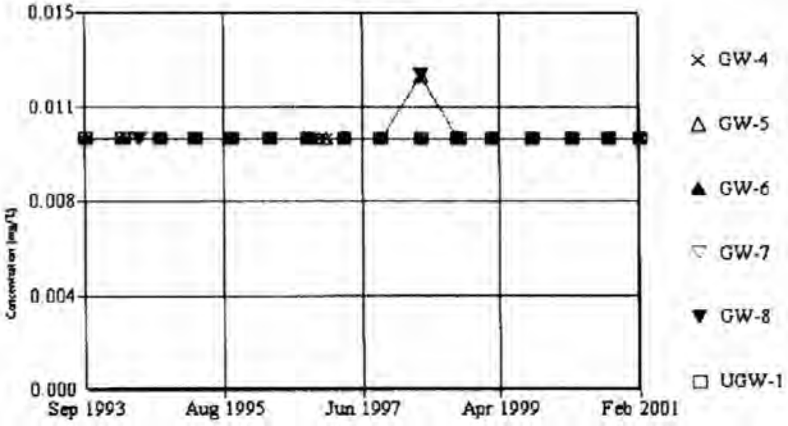
Constituent: cis-12-Dichloroethylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:05 AM Client: Timberlands LF View: _Batch_

TIME SERIES

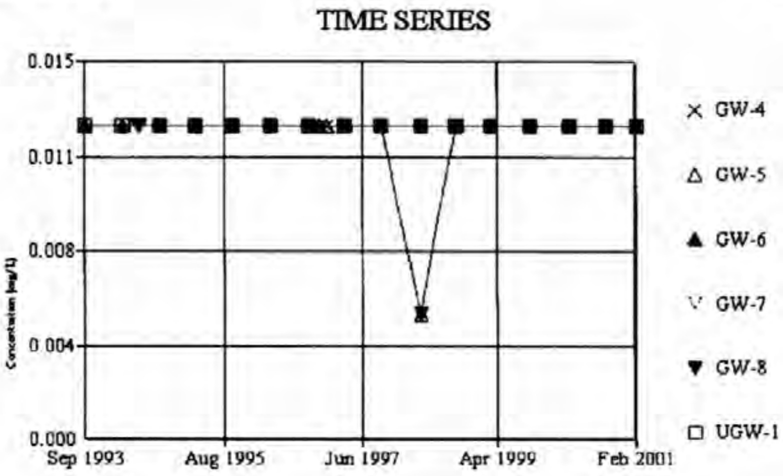


Constituent: cis-13-Dichloropropylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:05 AM Client: Timberlands LF View: _Batch_

TIME SERIES



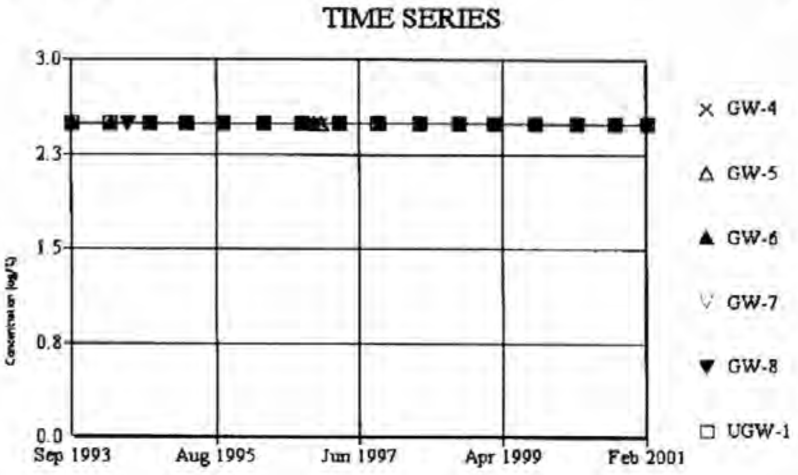
Constituent: Cobalt Total (mg/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:05 AM Client: Timberlands LF View: _Batch_



Constituent: Copper Total (mg/L)
Date: 4/5/01, 10:05 AM

Facility: Timberlands LF
Client: Timberlands LF

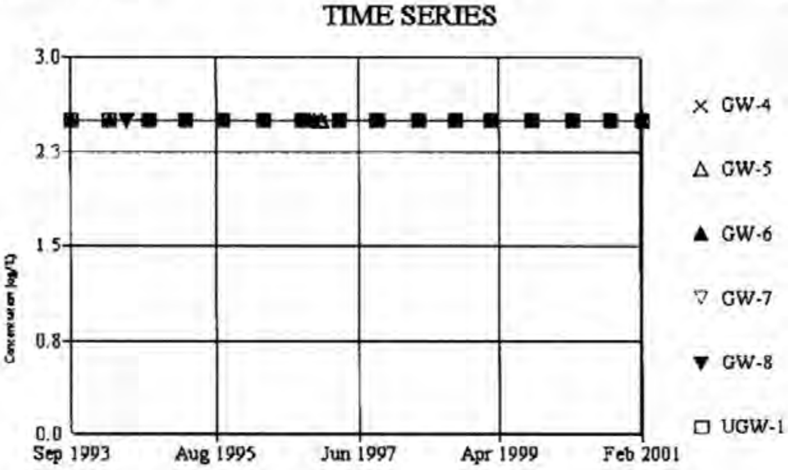
Data File: TIMBER
View: _Batch_



Constituent: Dibromochloromethane (ug/L)
Date: 4/5/01, 10:05 AM

Facility: Timberlands LF
Client: Timberlands LF

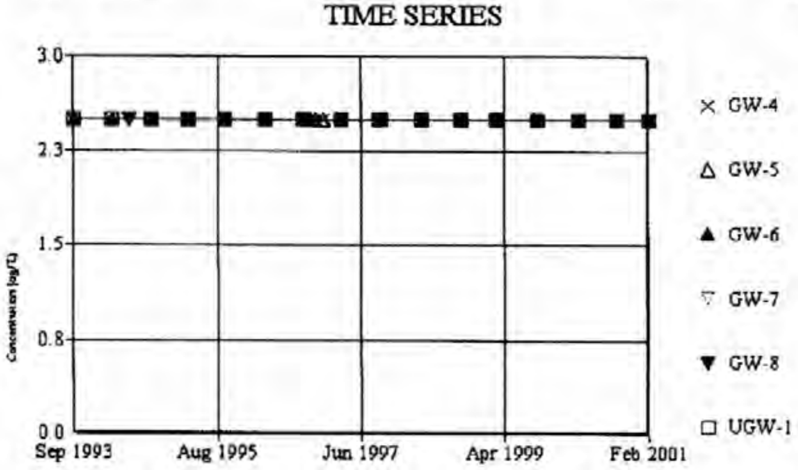
Data File: TIMBER
View: _Batch_



Constituent: Dibromomethane (ug/L)
Date: 4/5/01, 10:05 AM

Facility: Timberlands LF
Client: Timberlands LF

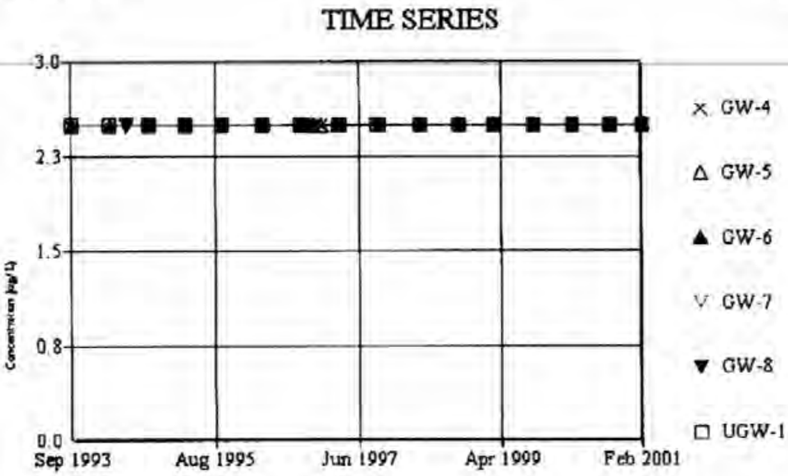
Data File: TIMBER
View: _Batch_



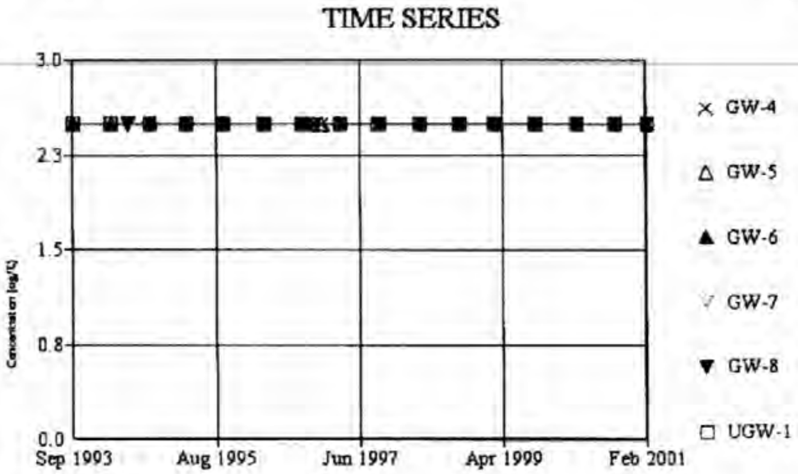
Constituent: Dichlorobromomethane (ug/L)
Date: 4/5/01, 10:05 AM

Facility: Timberlands LF
Client: Timberlands LF

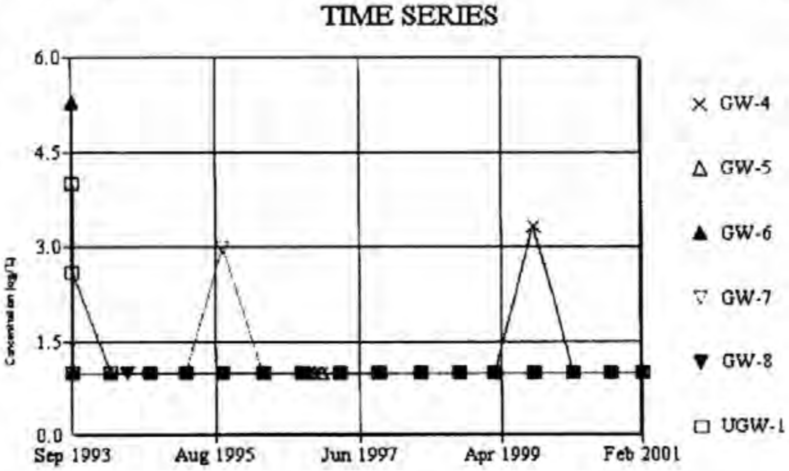
Data File: TIMBER
View: _Batch_



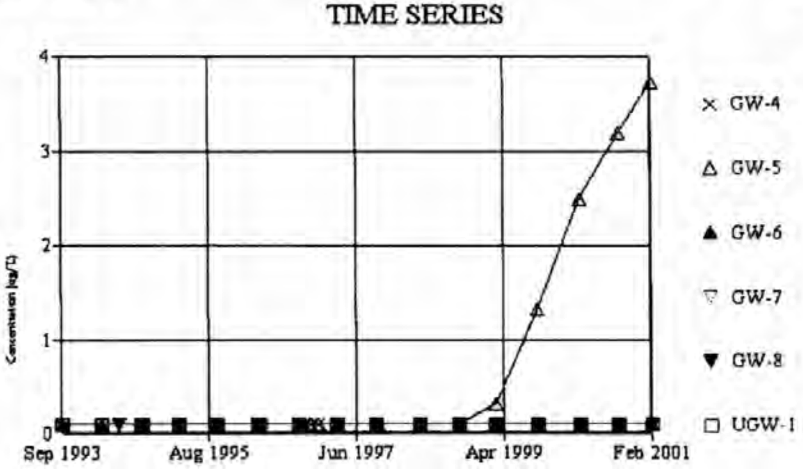
Constituent: Ethylbenzene (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**



Constituent: Iodomethane (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**

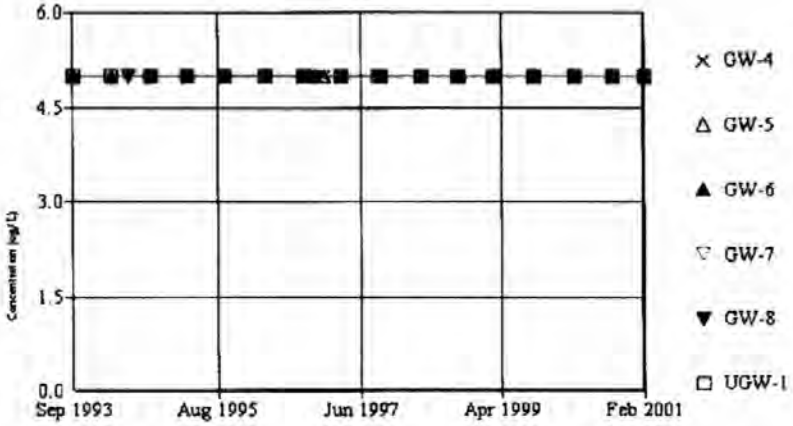


Constituent: Lead Total (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:05 AM **Client: Timberlands LF** **View: _Batch_**



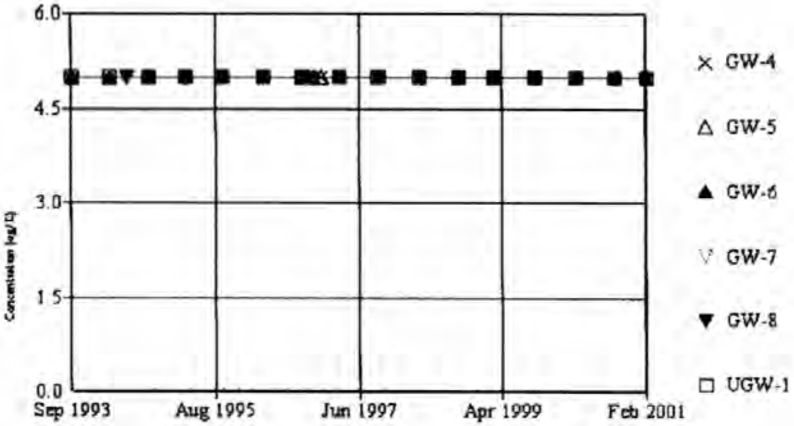
Constituent: Mercury Total (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:06 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



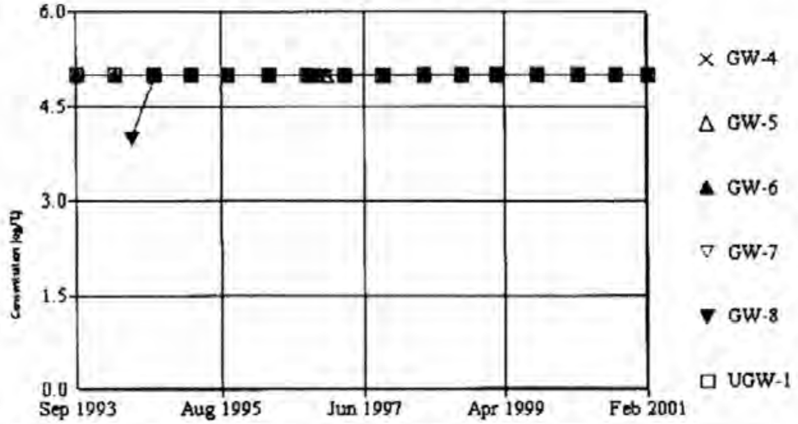
Constituent: Methyl bromide (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:06 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES



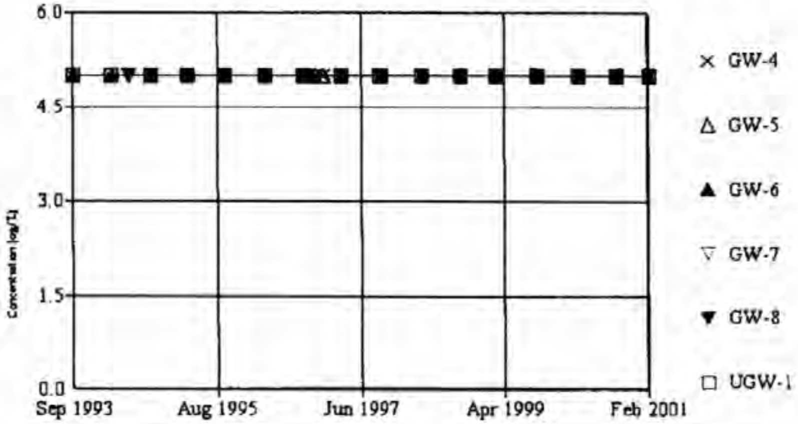
Constituent: Methyl chloride (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:06 AM **Client: Timberlands LF** **View: _Batch_**

TIME SERIES

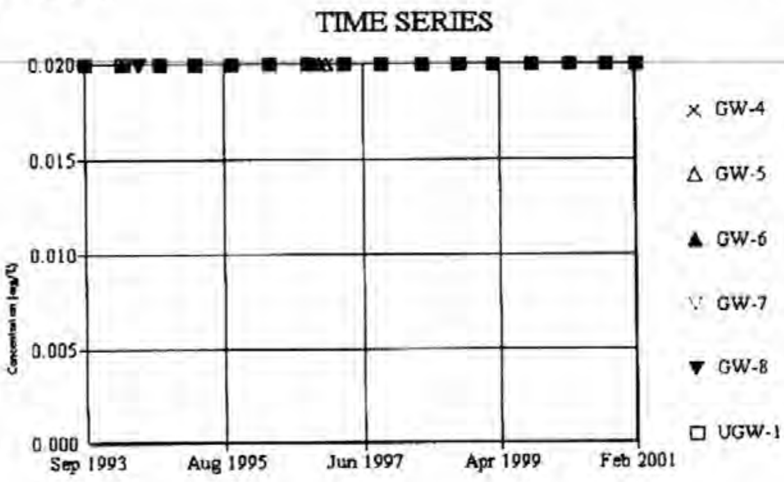


Constituent: Methyl ethyl ketone (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:06 AM **Client: Timberlands LF** **View: _Batch_**

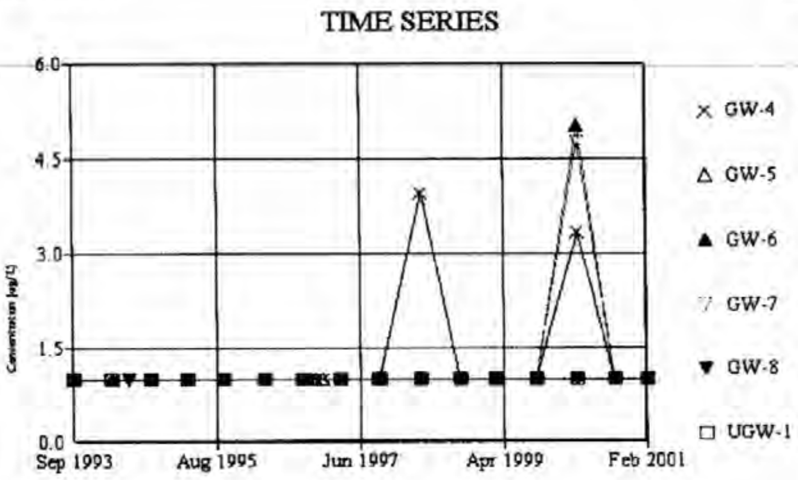
TIME SERIES



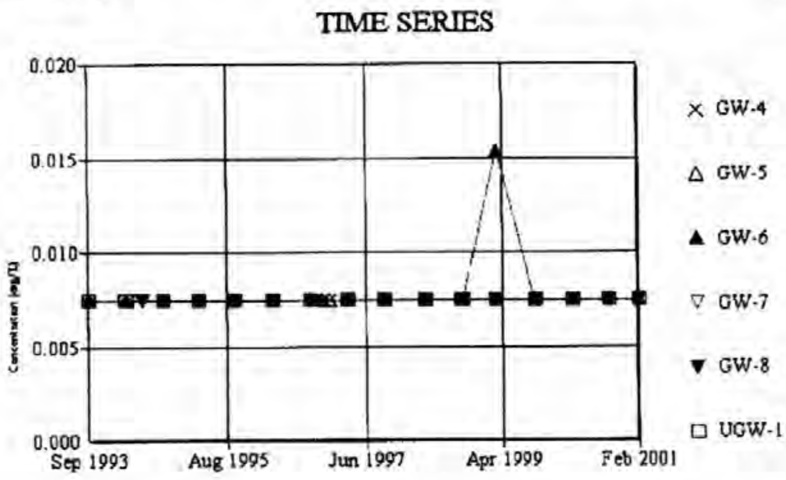
Constituent: Methyl-iso-butyl ketone (ug/L) **Facility: Timberlands LF** **Data File: TIMBER**
Date: 4/5/01, 10:06 AM **Client: Timberlands LF** **View: _Batch_**



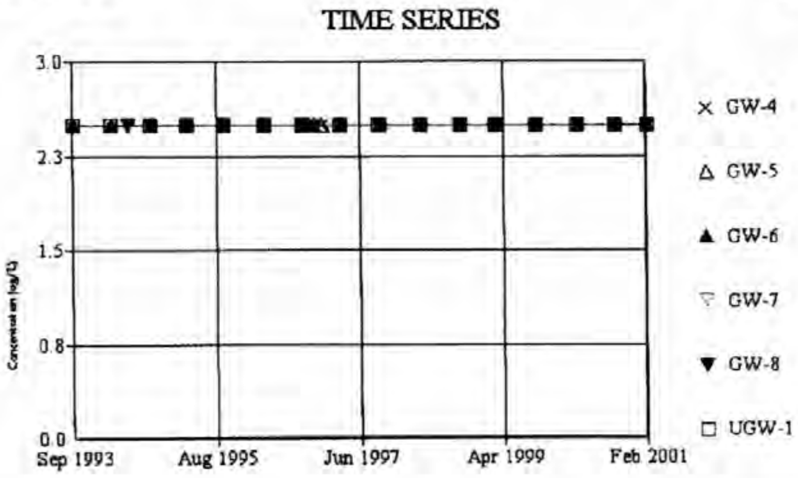
Constituent: Nickel Total (mg/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



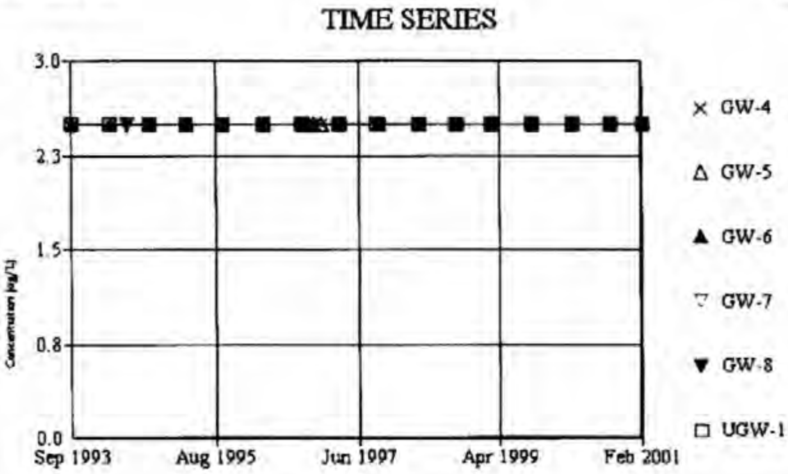
Constituent: Selenium Total (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



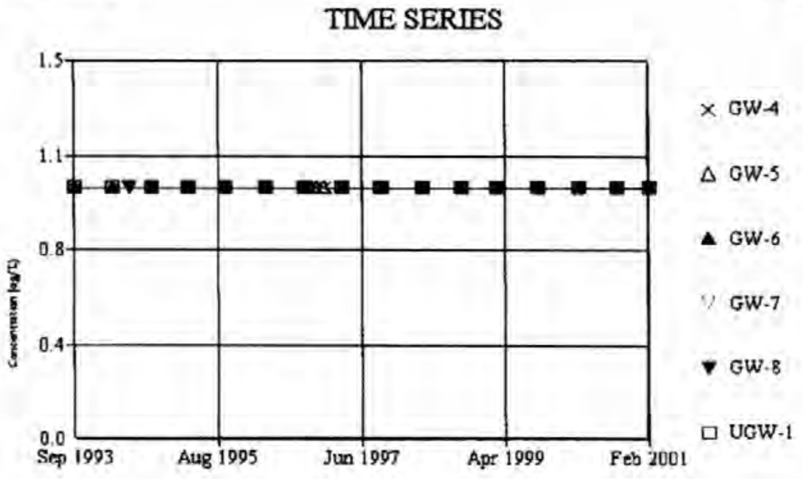
Constituent: Silver Total (mg/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



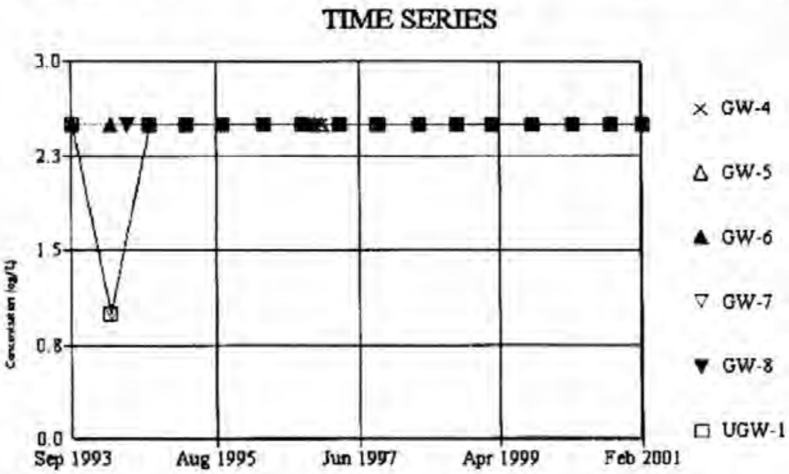
Constituent: Styrene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



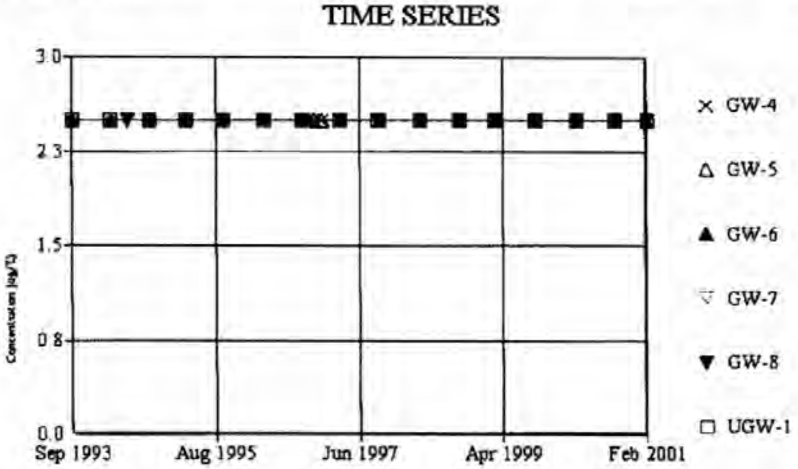
Constituent: Tetrachloroethylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



Constituent: Thallium Total (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_

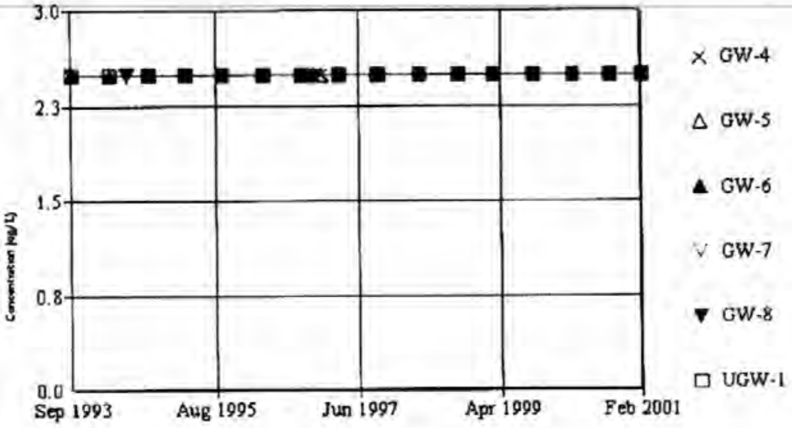


Constituent: Toluene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



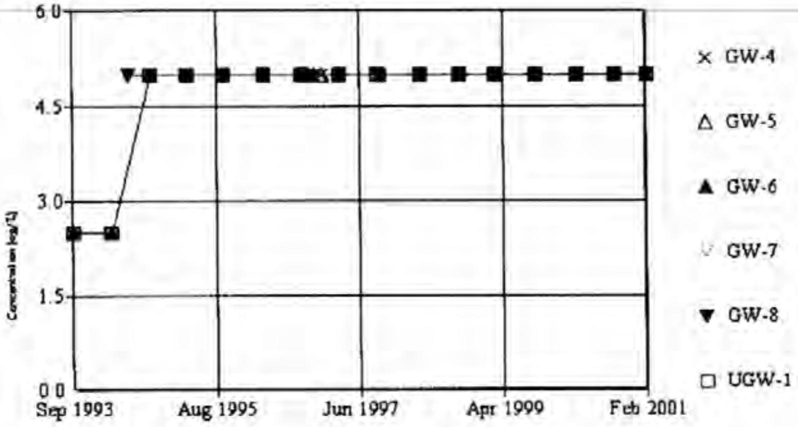
Constituent: trans-12-Dichloroethylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_

TIME SERIES



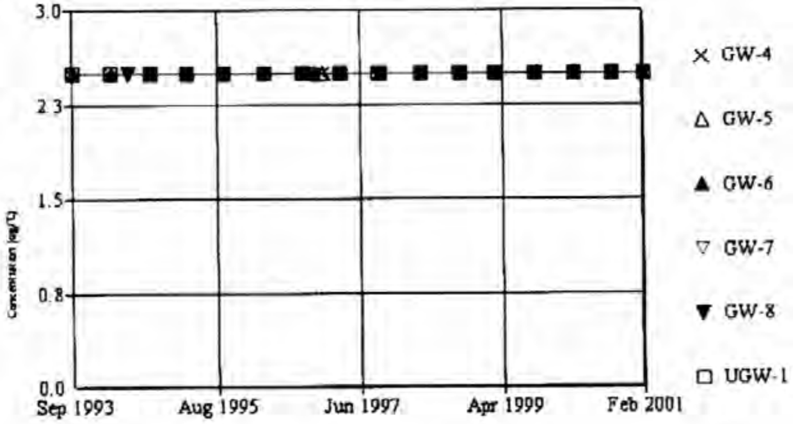
Constituent: trans-13-Dichloropropylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_

TIME SERIES



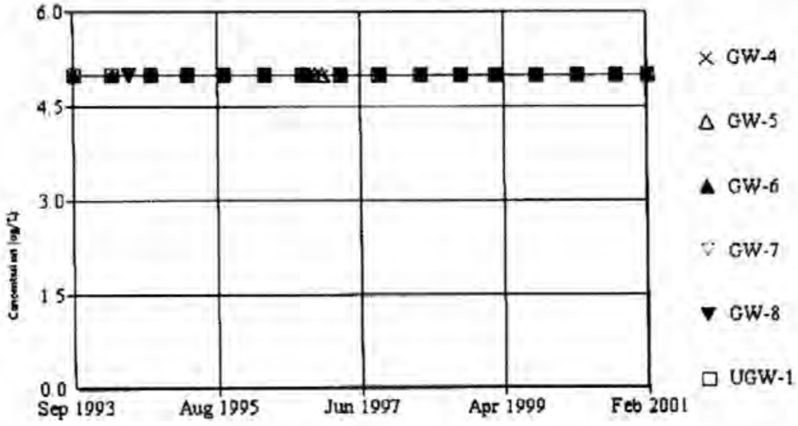
Constituent: trans-14-Dichloro-2-butene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_

TIME SERIES

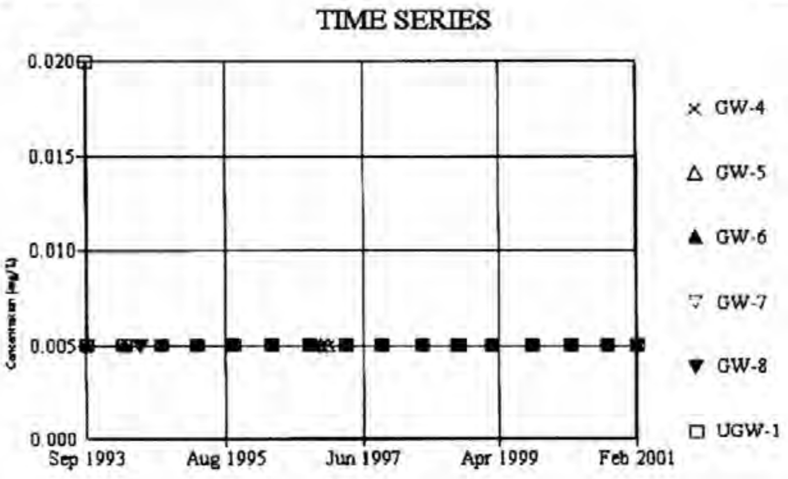


Constituent: Trichloroethylene (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_

TIME SERIES



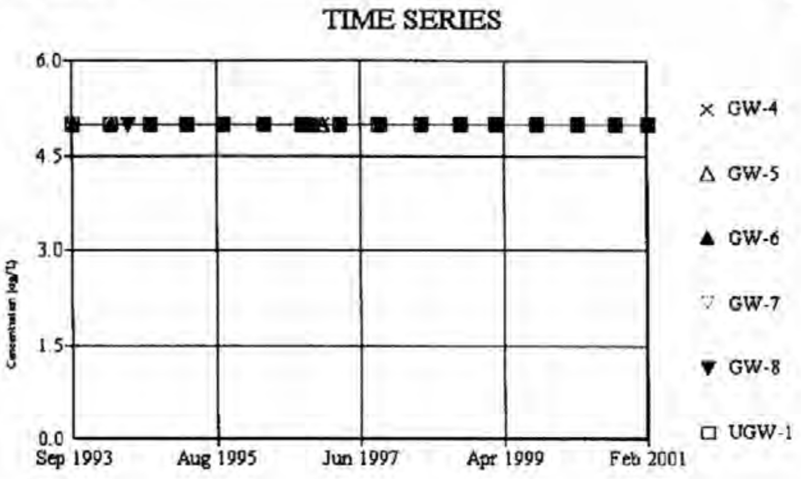
Constituent: Trichlorofluoromethane (ug/L) Facility: Timberlands LF Data File: TIMBER
Date: 4/5/01, 10:06 AM Client: Timberlands LF View: _Batch_



Constituent: Vanadium Total (mg/L)
Date: 4/5/01, 10:06 AM

Facility: Timberlands LF
Client: Timberlands LF

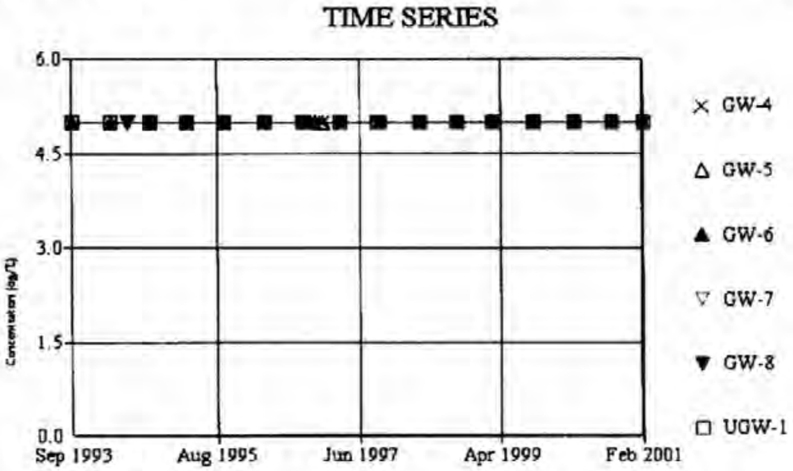
Data File: TIMBER
View: _Batch_



Constituent: Vinyl acetate (ug/L)
Date: 4/5/01, 10:06 AM

Facility: Timberlands LF
Client: Timberlands LF

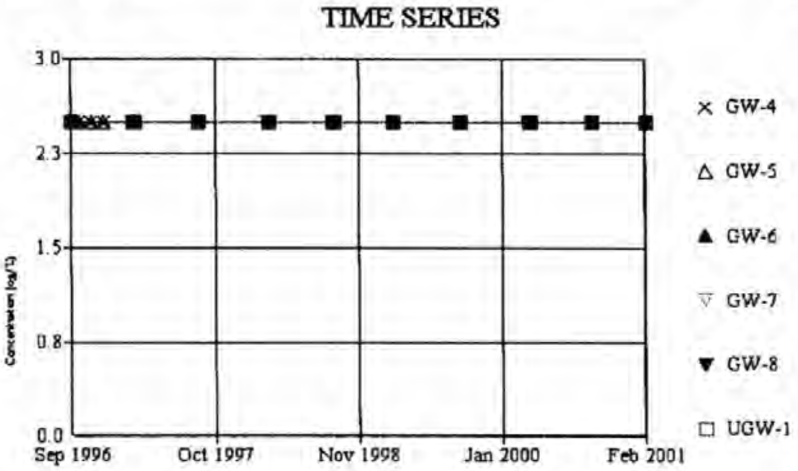
Data File: TIMBER
View: _Batch_



Constituent: Vinyl chloride (ug/L)
Date: 4/5/01, 10:07 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

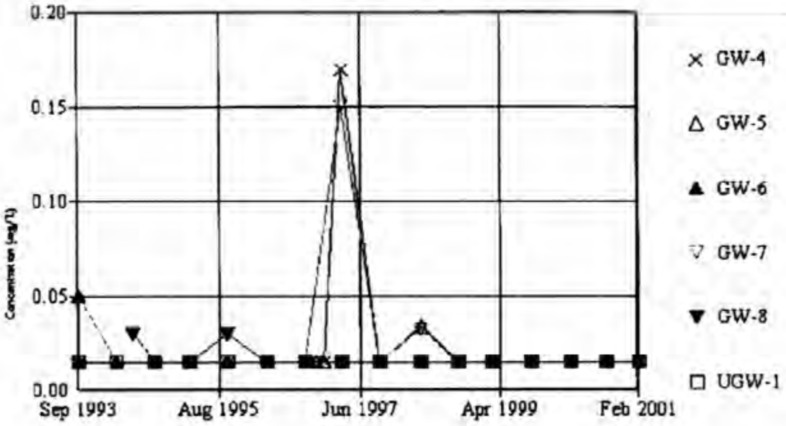


Constituent: Xylenes [Total] (ug/L)
Date: 4/5/01, 10:07 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

TIME SERIES



Constituent: Zinc Total (mg/L)
Date: 4/5/01, 10:07 AM

Facility: Timberlands LF
Client: Timberlands LF

Data File: TIMBER
View: _Batch_

9.0 GROUNDWATER MONITORING PLAN

9.1 SITE CONSIDERATIONS

9.1.1 Regional Geology

Escambia County lies within the Gulf Coastal Plain physiographic province. Escambia County is located along the southeastern limb of the Mississippi Embayment geosyncline. Sediments deposited in this geosynclinal trough extend northwest to Illinois and west to Texas.

Formations of Tertiary and Quaternary ages crop out in Escambia County. These formations are divided into six series which are, in ascending order: the Eocene (Te), Oligocene (Tb), Miocene (Tcp), and Pliocene (Tp) Series of Tertiary age; and the Pleistocene (Qt) and Recent (Qal) Series of Quaternary age. The Tertiary formations are underlain by rocks of Cretaceous and pre-Cretaceous age.

Rocks of Tertiary and Quaternary age in Escambia County dip south and southwest at rates ranging from 5 to 50 feet per mile and consist chiefly of limestone, sand, clay, silt, marl, and gravel. The geologic units of Tertiary and Quaternary age have an aggregate thickness that ranges from 700 feet in the northeastern part of the county to 1,500 feet in the southwestern part.

9.1.2 Soil Stratigraphy

Five generalized soil stratigraphic units were identified at the proposed sanitary landfill site representing Miocene (Tcp), Pliocene (Tp) and Recent Series (Qal) age sediments. Three soil units were interpreted as Miocene and designated in ascending order as stratum V (Tcp), stratum IV (Tcp Orange), and stratum III (Tcp Blue). In addition, sediments of the Pliocene Citronelle Formation and Recent Alluvium, designated (Tc) and (Qal) respectively, were also recognized. Pertinent characteristics of each stratum are described in the table below.

STRATUM	MAP UNITS	ELEVATION TO TOP OF STRATUM (FEET/MSL)	STRATUM THICKNESS (FEET)	DESCRIPTION
I	QUATERNARY AGE RECENT ALLUVIUM (CPAC) UNCONFORMITY	230 - 235	4 - 8.5	FINE SAND AND CLAYEY FINE SAND, TAN, DARK GRAY-BLACK, LOW PLASTICITY
II	TERTIARY AGE PLIOCENE SERIES CITRONELLE FORMATION (TC) UNCONFORMITY	252 - 312	5.5 - 14	FINE TO COARSE SAND, TAN TO RED TO ORANGE, TRACE TO SOME FINE GRAVEL AND CLAY,. NON-PLASTIC
III	MIOCENE SERIES UNDIFFERENTIATED (TCP BLUE)	246 - 298	15 - 61	CLAY, TAN, LIGHT GRAY, ORANGE, RED, BROWN, TRACE TO SOME FINE SAND, FREQUENT LIMONITE LENSES AND PARTINGS, FREQUENT DESICCATION FEATURE, OCCASIONAL FINE SAND LENSES, FREQUENT MOTTLING, LOW TO HIGH PLASTICITY
IV	(TCP ORANGE)	231 - 239	2 - 16	CLAY, LIGHT GRAY, TAN MOTTLED IN PART, TRACE TO SOME FINE SAND, OCCASIONAL FINE SAND SEAMS, HIGH PLASTICITY
V	(TCP)	218 - 229	13+ - 23+	FINE TO COARSE SAND, LIGHT GRAY, TAN, ORANGE, TRACE TO SOME CLAY, NON-PLASTIC, OCCASIONAL FINELY DISSEMINATED CARBONACEOUS MATERIAL, ROOTS, AND THIN TO MASSIVE CLAY LENSES

9.2 GROUNDWATER HYDROLOGY

The principal aquifers in Escambia County are the permeable beds of sand, gravel, and limestone in the Eocene (Te), Oligocene (Tb), Miocene (Tcp), and Pliocene (Tp) Series that dip south and southeast 5 to 50 feet per mile. These permeable beds are generally encountered under artesian conditions.

Artesian conditions prevail throughout the county in aquifers at a depth of 65 feet or more. Artesian flowing wells tapping aquifers in the Eocene (Te), Oligocene (Tb), and Miocene (Tcp) Series are obtained in lowland areas in and adjacent to the major streams in Escambia County. Flowing wells are common in the eastern and parts of Central Escambia County. Numerous flowing wells are obtained in lowland area adjacent to the Conecuh River and its larger tributaries. The stratum II Citronelle Formation (Tc) is the principal source of water supply in the western part of Escambia County. Beds of sand and gravel supply small to large quantities of water to many wells throughout the area. The formation also furnishes water to domestic and stock wells in the eastern part of Escambia County.

Moderate quantities can probably be obtained from beds of sand and gravel that are of sufficient thickness. Water table conditions prevail in beds of sand and gravel in alluvial (Qal) and terrace deposits (Qt) along the rivers and their larger tributaries and in the outcrop areas of the various formations. Wells less than 65 feet deep generally tap aquifers that are controlled by water table conditions.

Groundwater at the project site was encountered at a depth range of approximately 14 to 70 feet below ground surface. Groundwater elevations ranged from 212 to 220 feet MSL. The predominant groundwater flow direction is to the east, generally towards Burnt Corn Creek. The groundwater system encountered at the proposed landfill site is under partial artesian conditions and supplies water from Miocene (Tcp) age sediments. The groundwater reservoir component of the confined aquifer system is composed of fine to coarse, light gray, and tan sand, designated stratum V (Tcp). The overlying confining layers are generally composed of light gray and tan clays, designated stratum IV (Tcp Orange) and stratum III (Tcp Blue).

The confining clay layers thin from 80+ feet along the western property boundary to a zero thickness towards the east and southeast of the site generally along the low lying drainage swales. Then the confining layer are absent, the stratum V Miocene (Tcp) aquifer sand is exposed at the surface, or is in contact with the overlying stratum I Recent Alluvium (Qal) soils. The alluvial soils are generally composed of fine and clayey fine sands.

The local recharge system of groundwater flow to the confined aquifer is from precipitation. Rainfall and runoff seeps into the aquifer where permeable beds are exposed at the surface and percolates downgradient to become confined between relatively impermeable beds of clay, stratum IV (Tcp Orange) and stratum III (Tcp Blue).

9.3 WATER MONITORING RECOMMENDATIONS

9.3.1 General

Water quality monitoring is required by the Department Division Solid Waste Program to detect and quantify contamination, as well as to measure the effectiveness of engineered disposal systems. A groundwater and surface water monitoring network for this site has been designed to provide an early warning of aquifer impact. This plan will define the parameters for analysis (indicator parameters only), frequency of collection, procedures and techniques for sample collections sample preservation and shipment, analytical procedures and chain of custody control. This plan conforms to the Alabama Department of Environmental Management Code R.335-4 dated August 22, 1990. The information listed below is based on and taken from the data included in this report and on the Report of Preliminary Subsurface Investigation for the Timberlands Sanitary Landfill dated May 20, 1992 completed by Southern Earth Sciences, Inc. A complete copy of the site investigation report has previously been submitted to the Department.

9.3.2 Monitoring Locations

Groundwater monitoring will be consistent with the Alabama Department of Environmental Management Code R.335-13-4. Monitoring locations and sequencing are presented on Drawing 15 of the permit drawings, and provide for one upgradient and nine downgradient groundwater monitoring wells.

9.4 GROUNDWATER MONITORING WELL SPECIFICATIONS

9.4.1 General

(a) Drilling Equipment

Drilling equipment and tools shall be steam cleaned before use and between borehole locations to prevent cross-contamination of wells.

(b) Drilling Methods

The drilling will use hollow-stem auger, wet-rotary, air rotary, or cable-tool equipment.

9.4.2 Materials

(a) Well Casings and Screens

Four-inch inside diameter PVC pipe meeting ASTM requirements shall be used for the riser casings and well screens at this site. Specifically, all pipe sections shall be flush threaded or be connected by an approved mechanical means such as stainless steel screws.

(b) Filter Pack and Annular Sealant

The filter pack material shall be chemically inert, clean quartz sand. Fabric filters shall not be used as a filter materials.

The materials used to seal the annular space must prevent cross-contamination between strata. The materials should be chemically resistant to ensure seal integrity during the life of the monitoring well and chemically inert so they do not affect the quality of the ground water samples. A minimum of two feet of pelletized sodium bentonite should immediately overlie the filter pack. A cement and bentonite mixture consisting of neat Portland cement (with bentonite clay additives) shall be used as the sealant in the unsaturated zone above the pelletized sodium bentonite seal and below the frost line. The cement slurry is to be mixed with five to six gallons of potable water for each 94 pound sack of Type I Portland cement and 3 to 5 pounds of powdered bentonite. The water of the cement slurry should have a low sulfate content and a total dissolved solids content less than 2,000 parts per million and free of organics. No aggregate materials are to be included in the slurry.

The sodium bentonite seal should be placed around the casing by putting the pelletized bentonite between the casing and the inside of the borehold or auger stem. In shallow monitoring wells, a tamping device should be used to reduce the potential for bridging. In deeper wells, it may be necessary to pour a small amount of formation water down the casing to wash the bentonite down the hole.

The cement-bentonite grout mixture should be prepared using formation water or potable water and placed in the borehole using a side-discharge tremie pipe to avoid seal disturbance. The tremie method ensures good sealing of the borehole from the bottom

The remaining annular space should be sealed with cement mix to provide for security and an adequate surface seal with the well apron. Locating the interface between the cement and bentonite-cement mixture 1/2 to 1 foot below the frost line serves to protect the well from damage due to frost heaving. The cement should be placed in the borehole using the tremie method.

As with drilling machinery, installer shall decontaminate the well casing and screen by high pressure, hot-water or steam before use. Filter sands, well sealant materials, and anything else that may influence sample quality should be free of contamination.

(c) Well Apron

The concrete well apron should be constructed per the protective well casing detail shown on these plans and at the same time as the cement is placed in the remaining annular space.

(d) Protective Well Casing

An appropriate locking metal protective casing shall be provided around the PVC well casing. This casing should be embedded in the concrete well apron as shown in the protective well casing detail.

9.4.3 Well Intake Design

The design and construction of the intake of the monitoring wells shall: (1) allow sufficient groundwater flow to the well for sampling; (2) minimize the passage of formation materials (turbidity) into the well; and (3) ensure sufficient structural integrity to prevent the collapse of the intake structure.

The intake of a monitoring well shall consist of a screen or slotted casing with openings sized to ensure that formational material is prohibited from passing through the well during development. Extraneous fine-grained materials (clays and silts) that have been dislodged during drilling may be left on the screen, in the filter pack, and in the well water. These fines shall be removed from the screen and surrounding area during development. For quality-control purposes, only commercially manufactured screens or slotted casings shall be used; field slotting of screens is unacceptable

Screens with 0.010 inch slots shall be used unless geologic conditions discovered at the time of installation dictate a different size. The annular space shall be filled with a filter pack consisting of 20/30 sand to minimize passage of formation materials into the well. The filter pack shall extend about one foot above the well screen. A different filter pack material may have to be considered should geologic conditions at the time of drilling dictate the need for a different size. Only one aquifer shall be bridged with the well screen and/or filter medium.

9.4.4 Well Construction and Documentation

Approval of the monitoring well plan by Department must be received prior to the installation or abandonment of monitor wells at the site. Well installation, in accordance with the approved plan, will be conducted under the supervision of a geologist or geotechnical engineer licensed to practice in the State of Alabama.

The following information will be recorded to document the construction of each monitor well:

- name of driller, identification of drill rig
- Date/time of construction
- drilling method
- well location (±0.5 ft)
- borehole diameter and well casing diameter
- well depth (±0.1 ft.)
- drilling logs
- casing materials*
- Screen materials and design
- casing and screen joint type
- screen slot size/length
- filter pack material/size
- filter pack volume
- filter pack placement method
- sealant materials*
- sealant volume
- sealant placement method
- surface seal design/construction
- well development procedures
- type of protective well casing
- ground surface elevation (±0.10 ft.)
- depth (elevation) to groundwater (±0.01 ft.)
- well cap elevation (±0.01 ft.)
- top of casing elevation (±0.01 ft.)
- as-built drawing of well (include dimensions)

* Samples of materials, adequate for leaching/sorption tests should be retained.

The well construction documentation and certification must be prepared by a registered geologist or registered geotechnical engineer and submitted to the Department within 30 days of completion.

9.4.5 Well Development

After the construction of monitoring wells is completed, natural hydraulic conductivity of the formation shall be restored and all foreign sediment removed to ensure turbidity-free groundwater samples.

Development will consist of flow reversals created by removal of formation water by surging and purging with a submersible pump. Should a well be constructed in low yielding water-bearing formations, an outside source of non-formation water may be introduced into the well to facilitate development. In these cases, the non-formation water shall be sampled, labeled, and stored at or below 34° F. If formation water from the well indicates contamination, the non-formation water should be chemically analyzed to ensure that it did not cause any contamination of the aquifer. If compressed air is used in the development of wells proper aerosol filtration equipment should be used for development air to prevent oil and grease contamination. All equipment used to develop a well shall be decontaminated by using high-pressure, hot water or steam prior to its introduction into each well.

9.4.6 Well Purge

9.4.6.1 General Well Purge Information

Purging a monitoring well is just as important as the subsequent sampling of the well. Water standing in a monitoring well over a certain period of time may become unrepresentative of formation water because of chemical and biochemical changes which may cause water quality alterations.

Prior to monitoring well purge, inspection of the monitoring well integrity will be performed utilizing the BFI Ground Water Monitoring Well Condition Report.

9.4.6.2 Water Level Measurement

Prior to any purge or sampling activity at each monitoring well, a water level measurement is required to be taken. Measurement of the static water level is important in determining the hydrogeologic characteristics of the subsurface (e.g. upgradient and downgradient). Also, several other water level measurements are to be taken during the course of purge and sampling.

Water level indicator equipment will be constructed of chemically inert materials and, during mobilization preparation and following each monitoring point, will be decontaminated at each well with a non-phosphate detergent followed with multiple deionized water rinses. Decontamination water will be disposed of in each respective well's purge water containers. Water levels will be measured with a precision of $\underline{+}$ 0.01 foot. Water level indicator devices will be checked at the laboratory on a regular basis for proper calibration, prior to each monitoring event by reeling a 50' and 100' length of tape on a clean surface and checking the length with a steel measuring tape. Any discrepancies will be noted as a correction factor on the side water level reel.

Each monitoring well shall have a reference elevation point located at the wellhead seal access port measured by a licensed surveyor. This reference point elevation is measured in relation to Mean Sea Level (MSL). Basic procedures for water level measurement is indicated in Detection Monitoring Ground Water Sampling and Analysis Plan (GWSAP).

Ground water elevations in wells which monitor the waste management area must be measured within a forty-eight (48) hour period to avoid temporary variations in ground water flow which could preclude accurate determination of ground water flow rate and direction.

In addition to the static water level, a total well depth is required to be measured at each monitoring well during each ground water monitoring event. Well depth can be taken with a water level indicator device since the probe is heavy enough to keep the tape measure straight and to "feel" the bottom of the well.

9.4.6.3 Purge Equipment

Ground water wells will be purged with dedicated, permanently installed variable speed submersible pumps. Parts of the pump contacting the ground water will be constructed of stainless steel and Teflon. These pumps will remain dedicated to each respective well throughout monitoring unless replacement is necessary due to damage or wear, in which case repairs will be completed or a new pump will be dedicated.

9.4.6.4 Purge Procedures

Prior to purge and immediately after the well cap is removed, a MSA gascope combustible gas indicator or equivalent device will be used to check each monitoring well for the presence of any methane gas prior to well evacuation (ground water monitor well headspace gas checks will commence after initial receipt of waste at the landfill). See GWSAP for calibration and operation procedures.

Once the gascope check is completed, the sample crew will put on clean disposable nitrile gloves and an initial water level will be taken as described in Section 9.4.6.2.

Standard procedures for ground water monitoring well purge is as follows:

1. Start the generator (or other power source), electrical voltage to the converter must always be ± 10% of the specified power supply. Generator should be in the downwind direction from the sample point. Specified power supply.

   BMI/MPI 220 Volts, Single Phase AC (198 - 253 V)
   BMI/MPI 115 Volts, Single Phase AC (109 - 126 V)

   Check power supply with voltmeter for proper voltage range.

2. Connect converter lead to well head power plug and plug power cord from converter into generator.

3. Check the frequency display on the front of converter. It should read "Ø". If it doesn't, refer to the troubleshooting section in the converter owners manual.

4. If this is the first time the converter is being used or if it has not been used for more than six (6) months, leave the converter on for at least fifteen (15) minutes before proceeding to step 5.

5. Set the converters speed dial to mid scale or well specific upper historical limit.

6. Start the pump by pressing the start/stop switch into the "START" position.

7. Adjust the pump performance by turning the speed dial .

Rate of discharge and volume purged will be checked periodically with a graduated bucket and timer or an in-line device.

9.4.6.5 Purge Volume

Low yield wells will be purged to dryness. Moderate to high yield wells will be purged a minimum of three (3) well volumes and to stabilization of field parameters temperature, conductivity, and pH. Parameter stabilization is defined as:

- Specific Conductivity = ± 10% for three (3) consecutive measurements at approximately five (5) minute increments.

- pH = ± 10% standard pH units for three (3) consecutive measurements at approximately five (5) minute increments.

- Temperature = ± 10% for three (3) consecutive measurements at approximately five (5) minute increments.

Check water level after purge is complete.

Monitoring of temperature, pH, conductivity, and turbidity for stabilization will be recorded on each Field Log.

9.4.6.6 Purge Water Management

On an individual monitor well basis, if purge water is known to be historically contaminated or suspect due to prior monitoring analytical data, the purge water shall be stored in appropriate containers until analytical results are available. After review of these analyses, proper arrangements for disposal or treatment of the water shall be made. Otherwise, purge water will be discarded on the ground surface away from the immediate monitor well area.

9.4.7 Well Abandonment

Should it be indicated that it is necessary to abandon a monitoring well, the Department will be advised of the conditions and approval to abandon the well will be requested. No well will be abandoned until approval from the Department has been obtained.

If a well will be abandoned, the following plugging procedures will be used. Without proper plugging, the abandoned monitoring well may become and avenue of aquifer contamination from surface runoff. Proper plugging materials and techniques will vary according to the original well construction and the hydrogeology of the site.

The general procedure for plugging permanently installed, shallow groundwater monitoring wells completed in water table aquifers includes three steps:

(a) Removal of obstructions in the well that could interfere with the plugging operations and thorough flushing of the well to purge residual drilling fluids and other fine materials.

(b) Removal of the well casing (where practical) to ensure placement of an effective seal - as a minimum when the casing is not properly grouted, the upper 20 feet of casing must be removed.

(c) Sealing of the well with an impermeable filler such as neat cement or bentonite, as described herein.

9.5 GROUNDWATER SAMPLING

Samples will be obtained in accordance with the guidelines outlined below. Refer to Appendix B for a table of sample preservation procedures and holding times.

9.5.1 Sampling Frequency

The groundwater monitoring wells will be sampled according to the following schedule. The background sampling will consist of four quarterly samples and routine detection monitoring will be done semi-annually. Increased frequency of sampling and additional parameters may be required by the Department if deemed necessary. The background sampling is designed to establish spatial and temporal variation in the monitored unit. Semi-annual groundwater monitoring results will be submitted to the Department in May and November of each year.

9.5.2 Sampling Parameters

Background sampling parameters will include the following:

Inorganics (40 CFR 258 Appendix I Inorganic Constituents)
Volatile Organics (40 CFR 258 Appendix I Organic Constituents)

Sulfate
Nitrate
Chloride
Total Kjeldahl Nitrogen (TKN)
Ammonia
Endrin
Lindane
Methoxychlor
Toxaphene
2,4-D
2,4,5-TP Silvex
Trihalomethanes
Iron
Manganese
Acid extractables
Base Neutrals

Routine semi-annual sampling parameters will include the following:

Inorganics (40 CFR 258 Appendix I Inorganic Constituents)
Volatile Organics (40 CFR 258 Appendix I Organic Constituents)
Chlorides
Nitrate
Sulfate

9.5.3 Sampling Procedures

9.5.3.1 General Event Preparation

The laboratory performing the groundwater analysis shall supply all necessary coolers, pre-cleaned containers, trip blanks, chemical preservatives, packaged refrigerant, labels, custody seals, chain-of-custody and shipping forms. All field data shall be entered on a BFI Field Information Log (see Figures B.1 through B.6 in Appendix A). Adequate instructions to the laboratory must be given in advance of each monitoring event. Details concerning any changes to the monitoring plan and/or procedures need to be given to the laboratory in writing prior to the field sampling personnel arriving on the site. A specific contact person shall be established at both the facility and contract laboratory for communication between the two (2) parties.

9.5.3.2 Sample Container Selection

Sample containers need to be constructed of a material compatible and non-reactive with the material it is to contain. Consult GWSAP, *Containerization and Preservation of Samples*, to determine the number, type and volume of appropriate containers. As noted in Section 9.5.3.1, the contract laboratory performing the analysis shall supply all the required containers. In special circumstances when the facility must obtain its own containers, these containers will be purchased from local container distributors with the exception of the septum vials and PTFE (e.g. Teflon) lined caps required for organic analyses which are available from laboratory supply companies. Metal lids shall not be utilized for any sample containers.

9.5.3.3 Sample Container Preparation

Sample containers will be purchased as a pre-cleaned product or cleaned in the laboratory in a manner consistent with EPA protocol. An example protocol is as follows:

(a) Bottles, vials, cubitainers, liners and caps hand washed in a laboratory-grade, non-phosphate detergent.

(b) Rinse three (3) times with distilled water.

(c) Rinse with a chemically pure or reagent grade 10% nitric acid solution.

(d) Rinse three (3) times with organic-free water.

(e) Oven-dried (air-dried for high-density polyethylene containers and caps).

After containers and caps are cool and dry, cap each container and store in a clean and dry environment.

9.5.3.4 Equipment Preparation Prior to Site Arrival

Dedicated pump purge and sample devices for the Timberlands Sanitary Landfill are described in detail in Section 9.4.6.3 and 9.5.4.3. This section outlines the equipment preparation **prior** to site arrival for a specific monitoring event. This equipment preparation includes minimum decontamination procedures for water level indicator(s), pH/temperature meter, specific conductivity meter, and turbidity meter. Operation and calibration information for field instruments are contained in GWSAP.

(a) Water Level Indicator(s) - Water level indicator(s) will be decontaminated prior to initial site arrival by hand washing the sensor probe and entire length of tape in a laboratory grade non-phosphate detergent followed by a triple rinse with organic free water. While the tape is reeled back onto the carrying spool, the tape and probe will be wiped down with a clean dry paper towel.

(b) pH / Temperature Meter - Meters, both primary and back-up sets, will be decontaminated by hand washing the sample cells in a laboratory grade non-phosphate detergent followed by a triple rinse with organic free water. Meters will then be checked for proper calibration and operation as specified in GWSAP. Any malfunctioning meters will be replaced prior to packing.

(c) Specific Conductivity Meter - Meters, both primary and back-up sets, will be decontaminated by hand washing the probes in a laboratory grade non-phosphate detergent followed by a triple rinse with organic free water. Meters will then be checked for proper calibration and operation as specified in GWSAP. Any malfunctioning meters will be replaced prior to packing.

(d) Turbidity Meter - Meters, both primary and back-up sets, will be decontaminated by hand washing the sample cells in a laboratory grade non-phosphate detergent followed by a triple rinse with organic free water. Meters will then be checked for proper calibration and operation as specified in GWSAP. Any malfunctioning meters will be replaced prior to packing.

In case of equipment failure, at least one back-up instrument will be in the sample crew's possession. If a back-up instrument is not available, or fails in addition to the primary equipment, sampling will <u>not</u> proceed until proper equipment is made available.

9.5.4 Monitoring Well Sample Collection

Prior to purge and immediately after the well cap is removed, a MSA gascope combustible gas indicator or equivalent device will be used to check each monitoring well for the presence of any methane gas prior to well evacuation (ground water monitor well headspace gas checks will commence after initial receipt of waste at the landfill).

Once the gascope check is completed, the sample crew will put on clean disposable nitrile gloves and an initial water level will be taken as described in Section 9.4.6.2.

Standard procedures for ground water monitor well purge is as follows:

1. Start the generator (or other power source), electrical voltage to the converter must always be ± 10% of the specified power supply. Generator should be in the downwind direction from the sample point. Specified power supply.

   BMI/MPI 220 Volts, Single Phase AC (198 - 253 V)
   BMI/MPI 115 Volts, Single Phase AC (109 - 126 V)

   Check power supply with voltmeter for proper voltage range.

2. Connect converter lead to well head power plug and plug power cord from converter into generator.

3. Check the frequency display on the front of converter. It should read "Ø". If it doesn't, refer to the troubleshooting section in the converter owners manual.

4. If this is the first time the converter is being used or if it has not been used for more than six (6) months, leave the converter on for at least fifteen (15) minutes before proceeding to step 5.

5. Set the converters speed dial to mid scale or well specific upper historical limit.

6. Start the pump by pressing the start/stop switch into the "START" position.

7. Adjust the pump performance by turning the speed dial.

Rate of discharge and volume purged will be checked periodically with a graduated bucket and timer or an in-line device.

9.5.4.1 General Sample Collection Information

Sampling should take place as soon as purging is complete if the well has sufficient recharge. The time interval between the completion of well purge and sample collection normally should not exceed twenty-four hours.

9.5.4.2 Sample Collection Order

Monitoring well sampling at each event shall proceed from the point with the highest water level elevation to those with successively lower elevations unless contamination is known to be present.

If contamination is known to be present, samples will be collected from the least to most contaminated wells, to minimize the potential for any cross-contamination. Samples will be collected and containerized according of the volatility of the requested analyses. A specific collection order is as follows:

1. Field Parameters (Temperature/Specific Conductivity/pH/Turbidity)
2. Volatile Organics
3. Semi-Volatile Organics (if required)
4. Herbicides (if required)
5. Pesticides (if required)
6. Metals
7. Inorganics

9.5.4.3 Sampling Equipment/Procedures

Ground water samples will be collected with dedicated, permanently installed variable speed submersible pumps. Parts of the pump contacting the ground water sample will be constructed of stainless steel and Teflon. These are the same pumps used in well purge and have the ability to achieve low flow rates at approximately 100 ml/min.

Standard procedures for collecting representative ground water samples after completion of purge is as follows:

a. Reduce flow from pump to approximately 100 ml/minute and flow at this rate for approximately five (5) minutes.
b. Sample field parameters.
c. Sample for volatile organic compounds.
d. Increase flow to a moderate rate (0.2 to 1.0 liters/minute).
e. Sample metals.
f. Sample general water chemistry parameters.

9.5.4.4 Sample Filtration

As per Alabama Department of Environmental Management Admin. Code 335-13-4-.27(11), ground water samples shall not be field-filtered prior to laboratory analysis.

9.5.4.5 Sample Preservation

All samples will be containerized and preserved according to GWSAP, *Sample Containerization and Preservation of Samples*. In the goal to obtain the most representative sample possible, preserving the sample for transportation and storage to the laboratory is also important.

Methods of preservation are intended to retard biological action, retard hydrolysis of chemical compounds and complexes, and reduce the volatility of constituents. Samples requiring refrigeration to four degrees Centigrade will be accomplished by placing the sample containers immediately into coolers containing wet ice or the equivalent and delivering to the analytical laboratory as soon as possible.

9.5.4.6 Field Measurements

Required field measurements include water levels, total well depth, temperature, pH, specific conductivity, and turbidity. Water level and total depth measurement procedures are described in Section 9.4.6.3. Temperature should be measured immediately after collection of the sample. See GWSAP for pH/temperature, specific conductivity and turbidity procedures and schedule of calibration of these field instruments. Each of these measurements is important in the documentation of properly collected ground water samples.

All instruments shall be properly calibrated and checked with standards according to the manufacturer's instructions and the standard operating procedures outlined in GWSAP. Any improper operating instruments must be replaced prior to continuing sample collection operations. Back-up instruments will be available with the sample crew.

9.5.5 Record Keeping

9.5.5.1 Field Logs

All field notes must be completely and accurately documented to become part of the final report for a monitoring event. All field information will be entered on a standard BFI Field Information Log. Included on the BFI Field Information Log is an explanation of each requested piece of information and the proper location to enter the data.

All entries should be legible and made in black, indelible ink. Entry errors will be crossed out with a single line, dated, and initialed by the person making the corrections.

9.5.5.2 Chain-of-Custody

Proper chain of custody records are required to insure the integrity of the samples and the conditions of the samples upon receipt at the laboratory, including the temperature of the samples at the time of log in. The sample collector shall fill in all applicable sections and forward the original, with the respective sample(s), to the laboratory performing the analysis. Upon receipt of the samples at the laboratory, the sample coordinator is to complete the chain of custody, make a copy for his/her files, and make the original documents part of the final analytical report.

All sample containers will be labeled. The following will be indicated on an adhesive label with a waterproof pen:

(a) Collector's name, date and time of sampling.
(b) Sample source.
(c) Sample Identification number.

(d) Sample preservatives.
(e) Test(s) to be performed on the sample.

If the sample shuttle kit (cooler) does not employ a tamper proof seal, the collector is to date, sign and identify each sample on a tamper proof seal and attach it to each individual sample container and lid.

9.5.5.3 Sample Summary Log

A quick reference summary sheet referred to as a Field Sample Summary Log presents a general overview of the field sampling program. This document is to be prepared prior to a specific sampling event and appropriately filled in with sampling dates each day. The field sample summary log shall be included with the final analytical report as part of the field note documentation section.

9.6 MONITORING WELL SAMPLE ANALYSES

9.6.1 Analytical Procedures

The laboratory performing the analyses shall perform analyses per the Groundwater Monitoring Plan and EPA Manual SW-846, EPA 600/4-79-020. Reports of analytical results shall specify the test methods used in analysis.

Records of groundwater analyses shall include the methods used (by number), the extraction date, and date of actual analysis. Data from samples that are not analyzed within recommended holding times shall be considered suspect. Any deviation from an EPA approved method shall be adequately tested to ensure that the quality of the results meets the performance specifications (e.g. detection limit, sensitivity, precision, accuracy) of the reference method. A planned deviation shall be justified and submitted for approval by the Department prior to use.

These laboratory tests will be analyzed and a report submitted to Alabama Department of Environmental Management in accordance with procedures outlined herein.

If significant deviations from target parameter values occur, re-sampling and re-testing will be performed as a quality control check.

9.6.2 Field and Laboratory Quality Assurance/Quality Control

It is the responsibility of the Owner to insure the reliability of the analytical data being gathered during the monitoring program.

Field QA/QC samples consist of two (2) primary areas of quality control. The first area is the quality control designed to prevent sample contamination from occurring in the field and/or shipping procedures. This is monitored in the trip blank(s), field blank(s), and the equipment (rinsate) blank(s). A basic description of each is as follows:

(a) Trip Blank - These samples will be prepared in the laboratory by filling the appropriate clean sample containers with organic-free water and adding the applicable chemical preservative, if any, as indicated on Figure B.7 for each type of sample. These containers are to be labeled "Trip Blank", the analyses to be performed on each container indicated, and then shipped in the typical transportation cooler to the field and back to the laboratory along with the other sample set containers for a given event. This blank is tested for any contamination that may occur as a result of the containers, sample coolers, cleaning procedures, or chemical preservatives used. Trip blanks shall be taken and analyzed for each sampling event or a minimum of a one (1) in twenty (20) batch per monitoring event.

(b) Field Blank - Field blank containers will be prepared in the field at a routine sample collection point during a monitoring event by filling the appropriate sample containers from the field supply of organic-free water. This field supply water shall be the same water used for cleaning and decontamination of all field purge and sample equipment. This blank is tested for any contamination that may occur as a result of site ambient air conditions and serves as an additional check for contamination in the containers, sample transport coolers, cleaning procedures, and any chemical preservatives. Field blanks shall be taken and analyzed for each sampling event or a minimum of a one (1) in twenty (20) batch per monitoring event.

(c) Equipment (Rinsate) Blank - These blanks will be prepared in the field immediately following decontamination cleaning procedures on any <u>non-dedicated</u> equipment used for purging, sampling or sample filtration. Following decontamination, field supply organic-free water is passed through the non-dedicated equipment in the same procedure as a groundwater sample. This blank confirms proper field decontamination procedures on non-dedicated equipment utilized in the field.

Equipment blanks shall be taken and analyzed for all applicable parameters anytime non-dedicated equipment is used or new equipment is being dedicated to a well at a batch minimum of one (1) in ten (10) per monitoring event.

Other Field QA/QC Samples - A second area of standard field QA/QC samples are field duplicates, matrix spike and matrix spike duplicates.

(a) Field duplicates are an extra set of samples taken at a particular monitoring point and labeled "Field Duplicate". These are independent samples which are collected as close as possible to the same point in space and time. They are two (2) separate samples taken from the same source, stored in separate containers, and analyzed independently.

(b) Field duplicates are useful in documenting the precision of the sampling and analytical process. Samples shall be collected in proper alternating order for the sample point and field duplicate for each parameter (e.g. VOA - VOA, metals - metals, etc.) Field duplicates shall be taken and analyzed at a batch minimum of one (1) in ten (10).

(c) Field samples for matrix spike and matrix spike duplicate analyses are taken in the same manner as field duplicates and allow sufficient volumes of sample to perform matrix spike and matrix spike duplicate analyses.

Matrix spikes are those samples having a known amount of a target analyte added at the lab to the sample prior to sample preparation and analysis. The matrix spike is used to determine the bias of a method in a given sample matrix.

Matrix spike duplicates are intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs at the lab prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

Appropriate field QA/QC documentation should be recorded in the field notes (e.g. location where field blank was collected).

9.7 ANALYTICAL METHODS

Analytical methods will be as submitted by BFI to ADEM in our package of 4-28-94.

9.8 REPORTING

The monitoring report will include the description of field and laboratory procedures employed and the appropriate analytical results. Reports will be properly signed; on a form or in a format approved by the Department; and will be submitted within the time frame specified by the Department. Monitoring reports will be submitted to:

Alabama Department of Environmental Management
Land Division - Solid Waste Branch
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2059

9.9 ADDITIONAL REQUIREMENTS

Assessment monitoring is required in the event a statistically significant increase over background of any Appendix I constituent is confirmed. An assessment monitoring program, in accordance with Department regulations and 40 CFR, Subpart E, §258.55 through §258.58 will be initiated within ninety (90) days of such detection. Practicable capability will be provided in accordance with regulatory requirements.

10.0 LANDFILL CLOSURE PLAN

10.1 CLOSURE SEQUENCE

Placement of final cover; construction of drainage structures; and establishing a vegetative cover will be accomplished as each area reaches final grade. The sequence of operation and closure of TSL is shown on the permit drawings.

10.2 FINAL CLOSURE

Upon completion of filling operations, all areas not properly closed will be constructed to final closure requirements as described herein and shown on the permit drawings. Final closure will also be initiated if no more waste will be received or if waste will not be received for a period longer than one (1) year. A notice of intent to close the facility will be placed in the operating record and the Department will be notified. Closure activities will begin within thirty (30) days of final receipt of waste. Closure will be completed within one hundred eighty (180) days of commencing closure activities.

A sign will be posted at the closed landfill clearly stating that the site is closed and giving the location of the nearest permitted disposal facility. If waste is illegally dumped at the site after closure, it will be removed and taken to an approved facility for disposal. Litter will also be removed and disposed of properly.

The proposed ultimate use of TSL is for the site to remain as a "green area". Post-closure use of the property must not disturb the integrity or function of the final

LANCE R. LEFLEUR
DIRECTOR

ADEM

KAY IVEY
GOVERNOR

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Montgomery, Alabama 36130-1463
(334) 271-7700 ▪ FAX (334) 271-7950

November 21, 2019

MEMORANDUM

To: Blake Holden CBH
Engineering Section
Solid Waste Branch

From: Wesley S. Edwards WSE
Hydrogeology Section
Groundwater Branch

Through: Candace Barnes
Compliance Section CHB
Solid Waste Branch

RE: Groundwater Monitoring Plan
Timberlands LF #27-08
Escambia County, Alabama

Summary

The Department has received the Groundwater Monitoring Plan for the Timberlands Landfill No. 27-08 dated September 17, 2019. The ADEM Solid Waste Branch requested that the Hydrogeology Unit evaluate the submittal and provide pertinent comments and recommendations. This report is a result of that request.

Comments

1. The submitted Groundwater Statistical Analysis Plan, dated April 2001, references the Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities Interim Final Guidance, April 1989, and the July 1992 Addendum. The Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Unified Guidance dated March 2009 updates and replaces the two previously referenced documents. It is recommended that the

Statistical Analysis Plan be revised to reflect currently recommended techniques and reference current guidance prior to approval.

2. Section 4.2 of the Statistical Analysis Plan indicates that background will be updated after every sampling event provided no statistically significant increases were indicated. Currently the US EPA recommends that intrawell background be updated only after four to eight sampling events have transpired. Updating intrawell background after every sampling event does not allow statistical evaluation of whether the background mean is stationary over time as stated in Section 5.3.1 of the Unified Guidance. It is recommended that the background for each constituent in each well be evaluated to determine whether the outdated technique has increased background concentration means over time.

LANCE R. LEFLEUR
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December 2, 2019

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Andrew Rodgers
Republic Services, Inc.
22800 Highway 41
Brewton, Alabama 36426

Re: **Permit Renewal - Groundwater Monitoring Plan**
Timberlands Sanitary Landfill
Permit No. 27-08
Escambia County, Alabama

Dear Mr. Rodgers,

The Department has reviewed the Groundwater Monitoring Plan, dated September 17, 2019, for the above referenced facility. After review, the following comments and recommendations were made.

- The submitted Groundwater Statistical Analysis Plan, dated April 2001, references the Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities Interim Final Guidance, April 1989, and the July 1992 Addendum. The Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, Unified Guidance dated March 2009 updates and replaces the two previously referenced documents. It is recommended that the Statistical Analysis Plan be revised to reflect currently recommended techniques and reference current guidance prior to approval.

- Section 4.2 of the Statistical Analysis Plan indicates that background will be updated after every sampling event provided no statistically significant increases were indicated. Currently the US EPA recommends that intrawell background be updated only after four to eight sampling events have transpired. Updating intrawell background after every sampling event does not allow statistical evaluation of whether the background mean is stationary over time as stated in Section 5.3.1 of the Unified Guidance. Moving forward, it is recommended that intrawell background be updated only after four to eight sampling events.

In order for the Department to consider the permit renewal, please review all comments and provide the suggested information within the next 45 days of receipt of this letter. If you should

Birmingham Branch
110 Vulcan Road
Birmingham, AL 35209-4702
(205) 942-6168
(205) 941-1603 (FAX)

Decatur Branch
2715 Sandlin Road, S.W.
Decatur, AL 35603-1333
(256) 353-1713
(256) 340-9359 (FAX)

Mobile Branch
2204 Perimeter Road
Mobile, AL 36615-1131
(251) 450-3400
(251) 479-2593 (FAX)

Mobile-Coastal
3664 Dauphin Street, Suite B
Mobile, AL 36608
(251) 304-1176
(251) 304-1189 (FAX)

have any questions, please contact Mr. Blake Holden of the Solid Waste Branch at (334)-274-4248.

Sincerely,

S. Scott Story, Chief
Solid Waste Engineering Section
Land Division

SSS/bh

Cc: Ryan Holder

Civil & Environmental Consultants, Inc.

January 16, 2020

RECEIVED
JAN 17 2020
LAND DIVISION

Mr. S. Scott Story, Chief
Alabama Department of Environmental Management
Solid Waste Engineering Section -Land Division
1400 Coliseum Blvd.
Montgomery, Alabama 36110-2400

Dear Mr. Story:

Subject: Statistical Analysis Plan Update
Timberlands Sanitary Landfill -Permit No. 27-08
Escambia County, Alabama
CEC Project 160-229

In response to the correspondence from the Alabama Department of Environmental Management (ADEM) dated December 2, 2019, regarding the Department's review of the Groundwater Monitoring Plan dated September 17, 2019, Civil & Environmental Consultants, Inc. (CEC) has prepared the attached update to the Groundwater Statistical Analysis Plan (SAP) on behalf of the Timberlands Sanitary Landfill.

The Department's December 6, 2019 letter provided the following comments and recommendations regarding the SAP:

- The submitted Groundwater Statistical Analysis Plan, dated April 2001, references the Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Interim Final Guidance, April 1989, and the July 1992 Addendum. The Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance Dated March 2009 updates and replaces the two previously referenced documents. It is recommended that the Statistical Analysis Plan be revised to reflect currently recommended techniques and reference current guidance prior to approval.

- Section 4.2 of the Statistical Analysis Plan indicates that background will be updated after every sampling event provided that no statistically significant increases were indicated. Currently the US EPA recommends that intrawell background be updated only after four to eight sampling events have transpired. Updating intrawell background after every sampling event does not allow statistical evaluation of whether the background mean is stationary over time as stated in Section 5.3.1 of the Unified Guidance. Moving forward it is recommended that intrawell background be updated only after four to eight sampling events.

Based on CEC's review of the April 2001 SAP and available historical groundwater monitoring reports, the updated SAP for the Timberlands Sanitary Landfill has been modified to reflect the use of interwell statistical tests rather than the intrawell tests described in the April 2001 SAP. This modification is necessary due to the Site's use of interwell statistical analysis throughout the life of the groundwater-monitoring program, including sampling events that took place before and after the referenced April 2001 SAP update. A cursory review of available historical documents provided no explanation for the proposed use of intrawell analysis as described in the April 2001 SAP update, nor were there any supporting documents available to indicate that the Department approved the April 2001 SAP as written. The continued use of interwell analysis is appropriate for the Site based on the number and spacing of upgradient (background) monitoring wells providing a natural spatial variation conducive to performing interwell analysis and to maintain consistency with the historical approach to statistical analysis for the Site.

The attached SAP has also been revised to reflect currently recommended techniques and references the current US EPA Unified Guidance (March 2009) that replaces the previously cited *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Interim Final Guidance, April 1989, and the July 1992 Addendum*. The Timberlands Sanitary Landfill recognizes that currently the US EPA recommends that intrawell background be updated only after four to eight sampling events have transpired for quarterly sampling events. In addition, for semiannual sampling, as is the case for this site, the EPA Unified Guidance recommends updating the background data set every 2 to 3 years. The updated SAP uses interwell analysis rather than intrawell analysis; however, the same guidelines for updating background data sets can be applied to interwell background updates and will therefore be used in the updated SAP.

Please contact CEC at (615) 333-7797 with any questions or comments regarding this SAP update.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Michael Johnson
Project Manager

Kevin Wolfe, P.E.
Vice President

Attachment: Statistical Analysis Plan (January 2020 Update)

cc: Mr. Michael Guy, Environmental Manager, Timberlands Landfill (electronic)
Joe Montello, Senior Manager, Hydrogeology, Republic Services (electronic)

STATISTICAL ANALYSIS PLAN
January 2020 Update

TIMBERLANDS LANDFILL
BREWTON, ALABAMA

JANUARY 2020

Civil & Environmental Consultants, Inc.

Nashville

117 Seaboard Lane, Suite E100 | Franklin, TN 37067 | p: 615-333-7797 f: 615-333-7751 | www.cecinc.com

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APPENDICES

1.0 INTRODUCTION

The following is an updated Statistical Analysis Plan (SAP) for the Timberlands Landfill, Brewton, Alabama and supersedes all previous SAPs. The purpose of the SAP is to provide guidance and methods of statistically evaluating groundwater monitoring data collected at the facility. The statistical approach has been developed to comply with Alabama Department of Environmental Management (ADEM) regulation 335-13-4-.27 and the facility's permit.

2.0 GROUNDWATER QUALITY MONITORING NETWORK

The current groundwater monitoring network at the site consists of 11 wells. The current monitoring program wells are identified on Table 1.

TABLE 1
GROUNDWATER MONITORING PROGRAM WELLS

UPGRADIENT WELLS	DOWNGRADIENT WELLS
UGW-1, GW-1, GW-2, GW-3, GW-9, GW-10	GW-4, GW-5, GW-6, GW-7, GW-8

3.0 PARAMETERS

The parameters subject to statistical evaluation during detection monitoring are noted in Appendix I of ADEM 335-13-4-.27. These parameters (Numbered 1 through 63) are also listed in Appendix A of this report and are to be sampled and analyzed on a semi-annual basis.

4.0 STATISTICAL APPROACH

The statistical analysis software program *Sanitas*™ is licensed to the Timberlands Landfill. *Sanitas*™ will be utilized to evaluate the groundwater data during detection monitoring. An equivalent software package may be utilized if it complies with the statistical procedures allowed under USEPA and ADEM regulations. The *Sanitas*™ statistical analysis software package follows a documented decision logic that incorporates the following applicable regulations: USEPA. *"Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance" (March 2009).* Current regulations and acceptable industry standards for statistical analysis will be utilized to provide the most appropriate statistical analyses in consideration of the facility's groundwater monitoring data.

Interwell prediction limits will be used for statistical analysis at the facility.

4.1 BACKGROUND DATA

Prior to the September 2019 monitoring event, the background data set consisted of all historical data (September 1993 through March 2019) from upgradient wells (UGW-1, GW-1, GW-2, GW-3, GW-9, and GW-10). However, in response to ADEM's May 10, 2019 letter regarding the Department's review of the 2nd Semiannual 2018 Groundwater Report and follow-up conference call with ADEM that took place on August 28, 2019, a comprehensive background data evaluation was performed to determine their appropriateness for use in future statistical analysis.

The methods used to evaluate representative background data included the Sen's Slope/Mann-Kendall trend test, review of outliers, review of time series graphs, and determining if potential anthropogenic impacts are evident, such as the presence of man-made organic compounds (such as VOCs, SVOCs, pesticides, and herbicides). Older background data were also examined to determine whether it reflects current background conditions or if there is evidence of a change in background water quality over time.

The results of the background data evaluation identified historical (2007-2009) outliers present for barium at GW-2, GW-3, and GW-9, chromium at GW-3, and zinc at GW-1. However, these well/constituent pairs did not exhibit statistically significant increasing trends in concentrations. The background evaluation also identified a consistent, time series trend of decreasing pH values in all background wells beginning in 2010, thereby indicating a generalized change in groundwater quality within the background wells. Based on the results of the evaluation, the background data set was adjusted to reflect more current conditions.

Specifically, the updated background data set now consists of historical background data from March 2010 through March 2019, thereby removing the outliers observed during the 2007-2009 time frame, as well as including the more recent data that is undergoing the generalized change in background water quality indicated through the consistent decreasing trend in pH values. Although intrawell outliers were identified for barium and chromium at GW-3, and copper at GW-1 using the updated background data set from 2010-present, no apparent basis for a likely error or discrepancy could be identified with respect to field sampling or laboratory analysis procedures associated with these data points and they are consistent with what is observed in the pooled background time series for these parameters. Therefore, the data were not removed from the updated background data set.

Since the site utilizes interwell prediction limits, the background dataset may be updated with each event to include additional upgradient well data as it becomes available; however, the goal will be to update at least once every two years. Although updating background is primarily a concern for intrawell tests, the common (generally upgradient) interwell background pool can be tested for trends and/or significant changes since the previous update. If a significant change in water quality is identified, a closer investigation and review of the background data will be performed in order to determine which observations are most representative of the current groundwater conditions. After the updated background database is screened and evaluated, the database will be utilized to determine updated groundwater statistical limits for each constituent. These limits will be determined based on the most appropriate method given the distribution/characteristics (% non-detects) of the database.

4.2 STATISTICAL TESTS

Future monitoring well sampling event data will be compared to the interwell prediction limits that are calculated per this Plan. The data will be evaluated based on the percent of non-detections and distributional properties of the background data set.

Non-Detects

The percentage of non-detects for a sample parameter will be assessed during the statistical evaluation. The following approach will be used for non-detects.

- If non-detects are ≤ 15 percent, then non-detects will be replaced with one-half the laboratory reporting limit (RL) prior to running the analysis.

- If non-detects are > 15 percent and ≤ 50 percent, then the data's sample mean and standard deviation will be adjusted according to the Kaplan-Meier's adjustment method.

- If non-detects are > 50 percent, or the background dataset does not follow a normal distribution, a non-parametric prediction limit test will be used.

Outliers

Outliers or observations not derived from the same population as the rest of the results violate the basic statistical assumption of identically-distributed measurements. The background data will be evaluated for the presence of statistical outliers, and in accordance with the USEPA Unified Guidance, may not be removed in particular situations unless some basis for a likely error or discrepancy can be identified. Methodologies for determining a statistical outlier are defined in the USEPA Unified Guidance. According to the USEPA guidance, data that is not normally or log-normally distributed is not recommended for evaluation of outliers. In cases where the data is calculated to not be normally or log-normally distributed, outliers will not be removed from the data set. Background outliers identified in the data evaluation will be included in the calculation of updated interwell prediction limits, unless an apparent basis for a likely error or discrepancy is identified that would warrant removal of the data.

Distribution

Tests of normality will be conducted to assess the data distribution of groundwater concentrations. Shapiro-Wilks normality testing will be used for sample datasets with 50 or less samples. Shapiro-Francia normality testing will be used for sample datasets with greater than 50 samples. Original or transformed data (via ladder of powers) that are not normally distributed will be analyzed using non-parametric methods.

The background data distribution will first be evaluated for normality using the Shapiro-Wilk test with at Type I error rate of $\alpha = 0.1$ where $n < 10$, $\alpha = 0.05$ where $10 \leq n < 20$, and $\alpha = 0.05$ where $n \geq 20$. In those instances where the background data are not normally distributed, the data will be transformed using each of the possible transformations in the "ladder of powers": $x^{1/2}$, x^2, $x^{1/3}$, x^3, $\ln(x)$, x^4, x^5, x^6. Each transformed data set will then be re-evaluated for normality. If one or more of the transformations results in a normal distribution, the transformation that resulted in the highest Shapiro-Wilk statistic will be utilized for the determination of the interwell parametric prediction limit.

In those instances where the background data are normal or transformed-normal and also consist of less than 50% non-detects, a parametric prediction limit will be determined. If 15% or less of the background data consist of non-detects, the non-detects will be replaced with concentrations equal to one-half of the reporting limit prior to the determination of parametric prediction limits. If greater than 15%, but less than 50% of the background data consist of non-detects, then the mean and standard deviation utilized in the determination of the parametric prediction limit will be adjusted according to the Cohen's adjustment method.

Prediction Limit

The prediction limit is a statistical method used to compare a single observation to a group of observations. The prediction limit is calculated to include observations from the same population with a specified confidence. In groundwater monitoring, a prediction limit approach may be used to make comparison between background and compliance data. The interval is developed to contain all future observations, within a certain probability. Interwell prediction limits will be developed based on a 99% confidence that future observations will fall within the range. If any future observation exceeds this limit, this is considered potentially statistically significant evidence that the observation is not representative of the background set. Statistical calculations are based on the USEPA "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance" (March 2009).

During parametric prediction limit analysis, the mean and the standard deviation are calculated for the raw or transformed background data. The number of comparison observations, K, is defined to be included in the interval. During non-parametric analysis, the highest value from the background data is used to set the upper limit of the prediction interval.

Included in each statistical analysis report will be a summary of the prediction limits calculated from the background data. The summary tables define the background distribution for each parameter, identify any transformations applied to specific parameters, and the proportion of non-detects, and a summary of the prediction limit results.

In the event that a parameter is determined to exhibit an initial exceedance (i.e., exceeds the calculated prediction limit), the site may elect to conduct verification resampling, as described below in Section 4.4, to determine whether the initial exceedance is valid and should be included in calculations to determine whether there is a statistically significant increase (SSI).

4.3 VERIFICATION RESAMPLING

If the site elects to conduct verification resampling to determine whether an initial exceedance represents a statistically significant increase (SSI), the following procedures will be utilized. A "one of two" sampling protocol will be used for verification of initial exceedances. A "one of two" sampling method is defined as the collection of an initial sample and one confirmatory resample and is used to demonstrate that the initial exceedance was a false positive or to verify the exceedance. The "one of two" verification sampling protocol is very conservative and yields increased statistical power. If the resample is within its predicted limit, the initial exceedance is considered a false finding and the resample result will replace the exceeded value for any future statistical analyses.

The schedule for conducting a resample event shall be in accordance with the Unified Guidance recommendations for resampling to occur within 30-90 days from the original sample collection date.

5.0 RESPONSE TO STATISTICAL ANALYSIS

Regulations for initiating a response in the occurrence of a statistically significant increase (SSI) are established in ADEM regulation 335-13-4-.27(3)(c) within the detection monitoring program. These regulations will be followed such that, if the facility determines that there is a confirmed SSI over background for one or more of the constituents listed in Appendix I, the owner or operator:

Must, within 14 days of this finding, place a notice in the operating record, and submit a copy of this notice to the Department, indicating which constituents have shown statistically significant changes from background levels, and notify the Department that this notice was placed in the operating record.

If the SSI is suspected to be due to sampling or laboratory error, then the affected well(s) will be resampled. The resample data will be evaluated to assess the source of the SSI.

If the SSI is indicated to be a source other than the landfill, then an alternate source demonstration (in accordance with ADEM regulation 335-13-4-.27(3)(c)(3)) may be submitted to the ADEM. A successful demonstration must be made within 90 days of noting an SSI.

If an alternative source demonstration is not ADEM approved and/or landfill impacts cannot be eliminated as a potential source of an SSI, then an assessment monitoring program (in accordance with ADEM regulation 335-13-4-.27(3)(c)(2)) will be implemented within 90 days after notification of the SSI. Sampling requirements and statistical analysis methods for an assessment Monitoring Program are outlined in 335-13-4-.27(4).

APPENDIX A
STATISTICAL EVALUATION PARAMETERS

335-13-4-APPENDIX I CONSTITUENTS FOR DETECTION MONITORING[1]

	Common Name[2]	CAS Number[3]
	pH[4]	N/A
	Specific Conductance[4]	N/A
	Inorganic Constituents	
1.	Antimony	Total
2.	Arsenic	Total
3.	Barium	Total
4.	Beryllium	Total
5.	Cadmium	Total
6.	Chromium	Total
7.	Cobalt	Total
8.	Copper	Total
9.	Lead	Total
10.	Mercury	Total
11.	Nickel	Total
12.	Selenium	Total
13.	Silver	Total
14.	Thallium	Total
15.	Vanadium	Total
16.	Zinc	Total
	Organic Constituents	
17.	Acetone	67-64-1
18.	Acrylonitrile	107-13-1
19.	Benzene	71-43-2
20.	Bromochloromethane	74-97-5
21.	Bromodichloromethane	75-27-4
22.	Bromoform; Tribromomethane	75-25-2
23.	Carbon disulfide	75-15-0
24.	Carbon tetrachloride	56-23-5
25.	Chlorobenzene	108-90-7
26.	Chloroethane; Ethyl chloride	75-00-3
27.	Chloroform; Trichloromethane	67-66-3
28.	Dibromochloromethane; Chlorodibromomethane	124-48-1
29.	1,2-Dibromo-3-chloropropane (DBCP)	96-12-8
30.	1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4
31.	o-Dichlorobenzene; 1,2-Dichlorobenzene	95-50-1
32.	p-Dichlorobenzene; 1,4-Dichlorobenzene	106-46-7
33.	trans-1,4-Dichloro-2-butene	110-57-6
34.	1,1-Dichloroethane; Ethylidene chloride	75-34-3
35.	1,2-Dichloroethane; Ethylene dichloride	107-06-2
36.	1,1-Dichloroethylene; 1,1-dichloroethene; Vinylidene chloride	75-35-4
37.	cis-1,2-Dichloroethylene; cis-1,2Dichloroethene	156-59-2
38.	trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	156-60-5

	Common Name[2]	CAS Number[3]
39.	1,2-Dichloropropane; Propylene dichloride	78-87-5
40.	cis-1,3-Dichloropropene	10061-01-5
41.	trans-1,3-Dichloropropene	10061-02-6
42.	Ethylbenzene	100-41-4
43.	2-Hexanone; Methyl butyl ketone	591-78-6
44.	Methyl bromide; Bromomethane	74-83-9
45.	Methyl chloride; Chloromethane	74-87-3
46.	Methylene bromide; Dibromomethane	74-95-3
47.	Methylene chloride; Dichloromethane	75-09-2
48.	Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
49.	Methyl iodide; Iodomethane	74-88-4
50.	4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
51.	Styrene	100-42-5
52.	1,1,1,2-Tetrachloroethane	630-20-6
53.	1,1,2,2-Tetrachloroethane	79-34-5
54.	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
55.	Toluene	108-88-3
56.	l,l,l-Trichloroethane; Methylchloroform	71-55-6
57.	1,1,2-Trichloroethane	79-00-5
58.	Trichloroethylene; Trichloroethene	79-01-6
59.	Trichlorofluoromethane; CFC-11	75-69-4
60.	1,2,3-Trichloropropane	96-18-4
61.	Vinyl acetate	108-05-4
62.	Vinyl chloride	75-01-4
63.	Xylenes	1330-20-7

Notes

[1] This list contains 47 volatile organics for which possible analytical procedure provided in EPA Report SW-846, "Test Methods for Evaluating Solid Waste," Third Edition, November 1986, as revised December 1987, includes Method 8260; and 15 metals for which SW-846 provides either Method 6010 or a method from the 7000 series of methods.

[2] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

[3] Chemical Abstracts Service registry number. Where "Total" is entered, all species in the groundwater that contain this element are included.

[4] State specific requirements.

Author: Russell A. Kelly.
Statutory Authority: Code of Alabama 1975, §§ 22-27-4, 22-27-7.
History: Effective: November 2, 1993. **Amended**: Effective: July 26, 1996.
Amended: Filed: April 24, 2018; Effective: June 8, 2018.

LANCE R. LEFLEUR
DIRECTOR

ADEM

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KAY IVEY
GOVERNOR

March 24, 2020

MEMORANDUM

To: Blake Holden CBH
Engineering Section
Solid Waste Branch

From: Wesley S. Edwards WSE
Hydrogeology Section
Groundwater Branch

Through: Candace Barnes
Compliance Section CHB
Solid Waste Branch

RE: Statistical Analysis Plan Update
Timberlands LF #27-08
Escambia County, Alabama

Summary

The Department has received the Statistical Analysis Plan January 2020 Update for the Timberlands Landfill No. 27-08 dated January 2020. The ADEM Solid Waste Branch requested that the Hydrogeology Unit evaluate the submittal and provide pertinent comments and recommendations. This report is a result of that request.

Comments

The submitted Statistical Analysis Plan appears in general to comply with methods recommended in the March 2009 Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance. Because the characteristics of the groundwater monitoring data set may change as new data is collected potentially a different statistical tool than those specifically stated in the plan may be appropriate within the ten year permit period.

Geosyntec consultants

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Austin, Texas 78757
PH 512.451.4003
FAX 512.306.8042
www.Geosyntec.com

Memorandum

Date: 12 February 2017

To: Michael Guy (Republic Services, Inc. (Republic))

From: Scott M. Graves, P.E., Geosyntec Consultants (Geosyntec), Austin, TX

Subject: Site-wide Stormwater Management Master Plan
Timberlands Landfill
Brewton, Alabama

INTRODUCTION

This memorandum and attached information presents the Site-wide Stormwater Management Master Plan (SWMMP) for the Timberlands Landfill (the Landfill), located near Brewton in Escambia County, Alabama. The Landfill encompasses approximately 246 acres, of which 134 acres are permitted for landfill disposal. The SWMMP is based on an evaluation of existing and future stormwater management facilities at the site. The evaluation considered overall drainage patterns, conveyance capacities, and stormwater pond efficiencies – to develop recommendations for the type of stormwater management features around the perimeter of the landfill and the expected timing of their installation.

The SWMMP has been developed for what is referred to as "Phase 2" of landfill development – which represents future conditions as waste filling progresses towards the western end of the site. Note that "Phase 1" of landfill development refers to a separate evaluation performed previously by Geosyntec for conditions that existed on essentially the eastern half of the landfill in the 2015-2016 timeframe.

Figures 1 through 3 attached to this memorandum present the site layout and recommended drainage features. The figures present the results of the SWMMP in a concise graphical manner, and thus are intended to be able to be used "stand-alone". This memorandum and attached calculation package provides a description of the evaluation and backup documentation of the analyses.

DESCRIPTION OF DEVELOPMENT PHASES

Phase 1 (2015-2016 Site Conditions). "Phase 1" of the project was a previously-completed assessment of site conditions as they existed in 2015-2016. During this phase, Geosyntec evaluated the conditions and functionality of the existing stormwater management system and developed construction documents (drawings and specifications) for the design of interim stormwater management improvements around essentially the eastern half of the landfill perimeter (drainage areas contributing to Ponds 1-3). The outcome of Phase 1 was a design of short-term measures aimed at providing immediate stormwater management improvements, as reflected on Geosyntec's set of construction drawings titled "Interim Storm Water Management Improvements", dated May 2016. Many of these improvements were installed in 2016, with the remainder scheduled to be installed in 2017.

Phase 2A (Future Interim Site Conditions). "Phase 2A" of the project represents a future interim (pre-final) condition expected to exist after waste filling has progressed westward (see Figure 2). As shown in Figure 2, for this condition the eastern half of the landfill is configured to final grades, and the western half of the landfill that exists at the time of this phase is at interim grades. For this phase, it is assumed that all of the stormwater improvements recommended for Phase 1 are in-place. The eastern side of the site is modeled as being fully vegetated (representative of final cover conditions), and the western side of the site is modeled as being unvegetated. The reason this phase was analyzed was to assess whether the interim slopes and unvegetated conditions produced more critical rates of runoff for sizing of the perimeter features (ditches, culverts, and ponds).

Phase 2B (Future Final Site Conditions). "Phase 2B" of the project represents the condition when the landfill is constructed to final grades. However, two cases were evaluated – one with only partial vegetation on the western side of the site (representing the interim case before final cover is established), and one with the entire site fully vegetated under final conditions. The purpose for including this phase was to obtain runoff rates for "near-final" and final conditions, to evaluate whether they produced critical runoff rates for sizing of the perimeter features (ditches, culverts, and ponds).

OVERVIEW OF ANALYSIS APPROACH

A calculation package containing detailed hydrologic/hydraulic (H&H) modeling of the landfill under the interim and final conditions represented by the aforementioned phases is attached to this memorandum. Refer to the calculation package for a detailed discussion on the design storms, analysis methods, selected parameters, reference or justification for the selections, results, and other key assumptions. Highlights of the approach and methodology are noted below.

- For each analysis case, Geosyntec conducted H&H modeling to compute peak design discharges and hydrographs from the various drainage areas at the site using the SCS Curve Number method outlined by the U.S. Department of Agriculture (USDA) document *Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55).* The specialty engineering software HydroCAD 10.0 was used to perform the TR-55 modeling.
- The modeling results were used to size the perimeter ditches and pond inlet culverts. Manning's equation was used to size the ditches and obtain the information needed to recommend channel lining material. Federal Highway Administration (FHWA) methods from their *Hydraulic Design of Energy Dissipators for Culverts and Channels: Hydraulic Engineering Circular No. 14*, as coded in their software program commonly referred to as "HY-8" were used to design the culverts at the inlets to the ponds.
- The H&H model was used to route storms into and through the storm water ponds to check and design pond outlet riser structures and overflow spillways based on the detention capability of each pond and the hydraulic features of the outlets.
- These calculations were repeated for each phase and analysis case to determine the critical (governing) condition that produced the highest flow rates or otherwise controlling the design sizing of each given perimeter drainage feature.
    - For interim conditions, the 25-year, 24-hour storm event was modeled.

  - For final conditions, the 100-year, 24-hour storm event was also modeled.
- The reason for analyzing multiple phases and different storm events was to attempt to account for a wider variety of conditions that may govern the design. For example, in some situations the interim (temporary) drainage area to a given set of drainage features is greater than the final drainage area. Similarly, the "bare ground" runoff conditions for interim slopes that are not yet vegetated may produce larger flows in a given set of drainage features for a 25-year storm event than would be produced for a larger (100-year) storm event under long-term final vegetated conditions.

RESULTS

The attached calculation package presents the complete results of the various analysis cases through a series of tables providing key design information including the following:

- H&H modeling input values (flow lengths, slopes, drainage areas, % vegetative cover, curve numbers, etc.);
- calculated peak discharges by drainage area;
- ditch sizing (with flow rates, channel dimensions, slopes, flow depths, tractive stresses, and channel lining materials);
- culvert analysis and sizing (controlling cases, culvert diameter and length, slope, inlet and outlet elevations); and
- pond analysis and design (pond geometry and capacity, riser structure features, outlet culvert features, inflow and outflow rates, peak water elevations, etc.).

MASTER PLAN

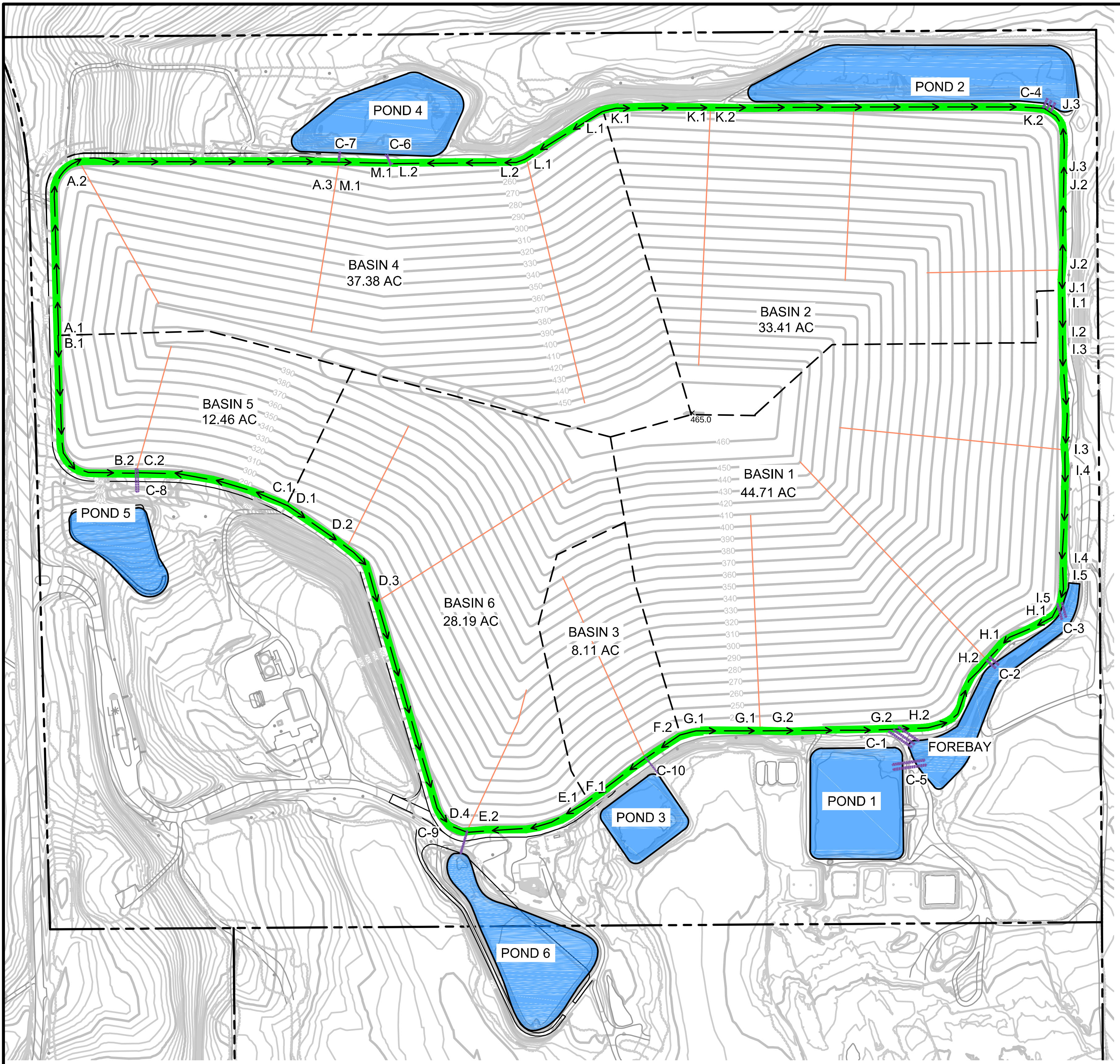
The SWMMP is presented on Figures 1 through 3. The information presented on the figures is as follows.

- Figure 1 – Final Conditions. This figure shows the site layout under final buildout of the landfill. It defines all perimeter features (ditch reaches, culverts, and ponds), and delineates the final drainage areas. The table on Figure 1 identifies the phase of work when each feature should be constructed, the status of installation, and a reference of where detailed information on each drainage feature can be found.
- Figure 2 – Phase 2A. This figure shows the site layout under a future interim (pre-final) conditions representative of the next planned progression of waste filling. These conditions were considered in analysis scenarios to determine whether the interim conditions govern the design (sizing) of various drainage features. The figure presents tabulated information on the ditches and culverts that are recommended for installation when the landfill filling progression reaches this condition.
- Figure 3 – Phase 2B. This figure shows the site layout under a future condition where waste filling is complete. These conditions were considered in analysis scenarios before final closure of all landfill areas, and after final closure - to determine which scenario governed the design

(sizing) of various drainage features. The figure presents tabulated information on the ditches, culverts, and pond that are recommended for installation when the landfill filling progression reaches this condition.

* * * * *

FIGURES



LEGEND

230	EXISTING GROUND SURFACE ELEVATION (MAJOR) (10 FT..INTERVAL)
	EXISTING GROUND SURFACE ELEVATION (MINOR) (2 FT..INTERVAL)
280	FINAL COVER CONTOUR
— — — — —	DRAINAGE BASIN DELINEATION
▨	PERIMETER CULVERT
🟩	PERIMETER DITCH
→ → → →	FLOW DIRECTION
———	DOWNDRAIN PIPE
—— - - —— - - ——	PROPERTY BOUNDARY
—— · —— · ——	PERMITTED LIMIT OF WASTE

N

0 400'

SCALE IN FEET

PHASE #	PERMANENT DRAINAGE FEATURES	STATUS	REFERENCE
PREVIOUS WORK	POND 6	COMPLETE	TERRACON POND DWG 7
	DITCH D.1 TO D.4	COMPLETE	TERRACON SW DWG 8
PHASE 1A	FOREBAY	COMPLETE	GEOSYNTEC DWG 12
	POND 1	COMPLETE	GEOSYNTEC DWG 12
	POND 2	COMPLETE	GEOSYNTEC DWG 13
	POND 3	COMPLETE	GEOSYNTEC DWG 14
	DITCH G.1 TO J.3	COMPLETE	GEOSYNTEC DWG 3
	CULVERT C-1 , C-2 , C-3 , C-5	COMPLETE	GEOSYNTEC DWG 12
	CULVERT C-4	COMPLETE	GEOSYNTEC DWG 13
PHASE 1B	POND 4	UPGRADES PENDING	GEOSYNTEC DWG 15
	DITCH K.2 TO K.1	PENDING	GEOSYNTEC DWG 3
PHASE 2A	DITCH L.1 TO M.1 , E.1 TO F.2	FUTURE	FIGURE 2
	CULVERT C-6 , C-9 , C-10	FUTURE	FIGURE 2
PHASE 2B	POND 5	FUTURE	FIGURE 3
	DITCH A.3 TO C.1	FUTURE	FIGURE 3
	CULVERT C-7, C-8	FUTURE	FIGURE 3

NOTES:

1. TERRACON POND DRAWING REFER TO THE 8/6/14 TERRACON "STORMWATER POND PLAN (CONTRACT DRAWINGS FOR CELL 10B)"
2. TERRACON SW DRAWING REFERS TO THE 6/3/14 TERRACON "STORMWATER DRAINAGE PLAN DRAWINGS (PERMIT RENEWAL PLANS WITH MINOR MODS)"
3. GEOSYNTEC DRAWINGS REFER TO THE 5/11/2016 GEOSYNTEC "INTERIM STORM WATER MANAGEMENT IMPROVEMENTS (CONSTRUCTION DRAWINGS)"

OVERALL STORM WATER MANAGEMENT MASTER PLAN
FINAL CONDITIONS
TIMBERLAND SANITARY LANDFILL

Geosyntec
consultants

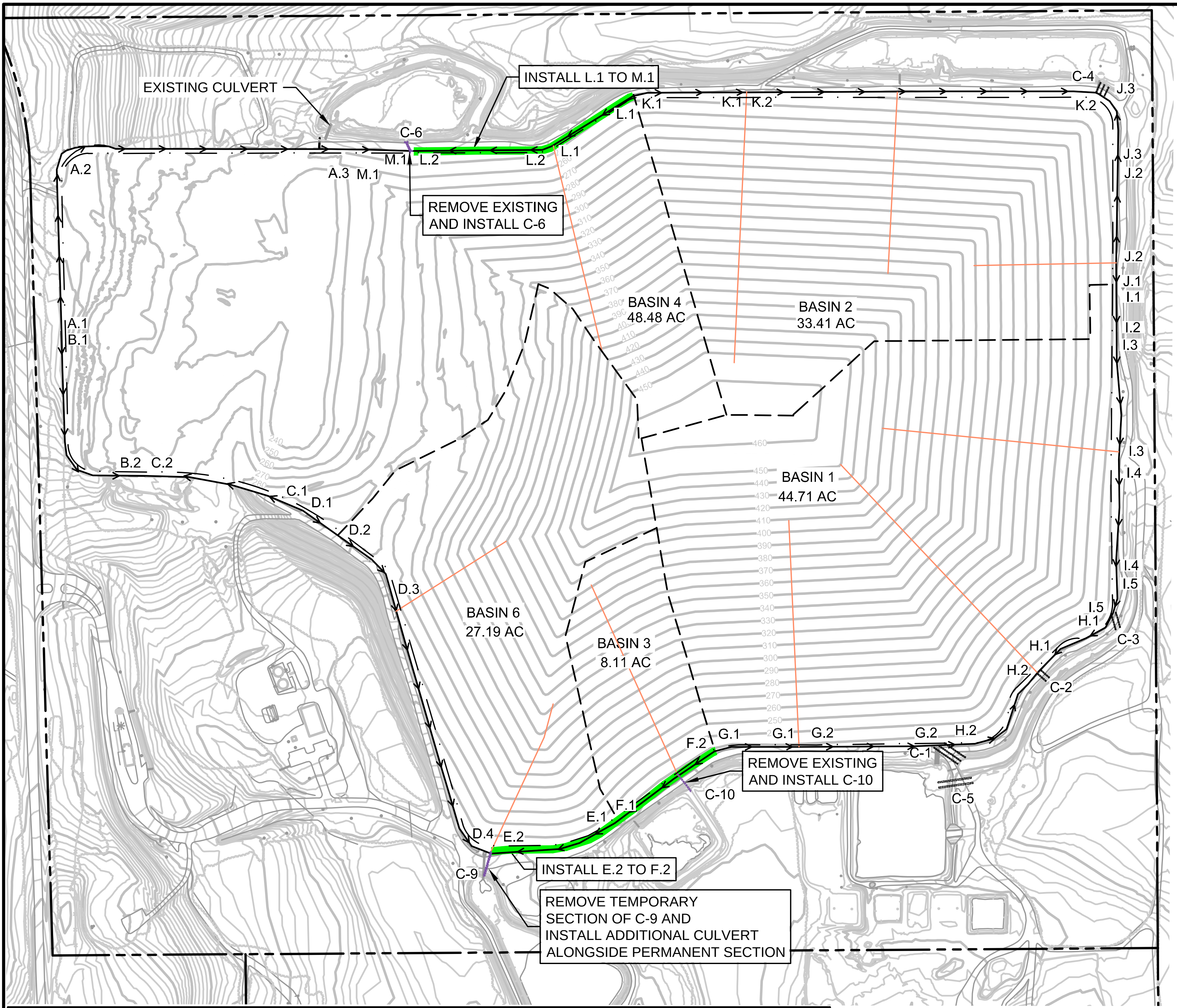
PROJECT NO: GK5913

FEBRUARY 2017

FIGURE

1

H:\T\TIMBERLANDS LANDFILL\(GK5913.2.TASK2.5)\DRAWINGS\5913-001



—— 230 ——	EXISTING GROUND SURFACE ELEVATION (MAJOR) (10 FT..INTERVAL)
———	EXISTING GROUND SURFACE ELEVATION (MINOR) (2 FT..INTERVAL)
—— 280 ——	FINAL COVER CONTOUR
— — — —	DRAINAGE BASIN DELINEATION
▨	PERIMETER CULVERT
🟩	PERIMETER DITCH
→ → →	FLOW DIRECTION
———	DOWNDRAIN PIPE
— - - —	PROPERTY BOUNDARY
— · — ·	PERMITTED LIMIT OF WASTE

N

0 400'
SCALE IN FEET

PHASE 2A CULVERT SCHEDULE

LOCATION	DESIGNATION	TYPE	LENGTH (FT)
POND 4	C-6	TWO 36" CORRUGATED HDPE[1] (SMOOTH INTERIOR)	50
POND 6	C-9	ONE 30" CORRUGATED HDPE[1][2] (SMOOTH INTERIOR)	95
POND 3	C-10	ONE 36" CORRUGATED HDPE[1] (SMOOTH INTERIOR)	100

NOTES:

1. USE ADS N-12 WT PIPE, OR EQUAL.
2. INSTALLED ALONGSIDE EXISTING 48" CULVERT.

PHASE 2A DITCH SCHEDULE

LOCATION	DITCH SEGMENT	LENGTH (FT)	DEPTH (FT)	LINING
POND 4	L.1	310	3	GRASS WITH CLASS 5.A TRM
	L.2	460	1	GRASS WITH CLASS 5.A TRM
	M.1	180	1	GRASS WITH CLASS 5.A TRM
POND 6	E.1-E.2 [4]	430	2	VEGETATION / ECM
POND 3	F.1-F.2 [4]	380	2	VEGETATION / ECM

3. ALL SEGMENTS HAVE A BASE WIDTH OF 2 FT AND 3:1 SIDESLOPES.
4. SEGMENT FOLLOW DIMENSIONS AND LINING SPECIFICATIONS PRESENTED IN DWG 8 OF THE 6/3/14 TERRACON "STORMWATER DRAINAGE PLAN DRAWINGS (PERMIT RENEWAL PLANS WITH MINOR MODS)".

STORMWATER MANAGEMENT MASTER PLAN
PHASE 2A
TIMBERLAND SANITARY LANDFILL

Geosyntec
consultants

FIGURE
2

PROJECT NO: GK5913
FEBRUARY 2017

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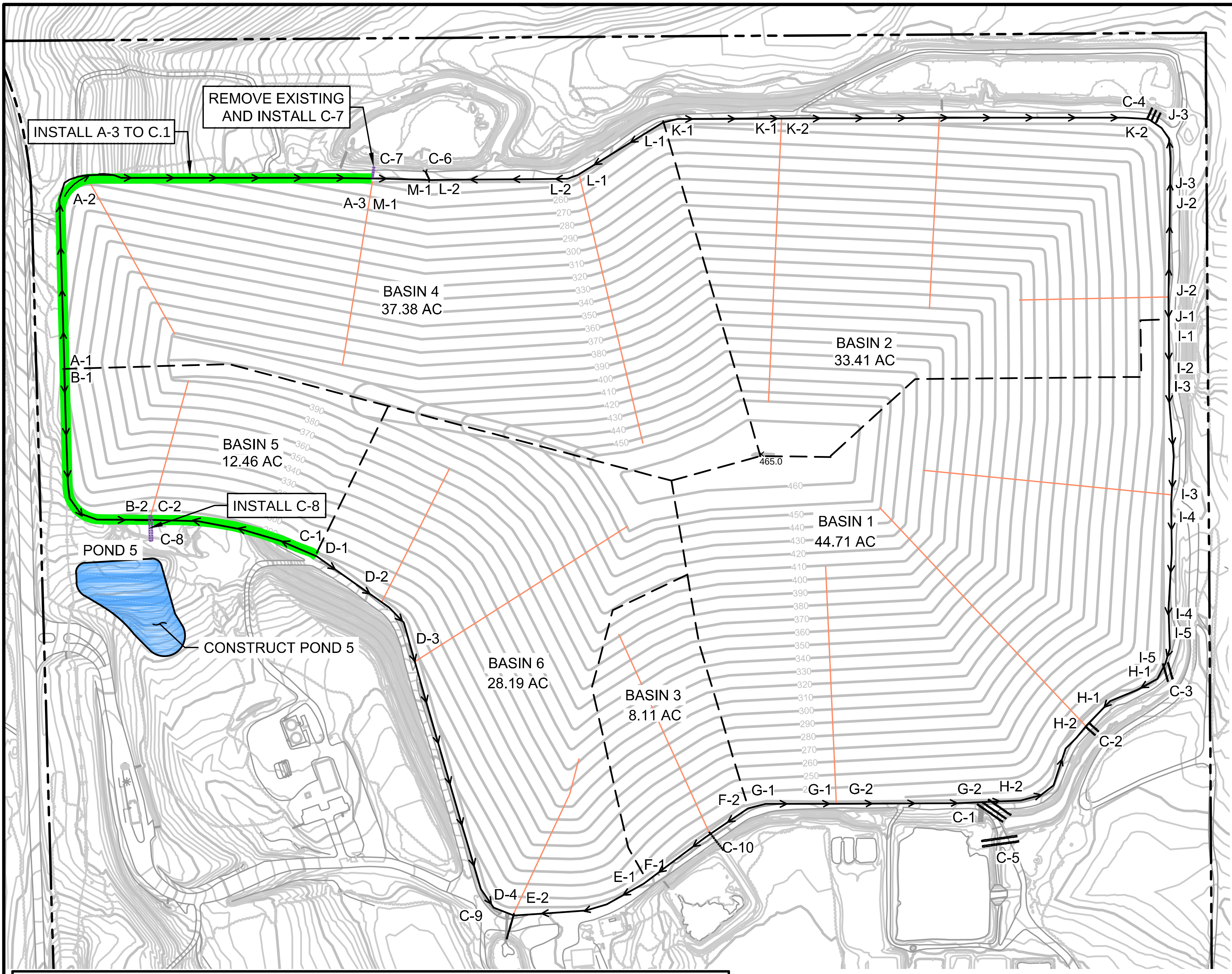

230 EXISTING GROUND SURFACE ELEVATION (MAJOR) (10 FT--INTERVAL)

EXISTING GROUND SURFACE ELEVATION (MINOR) (2 FT--INTERVAL)

280 FINAL COVER CONTOUR

DRAINAGE BASIN DELINEATION

PERIMETER CULVERT

PERIMETER DITCH

FLOW DIRECTION

DOWNDRAIN PIPE

PROPERTY BOUNDARY

PERMITTED LIMIT OF WASTE

0 400'
SCALE IN FEET

N

POND 5 FEATURES	
POND GEOMETRY AND FEATURES	
(A) EMBANKMENT CREST ELEVATION (MIN) (FT, MSL)	258
(B) EMERGENCY SPILLWAY ELEVATION (FT, MSL)	257
(C) EMERGENCY SPILLWAY BOTTOM WIDTH (FT)	20.0
(D) EMERGENCY SPILLWAY DEPTH (FT)	1.0
(E) EMERGENCY SPILLWAY SLOPE	3:1
RISER STRUCTURE	
(F) RISER DIAMETER (IN)	48
(G) TOP OF RISER (FT, MSL)	254.5
(H) NORMAL POOL ORIFICE INVERT (FT, MSL)	253
(I) DEWATERING ORIFICE INVERT (FT, MSL)	252
(J) REQUIRED BALLAST DEPTH (MIN) (FT)	2.5
OUTLET CULVERT	
(K) OUTLET CULVERT DIAMETER (IN)	≥ 24
(L) OUTLET CULVERT INLET INVERT ELEVATION (FT, MSL)	252
(M) OUTLET CULVERT OUTLET INVERT ELEVATION (FT, MSL)	251
PONDING ELEVATION FOR STORM FREQUENCY	
(N) NORMAL POOL ELEVATION (FT, MSL)	253
(O) 25-YEAR STORM EVENT (FT, MSL)	257.0
(P) 100-YEAR STORM EVENT (FT, MSL)	257.5

PHASE 2B CULVERT SCHEDULE

LOCATION	DESIGNATION	TYPE	LENGTH (FT)
POND 4	C-7	TWO 42" CORRUGATED HDPE[1] (SMOOTH INTERIOR)	105
POND 5	C-8	ONE 42" CORRUGATED HDPE[1] (SMOOTH INTERIOR)	100

PHASE 2B DITCH SCHEDULE

LOCATION	DITCH SEGMENT	LENGTH (FT)	DEPTH (FT)	LINING
POND 4	A.2-A.3	860	3	ALDOT CLASS 2 RIPRAP
	A.1-A.2	650	2	VEGETATION / ECM
POND 5	B.1-B.2	680	2	VEGETATION / ECM
	C.1-C.2	510	2	VEGETATION / ECM

NOTES:

1. USE ADS N-12 WT PIPE, OR EQUAL.

2. ALL SEGMENTS HAVE A BASE WIDTH OF 2 FT AND 3:1 SIDESLOPES.

3. ALL SEGMENTS FOLLOW DIMENSIONS AND LINING SPECIFICATIONS PRESENTED IN DWG 8 OF THE 6/3/14 TERRACON "STORMWATER DRAINAGE PLAN DRAWINGS (PERMIT RENEWAL PLANS WITH MINOR MODS)".

STORM WATER MANAGEMENT MASTER PLAN
PHASE 2B
TIMBERLAND SANITARY LANDFILL

Geosyntec consultants

FIGURE
3

PROJECT NO: GK5913
FEBRUARY 2017

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CALCULATION PACKAGE

PHASE 2 STORMWATER MANAGEMENT SYSTEM DESIGN

(HYDROLOGY/HYDRAULICS ANALYSIS AND DESIGN)

Note: Provided as a separate pdf file to keep file size manageable.

PHASE 2 STORMWATER MANAGEMENT SYSTEM DESIGN

No. 23929
SCOTT M. GRAVES

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INFORMATIONAL PURPOSES.
ORIGINAL CONTROLLED ELECTRONIC DOCUMENT WITH
AUTHENTICATED DIGITAL SIGNATURE MEETING THE
CRITERIA OF ALABAMA ADMINISTRATIVE CODE 330-X-2-(10)
(b) IS ON FILE WITH LANDFILL OPERATOR.

Digitally signed by Scott M. Graves
DN: cn=Scott M. Graves, o, ou, email=sgraves@geosyntec.com, c=US
Date: 2017.02.12 16:03:52 -06'00'

SEALED FOR
CALCULATION PAGES
1 THROUGH 357

PURPOSE

The purpose of this calculation package is to present the analysis and design for the "Phase 2" Timberlands Landfill stormwater management system features and improvements. Phase 2 represents future site conditions representative of ongoing landfill development towards the western part of the site, up through final closure conditions (full landfill buildout). This package provides calculations of peak design discharges (i.e., hydrology) and design of the following perimeter surface water management system components (i.e., hydraulic design) that are part of the Phase 2 portions of the site:

- perimeter ditches;
- pond inlet culverts; and
- pond features (spillways, grading, outlet culverts, and riser pipes).

PROJECT BACKGROUND

Final Surface Water Management System - Overview

This calculation package accompanies the Storm Water Management Master Plan (SWMMP) memorandum. The SWMMP memorandum includes a figure (Memorandum

Figure 1) that shows the landfill final cover grading plan and layout/identification of the perimeter surface water management system features. Key features of the landfill surface water management system for final closure conditions are described below.

- The final cover system ground surface will be vegetated with grass, and will have sideslopes inclined at four horizontal to one vertical (4H:1V) in-between drainage terraces.
- The final cover sideslopes have drainage terraces spaced approximately every 20 feet vertically, and with typical drainage profile slopes typically at about two (2) percent.
- The drainage terraces will convey water to downdrain pipes spaced periodically around each landfill area.
- Downdrain pipes will outlet into either perimeter drainage ditches, or will directly outlet into storm water ponds.
- Drainage ditches (with segments designated as Ditches A through M) will convey water to periodic low points where culvert pipes will be situated to carry flow underneath the perimeter road and into storm water ponds.
- Storm water ponds (designated as Ponds 1 through 6) are positioned around the perimeter of the landfill. The ponds will receive runoff from the contributing upstream drainage areas of the landfill and will attenuate outflows through riser pipes at each pond outlet (as well as emergency spillway channels) before surface water is discharged off-site downstream from each pond.

Overview of Development Phases

Phase 1 (2015-2016 Site Conditions). "Phase 1" of the project was a previously-completed assessment of site conditions as they existed in 2015-2016. During this phase, Geosyntec evaluated the conditions and functionality of the existing stormwater management system and developed construction documents (drawings and specifications) for the design of interim stormwater management improvements around essentially the eastern half of the landfill perimeter (drainage areas contributing to Ponds 1-3). The Phase 1 analysis considered two ground cover cases for the landfill slopes: a short-term condition (existing grades and partial vegetation & bare ground conditions); and a long-term condition (final grades and fully vegetated). The outcome of Phase 1 was a design of short-term measures aimed at providing immediate stormwater management improvements, as reflected on Geosyntec's set of construction drawings titled "Interim Storm Water Management Improvements", dated May 2016. Many of these improvements were installed in 2016, with the remainder scheduled to be installed in 2017. Phase 1 involved design/re-design and construction of the following perimeter surface water management system components:

- Ditches G through K (perimeter ditches that convey flow to Ponds 1 and 2);
- Culverts C-1 through C-5 (culverts that convey flow to Ponds 1 and 2);
- Forebay to Pond 1;
- Ponds 1 through 3 updated pond features (re-establish base grades, install baffles; install new outlet riser structures, principal spillway pipes, and emergency spillways); and
- Pond 4 (re-establish base grades, install baffles).

<u>Phase 2A (Future Interim Site Conditions).</u> "Phase 2A" of the project represents a future interim (pre-final) condition expected to exist after waste filling has progressed westward (see Figure 2). As shown in Figure 2, for this condition the eastern half of the landfill is configured to final grades, and the western half of the landfill that exists at the time of this phase is at interim grades. For this phase, it is assumed that all of the stormwater improvements recommended for Phase 1 are in-place. The eastern side of the site is modeled as being fully vegetated (representative of final cover conditions), and the western side of the site is modeled as being unvegetated. The reason this phase was analyzed was to assess whether the interim slopes and unvegetated conditions produced more critical rates of runoff for sizing of the perimeter features (ditches, culverts, and ponds). Phase 2A will involve installation of the following perimeter surface water management system features:

- Ditches L and M (perimeter ditches that convey flow to Pond 4);
- Ditches E and F (perimeter ditches that convey flow to Ponds 3 and 6, respectively); and

- Culverts C-6, C-9, and C-10 (which convey flow to Ponds 4, 6, and 3, respectively).

<u>Phase 2B (Future Final Site Conditions).</u> "Phase 2B" of the project represents the condition when the landfill is constructed to final grades. However, two cases were evaluated – one with only partial vegetation on the western side of the site (representing the interim case before final cover is established), and one with the entire site fully vegetated under final conditions. The purpose for including this phase was to obtain runoff rates for "near-final" and final conditions, to evaluate whether they produced critical runoff rates for sizing of the perimeter features (ditches, culverts, and ponds). Phase 2A will involve installation of the following perimeter surface water management system features:

- Ditch A (perimeter ditch that conveys flow to Pond 4);
- Ditches B and C (perimeter ditches that convey flow to new Pond 5);
- Culverts C-7 and C-8 (which convey flow to Ponds 4 and 5, respectively); and
- Pond 5 (new pond; with associated outlet riser structure, principal spillway pipe, and emergency spillway).

SUMMARY OF ANALYSIS CASES

As mentioned, Phase 2 was subdivided into two sub-phases: Phase 2A and Phase 2B. To evaluate the critical condition governing the design/sizing of each specific surface water management system features, H&H analyses were performed for four (4) cases as described below.

- Case 1 (Figure 1). This case considers current site conditions (landfill grades and vegetative cover) based on 2016 aerial topography, to check whether existing drainage features associated with Ponds 3, 4, and 6 (i.e., temporary inlet culverts to the ponds, pond capacity, pond outlet features) can handle the predicted short-term peak flows.

- Case 2 (Figure 2). This case corresponds to the completion of waste filling of Phase 2A. As such, it considers interim conditions, with the southwest portion of the landfill (referred to as “Area 1” on Figure 2) filled to final grades but unvegetated, and the northwest portion of the interim landfill (referred to as “Area 2” on Figure 2) is still at the same grades as in Case 1 and unvegetated. The eastern half of the landfill is considered to be at final grades and fully vegetated. Proposed and existing permanent culverts and ditches in areas at final grades are checked and designed. The existing pond inlet culvert not yet at final grades (Pond 4 inlet only) is re-checked to ensure upgrades are not needed prior to being replaced with the designed permanent pond inlet culvert.

- Case 3 (Figure 3) considers interim conditions in which all landfill areas are at final grades and only Landfill Area 2 is unvegetated (bare ground). In Case 3, all temporary features are removed. Proposed and existing permanent inlet culverts and ditches are designed and checked against Case 2 (when applicable) to determine the worst-case condition.

- Case 4 (Figure 3) considers final conditions (fully vegetated landfill slopes at final landfill grades). Proposed and existing permanent culverts and ditches are designed and checked against Case 3 and Case 2 (when applicable) to determine the worst-case condition.

The reason for the above cases is that interim conditions (with corresponding areas of bare ground, and temporary drainage areas) may be more critical (governing case) for sizing of the various drainage features. Note that existing Ponds 3, 4, and 6 are checked for Cases 1 through 4, as the four different vegetation and grading conditions results in four different flow profiles. Pond 5 is a future pond that will be constructed as part of Phase 2B, and therefore is checked for Cases 3 and 4 and sized accordingly.

METHODOLOGY

Hydrologic Modeling

The specialty engineering software HydroCAD 10.0 (HydroCAD, 2011) was used to perform hydrologic modeling of storm water runoff produced by hypothetical design precipitation events for the various analysis cases for selected. Using HydroCAD, peak design discharges and hydrographs were computed using the SCS Curve Number method outlined by the U.S. Department of Agriculture (USDA) document *Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55)* (USDA, 1986). Hydrographs generated within the computer program are routed through a user-specified network of reaches and ponds using documented hydraulic routing techniques, summarized below.

- Precipitation-specifications were selected using published frequency-based hypothetical precipitation events (i.e., design rainfall or storm events). For these analyses, the following hypothetical precipitation events were evaluated: the 25-year (4% annual chance), 24-hour duration event (herein referred to as the 25-year, 24-hour event) and the 100-year (1% annual chance), 24-hour duration event (herein referred to as the 100-year, 24-hour event).

- Water loss models are used to estimate the volume of runoff given the precipitation and properties of the watershed. For these analyses, the Soil Conservation Service (SCS) Curve Number Loss Model was used (USDA, 1986).

- Direct runoff transform models can be used to account for overland flow, storage, and energy losses as surface water runs off a watershed and into the drainage channels. For these analyses, the SCS Unit Hydrograph Model was used.

- Hydraulic routing models account for storage and energy flux as surface water flows through drainage ditches. For these analyses, the Kinematic Wave method was used for reach routing and an Outflow Curve method was used for routing through ponds (since the outlet structure has a complex design with a combination of orifices, weirs, and culverts).

Hydraulic Analysis and Design

Principles of open channel flow using Manning's equation (Chow, 1959) were used to size the perimeter ditches based on the peak flows derived from the HydroCAD hydrologic modeling. Manning's Equation in its general form is expressed as:

$$Q = \frac{1.49}{n} AR^{2/3} S_o^{1/2}$$

where: Q = discharge (cfs);

n = manning's roughness coefficient;

A = area of cross-section of flow (ft^2);

P = wetted perimeter (ft);

R = hydraulic radius (ft) = A/P; and

S_0 = longitudinal slope (ft/ft).

Tractive stresses, as well as flow velocities resulting from peak flows, were calculated to select the type of channel lining that would be necessary to prevent erosion of the drainage features. The average tractive stress for a given depth of flow in a channel is calculated by:

$$\tau_o = \gamma_w RS$$

where: τ_o = average tractive stress (lb/ft^2);

γ_w = unit weight of water (lb/ft^3);

R = hydraulic radius (ft); and

S = channel slope (ft/ft).

Federal Highway Administration (FHWA) methods from their *Hydraulic Design of Energy Dissipators for Culverts and Channels: Hydraulic Engineering Circular No. 14,* [FHWA (2006) and NHI (2011)] as coded in their "HY-8" software program were used to design the culverts at the inlets to the ponds. The performance of each culvert is modeled and assessed based on boundary conditions of the structure, culvert configuration, peak flow criteria, and tailwater levels. The tailwater levels were selected based on the computed water depth in the downstream feature predicted at the time the culvert is predicted to experience peak flows for the respective design rainfall events.

HydroCAD was used to develop outflow curves for the pond riser structures, outlet culverts, and overflow (emergency) spillways. HydroCAD allows for complex outlet structures and models the structure using orifice and weir equations.

DESIGN CRITERIA

The design criteria adopted for these calculations are as follows:

- Perimeter Ditches. The perimeter ditches have been designed to convey the peak flows from the 25-year, 24-hour rainfall event, while maintaining at least 0.5-ft of freeboard. Additionally, perimeter ditches have been sized with the capacity to convey the 100-year, 24-hour rainfall event without overtopping. Tractive stresses and velocities for peak flows during the 100-year, 24-hour rainfall event have been computed and channel linings have been selected to withstand the predicted tractive stresses.

- Culverts (at Pond inlets). Inlet culverts have been designed to ensure that one (1) foot of headwater freeboard is maintained during the 25-year event and that the 100-year event is fully contained.

- Ponds. The permanent ponds (Ponds 1 through 6) have been designed to detain both the 25-year, 24-hour storm and the 100-year, 24-hour storm. More specifically, Ponds 1 through 6 have been designed to pass the 25-year, 24-hour storm through the principal spillway (i.e., without engaging the emergency spillway) and maintaining at least a 1-ft freeboard in the ponds. Ponds 1 through 6 have also been designed to pass the 100-year, 24-hour event (i.e., through the principal and emergency spillway) without overtopping the pond berms.

DESIGN PARAMETERS

Estimation of Contributing Drainage Areas

The watershed areas for each basin or reach are broken into subareas (subcatchments). Each subcatchment is routed to a particular reach or basin. Each subcatchment is assigned a curve number based on soil type and representing the type of ground cover for each analysis case, and a time of travel associated with it (discussed subsequently).

Figures 1, 2, and 3 of this calculation package provide drawings showing delineation of the contributing drainage areas for each of the surface water management system components for Cases 1 through 4. From these delineations, “nodal network diagrams” (the interconnected sequence of flow into and through the various slopes, reaches, and drainage features) were developed and input into the HydroCAD model. The nodal network diagrams for each case are presented with the HydroCAD output in the appendices of this calculation package.

Rainfall Information

The design rainfall distribution for the site is selected from the rainfall distribution map of the United States (USDA, 1986). The site is located in an area categorized by Soil Conservation Service (SCS) Type III Rainfall Distribution. This rainfall distribution is used as input to the hydrologic model and is converted into a runoff hydrograph.

The 2-year, 25-year, and 100-year rainfall depths for a 24-hour storm event utilized for analyses were obtained from the National Weather Service *Technical Paper No. 40: Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years,* (USDOC, 1961) for the site location in Escambia County, Alabama. A 2-year, 24-hour rainfall depth is used in the hydrologic model to estimate travel times for sheet flow conditions for the times of concentration (discussed subsequently) for each subarea. Then, rainfall depths of 9.6 inches and 12.1 inches were selected for 25-year, 24-hour and 100-year, 24-hour rainfall events, respectively.

Table 1 of this calculation package presents a summary of the design rainfall events, as well as the main design criteria used for the design of the various drainage features.

Estimation of Basin Curve Numbers, CN

Figures 1, 2, and 3 also identify the assumed ground cover conditions on the landfill slopes for the various analysis cases. Table 2 details the ground cover assumptions (e.g., vegetated, bare ground) for the analysis cases. To select curve numbers for use in the HydroCAD model, the ground cover conditions along with published soils data for Escambia County, Alabama [USDA (2015)] were evaluated. To select soil types, the landfill site was superimposed on the Escambia County soils map, and hydrologic soil groups (HSG) were identified based on the predominant surficial soil types in the area. The resulting types and percentages of ground cover are used to select Basin Curve Numbers, CN, using recommendations for TR-55 from USDA (1986).

Estimation of Time of Concentration, T_c, for SCS Curve Number Method

The time of concentration is defined as the time for runoff to flow from the most hydraulically remote point of the drainage area to the point under investigation. The time of concentration (T_c) is a summation of sheet flow travel time, shallow concentrated flow travel time, and channel flow (open and pipe) travel time. The method to estimate the sheet flow travel time was obtained using the TR-55 method (USDA, 1986). Manning's kinematic solution is used for estimating travel time for sheet flow for flow distances less than 300 ft (USDA, 1986):

$$T_t = \frac{0.007(nL)^{0.8}}{P_{2-24}{}^{0.5} S^{0.4}}$$

where: T_t = travel time for overland sheet flow (hr);
n = Manning's roughness coefficient;
L = flow length (ft);
P_{2-24} = 2-year, 24-hour rainfall (in.); and
S = slope of hydraulic grade line (land slope, ft/ft).

For the undeveloped contributing areas, shallow concentrated flow will occur after the allowable 300 ft of sheet flow but prior to open channel flow. The travel time for shallow concentrated flow is estimated using the Upland Method (USDA, 1986) as described above. Manning's roughness coefficients are calculated based assumptions of the percentage of short grass cover and bare soil cover along the path of the sheet flow, detailed in Table 2. Based on the designed conveyance system, runoff will be converted from sheet flow to side-slope open channel flow or downdrain pipe channel flow relatively quickly, typically before shallow concentrated flow can develop (shallow concentrated flow is only encountered in Basin 4c for Case 1). The Upland Method (USDA, 1986) is used to estimate the shallow concentrated flow velocities, where applicable, using the equation below.

$$V = K_v \sqrt{S}$$

where: V = average velocity (ft/sec),

K_v = shallow concentrated flow velocity factor (ft/sec) based on surface type, and
S = land slope (ft/ft).

A velocity factor of $K_v = 7.0$ ft/sec was selected for undeveloped areas based on a short grass pasture surface description. The land slopes were estimated from the existing conditions topographic shown for Case 1.

The method selected to estimate the shallow concentrated flow and open channel flow travel time is based on guidance provided in TR-55 (USDA, 1986). Travel time for shallow concentrated flow and open channel flow is estimated by dividing the longest drainage path by the velocity of runoff:

$$T_t = \frac{L}{V}\left(\frac{1}{60}\right)$$

where: T_t = travel time (min);
L = flow length (ft); and
V = average velocity (ft/sec).

The shallow concentrated flow velocities are defined above. The open channel and downdrain pipe channel flow velocities are estimated using Manning's equation based on guidance provided in TR-55 (USDA, 1986). The average flow velocities were determined for bank-full elevation as:

$$V = \frac{1.49}{n} R_h^{2/3} S^{1/2}$$

where: V = average velocity (ft/sec);
n = Manning's roughness coefficient;
R_h = hydraulic radius (ft) = A/P;
A = cross sectional area (ft^2);
P = wetted perimeter (ft); and
S = slope of hydraulic grade line (channel slope, ft/ft).

A minimum time of concentration of 6 minutes is used to calculate the rainfall intensity as recommended by the TR-55 method, because small areas with exceedingly short times of concentration could result in design rainfall intensities that are unrealistically high (USDA, 1986).

Table 3 presents the selected flow lengths and slopes used for the time of concentration calculations.

Calculated Drainage Areas

Table 4 provides the calculated area, in acres, for each of the drainage areas (subcatchments) labeled on Figures 1, 2, and 3.

Pond Stage-Storage Relationships

The pond layouts (grading plans) were used to develop stage-storage relationships for each pond. For each pond height increment (elevation increment), the plan area was measured. From this, a stage-storage curves were developed, providing the volume of storage available in the pond based on the variation in water elevation. This information, along with the outlet structure characteristics, were input into the HydroCAD model, for use in routing hydrographs into and out of the ponds.

COMPUTATIONS

Using the methods, design criteria, and parameters described above, the analysis computations were performed.

- The HydroCAD modeling runs were conducted for each analysis case. The hydrographs generated provide the peak discharge rates for each drainage area.
    - To obtain the design discharge for a specific ditch or inlet culvert in the surface water management system, the peak discharges for each drainage area upstream of the point were added at the point of interest. This technique slightly overestimates peak discharge because peak flows from upstream drainage areas will likely combine downstream at different times. However,

this technique is conservative and appropriate for design given the small drainage areas and short times of concentration.

  - HydroCAD modeling runs provided inflow and outflow hydrographs at the ponds, which was used to check and design pond outlet riser structures (Pond 3, 5, 6), outlet culverts (Pond 4), and emergency spillways (Pond 3, 5, 6).

  - Note that the conditions upstream from existing culverts EC-7 (existing inlet culvert for Pond 4 during Case 1) and EC-9 (existing inlet culvert for Pond 6 during Case 1 and 2) were more representative of temporary ponds. Accordingly, both features were also modeled as detention pond culverts in HydroCAD using inflow and outflow hydrographs.

- To evaluate/design the perimeter ditches, the peak discharges computed by HydroCAD, along with the channel configuration, dimensions, and slopes, were input into Manning's Equation to check whether the ditch size met the design criteria (and adjust the size as needed to comply with the criteria). After this, the channel lining was selected using the tractive stress approach and based on the shear stress resistance of various potential channel lining materials.

- To evaluate the culverts at the inlets to the ponds (with the exception of EC-7 and EC-9 as discussed above), the peak discharge rates computed by HydroCAD, along with the culvert characteristics, were input into the HY-8 model. From this, the culvert sizes needed to adequately convey the flows in compliance with the design criteria were selected.

- The HydroCAD model also routed the design storms through the ponds for the various design cases. For each case, the results were checked for compliance with the design criteria, and the outlet structures were adjusted accordingly using an iterative approach, until they resulted in a satisfactory design.

RESULTS

Overview

Results of the modeling computations and resulting design/sizing of drainage features are presented in the tables and appendices included with this calculation package. More specifically, these results are provided as outlined below.

- Table 5 presents the calculated peak discharges computed by HydroCAD at each drainage area for the various design storms and analysis cases.
- Table 6 provides the characteristics of the pond outlet structures, as well as other relevant assumptions regarding the HydroCAD analysis of the ponds.
- Table 7 presents the results of the pond analysis and design. This includes key information on the various pond components (elevation of outlet features, etc.).
- Table 8 provides a summary of the design criteria and relevant assumptions used for the HY-8 analysis of the culverts.
- Table 9 presents the results of the culvert analysis and design. This includes key information on the culverts (pipe type, diameter, lengths, slopes, etc.).
- Table 10 provides a summary of the design criteria and relevant assumptions used for the ditch design.
- Table 11 presents the results of the ditch analysis and design. This includes key information on each ditch (channel dimensions, slope, channel lining, etc.).
- Appendices 1 through 4 provide the modeling output and other backup documentation on the computations, as follows:
    - output files for the HydroCAD modeling are provided in Appendix 1;
    - computation sheets for the Manning's Equation ditch sizing are compiled in Appendix 2;

  - output files for the HY-8 modeling are provided in Appendix 3.

Assumptions and references for the HydroCAD input are summarized in Table 6. Design and analysis of the pond features is summarized in Table 7.

Discussion of Results

Ponds 3 and 6 are calculated to convey the 25-year and 100-year stormwater events without reaching the spillway features. The proposed Pond 5 spillway is designed to only flow during the 100-year event. Pond 4 does not have a spillway feature and is calculated to convey the 100-year storm with a substantial amount (minimum seven feet) of freeboard. Temp Pond 4 (upstream from EC-7) was found to convey the 25-year event during applicable interim Cases 1 and 2. Temp Pond 6 (upstream from EC-9) was found to convey the 25-year event during applicable interim Case 1.

The perimeter ditch segments previously installed (D.1 through D.4) per Terracon (2014a) and proposed ditch segments per Terracon (2014a) are calculated to maintain 1 foot or greater freeboard during the 25-year event, fully convey the 100-year event, and have adequate liner specifications. Ditch segments L.1, L.2, and M.1 were designed to maintain 0.5 feet or greater freeboard during the 25-year event, fully convey the 100-year event, and use grass lining with Class 5.A TRM erosion mat.

Temporary inlet culverts at Ponds 3 and 4 were determined to convey the 25-year event with one foot of freeboard. Permanent inlet culverts for Pond 3, 4, and 5 were designed to maintain one foot or greater freeboard during the 25-year event and fully convey the 100-yr event. Although the inlet culvert for Pond 6 conveys the 25-year event for interim Case 1, it requires that a 30-inch diameter inlet culvert be installed alongside the existing 48-inch diameter inlet culvert to maintain one foot or greater freeboard during the 25-year event and convey the 100-yr event.

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Tables

Table 1: Design Rainfall Events and Criteria

DESIGN EVENTS (input for HydroCAD using SCS	Value	Design Case	Notes	Reference
25 yr 24 hr Event	--	ALL	SCS Type III 24-hr, For intermediate and final conditions	USDA (1986)
Design Rainfall:	9.6 in	ALL	For Escambia county	USDOC (1961)
Temp Pond Freeboard Constraint:	0.0 ft	ALL	Must collect and control the 24-hour, 25 year storm	ADEM (2005) 335-13-4-.17 (2)
Ditch Freeboard Constraint:	0.5 ft	ALL	Must collect and control the 24-hour, 25 year storm	ADEM (2005) 335-13-4-.17 (2)
Pond & Culvert Freeboard Constraint:	1.0 ft	ALL	Must collect and control the 24-hour, 25 year storm	ADEM (2005) 335-13-4-.17 (2)
100 yr 24 hr Event	--	4	SCS Type III 24-hr, For final conditions	USDA (1986)
Design Rainfall:	12.1 in	4	For Escambia county	USDOC (1961)
Freeboard Constraint (All):	0.0 ft	4	Must collect and control the 24-hour, 25 year storm	ADEM (2005) 335-13-4-.17 (2)
Maximum Permissible Shear Stress:	2 lb/ft^2	ALL	For vegetation with SC150 Erosion Control Blanket	ASWCC (2003), Tensar (2016)
Maximum Permissible Shear Stress:	6 lb/ft^2	4	For Grass with Class 5.A TRM and ALDOT Class 2/3 Riprap	ASWCC (2003)

Table 2: Assumptions for HydroCAD Inputs – Basin Runoff Area, CN, and T_c

RUNOFF CALCULATIONS (input for HydroCAD using SCS	Value	Design Case	Notes	Reference
Basin Runoff Area	--	-	-	USDA (1986)
Existing Acreage:	*See Table 4*	1	Based on existing contours; assume no regrading	Geosyntec (2016) DWG 3
Intermediate Acreage:	*See Table 4*	2	Based on final contours; assume Area 2 is at base grades, intersecting final contours at a 3:1 slope.	Geosyntec (2016) DWG 3 Terracon (2014a)
Final Acreage:	*See Table 4*	3 , 4	Based on final contours; assume no regrading	Terracon (2014a)
Pond Acreage:	*See Table 4*	ALL	Additional acreage is added directly to each respective pond based on the difference between the total pond subbasin area and the final permitted basin acreage	Terracon (2014a)
Basin Curve Number, CN	--	ALL	Assume pasture, grassland, or range on Type C* soil (where values of 86, 79, and 74 represent poor, fair, and good cover conditions, respectively). USDA (2015) surves indicates site is composed of Type A, B, and C soil; conservatively assume all landfill cover is Type C soil.	USDA (1986) Table 2-2c USDA (2015)
	See Table 4	1[1]	Approximated from the existing percentage of grass cover at site	Figure 1, Google (2015)
	See Table 4	2[1]	Assume 30% short grass cover in Areas 1 and 2; assume 90% cover elsewhere	Figure 2
	See Table 4	3[1]	Assume 30% short grass cover in Area 2; assume 90% cover elsewhere	Figure 3
	74	4	Assume 90% short grass cover everywhere (i.e. good cover)	Figure 3
	98	1 , 2	Assume impermeable water surface for Temp Pond 4 and Temp Pond 6 areas	Figure 1
Time of Concentration, Tc	-- min	ALL	Calculated for each subbasin	USDA (1986) Ch.3
Slope (sheet, shallow, channel):	-- ft/ft	1	Average slope across the flow length for each respective sheet, shallow, and channel flow section.	Geosyntec (2016) DWG 3
Slope (sheet, shallow, channel):	-- ft/ft	2 , 3 , 4	Average slope across the flow length for each respective sheet, shallow, and channel flow section.	Terracon (2014a) Chow (1959)
Flow Length (sheet):	< 300 ft	ALL	Assume to become shallow concentrated flow after 300 ft	USDA (1986) Ch.3
Manning's Number, n (sheet):	--	ALL	Aggregate value based on percentage of short grass cover (n= 0.15) and bare soil cover (n= 0.011) along the path of the sheet flow	USDA (1986) Table 3-1
	See Table 4	1[1]	Approximated from the existing percentage of grass cover at site	Figure 1, Google (2015)
	See Table 4	2[1]	Assume 30% short grass cover in Areas 1 and 2; assume 90% cover elsewhere	Figure 2
	See Table 4	3[1]	Assume 30% short grass cover in Area 2; assume 90% cover elsewhere	Figure 3
	0.136	4	Assume 90% short grass cover (n= 0.15) and 10% bare soil cover (n= 0.011)	Figure 3
P2 (sheet):	5.40 in	ALL	24-hour, 2-year storm event for Escambia County	USDOC (1961)
Velocity Factor (shallow):	-- ft/s	1 , 2	Assume fully unpaved	USDA (1986) Fig. 3-1
Channel Type (channel):	--	1	Assume 18" dia CMP (n= 0.20) where piping is clearly marked; assume nominally-sized straight, weathered earth channel (n= 0.22) with dimensions approximated from Geosyntec (2016) DWG 3	Geosyntec (2016) DWG 3 Chow (1959)
Channel Type (channel):	--	2 , 3 , 4	Assume 18" dia CMP (n= 0.20) where piping is clearly marked; assume 1.5' v-ditch with straight, weathered earth channel (n= 0.22) at 3:1 elsewhere	Terracon (2014a) Chow (1959)

[1] The aggregate percentage of grass cover is determined on a subbasin by subbasin basis.

Table 3: HydroCAD Inputs – Flow Lengths and Slopes for T_c Calculation

BASIN	CASE #	Overland Sheet Flow		Side Slope Drainage Terrace Flow		Downdrain Channel/Pipe Flow		Open Channel Flow	
		Length (ft)	Slope (ft/ft)	Length (ft)	Slope (ft/ft)	Length (ft)	Slope (ft/ft)	Length (ft)	Slope (ft/ft)
3c	1	190	0.17	344	0.02	192	0.20	454	0.01
3c	2 , 3 , 4	80	0.25	245	0.02	655	0.24		
3a	2 , 3 , 4	85	0.25						
3b	2 , 3 , 4	85	0.25						
4a	2 , 3 , 4	18	0.25						
4b.1	1	243	0.15					477	0.02
4b.1	2 , 3 , 4	187	0.08	200	0.02	813	0.25		
4b.2	2 , 3 , 4	47	0.25						
4c	1	300	0.08	984	0.03	404	0.16		
4c	2	113	0.09	691	0.04	256	0.10		
4c	3 , 4	107	0.19	301	0.02	594	0.24		
4d	3 , 4	83	0.24	427	0.02	89	0.24		
4e	3 , 4	71	0.25						
5a	3 , 4	81	0.25						
5b	3 , 4	102	0.20	462	0.02	437	0.22		
5c	3 , 4	95	0.25						
6a	3 , 4	37	0.25						
6b	2	200	0.18	517	0.06			471	0.02
6b	3 , 4	81	0.25	318	0.02	438	0.24		
6c	1	192	0.22	1346	0.04	88	0.18		
6c	2 , 3 , 4	180	0.08	113	0.02	726	0.24		
6d	2 , 3 , 4	80	0.25	306	0.02	189	0.18		
6e	2 , 3 , 4	79	0.25						

[1] Shallow concentrated flow was only encountered for Basin 4c, Case 1, with a velocity factor of 7, Path Length of 96 ft, and slope of 0.22.

[2] Tc_{min} (6 minutes) is assumed for all pond basin areas

Table 4: HydroCAD Inputs – Basin Runoff Area, Basin Curve Number, CN, and Manning's Number, n

BASIN	Basin Area (acre)				% Of Vegetative Cover				Basin Curve Number, CN				Manning's Number, n (sheet flow)			
	Case 1	Case 2	Case 3	Case 4	Case 1	Case 2	Case 3	Case 4	Case 1	Case 2	Case 3	Case 4	Case 1	Case 2	Case 3	Case 4
3a		0.59	0.59	0.59		0.3	0.9	0.9		86	44	74		0.05	0.14	0.14
3b		0.40	0.40	0.40		0.3	0.9	0.9		86	74	74		0.05	0.14	0.14
3c	7.70	5.76	5.76	5.76	0.44	0.3	0.9	0.9	86	86	74	74	0.14	0.05	0.14	0.14
Pond 3	1.04	1.04	1.04	1.04	0.0	0.0	0.0	0.0	98	98	98	98				
4a		0.33	0.33	0.33		0.9	0.9	0.9		74	74	74		0.14	0.14	0.14
4b.1	3.11	12.33	15.83	15.83	0.11	0.9	0.82	0.9	86	74	74	74	0.01	0.14	0.14	0.14
4b.2		0.47	0.47	0.47		0.9	0.9	0.9		74	74	74		0.14	0.14	0.14
4c	37.68	32.54	10.68	10.68	0.46	0.3	0.3	0.9	86.9	87.1	86	74	0.01	0.05	0.05	0.14
4d			6.40	6.40			0.3	0.9			86	74			0.05	0.14
4e			0.87	0.87			0.3	0.9			86	74			0.05	0.14
Pond 4	2.20	2.20	2.20	2.20	0.0	0.0	0.0	0.0	98	98	98	98				
5a			1.49	1.49			0.3	0.9			86	74			0.05	0.14
5b			7.37	7.37			0.3	0.9			86	74			0.05	0.14
5c			1.32	1.32			0.3	0.9			86	74			0.05	0.14
Pond 5			1.06	1.06			0.0	0.0			98	98				
6a			0.31	0.31			0.56	0.9			79	74			0.14	0.14
6b		9.79	6.38	6.38		0.3	0.60	0.9		86	79	74		0.05	0.14	0.14
6c	31.96	7.97	12.08	12.08	0.45	0.3	0.88	0.9	86.5	86	74	74	0.14	0.05	0.14	0.14
6d		3.84	3.84	3.84		0.3	0.9	0.9		86	74	74		0.05	0.14	0.14
6e		0.93	0.93	0.93		0.3	0.9	0.9		86	74	74		0.05	0.14	0.14
Pond 6	3.07	3.07	3.07	3.07	0.0	0.0	0.0	0.0	98	98	98	98				

Table 5: Results – Calculated Peak Basin Discharges

BASIN	25-Year, 24-Hr Flow (cfs)				100-Year, 24-Hr Flow (cfs)
	Case 1	Case 2	Case 3	Case 4	Case 4
3a		5	4	4	6
3b		4	3	3	4
3c	67	50	43	43	58
Pond 3	13	13	13	13	16
4a		2	2	2	3
4b.1	27	86	111	111	150
4b.2		3	3	3	5
4c	333	288	94	79	107
4d			56	47	64
4e			8	6	9
Pond 4	27	27	27	27	33
5a			13	11	15
5b			65	55	74
5c			12	10	13
Pond 5			21	21	27
6a			2	2	3
6b		86	51	47	64
6c	280	70	86	86	116
6d		34	28	28	38
6e		8	7	7	9
Pond 6	44	44	44	44	55

Table 6: Key Assumptions for Pond Analysis and Design

POND OUTLET FEATURE DESIGN (input for HydroCAD using SCS	Value	Design Phase	Notes	Reference
Stage-Storage:	-- acre	ALL	Storage area of ponds and temp ponds was surveyed in 1' stages using AutoCAD-calculated 2-dimensional areas	Geosyntec (2016) DWG 3 Terracon (2014a) Terracon (2014b)
Standpipe Features	--	ALL	Standpipe installed in Pond 6 was used as the basis Pond 3 and Pond 5	Terracon (2014a)
36" Half-Round CMP Grate:	--[1]	ALL	Grate with 0.5" orifices; 6 rows by 32 columns at 3" spacing	
3" Normal Pool Valve:	--		3" CPP, projecting, no headwall (n= 0.013, Ke= 0.90, S_o= 0)	
Riser Slits:	--[1]		Four 24.7" by 6.0" rectangular orifices	
HDPE Outlet Pipe (indluding Pond 4):	--		CPP, projecting, no headwall (n= 0.013, Ke= 0.90) of varying diameters. Includes Pond 4, Temp Pond 4, and Temp Pond 6.	

[1] Assume a discharge coefficient of 0.60 for all orifices.

Table 7: Results – Pond Analysis and Design

DETENTION PONDS						
ITEM	**POND 3**	**TEMP POND 4[1]**	**POND 4**	**POND 5**	**TEMP POND 6[2]**	**POND 6**
(_) References	DWG 14[A]	DWG 15[A]	DWG 15[A]	DWG 8[B]	DWG 3[A] DWG 7[C]	DWG 7[C]
POND GEOMETRY AND FEATURES						
1. embankment crest elevation (min) (ft, msl)	219	238	240	258	226	224
2. emergency spillway elevation (ft, msl)	218	-	-	257	-	221
3. emergency spillway bottom elevation (ft)	20	-	-	20	-	20
4. emergency spillway depth (ft)	2	-	-	1	-	3
5. emergency spillway slope	3:1	-		3:1	-	3:1
6. emergency spillway material type	RIPRAP	-	-	RIPRAP	-	RIPRAP
RISER STRUCTURE						
7. riser diameter (in)	48	-	-	48	-	48
8. top of riser (ft, msl)	216.5	-	-	254.5	-	219.5
9. normal pool orifice invert (ft, msl)	212	-	-	253	-	215
10. dewatering orifice invert (ft, msl)	211	-	-	252	-	214
11. required ballast depth (min) (ft)	2.5	-	-	2.5	-	2.5
OUTLET CULVERT						
12. outlet culvert diameter (in)	NOTE 1	24 (two)	36	≥ 24	48	36
13. outlet culvert inlet invert elevation (ft, msl)	211	232	225	252	217.4	214
14. outlet culvert outlet invert elevation (ft, msl)	210	230	224	251	215	213.5
15. normal pool elevation (ft, msl)	212	232	225	253	220	215
WOST-CASE 25-YEAR STORM EVENT						
16. controlling case	Case 1	Case 1	Case 3	Case 3	Case 1	[3]
17. peak stormwater elevation (ft, msl)	216.8	238.2[4]	231.5	257.0	224.4	221.1
18. peak inflow (cfs)	79	333	298	111	282	241
19. peak outflow (cfs)	4	54	60	24	139	11
CASE 4, 100-YEAR STORM EVENT						
21. peak stormwater elevation (ft, msl)	216.8	-	232.8	257.5	-	220.4
22. peak inflow (cfs)	84	-	368	129	-	284
23. peak outflow (cfs)	4	-	68	27	-	16

[1] The inlet feature in Pond 4 (EC-7) was modeled as a detention pond (Temp Pond 4) to account for the storage attributing to EC-7 during Case 1 and Case 2

[2] The inlet feature in Pond 6 (EC-9) was modeled as a detention pond (Temp Pond 6) to account for the storage attributing to EC-9 during Case 1

[3] Peak inflow and outflow occurred in Case 2. Peak stormwater elevation occurred in Case 1.

[4] Temp Pond 4 peak stormwater elevation is within acceptable limits of the crest elevation survey resolution.

[A] Refers to Geosyntec (2016)

[B] Refers to Terracon (2014a)

[C] Refers to Terracon (2014b)

Table 8: Key Assumptions for Inlet Culvert Analysis and Design

Culvert Inlet Design (Input for HY-8)	Value	Design Phase	Notes	Reference
Culvert Material:	--	ALL	Corrugated HDPE, smooth interior (n= 0.013)	HydroCAD (2011)
Inlet Configuration:	--	ALL	Beveled edge (1:1)	-
Design Flow, Q:	-- cfs	ALL	Based on combined subbasin Flows from HydroCAD	HydroCAD (2011) , Table 5

Table 9: Results – Inlet Culvert Analysis and Design

Culvert Designation	Reference	Culvert Location	Attributing Subbasins	Culvert Type	Applicable Cases	Controlling case[3]	Culvert Length (ft)	Slope (%)	Roadway Crest Elevation	Inlet Invert Elevation (ft, msl)	Outlet Invert Elevation (ft, msl)
EXISTING INLET CULVERTS											
EC-6	DWG 15[A]	Pond 4	4b.1	Existing 30" HDPE	1	1	50	4.0	244.0	239.5	237.5
EC-10	DWG 14[A]	Pond 3	3c	Existing, not provided (Assume ≥ 30" HDPE)	1	1	55	3.6	230.0	220.0	218.0
PROPOSED INLET CULVERTS											
C-6	DWG 15[A]	Pond 4	4a , 4b.1 , 4b.2	Two 36" Corrugated HDPE[1]	2 , 3 , 4	4	50	2.0	244.0	237.0	236.0
C-7	DWG 15[A]	Pond 4	4c , 4d , 4e	Two 42" Corrugated HDPE[1]	3 , 4	3	105	11.4	248.0	242.0	230.0
C-8	DWG 8[B]	Pond 5	5a , 5b , 5c	One 42" Corrugated HDPE[1]	3 , 4	3	100	9.0	284.0	277.0	268.0
C-9	DWG 7[C]	Pond 6	6a,6b,6c,6d,6e	One 30" Corrugated HDPE[1][2]	2 , 3 , 4	2	95	1.7	226.9	216.6	215.0
C-10	DWG 14[A]	Pond 3	3a , 3b , 3c	One 36" Corrugated HDPE[1]	2 , 3 , 4	2	100	6.0	230.0	224.0	218.0

[1] Assumes ADS N-12 WT pipe with smooth interior, or equal

[2] Installed alongside existing 48" culvert (EC-10)

[3] Cases 1, 2, and 3 are analyzed for the 25-yr event. case 4 (final site conditions) is analyzed for both the 25-yr and 100-yr events.

[4] Existing inlet culverts EC-7 and EC-9 were modeled as detention ponds (see table 3)

[A] Refers to Geosyntec (2016)

[B] Refers to Terracon (2014a)

[C] Refers to Terracon (2014b)

Table 9 (cont.): Results – Inlet Culvert Analysis and Design

Culvert Designation	25-yr, 24-hr Peak Flow, Q (cfs)	25-yr, 24-hr Tailwater (ft)	25-yr, 24-hr Headwater (ft)	25-yr, 24-hr Freeboard (ft)	100-yr, 24-hr Peak Flow, Q (cfs)[3]	100-yr, 24-hr Tailwater (ft)[3]	100-yr, 24-hr Headwater (ft)	100-yr, 24-hr Freeboard (ft)
EXISTING INLET CULVERTS								
EC-6	27	229.72	242.4	1.6	N/A	N/A	N/A	N/A
EC-10	67	216.75	229.0	1.0	N/A	N/A	N/A	N/A
PROPOSED INLET CULVERTS								
C-6	117	231.0	241.7	2.3	158	232.8	243.9	0.11
C-7	157	231.5	246.8	1.2	180	232.8	247.6	0.42
C-8	89	257.0	282.6	1.4	102	257.5	283.6	0.36
C-9	197	220.0	224.5	2.4	231	220.4	226.4	0.55
C-10	59	216.7	228.7	1.3	68	216.8	229.5	0.47

[1] Assumes ADS N-12 WT pipe with smooth interior, or equal

[2] Installed alongside existing 48" culvert (EC-10)

[3] Cases 1, 2, and 3 are analyzed for the 25-yr event. case 4 (final site conditions) is analyzed for both the 25-yr and 100-yr events.

[4] Existing inlet culverts EC-7 and EC-9 were modeled as detention ponds (see table 3)

[A] Refers to Geosyntec (2016)

[B] Refers to Terracon (2014a)

[C] Refers to Terracon (2014b)

Table 10: Key Assumptions for Ditch Analysis and Design

DITCH SIZING (input for Manning's Equation)	Value	Design Phase	Notes	Reference
Peak Flow, Q:	-- cfs	ALL	Based on HydroCAD subcatchment peak discharges	HydroCAD (2011)
Manning's Roughness Coefficient, n:	0.027	ALL	For all new channels and permitted channels with Vegetation/ECM and Class 5.A TRM lining, assume excavated earth with short grass	Terracon (2014a) Chow (1959)
Manning's Roughness Coefficient, n:	0.078	ALL	For all all permitted channels with rip-rap lining	Terracon (2014a) Chow (1959)
Longitudinal Slope, S_o:	-- ft/ft	ALL	Based on final contours	Terracon (2014a)

Table 11: Results – Ditch Analysis and Design

Input Parameters	BASIN 3		BASIN 4					BASIN 5		BASIN 6			
Ditch Designation:	F.1	F.2	L.1[1]	L.2[1]	M.1[1]	A.2-A.3	A.1-A.2	B.1-B.2	C.1-C.2	D.1-D.2	D.2-D.3	D.3-D.4	E.1-E.2
Attributing Subbasins:	3a	3b	4b.1 + 4a	4a	4b.2	4d + 4e	4e	5a	5c	6a	6b + 6a	6c + 6b + 6a	6e
25-yr Worst-Case Design Condition:	Case 2	Case 2	Case 4	Case 4	Case 4	Case 3	Case 3	Case 3	Case 3	Case 4	Case 2	Case 2	Case 2
Peak Discharge, Q_{25} (cfs):	5.2	3.5	113.1	2.4	3.5	63.7	7.6	13.1	11.6	2.5	85.8	155.7	8.2
Peak Discharge, Q_{100} (cfs):	5.9	4.0	152.8	3.3	4.7	72.7	8.7	14.9	13.2	3.1	66.9	183.4	9.3
Bottom Width, B (ft):	2	2	2	2	2	2	2	2	2	2	2	2	2
Left Side Slope, Z_1(hor: 1 vert):	3	3	3	3	3	3	3	3	3	3	3	3	3
Right Side Slope, Z_2 (hor: 1 vert):	3	3	3	3	3	3	3	3	3	3	3	3	3
Channel Depth, Y (ft):	2	2	3	1	1	3	2	2	2	2	3	4	2
Top Width, T (ft):	14	14	20	8	8	20	14	14	14	14	20	26	14
Manning's Roughness Coeff., n:	0.027	0.027	0.027	0.027	0.027	0.078	0.027	0.027	0.027	0.027	0.078	0.078	0.027
Longitudinal Channel Slope, S_o (ft/ft):	0.009	0.009	0.017	0.017	0.017	0.049	0.041	0.039	0.011	0.045	0.045	0.050	0.009
Output Parameters & Lining													
25-yr Freeboard (ft):	1.46	1.56	1.06	0.69	0.63	1.10	1.56	1.41	1.23	1.77	0.81	1.24	1.33
y_{25} (ft):	0.54	0.44	1.94	0.31	0.37	1.90	0.44	0.59	0.77	0.23	2.19	2.76	0.67
y_{100} (ft):	0.54	0.44	1.94	0.31	0.37	1.90	0.44	0.59	0.77	0.23	2.19	2.76	0.67
100-yr Avg. Tractive Stress, τ_0 (lb/ft^2)	0.20	0.44	1.11	0.24	0.28	3.17	0.79	0.94	0.32	0.51	3.35	4.54	0.25
Channel Lining Selection:	[2]	[2]	[3]	[3]	[3]	[4]	[2]	[2]	[2]	[2]	[4]	[5]	[2]

[1] All ditch sections (besides L.1, L.2, and M.1) follow dimensions and liner specifications presented in Terracon (2014a) DWG 8 (permit renewal plans with minor mods)." Sections L.1, L.2, and M.1 were lined and dimensioned to be consistent with the Terracon specifications.

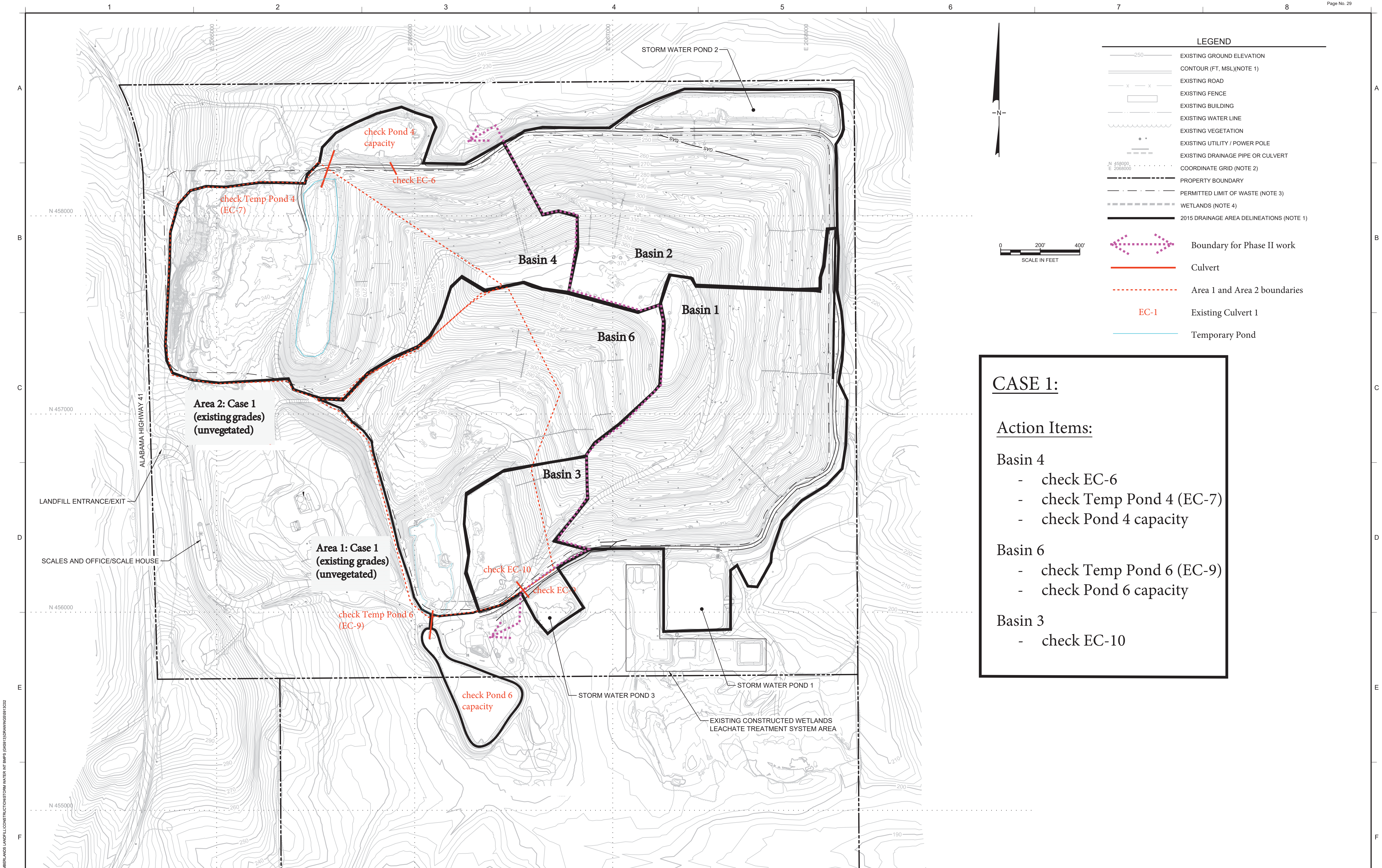
[2] American Green SC150 Erosion Control Mat with vegetation, or equivalent; See Terracon (2014a) DWG 8

[3] Grass with Class 5.A TRM

[4] ALDOT Class 2 Riprap, or equivalent; See Terracon (2014a) DWG 8

[5] ALDOT Class 3 Riprap, or equivalent; See Terracon (2014a) DWG 8

Figures



CASE 1:

Action Items:

Basin 4
- check EC-6
- check Temp Pond 4 (EC-7)
- check Pond 4 capacity

Basin 6
- check Temp Pond 6 (EC-9)
- check Pond 6 capacity

Basin 3
- check EC-10

Figure 1: Case 1 (Existing Grades and Existing Vegetation Conditions)

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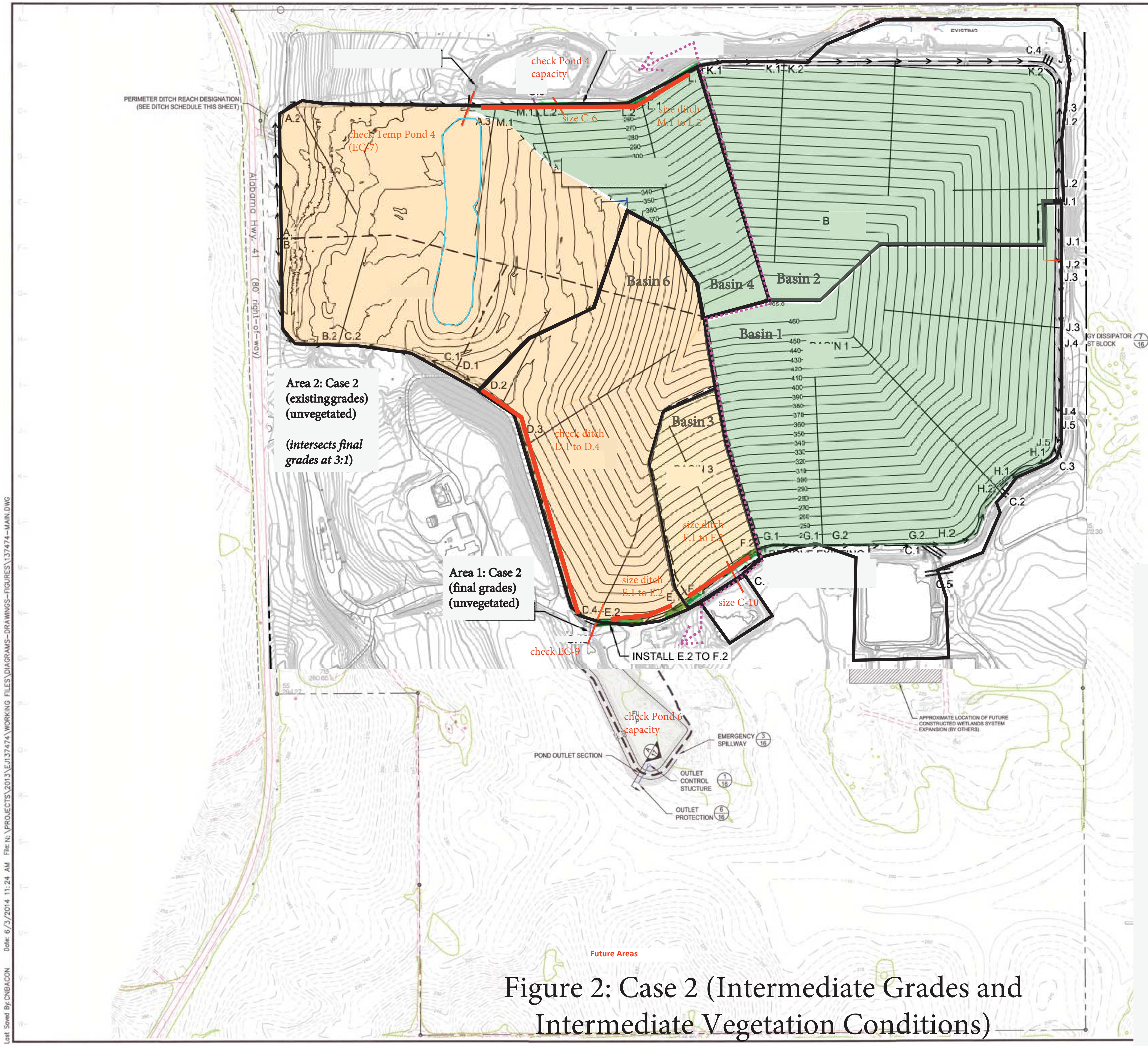


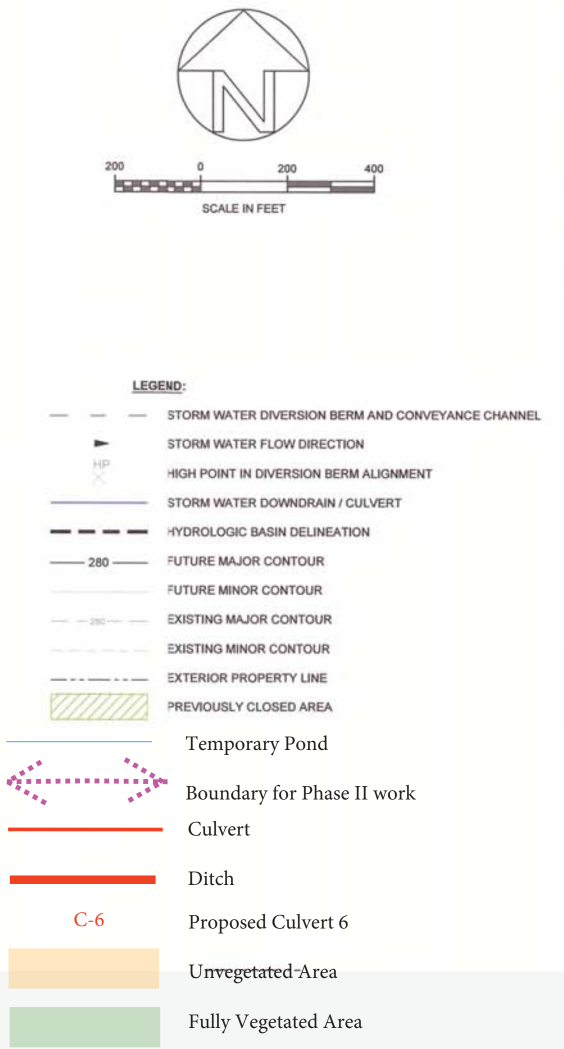


Figure 2: Case 2 (Intermediate Grades and Intermediate Vegetation Conditions)

Case 2:

Action Items:

Basin 4
- check Pond 4 capacity
- size ditch M.1 to L.2
- size C-6
- check Temp Pond 6 (EC-7)

Basin 6
- check Pond 6 capacity
- check ditch D.1 to D.4
- size ditch E.1 to E.2
- check EC-9

Basin 3
- size ditch F.1 to F.2
- size C-10

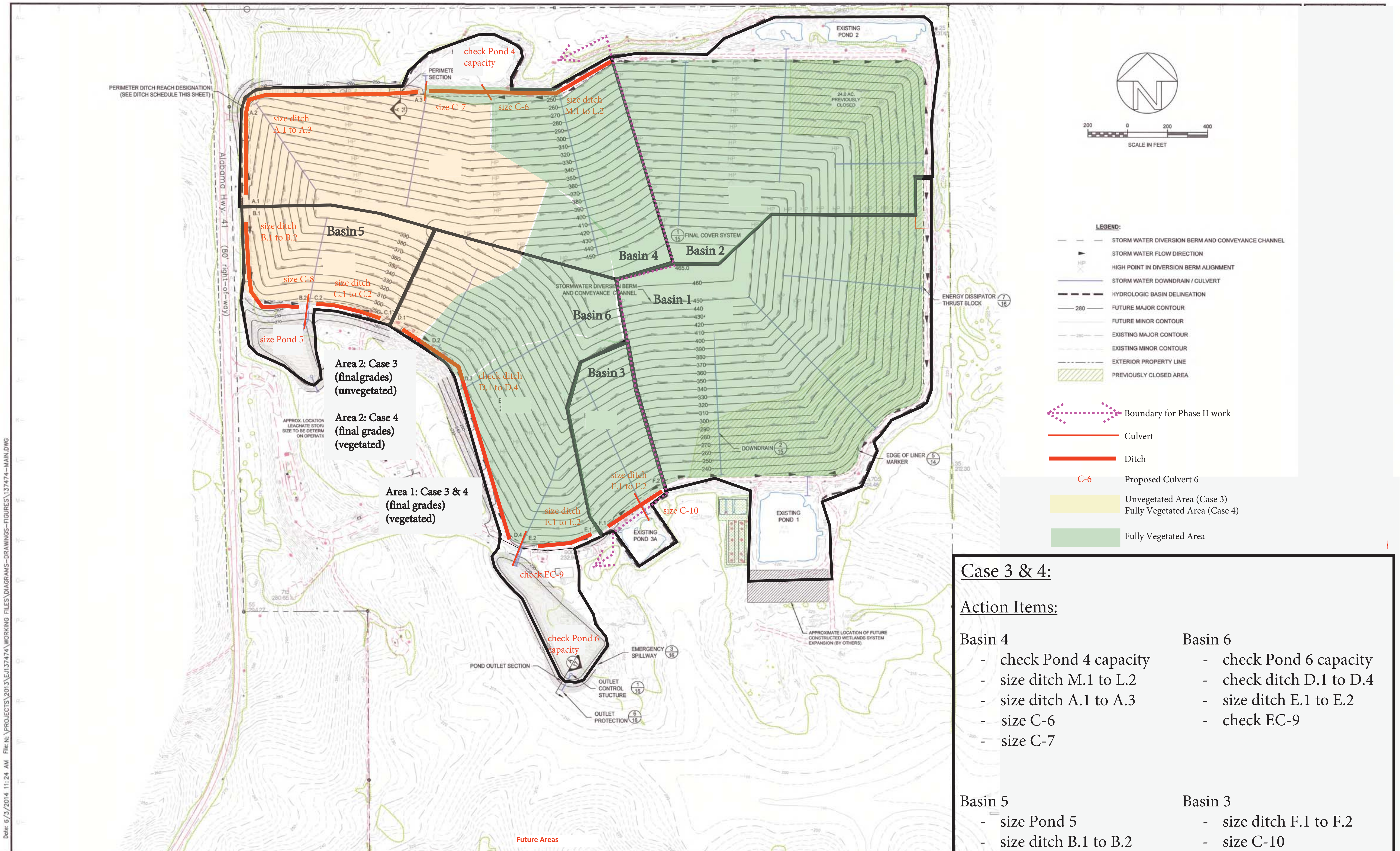


Figure 3: Case 3 (Final Grades and Intermediate Vegetation Conditions) and Case 4 (Final Grades and Final Vegetation Conditions)

Case 3 & 4:

Action Items:

Basin 4
- check Pond 4 capacity
- size ditch M.1 to L.2
- size ditch A.1 to A.3
- size C-6
- size C-7

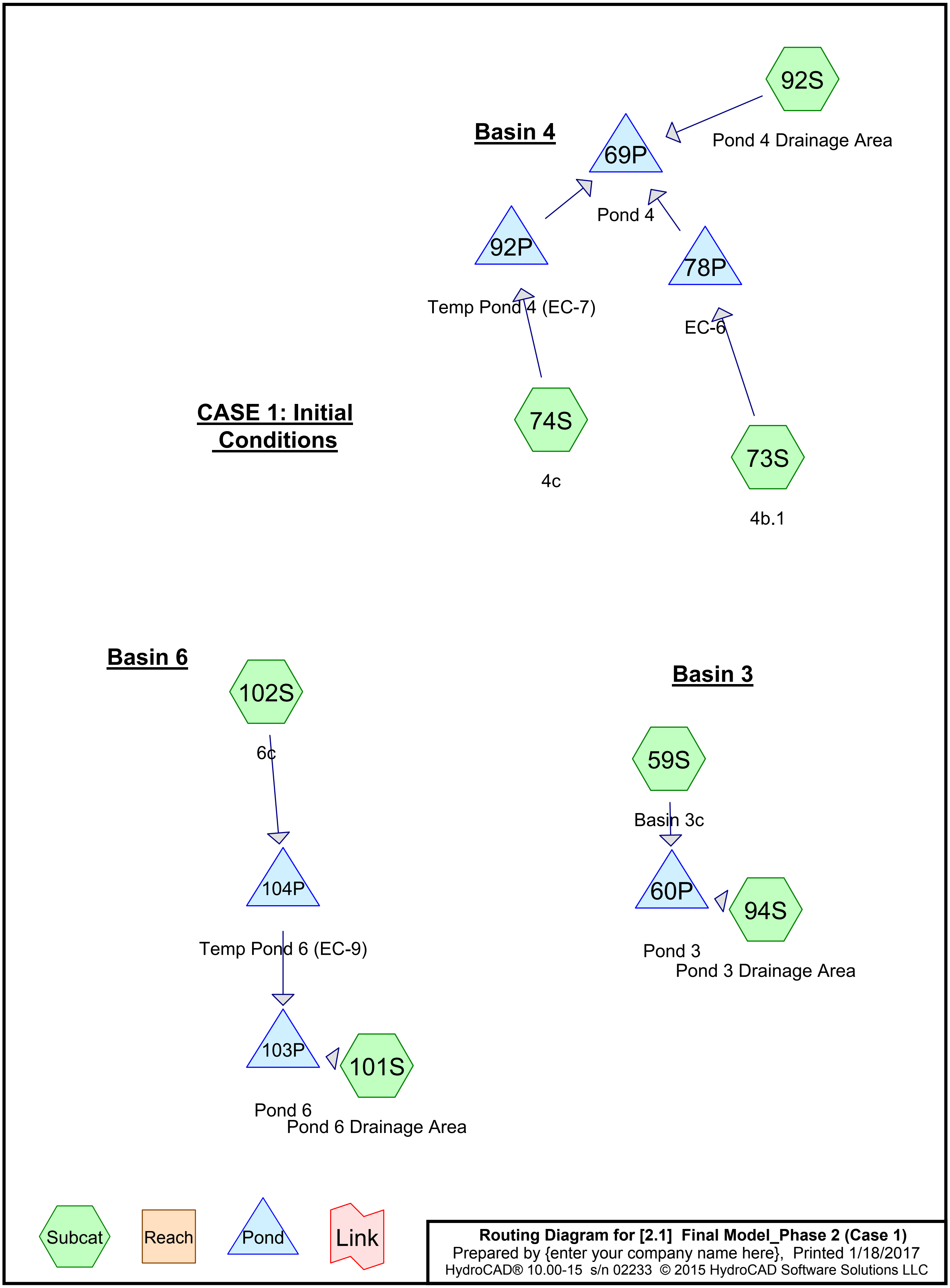
Basin 6
- check Pond 6 capacity
- check ditch D.1 to D.4
- size ditch E.1 to E.2
- check EC-9

Basin 5
- size Pond 5
- size ditch B.1 to B.2
- size ditch C.1 to C.2
- size C-8

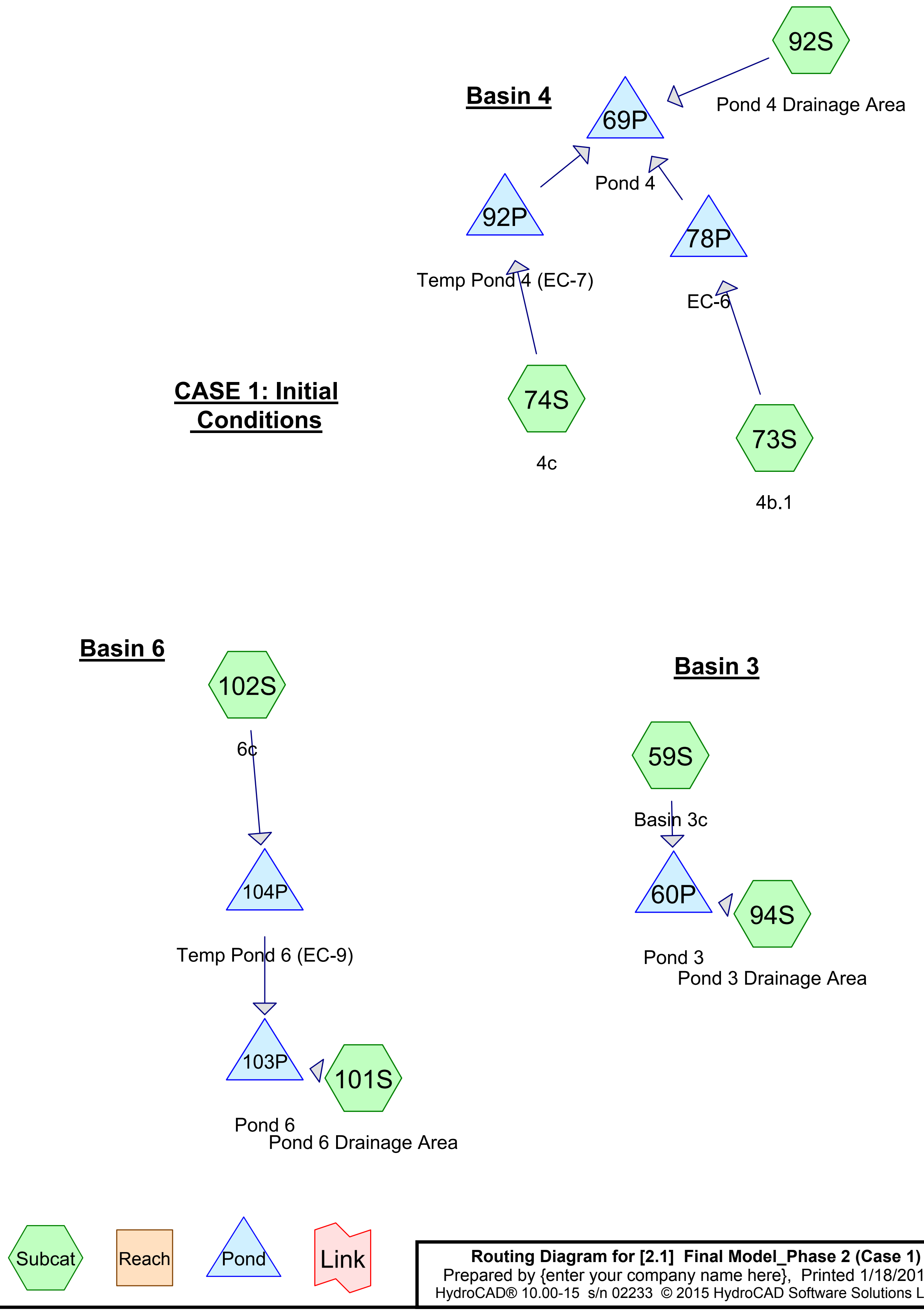
Basin 3
- size ditch F.1 to F.2
- size C-10

Appendix 1

HydroCAD Output – Case 1



Routing Diagram for [2.1] Final Model_Phase 2 (Case 1)
Prepared by {enter your company name here}, Printed 1/18/2017
HydroCAD® 10.00-15 s/n 02233 © 2015 HydroCAD Software Solutions LLC



Routing Diagram for [2.1] Final Model_Phase 2 (Case 1)
Prepared by {enter your company name here}, Printed 1/18/2017
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
10.807	86	Pasture/grassland/range, Good, HSG C (59S, 73S)
69.636	87	Pasture/grassland/range, Good, HSG C (74S, 102S)
8.822	98	Water Surface, HSG A (92S, 94S, 101S)
89.265	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.822	HSG A	92S, 94S, 101S
0.000	HSG B	
80.443	HSG C	59S, 73S, 74S, 102S
0.000	HSG D	
0.000	Other	
89.265		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	80.443	0.000	0.000	80.443	Pasture/grassland/range, Good	59S, 73S, 74S, 102S
8.822	0.000	0.000	0.000	0.000	8.822	Water Surface	92S, 94S, 101S
8.822	**0.000**	**80.443**	**0.000**	**0.000**	**89.265**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	59S	0.00	0.00	192.0	0.2187	0.020	18.0	0.0	0.0
2	74S	0.00	0.00	404.0	0.1609	0.020	18.0	0.0	0.0
3	102S	0.00	0.00	88.0	0.1818	0.020	18.0	0.0	0.0
4	60P	211.00	210.00	100.0	0.0100	0.013	12.0	0.0	0.0
5	69P	225.00	224.00	108.0	0.0093	0.013	36.0	0.0	0.0
6	92P	232.00	230.00	113.0	0.0177	0.013	24.0	0.0	0.0
7	103P	214.00	213.50	100.0	0.0050	0.013	24.0	0.0	0.0
8	104P	217.14	215.00	92.0	0.0233	0.012	48.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 59S: Basin 3c Runoff Area=7.700 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=1,180' Tc=6.4 min CN=86 Runoff=66.55 cfs 5.062 af

Subcatchment 73S: 4b.1 Runoff Area=3.107 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=720' Tc=6.0 min CN=86 Runoff=27.23 cfs 2.043 af

Subcatchment 74S: 4c Runoff Area=37.676 ac 0.00% Impervious Runoff Depth=8.01"
Flow Length=1,784' Tc=6.0 min CN=87 Runoff=333.47 cfs 25.160 af

Subcatchment 92S: Pond 4 Drainage Area Runoff Area=2.810 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=26.50 cfs 2.192 af

Subcatchment 94S: Pond 3 Drainage Area Runoff Area=1.359 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=12.82 cfs 1.060 af

Subcatchment 101S: Pond 6 Drainage Area Runoff Area=4.653 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=43.89 cfs 3.629 af

Subcatchment 102S: 6c Runoff Area=31.960 ac 0.00% Impervious Runoff Depth=8.01"
Flow Length=1,773' Tc=6.1 min CN=87 Runoff=281.89 cfs 21.343 af

Pond 60P: Pond 3 Peak Elev=216.75' Storage=4.520 af Inflow=79.34 cfs 6.122 af
Outflow=3.91 cfs 2.716 af

Pond 69P: Pond 4 Peak Elev=229.72' Storage=6.291 af Inflow=98.80 cfs 29.393 af
36.0" Round Culvert n=0.013 L=108.0' S=0.0093 '/' Outflow=48.19 cfs 29.285 af

Pond 78P: EC-6 Inflow=27.23 cfs 2.043 af
Primary=27.23 cfs 2.043 af

Pond 92P: Temp Pond 4 (EC-7) Peak Elev=238.15' Storage=8.982 af Inflow=333.47 cfs 25.160 af
24.0" Round Culvert x 2.00 n=0.013 L=113.0' S=0.0177 '/' Outflow=54.19 cfs 25.159 af

Pond 103P: Pond 6 Peak Elev=221.06' Storage=16.432 af Inflow=172.83 cfs 24.972 af
Outflow=24.28 cfs 13.376 af

Pond 104P: Temp Pond 6 (EC-9) Peak Elev=224.43' Storage=2.239 af Inflow=281.89 cfs 21.343 af
48.0" Round Culvert n=0.012 L=92.0' S=0.0233 '/' Outflow=139.13 cfs 21.343 af

Total Runoff Area = 89.265 ac Runoff Volume = 60.490 af Average Runoff Depth = 8.13"
90.12% Pervious = 80.443 ac 9.88% Impervious = 8.822 ac

Summary for Subcatchment 59S: Basin 3c

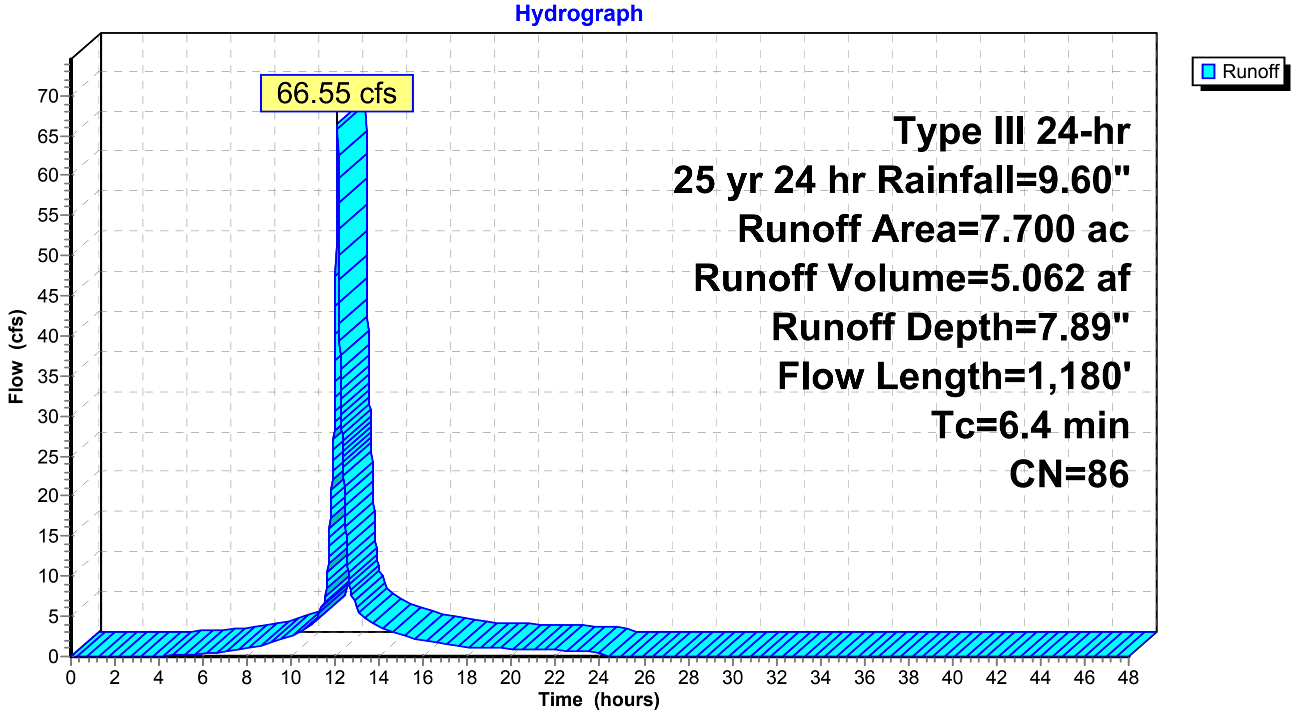
Runoff = 66.55 cfs @ 12.09 hrs, Volume= 5.062 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	7.700	86	Pasture/grassland/range, Good, HSG C
	7.700		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	190	0.1684	0.64		**Sheet Flow,** n= 0.136 P2= 5.40"
0.5	344	0.0203	11.71	583.19	**Channel Flow, SSDT Flow** Area= 49.8 sf Perim= 37.1' r= 1.34' n= 0.022 Earth, clean & straight
0.2	192	0.2187	18.07	31.93	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
0.7	454	0.0110	10.74	437.17	**Channel Flow,** Area= 40.7 sf Perim= 21.8' r= 1.87' n= 0.022 Earth, clean & straight
6.4	1,180	Total			

Subcatchment 59S: Basin 3c



Summary for Subcatchment 73S: 4b.1

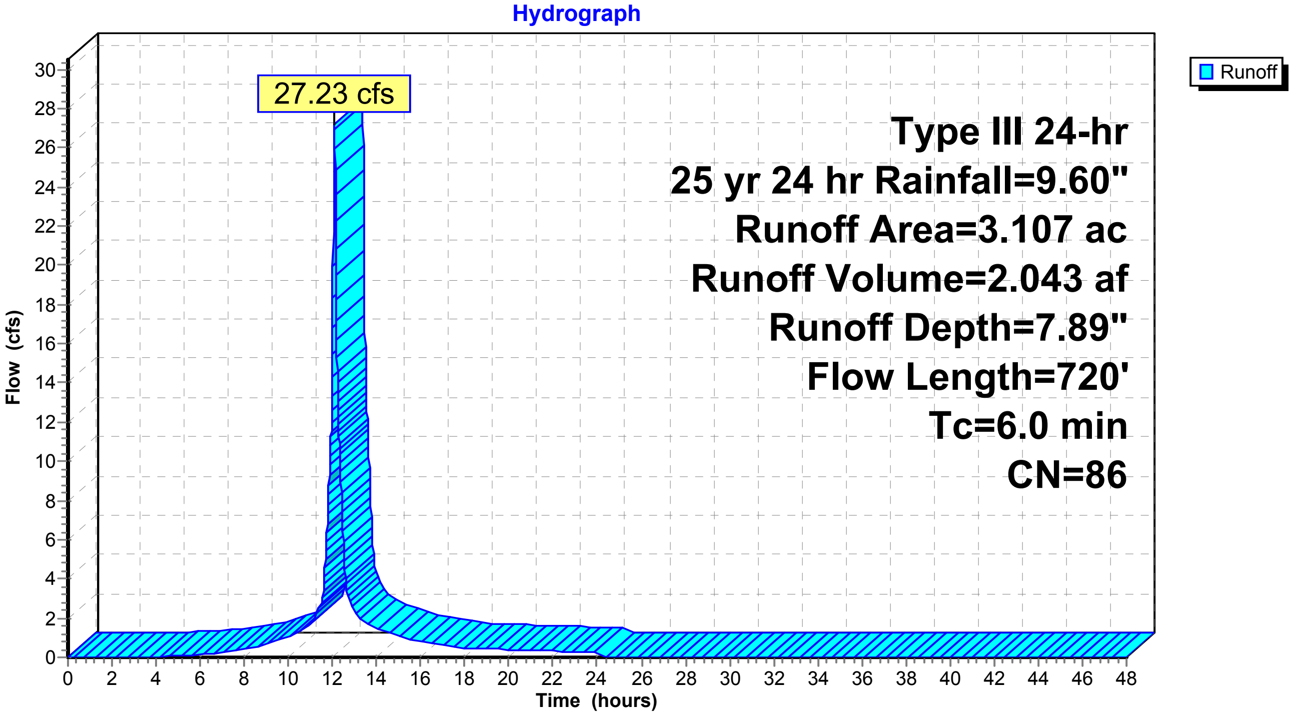
Runoff = 27.23 cfs @ 12.08 hrs, Volume= 2.043 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	3.107	86	Pasture/grassland/range, Good, HSG C
	3.107		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	243	0.1484	4.76		**Sheet Flow,** n= 0.011 P2= 5.40"
0.8	477	0.0210	9.73	307.37	**Channel Flow, SSDT Flow** Area= 31.6 sf Perim= 31.9' r= 0.99' n= 0.022 Earth, clean & straight
1.7	720	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 73S: 4b.1



Summary for Subcatchment 74S: 4c

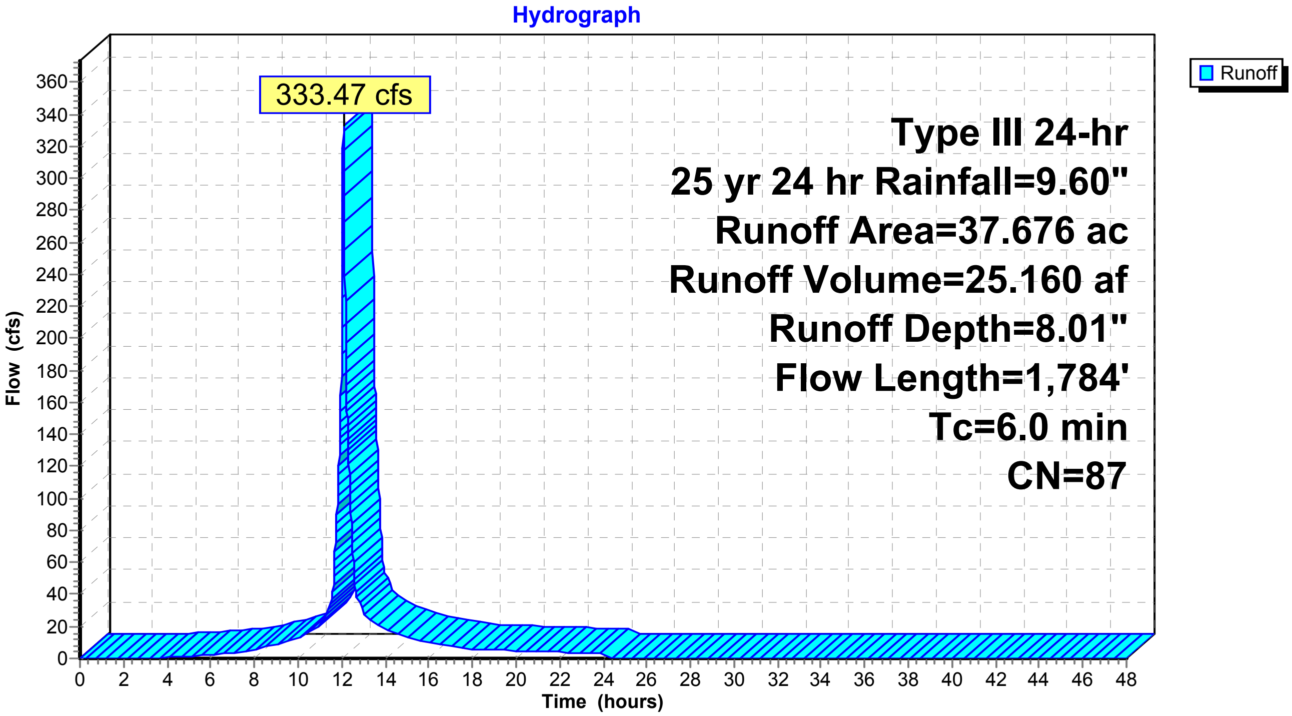
Runoff = 333.47 cfs @ 12.08 hrs, Volume= 25.160 af, Depth= 8.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	37.676	87	Pasture/grassland/range, Good, HSG C
	37.676		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	300	0.0783	3.84		**Sheet Flow,** n= 0.011 P2= 5.40"
2.4	984	0.0250	6.73	86.12	**Channel Flow, SSDT Flow** Area= 12.8 sf Perim= 25.6' r= 0.50' n= 0.022 Earth, clean & straight
0.4	404	0.1609	15.50	27.39	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
0.5	96	0.2187	3.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.6	1,784	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 74S: 4c



Summary for Subcatchment 92S: Pond 4 Drainage Area

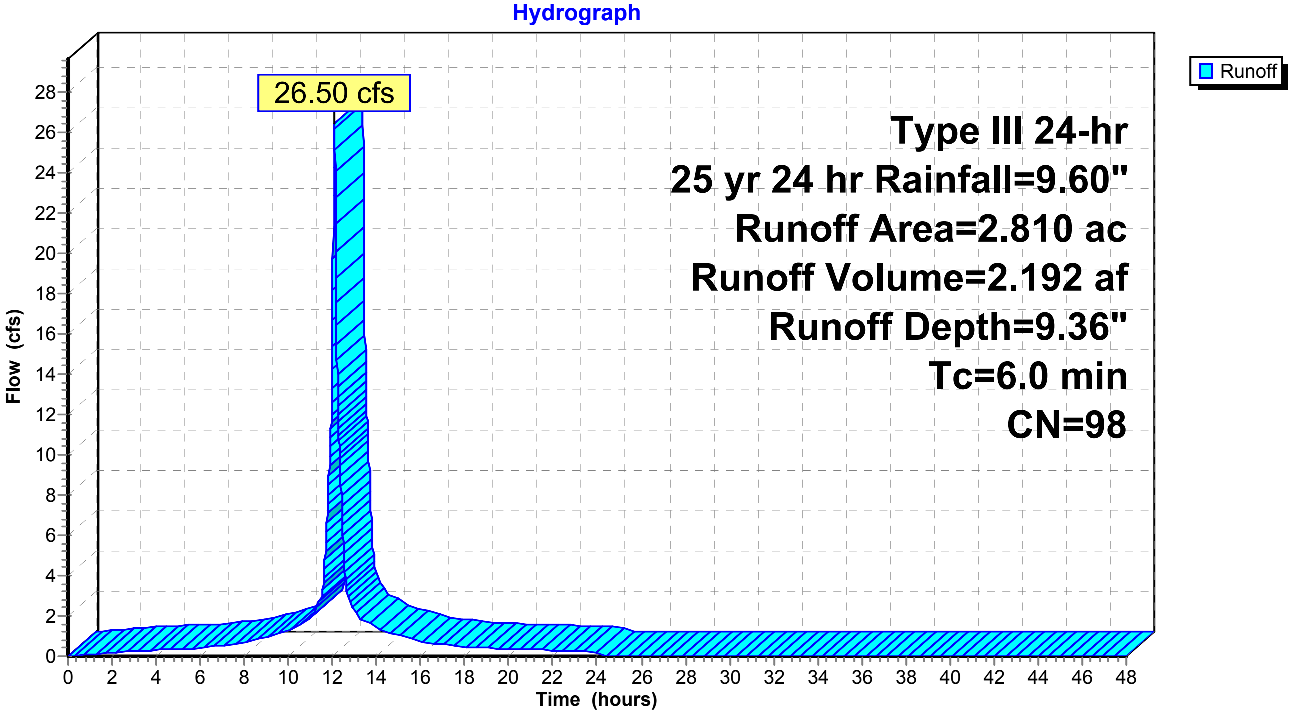
Runoff = 26.50 cfs @ 12.08 hrs, Volume= 2.192 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
2.810	98	Water Surface, HSG A
2.810		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 92S: Pond 4 Drainage Area



Summary for Subcatchment 94S: Pond 3 Drainage Area

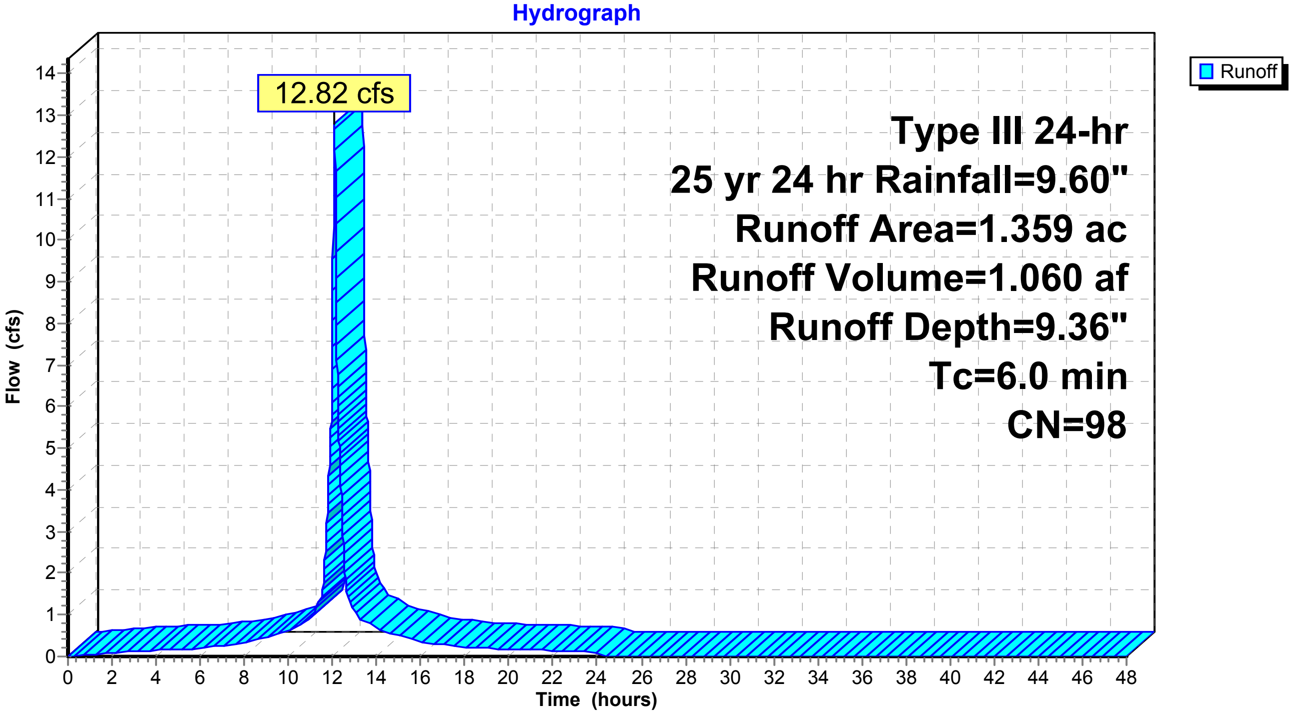
Runoff = 12.82 cfs @ 12.08 hrs, Volume= 1.060 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
1.359	98	Water Surface, HSG A
1.359		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 94S: Pond 3 Drainage Area



Summary for Subcatchment 101S: Pond 6 Drainage Area

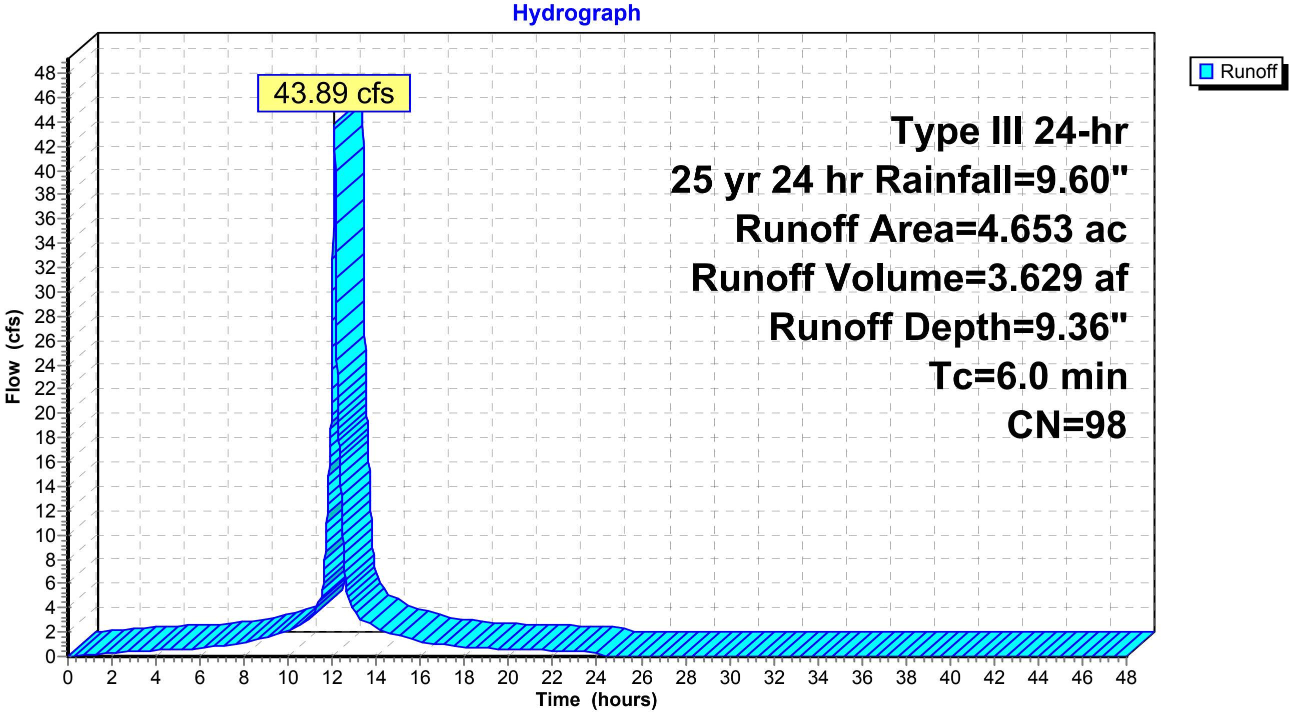
Runoff = 43.89 cfs @ 12.08 hrs, Volume= 3.629 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
4.653	98	Water Surface, HSG A
4.653		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 101S: Pond 6 Drainage Area



Summary for Subcatchment 102S: 6c

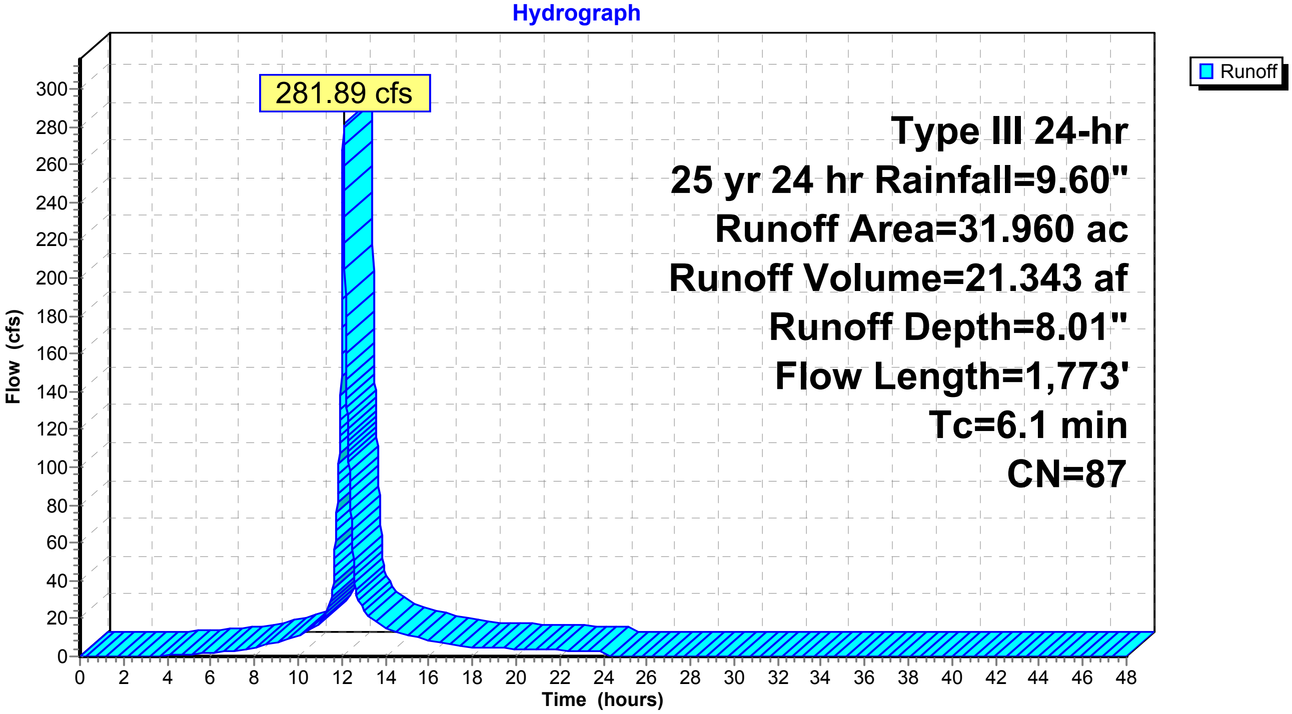
Runoff = 281.89 cfs @ 12.09 hrs, Volume= 21.343 af, Depth= 8.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	31.960	87	Pasture/grassland/range, Good, HSG C
	31.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	192	0.2187	0.71		**Sheet Flow,** n= 0.136 P2= 5.40"
1.5	1,493	0.0576	16.09	429.62	**Channel Flow, SSDT Flow** Area= 26.7 sf Perim= 27.0' r= 0.99' n= 0.022 Earth, clean & straight
0.1	88	0.1818	16.47	29.11	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
6.1	1,773	Total			

Subcatchment 102S: 6c



Summary for Pond 60P: Pond 3

Inflow Area = 9.059 ac, 15.00% Impervious, Inflow Depth = 8.11" for 25 yr 24 hr event
Inflow = 79.34 cfs @ 12.09 hrs, Volume= 6.122 af
Outflow = 3.91 cfs @ 14.38 hrs, Volume= 2.716 af, Atten= 95%, Lag= 137.4 min
Primary = 3.91 cfs @ 14.38 hrs, Volume= 2.716 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 216.75' @ 14.38 hrs Surf.Area= 0.919 ac Storage= 4.520 af

Plug-Flow detention time= 758.2 min calculated for 2.716 af (44% of inflow)
Center-of-Mass det. time= 630.4 min (1,405.2 - 774.8)

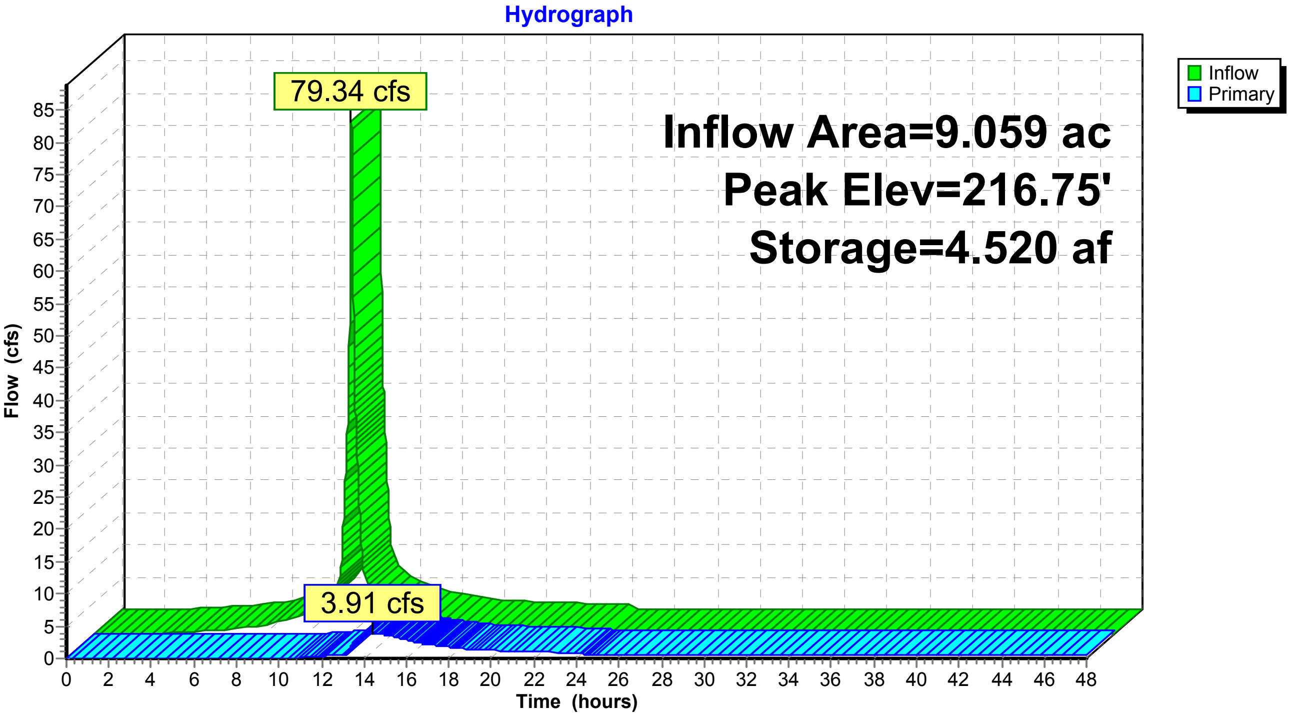
Volume	Invert	Avail.Storage	Storage Description
#1	211.00'	6.719 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
211.00	0.634	0.000	0.000
212.00	0.728	0.681	0.681
214.00	0.777	1.505	2.186
215.00	0.827	0.802	2.988
216.00	0.879	0.853	3.841
217.00	0.932	0.906	4.746
218.00	0.986	0.959	5.705
219.00	1.042	1.014	6.719

Device	Routing	Invert	Outlet Devices
#1	Device 2	211.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	212.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	216.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	211.00'	**12.0" Round 12" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 211.00' / 210.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#5	Primary	217.50'	**143.1 deg x 20.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=3.91 cfs @ 14.38 hrs HW=216.75' (Free Discharge)
- **4=12" culvert** (Passes 3.91 cfs of 6.74 cfs potential flow)
  - **2=3" Pipe** (Orifice Controls 0.51 cfs @ 10.36 fps)
    - **1=grate (36" half-circle)** (Passes 0.51 cfs of 2.73 cfs potential flow)
  - **3=riser slits** (Orifice Controls 3.40 cfs @ 1.62 fps)
- **5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 60P: Pond 3



Summary for Pond 69P: Pond 4

```
Inflow Area =       43.593 ac,    6.45% Impervious,  Inflow Depth =   8.09"    for  25 yr 24 hr event
Inflow       =      98.80 cfs @   12.09 hrs,  Volume=          29.393 af
Outflow      =      48.19 cfs @   14.26 hrs,  Volume=          29.285 af,  Atten= 51%,  Lag= 130.0 min
Primary      =      48.19 cfs @   14.26 hrs,  Volume=          29.285 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 229.72' @ 14.26 hrs Surf.Area= 1.510 ac Storage= 6.291 af

Plug-Flow detention time= 107.3 min calculated for 29.285 af (100% of inflow)
Center-of-Mass det. time= 104.6 min (940.7 - 836.1)

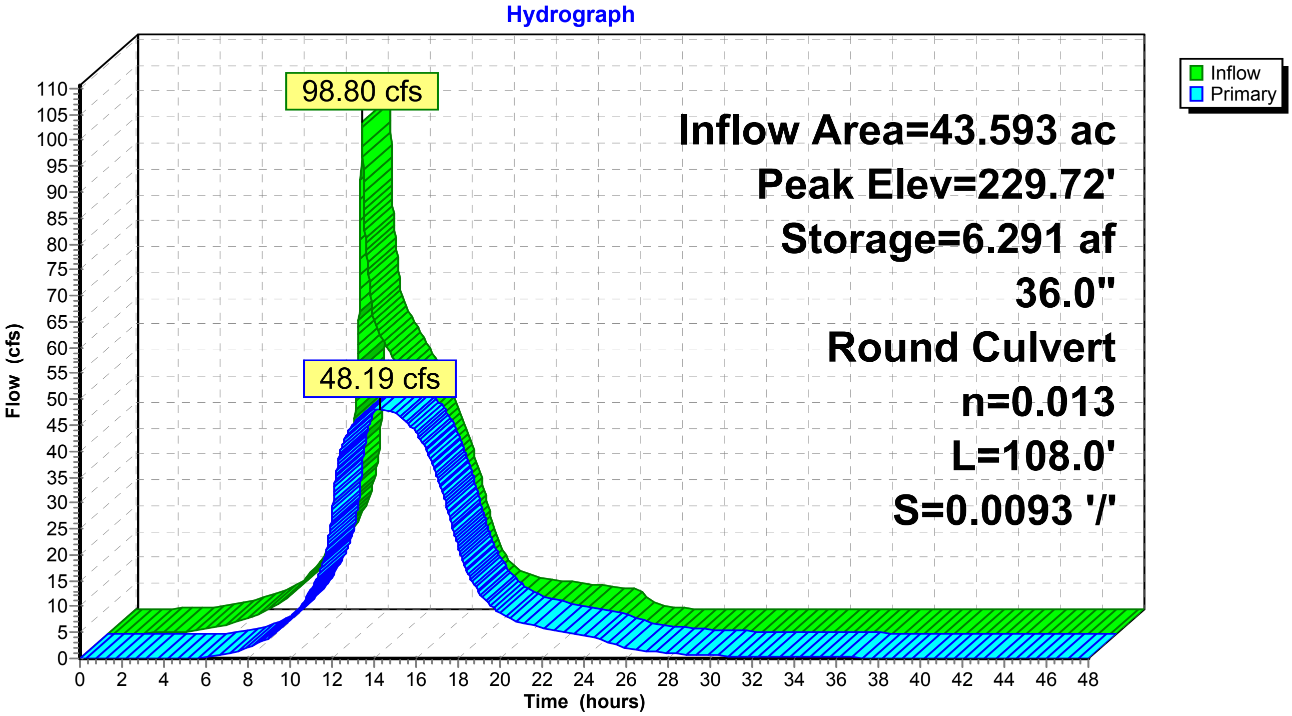
Volume	Invert	Avail.Storage	Storage Description
#1	225.00'	21.581 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
225.00	1.164	0.000	0.000
226.00	1.234	1.199	1.199
227.00	1.306	1.270	2.469
228.00	1.380	1.343	3.812
229.00	1.455	1.418	5.230
230.00	1.532	1.493	6.723
231.00	1.610	1.571	8.294
232.00	1.690	1.650	9.944
233.00	1.771	1.730	11.674
234.00	1.853	1.812	13.486
235.00	1.937	1.895	15.381
236.00	2.023	1.980	17.361
237.00	2.109	2.066	19.427
238.00	2.198	2.153	21.581

Device	Routing	Invert	Outlet Devices
#1	Primary	225.00'	**36.0" Round 36" culvert** L= 108.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0093 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=48.19 cfs @ 14.26 hrs HW=229.72' (Free Discharge)
↑**1=36" culvert** (Inlet Controls 48.19 cfs @ 6.82 fps)

Pond 69P: Pond 4



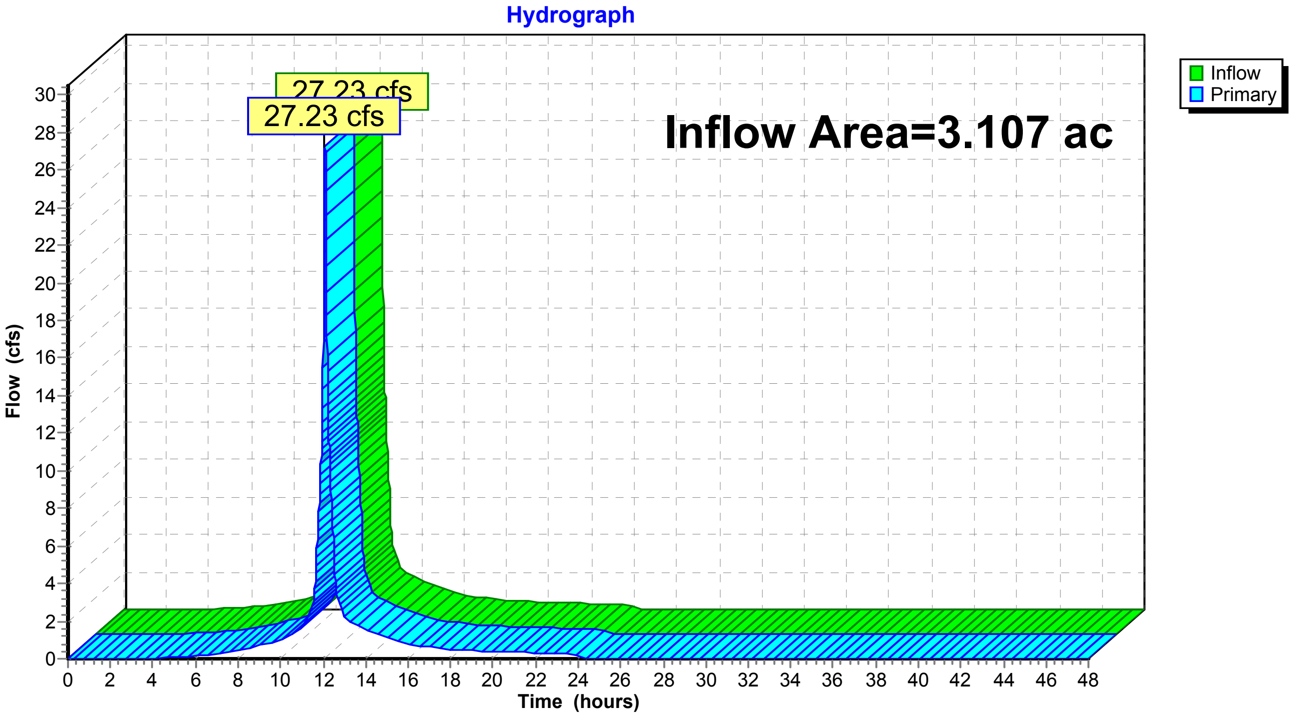
Summary for Pond 78P: EC-6

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	3.107 ac,	0.00% Impervious,	Inflow Depth =	7.89"	for 25 yr 24 hr event
Inflow =	27.23 cfs @	12.08 hrs,	Volume=	2.043 af	
Primary =	27.23 cfs @	12.08 hrs,	Volume=	2.043 af,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 78P: EC-6



Summary for Pond 92P: Temp Pond 4 (EC-7)

Inflow Area = 37.676 ac, 0.00% Impervious, Inflow Depth = 8.01" for 25 yr 24 hr event
Inflow = 333.47 cfs @ 12.08 hrs, Volume= 25.160 af
Outflow = 54.19 cfs @ 12.56 hrs, Volume= 25.159 af, Atten= 84%, Lag= 28.2 min
Primary = 54.19 cfs @ 12.56 hrs, Volume= 25.159 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 238.15' @ 12.56 hrs Surf.Area= 2.526 ac Storage= 8.982 af

Plug-Flow detention time= 69.8 min calculated for 25.159 af (100% of inflow)
Center-of-Mass det. time= 69.7 min (849.0 - 779.3)

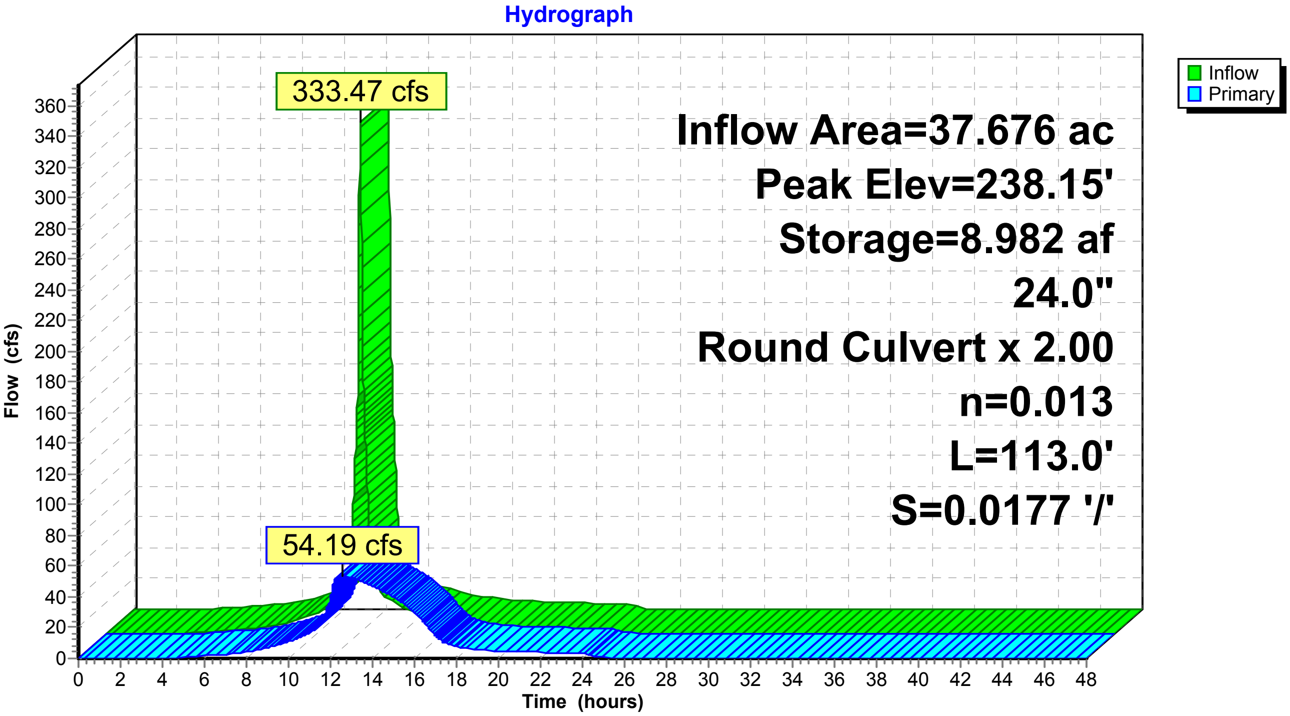
Volume	Invert	Avail.Storage	Storage Description
#1	232.00'	14.078 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
232.00	0.183	0.000	0.000
234.00	0.994	1.177	1.177
236.00	1.975	2.969	4.146
238.00	2.490	4.465	8.611
240.00	2.977	5.467	14.078

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" Round 36" culvert X 2.00** L= 113.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.00' / 230.00' S= 0.0177 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=54.19 cfs @ 12.56 hrs HW=238.15' TW=228.92' (Dynamic Tailwater)
└─**1=36" culvert** (Inlet Controls 54.19 cfs @ 8.62 fps)

Pond 92P: Temp Pond 4 (EC-7)



Summary for Pond 103P: Pond 6

```
Inflow Area =        36.613 ac,  12.71% Impervious,  Inflow Depth =   8.18"    for  25 yr 24 hr event
Inflow      =      172.83 cfs @   12.11 hrs,  Volume=          24.972 af
Outflow     =       24.28 cfs @   13.23 hrs,  Volume=          13.376 af,  Atten= 86%,  Lag= 67.2 min
Primary     =       24.28 cfs @   13.23 hrs,  Volume=          13.376 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 221.06' @ 13.23 hrs Surf.Area= 2.724 ac Storage= 16.432 af

Plug-Flow detention time= 417.6 min calculated for 13.376 af (54% of inflow)
Center-of-Mass det. time= 302.7 min (1,080.2 - 777.5)

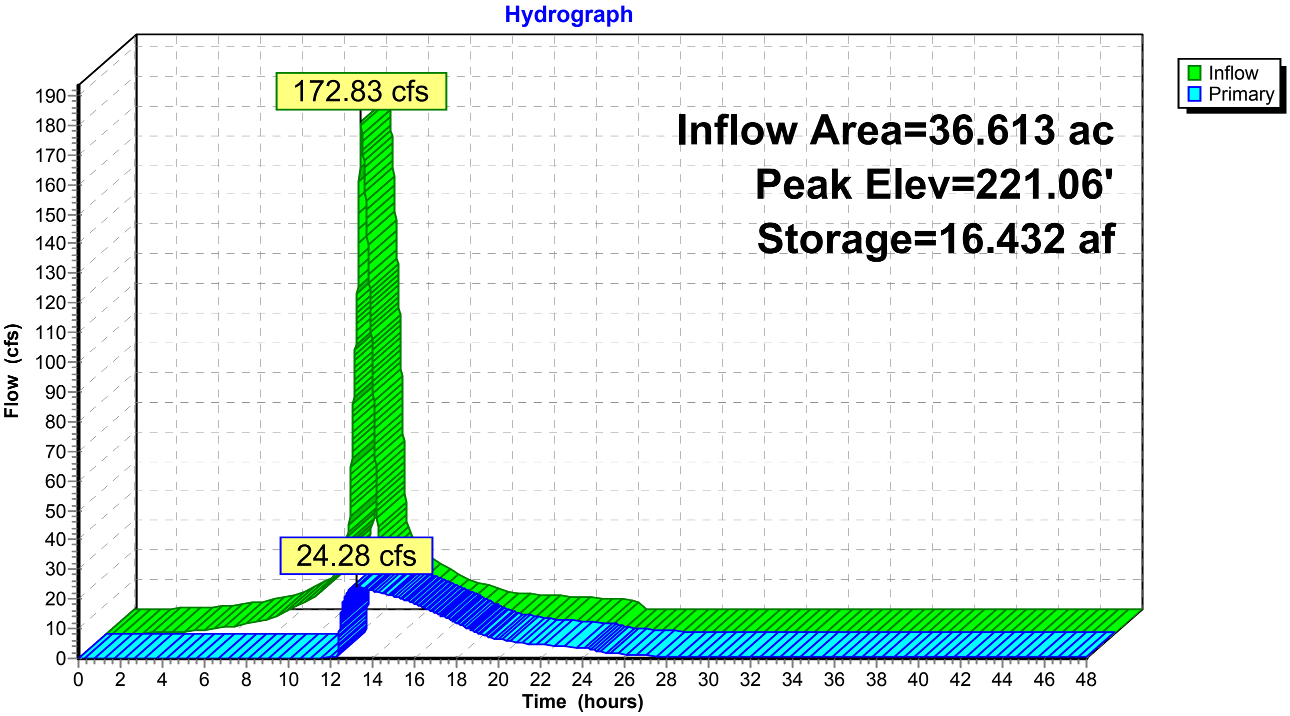
Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	24.939 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
214.00	1.929	0.000	0.000
216.00	2.159	4.088	4.088
218.00	2.377	4.536	8.624
220.00	2.599	4.976	13.600
222.00	2.834	5.433	19.033
224.00	3.072	5.906	24.939

Device	Routing	Invert	Outlet Devices
#1	Device 2	214.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	215.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	219.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	214.00'	**24.0" Round 24" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	221.00'	**157.4 deg x 20.0' long x 3.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow  Max=24.28 cfs @ 13.23 hrs  HW=221.06'   (Free Discharge)
↑
├─4=24" culvert  (Passes 23.26 cfs of 29.41 cfs potential flow)
│ ↑
│ ├─2=3" Pipe  (Orifice Controls 0.58 cfs @ 11.73 fps)
│ │ ↑
│ │ └─1=grate (36" half-circle)  (Passes 0.58 cfs of 3.09 cfs potential flow)
│ └─3=riser slits  (Orifice Controls 22.69 cfs @ 5.51 fps)
└─5=Sharp-Crested Vee/Trap Weir  (Weir Controls 1.02 cfs @ 0.78 fps)
```

Pond 103P: Pond 6



Summary for Pond 104P: Temp Pond 6 (EC-9)

```
Inflow Area =       31.960 ac,   0.00% Impervious,  Inflow Depth =   8.01"    for  25 yr 24 hr event
Inflow      =     281.89 cfs @   12.09 hrs,  Volume=          21.343 af
Outflow     =     139.13 cfs @   12.23 hrs,  Volume=          21.343 af,  Atten= 51%,  Lag= 8.9 min
Primary     =     139.13 cfs @   12.23 hrs,  Volume=          21.343 af
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 224.43' @ 12.23 hrs Surf.Area= 1.089 ac Storage= 2.239 af

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 4.6 min (784.0 - 779.4)

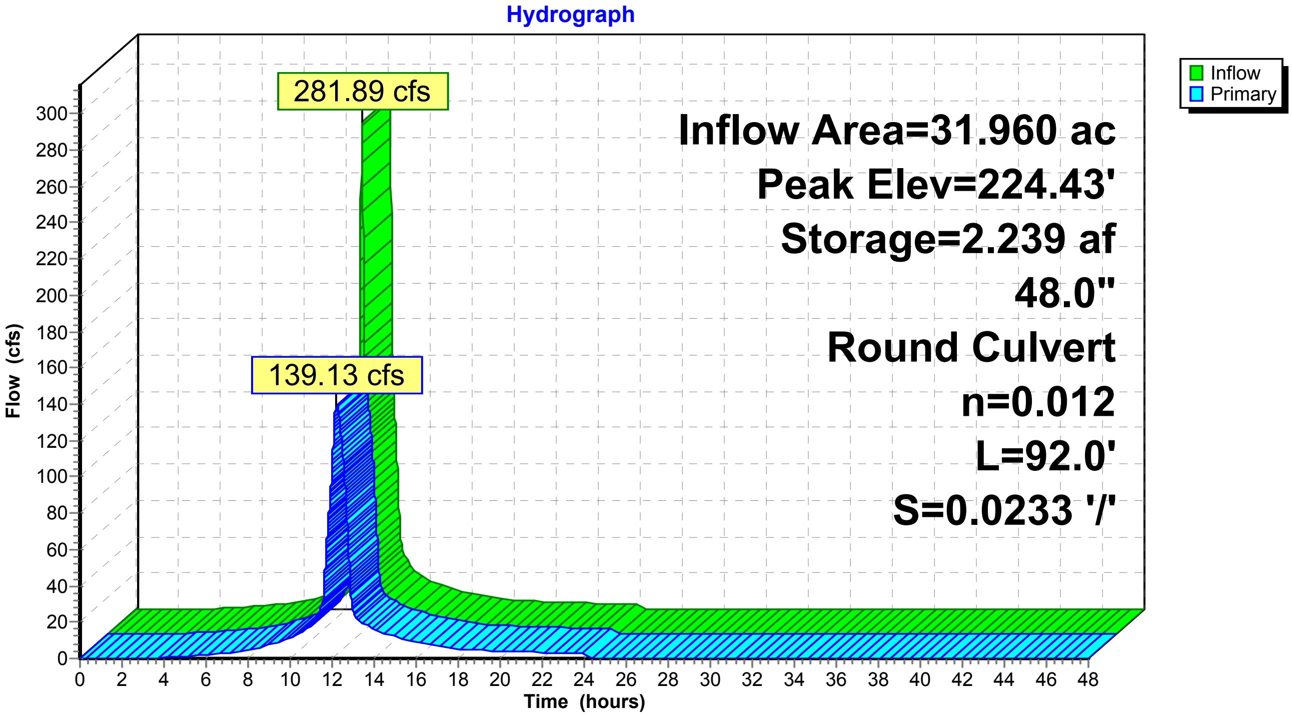
Volume	Invert	Avail.Storage	Storage Description
#1	220.00'	4.242 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
220.00	0.040	0.000	0.000
222.00	0.383	0.423	0.423
224.00	0.989	1.372	1.795
226.00	1.458	2.447	4.242

Device	Routing	Invert	Outlet Devices
#1	Primary	217.14'	**48.0" Round 3-36" HDPE** L= 92.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 217.14' / 215.00' S= 0.0233 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 12.57 sf

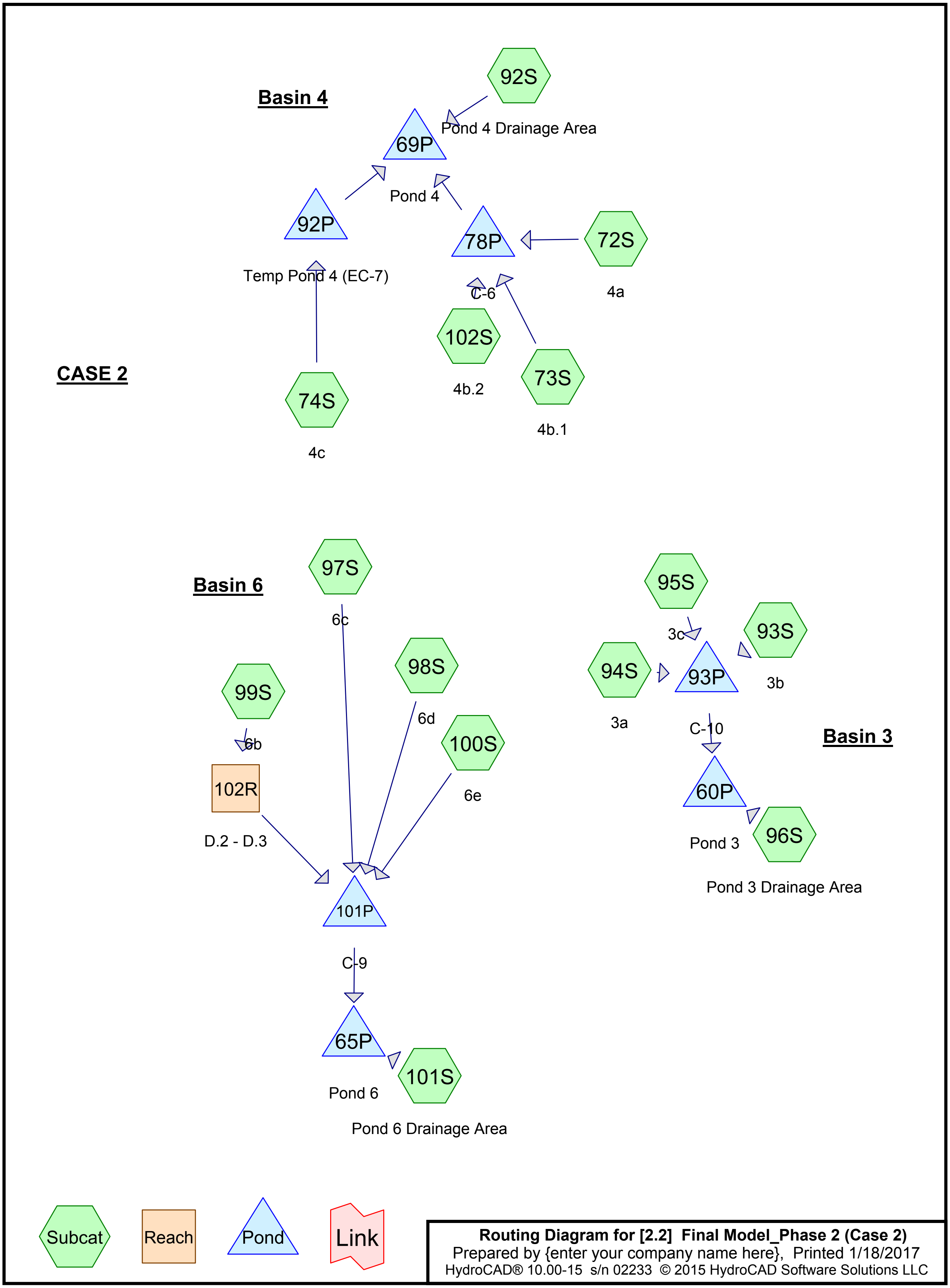
Primary OutFlow Max=139.12 cfs @ 12.23 hrs HW=224.43' TW=219.09' (Dynamic Tailwater)
↑—**1=3-36" HDPE** (Inlet Controls 139.12 cfs @ 11.07 fps)

Pond 104P: Temp Pond 6 (EC-9)



Appendix 1

HydroCAD Output – Case 2



Routing Diagram for [2.2] Final Model_Phase 2 (Case 2)
Prepared by {enter your company name here}, Printed 1/18/2017
HydroCAD® 10.00-15 s/n 02233 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.128	74	Pasture/grassland/range, Good, HSG C (72S, 73S, 102S)
32.540	87	Pasture/grassland/range, Good, HSG C (74S)
29.279	86	Pasture/grassland/range, Good, HSG C (93S, 94S, 95S, 97S, 98S, 99S, 100S)
8.822	98	Water Surface, HSG A (92S, 96S, 101S)
83.769	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.822	HSG A	92S, 96S, 101S
0.000	HSG B	
74.947	HSG C	72S, 73S, 74S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S
0.000	HSG D	
0.000	Other	
83.769		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	74.947	0.000	0.000	74.947	Pasture/grassland/range, Good	72S, 73S, 74S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S
8.822	0.000	0.000	0.000	0.000	8.822	Water Surface	92S, 96S, 101S
8.822	**0.000**	**74.947**	**0.000**	**0.000**	**83.769**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	73S	0.00	0.00	813.0	0.2424	0.020	18.0	0.0	0.0
2	74S	0.00	0.00	256.0	0.1953	0.020	18.0	0.0	0.0
3	95S	0.00	0.00	655.0	0.2366	0.020	18.0	0.0	0.0
4	97S	0.00	0.00	726.0	0.2449	0.020	18.0	0.0	0.0
5	98S	0.00	0.00	189.0	0.1793	0.020	18.0	0.0	0.0
6	60P	211.00	210.00	100.0	0.0100	0.013	12.0	0.0	0.0
7	65P	214.00	213.50	100.0	0.0050	0.013	24.0	0.0	0.0
8	69P	225.00	224.00	108.0	0.0093	0.013	36.0	0.0	0.0
9	92P	232.00	230.00	113.0	0.0177	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 72S: 4a Runoff Area=0.328 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=18' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=2.43 cfs 0.174 af

Subcatchment 73S: 4b.1 Runoff Area=12.330 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,200' Tc=7.7 min CN=74 Runoff=86.23 cfs 6.554 af

Subcatchment 74S: 4c Runoff Area=32.540 ac 0.00% Impervious Runoff Depth=8.01"
Flow Length=1,060' Tc=6.0 min CN=87 Runoff=288.01 cfs 21.731 af

Subcatchment 92S: Pond 4 Drainage Area Runoff Area=2.810 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=26.50 cfs 2.192 af

Subcatchment 93S: 3b Runoff Area=0.400 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=80' Slope=0.2500 '/' Tc=6.0 min CN=86 Runoff=3.51 cfs 0.263 af

Subcatchment 94S: 3a Runoff Area=0.590 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=85' Slope=0.2500 '/' Tc=6.0 min CN=86 Runoff=5.17 cfs 0.388 af

Subcatchment 95S: 3c Runoff Area=5.760 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=980' Tc=6.0 min CN=86 Runoff=50.48 cfs 3.787 af

Subcatchment 96S: Pond 3 Drainage Area Runoff Area=1.359 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=12.82 cfs 1.060 af

Subcatchment 97S: 6c Runoff Area=7.970 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=1,019' Tc=6.0 min CN=86 Runoff=69.85 cfs 5.240 af

Subcatchment 98S: 6d Runoff Area=3.837 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=575' Tc=6.0 min CN=86 Runoff=33.63 cfs 2.523 af

Subcatchment 99S: 6b Runoff Area=9.790 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=1,188' Tc=6.0 min CN=86 Runoff=85.80 cfs 6.437 af

Subcatchment 100S: 6e Runoff Area=0.932 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=79' Slope=0.2500 '/' Tc=6.0 min CN=86 Runoff=8.17 cfs 0.613 af

Subcatchment 101S: Pond 6 Drainage Area Runoff Area=4.653 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=43.89 cfs 3.629 af

Subcatchment 102S: 4b.2 Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=47' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=3.48 cfs 0.250 af

Reach 102R: D.2 - D.3 Avg. Flow Depth=1.43' Max Vel=5.75 fps Inflow=85.80 cfs 6.437 af
n=0.027 L=230.0' S=0.0100 '/' Capacity=242.37 cfs Outflow=85.41 cfs 6.437 af

Pond 60P: Pond 3 Peak Elev=216.66' Storage=4.434 af Inflow=71.98 cfs 5.498 af
Outflow=2.22 cfs 2.096 af

```
Pond 65P: Pond 6                              Peak Elev=220.04'  Storage=13.696 af   Inflow=240.66 cfs  18.441 af
                                                                                     Outflow=10.73 cfs  6.864 af

Pond 69P: Pond 4                               Peak Elev=230.51'  Storage=7.507 af   Inflow=161.06 cfs  30.898 af
                            36.0"  Round Culvert  n=0.013  L=108.0'  S=0.0093 '/'   Outflow=53.77 cfs  30.790 af

Pond 78P: C-6                                                                        Inflow=91.95 cfs  6.978 af
                                                                                    Primary=91.95 cfs  6.978 af

Pond 92P: Temp Pond 4 (EC-7)                   Peak Elev=237.54'  Storage=7.504 af   Inflow=288.01 cfs  21.731 af
                       24.0"  Round Culvert x 2.00  n=0.013  L=113.0'  S=0.0177 '/'   Outflow=50.92 cfs  21.729 af

Pond 93P: C-10                                                                       Inflow=59.16 cfs  4.438 af
                                                                                    Primary=59.16 cfs  4.438 af

Pond 101P: C-9                                                                     Inflow=196.83 cfs  14.812 af
                                                                                  Primary=196.83 cfs  14.812 af

          Total Runoff Area = 83.769 ac   Runoff Volume = 54.839 af   Average Runoff Depth = 7.86"
                                        89.47% Pervious = 74.947 ac     10.53% Impervious = 8.822 ac
```

Summary for Subcatchment 72S: 4a

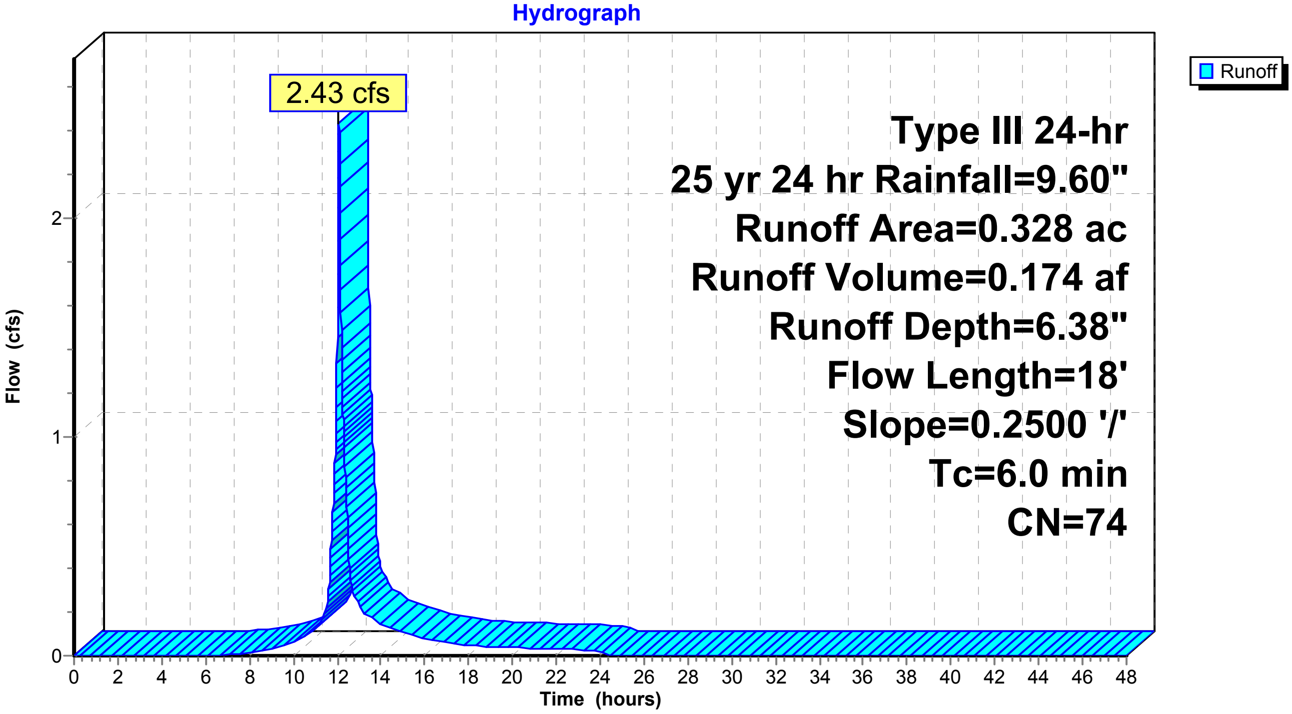
Runoff = 2.43 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.328	74	Pasture/grassland/range, Good, HSG C
0.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	18	0.2500	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.6	18	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 72S: 4a



Summary for Subcatchment 73S: 4b.1

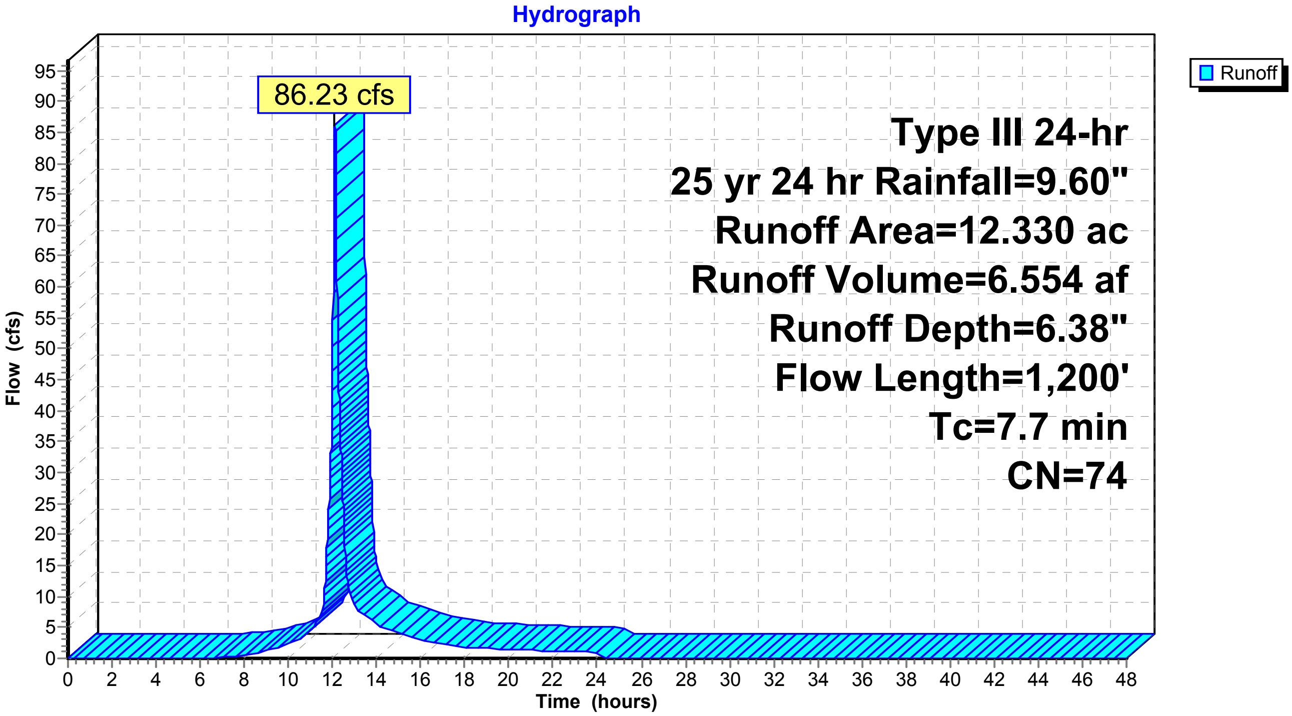
Runoff = 86.23 cfs @ 12.11 hrs, Volume= 6.554 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
12.330	74	Pasture/grassland/range, Good, HSG C
12.330		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	187	0.0802	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.4	200	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.7	813	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.7	1,200	Total			

Subcatchment 73S: 4b.1



Summary for Subcatchment 74S: 4c

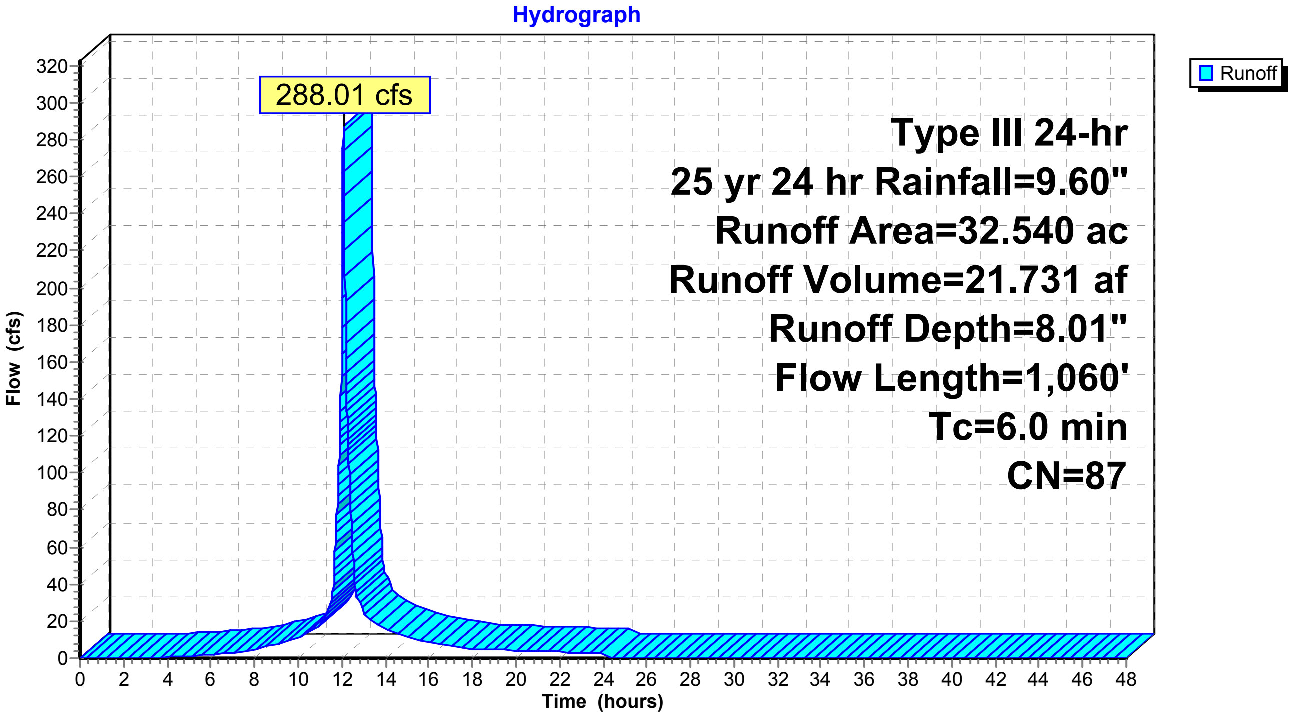
Runoff = 288.01 cfs @ 12.08 hrs, Volume= 21.731 af, Depth= 8.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	32.540	87	Pasture/grassland/range, Good, HSG C
	32.540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	113	0.1770	1.25		**Sheet Flow,** n= 0.053 P2= 5.40"
0.6	691	0.0724	18.10	602.80	**Channel Flow, SSDT Flow** Area= 33.3 sf Perim= 33.5' r= 0.99' n= 0.022 Earth, clean & straight
0.2	256	0.1953	17.08	30.17	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
2.3	1,060	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 74S: 4c



Summary for Subcatchment 92S: Pond 4 Drainage Area

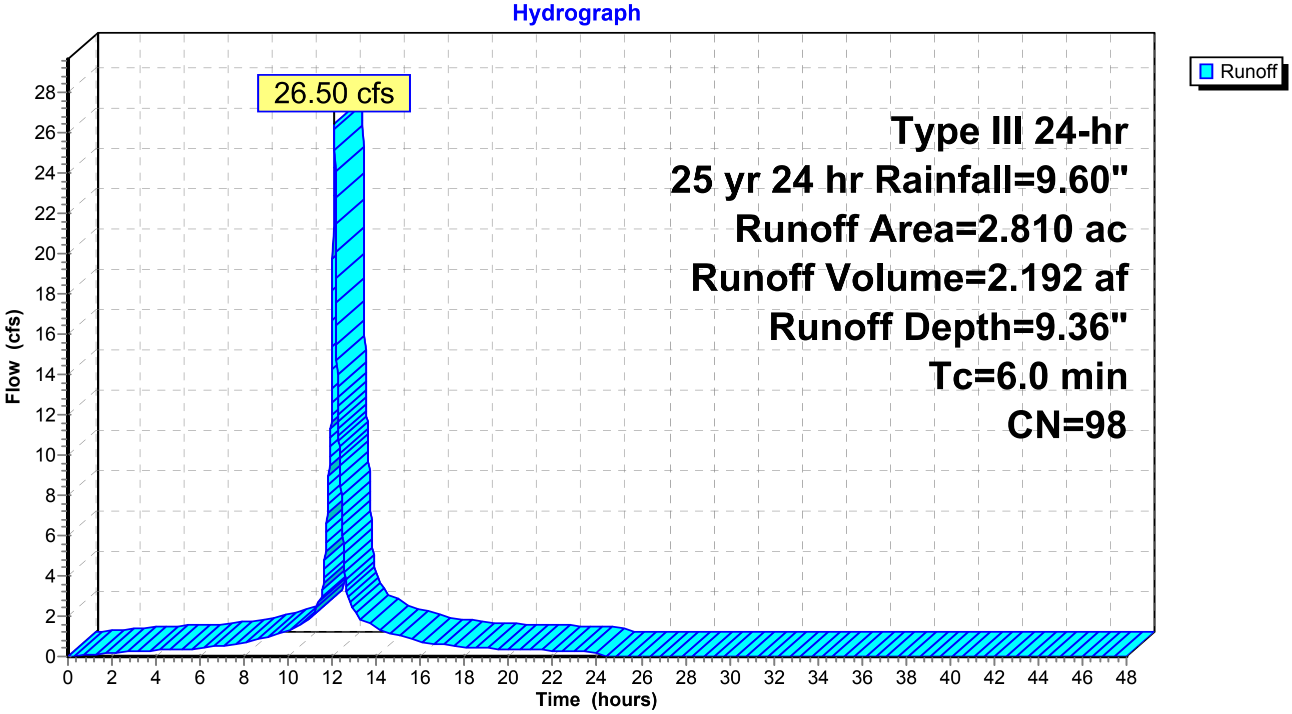
Runoff = 26.50 cfs @ 12.08 hrs, Volume= 2.192 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
2.810	98	Water Surface, HSG A
2.810		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 92S: Pond 4 Drainage Area



Summary for Subcatchment 93S: 3b

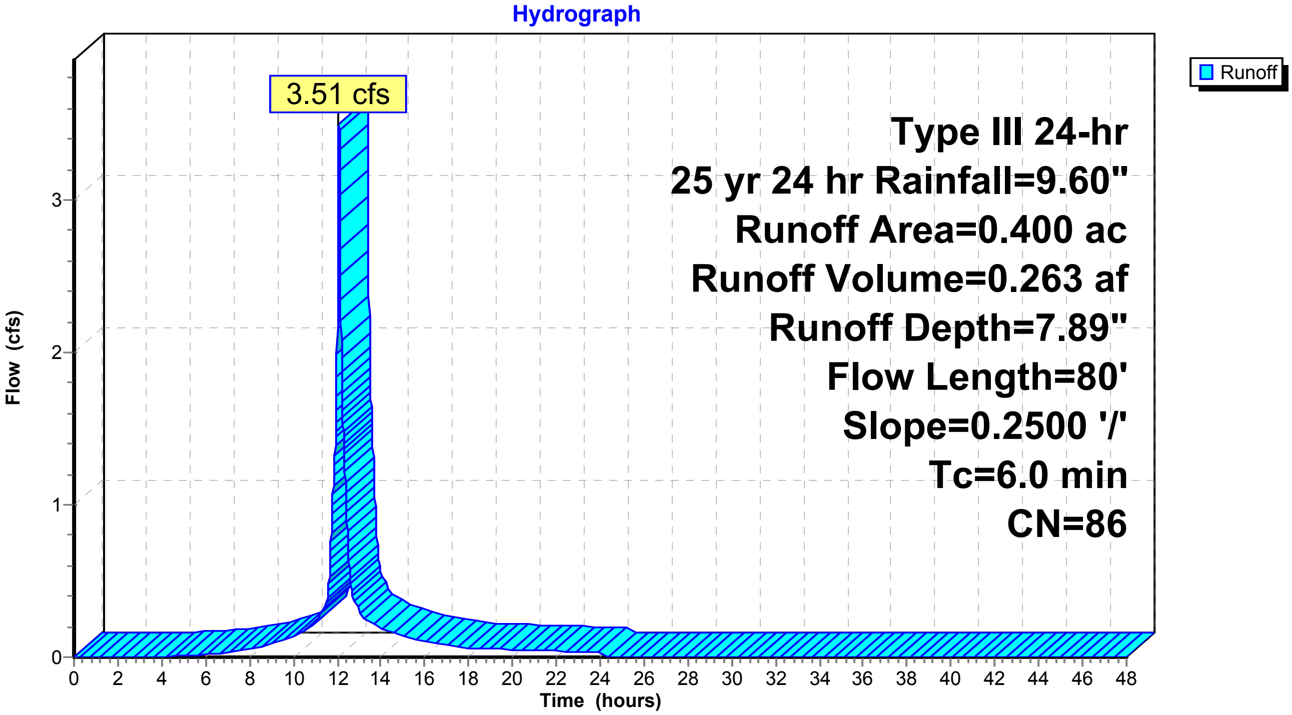
Runoff = 3.51 cfs @ 12.08 hrs, Volume= 0.263 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.400	86	Pasture/grassland/range, Good, HSG C
	0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	80	0.2500	1.33		**Sheet Flow,** n= 0.053 P2= 5.40"
1.0	80	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 93S: 3b



Summary for Subcatchment 94S: 3a

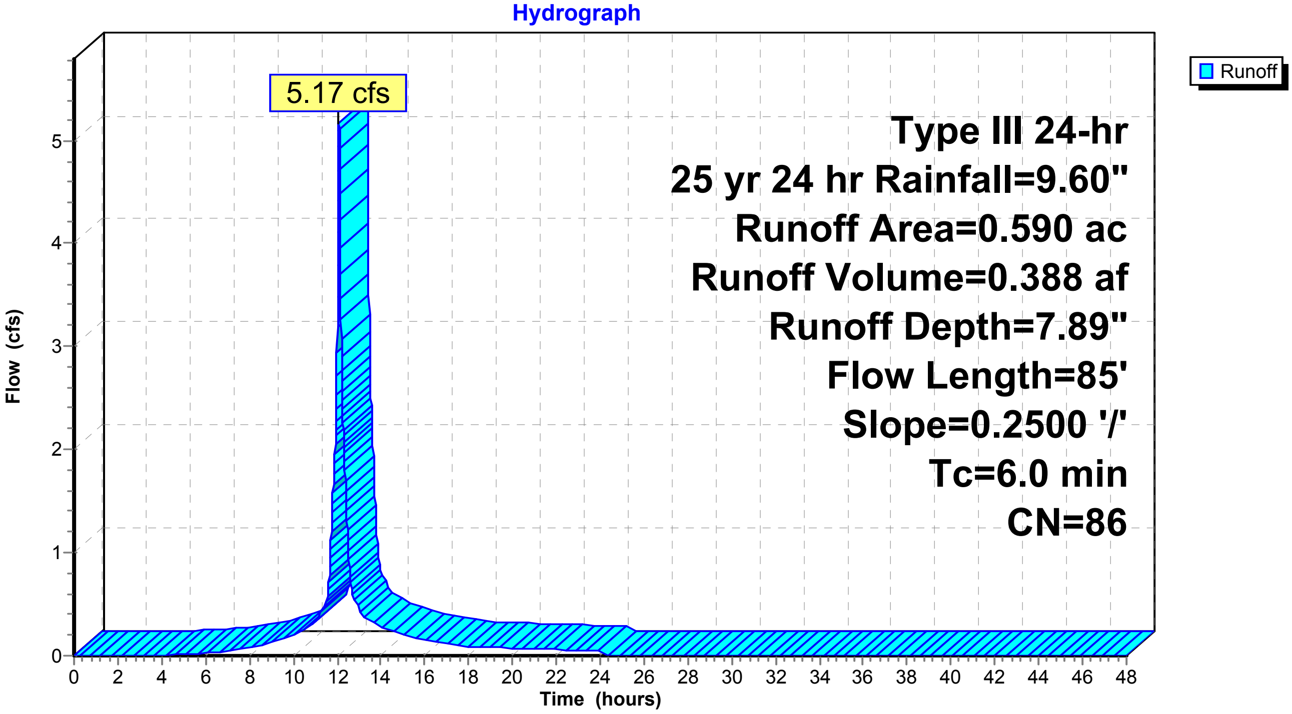
Runoff = 5.17 cfs @ 12.08 hrs, Volume= 0.388 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.590	86	Pasture/grassland/range, Good, HSG C
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	85	0.2500	1.35		**Sheet Flow,** n= 0.053 P2= 5.40"
1.0	85	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 94S: 3a



Summary for Subcatchment 95S: 3c

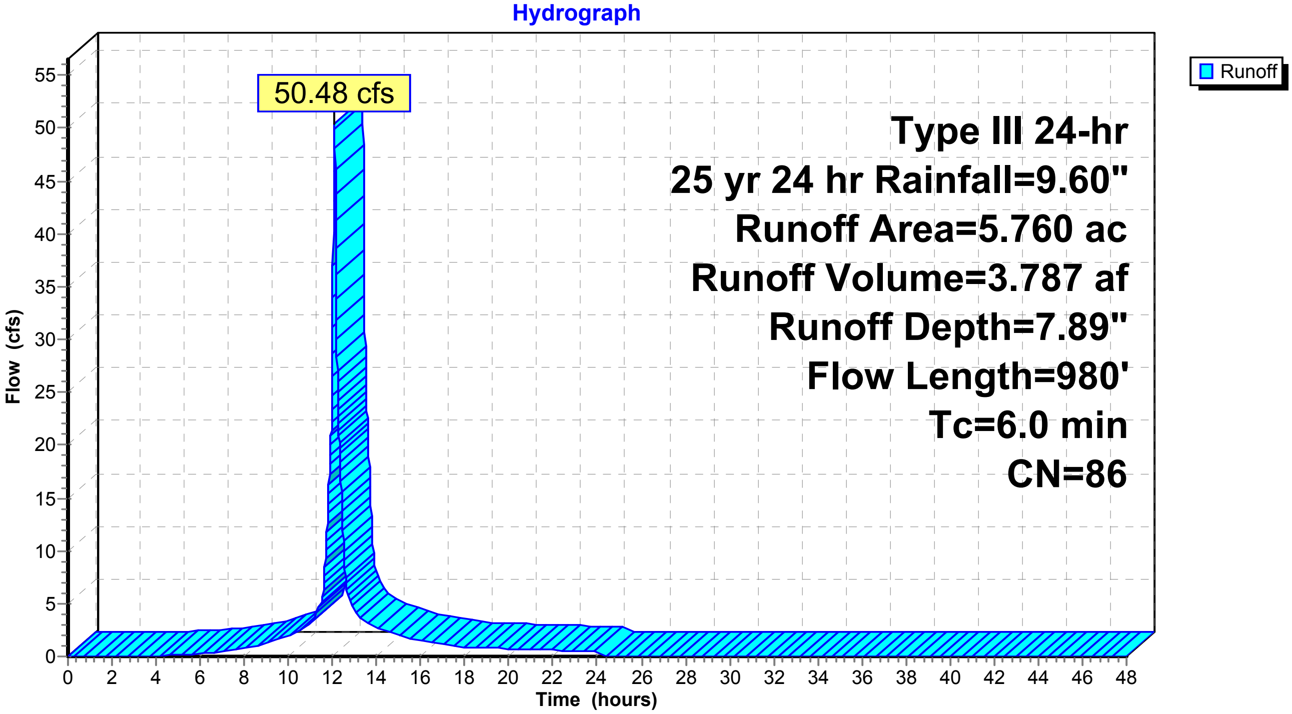
Runoff = 50.48 cfs @ 12.08 hrs, Volume= 3.787 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	5.760	86	Pasture/grassland/range, Good, HSG C
	5.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	80	0.2500	1.33		**Sheet Flow,** n= 0.053 P2= 5.40"
0.5	245	0.0204	7.64	51.21	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	655	0.2366	18.79	33.21	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
2.1	980	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 95S: 3c



Summary for Subcatchment 96S: Pond 3 Drainage Area

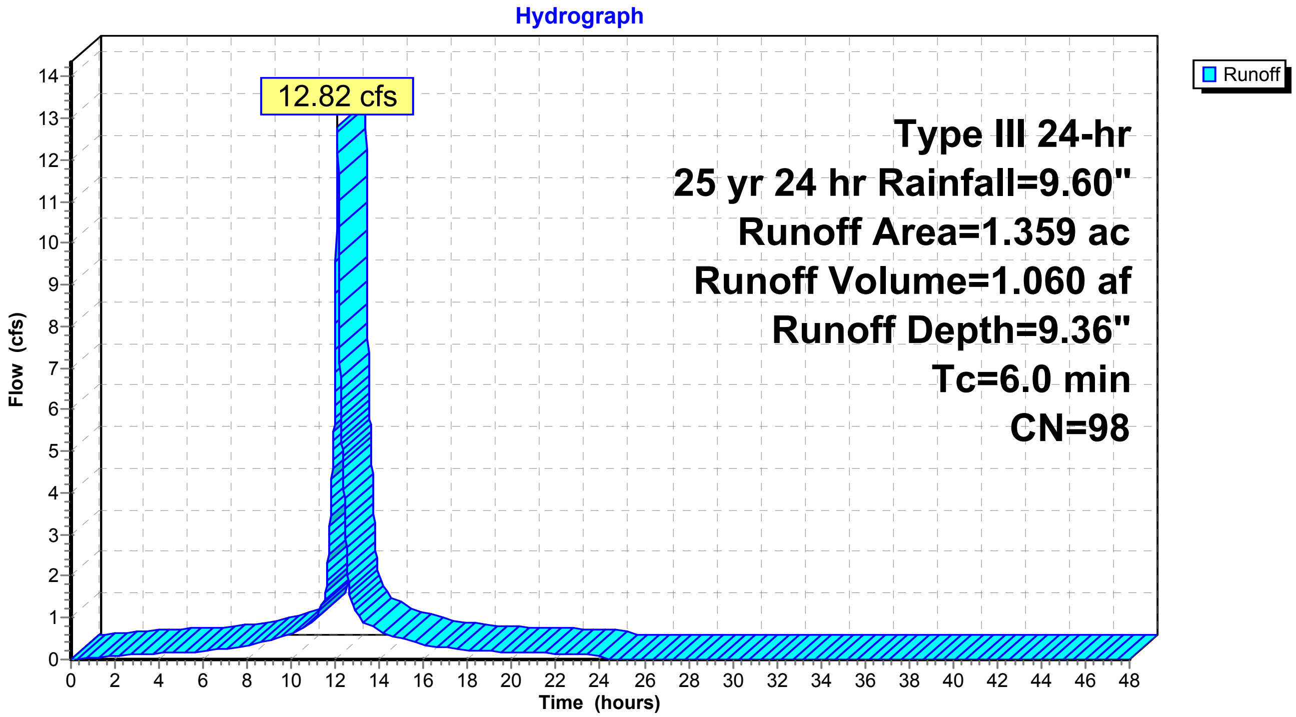
Runoff = 12.82 cfs @ 12.08 hrs, Volume= 1.060 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
1.359	98	Water Surface, HSG A
1.359		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 96S: Pond 3 Drainage Area



Summary for Subcatchment 97S: 6c

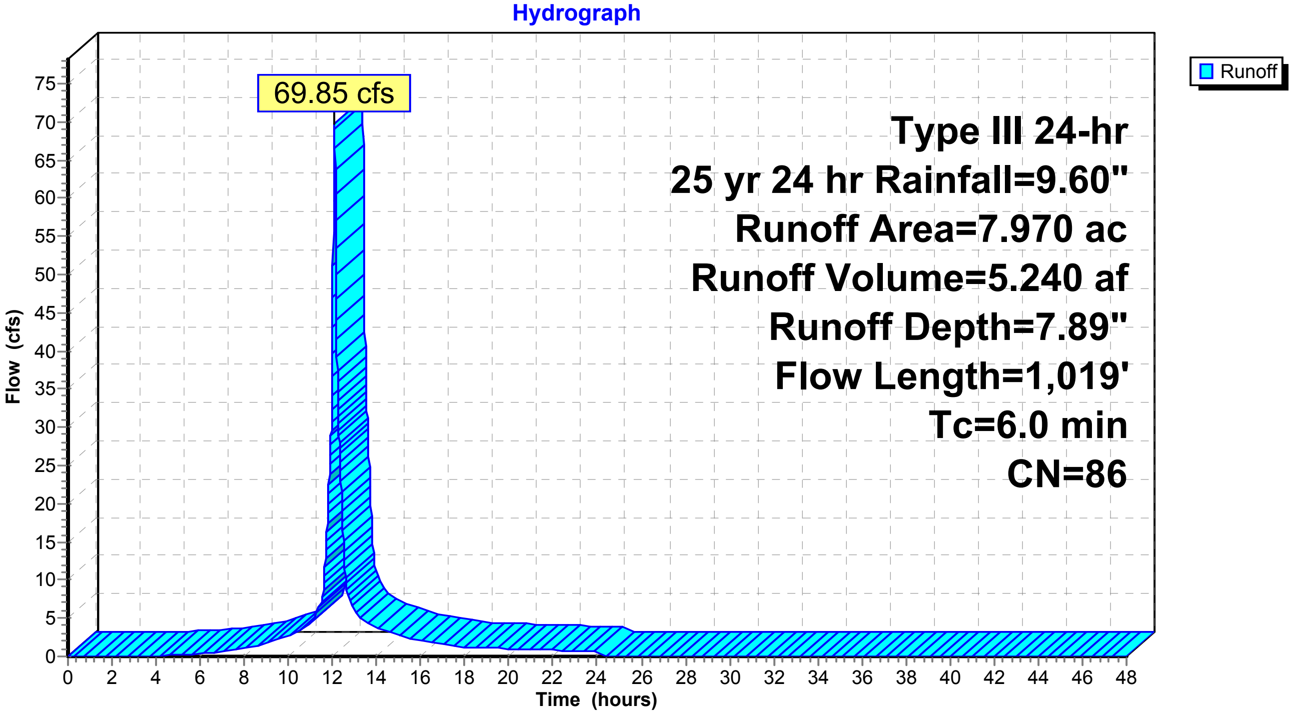
Runoff = 69.85 cfs @ 12.08 hrs, Volume= 5.240 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	7.970	86	Pasture/grassland/range, Good, HSG C
	7.970		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	180	0.0833	1.01		**Sheet Flow,** n= 0.053 P2= 5.40"
0.2	113	0.0199	7.55	50.58	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	726	0.2449	19.12	33.79	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.8	1,019	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 97S: 6c



Summary for Subcatchment 98S: 6d

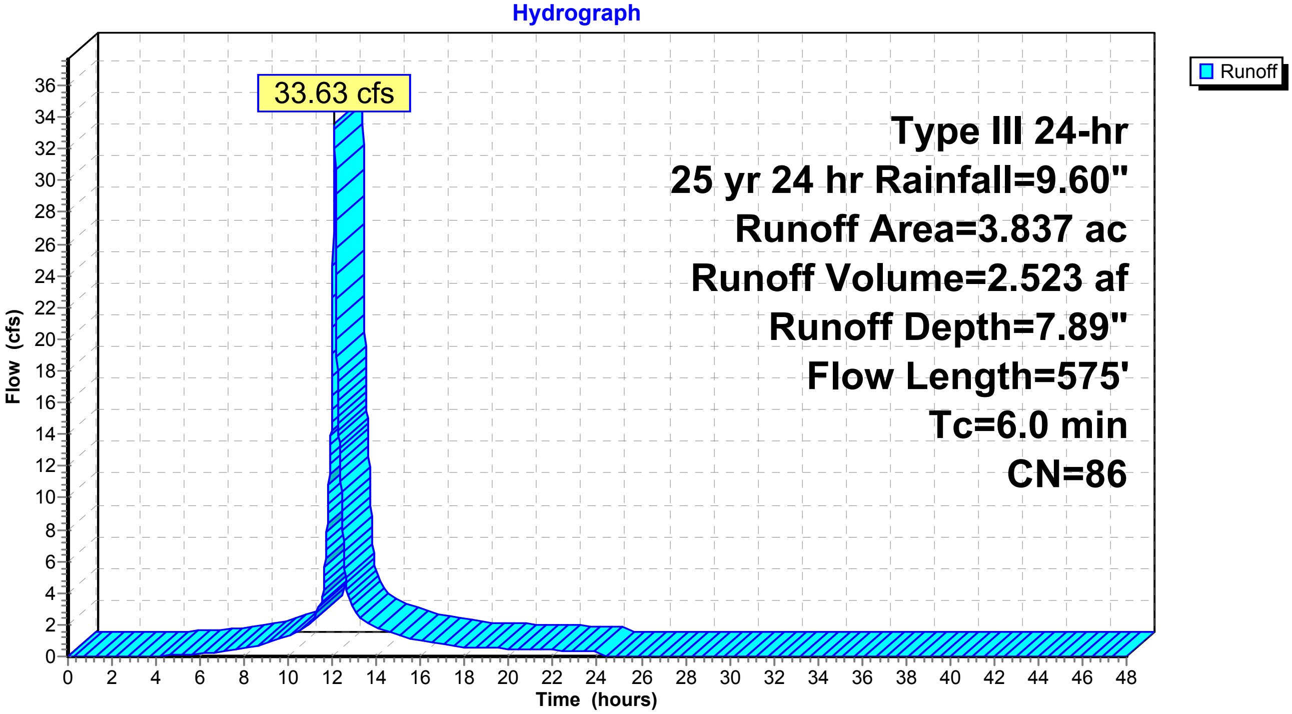
Runoff = 33.63 cfs @ 12.08 hrs, Volume= 2.523 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	3.837	86	Pasture/grassland/range, Good, HSG C
	3.837		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	80	0.2500	1.33		**Sheet Flow,** n= 0.053 P2= 5.40"
0.7	306	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.2	189	0.1793	16.36	28.91	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
1.9	575	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 98S: 6d



Summary for Subcatchment 99S: 6b

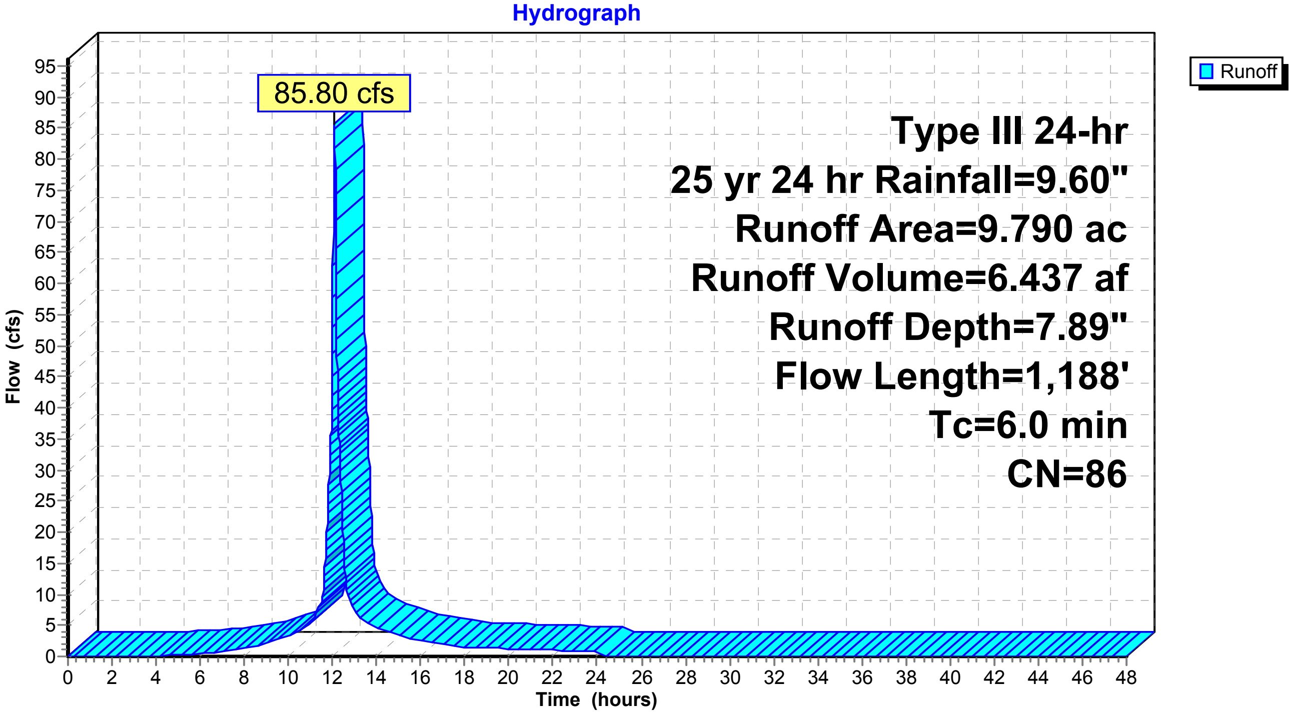
Runoff = 85.80 cfs @ 12.08 hrs, Volume= 6.437 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	9.790	86	Pasture/grassland/range, Good, HSG C
	9.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	200	0.3500	1.83		**Sheet Flow,** n= 0.053 P2= 5.40"
0.5	517	0.1160	18.23	122.12	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.9	471	0.0420	8.72	201.44	**Channel Flow,** Area= 23.1 sf Perim= 46.2' r= 0.50' n= 0.022 Earth, clean & straight
3.2	1,188	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 99S: 6b



Summary for Subcatchment 100S: 6e

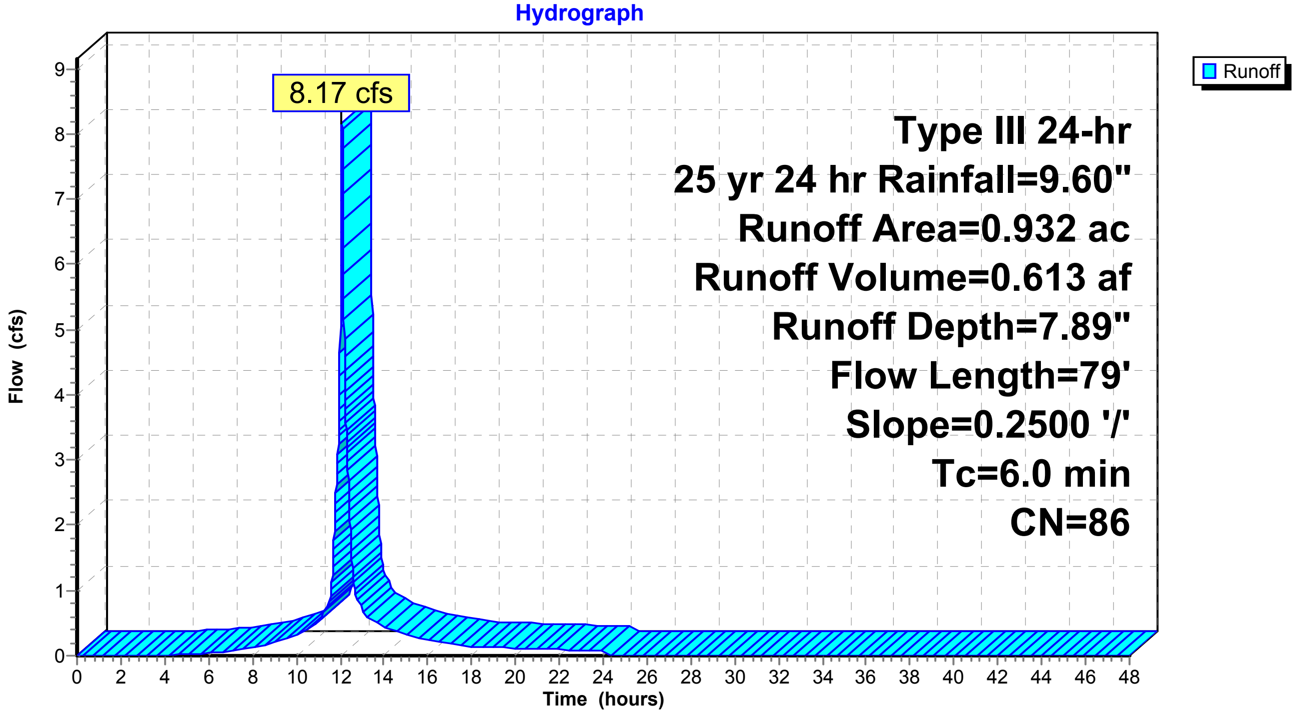
Runoff = 8.17 cfs @ 12.08 hrs, Volume= 0.613 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.932	86	Pasture/grassland/range, Good, HSG C
	0.932		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	79	0.2500	1.33		**Sheet Flow,** n= 0.053 P2= 5.40"
1.0	79	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 100S: 6e



Summary for Subcatchment 101S: Pond 6 Drainage Area

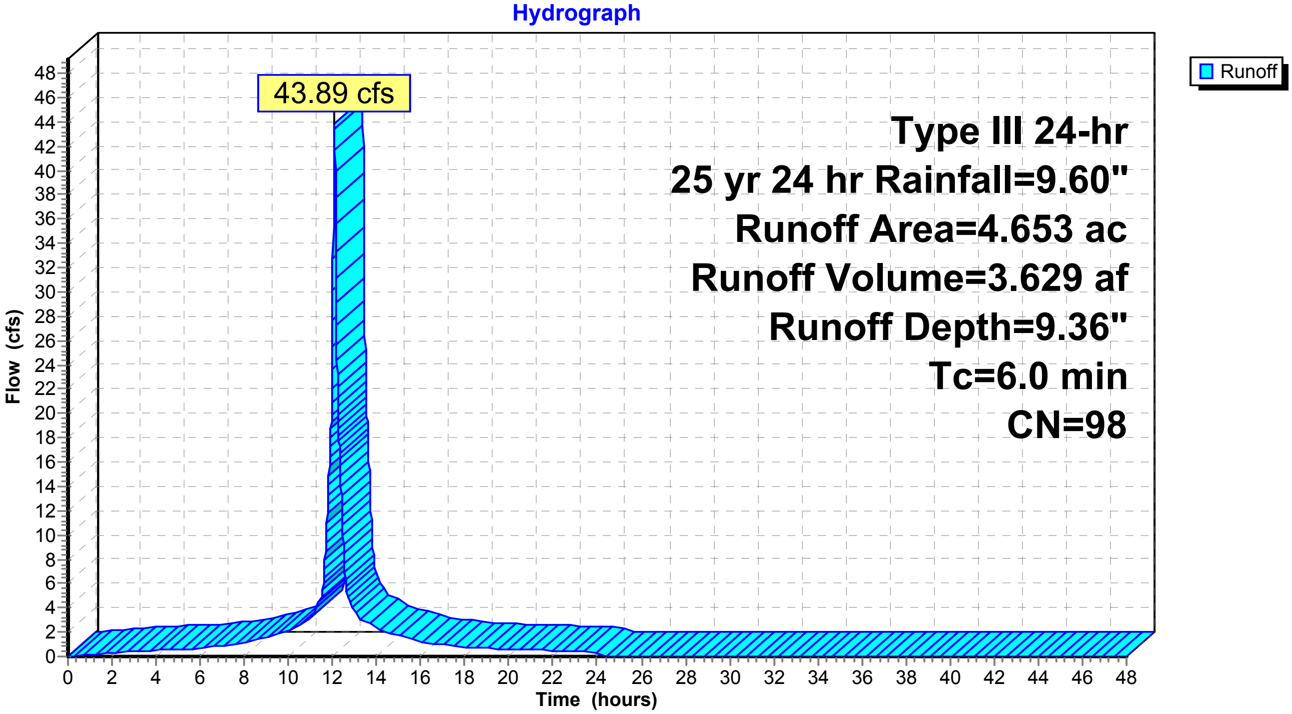
Runoff = 43.89 cfs @ 12.08 hrs, Volume= 3.629 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
4.653	98	Water Surface, HSG A
4.653		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 101S: Pond 6 Drainage Area



Summary for Subcatchment 102S: 4b.2

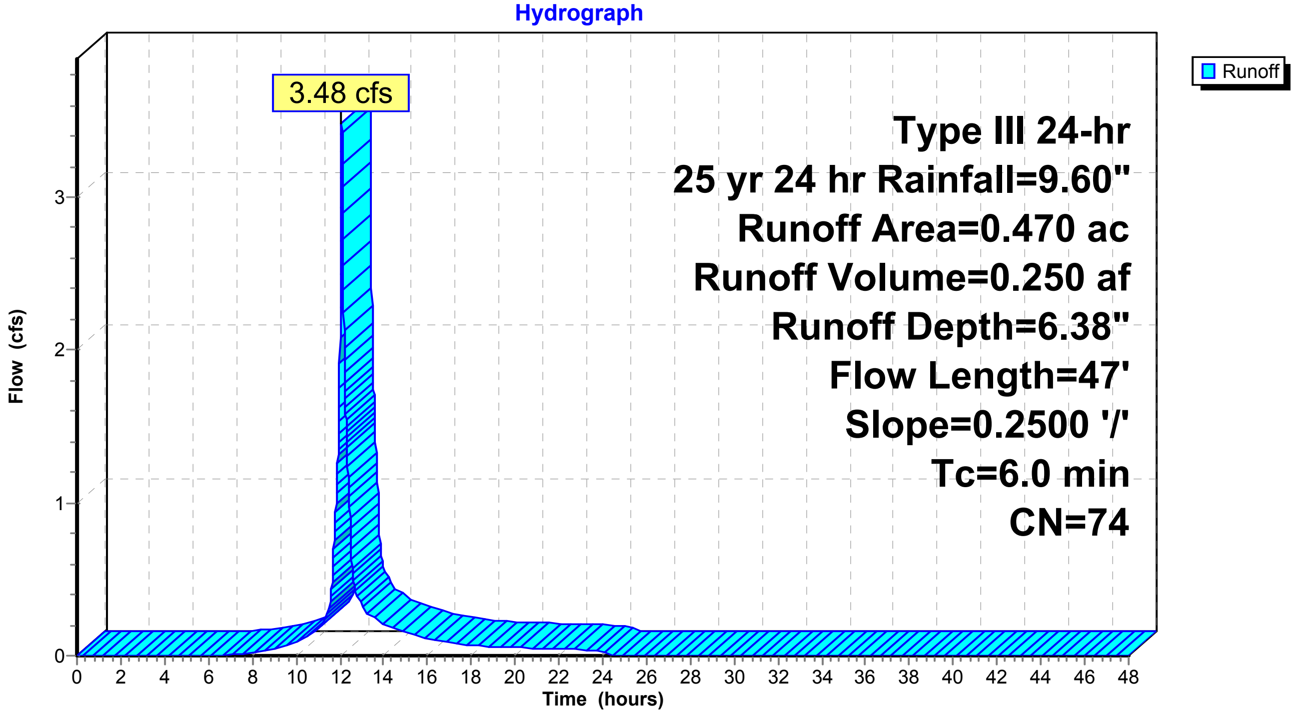
Runoff = 3.48 cfs @ 12.09 hrs, Volume= 0.250 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.470	74	Pasture/grassland/range, Good, HSG C
0.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	47	0.2500	0.56		**Sheet Flow,** n= 0.136 P2= 5.40"
1.4	47	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 102S: 4b.2



Summary for Reach 102R: D.2 - D.3

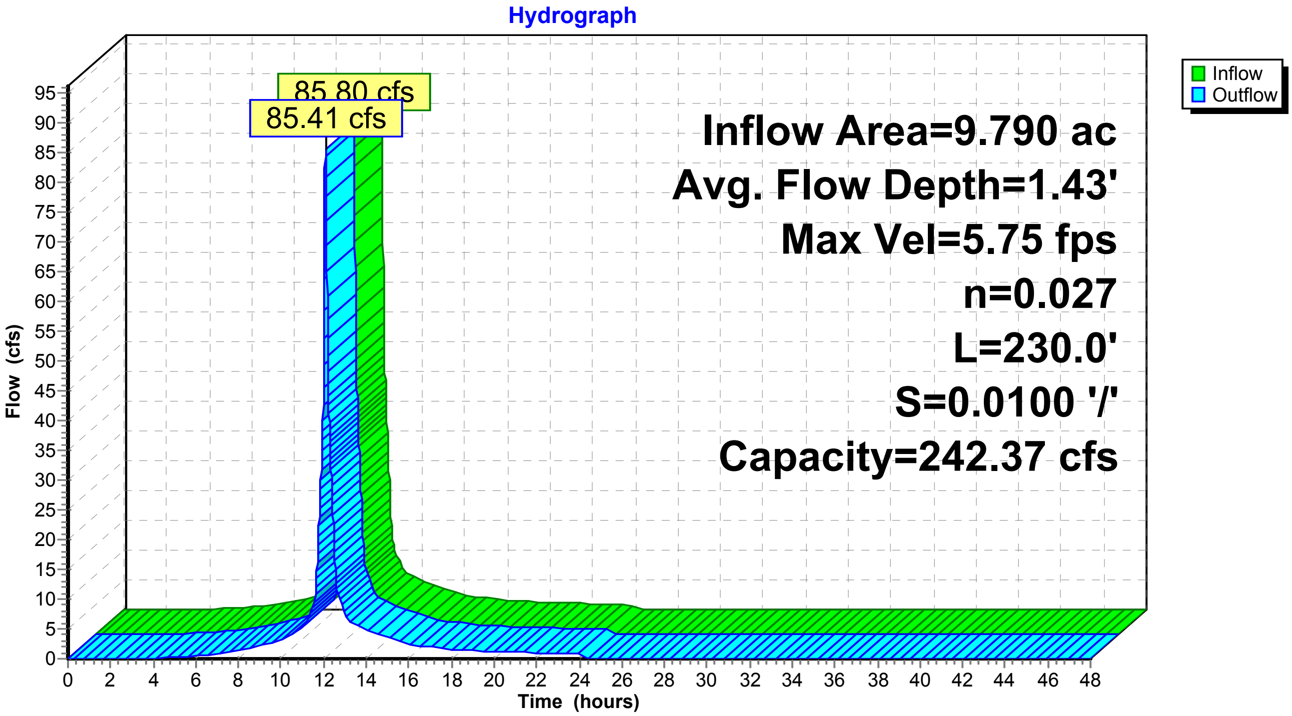
Inflow Area = 9.790 ac, 0.00% Impervious, Inflow Depth = 7.89" for 25 yr 24 hr event
Inflow = 85.80 cfs @ 12.08 hrs, Volume= 6.437 af
Outflow = 85.41 cfs @ 12.09 hrs, Volume= 6.437 af, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.75 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.55 fps, Avg. Travel Time= 2.5 min

Peak Storage= 3,416 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.43'
Bank-Full Depth= 2.50' Flow Area= 31.3 sf, Capacity= 242.37 cfs

7.50' x 2.50' deep channel, n= 0.027
Side Slope Z-value= 2.0 '/' Top Width= 17.50'
Length= 230.0' Slope= 0.0100 '/'
Inlet Invert= 226.09', Outlet Invert= 223.79'

Reach 102R: D.2 - D.3



Summary for Pond 60P: Pond 3

Inflow Area = 8.109 ac, 16.76% Impervious, Inflow Depth = 8.14" for 25 yr 24 hr event
Inflow = 71.98 cfs @ 12.08 hrs, Volume= 5.498 af
Outflow = 2.22 cfs @ 15.84 hrs, Volume= 2.096 af, Atten= 97%, Lag= 225.2 min
Primary = 2.22 cfs @ 15.84 hrs, Volume= 2.096 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 216.66' @ 15.84 hrs Surf.Area= 0.914 ac Storage= 4.434 af

Plug-Flow detention time= 916.9 min calculated for 2.095 af (38% of inflow)
Center-of-Mass det. time= 775.8 min (1,549.5 - 773.7)

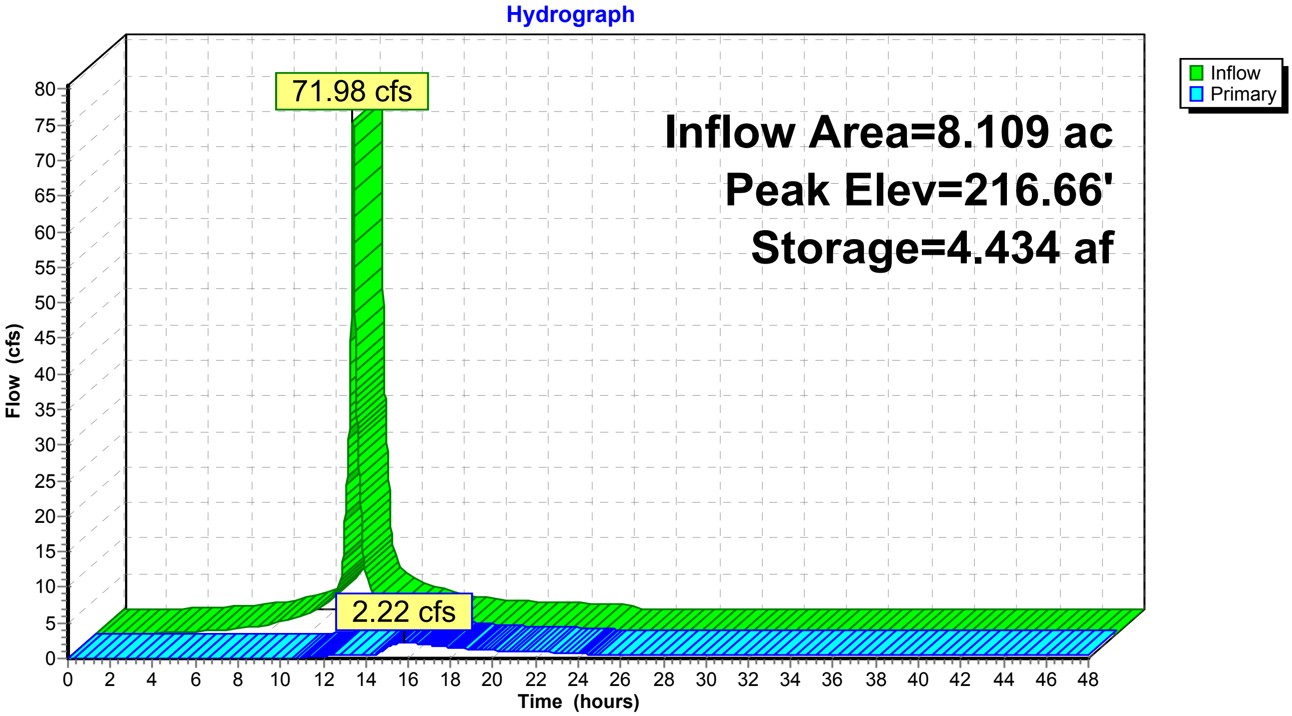
Volume	Invert	Avail.Storage	Storage Description
#1	211.00'	6.719 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
211.00	0.634	0.000	0.000
212.00	0.728	0.681	0.681
214.00	0.777	1.505	2.186
215.00	0.827	0.802	2.988
216.00	0.879	0.853	3.841
217.00	0.932	0.906	4.746
218.00	0.986	0.959	5.705
219.00	1.042	1.014	6.719

Device	Routing	Invert	Outlet Devices
#1	Device 2	211.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	212.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	216.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	211.00'	**12.0" Round 12" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 211.00' / 210.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#5	Primary	217.50'	**143.1 deg x 20.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=2.22 cfs @ 15.84 hrs HW=216.66' (Free Discharge)
- **4=12" culvert** (Passes 2.22 cfs of 6.68 cfs potential flow)
  - **2=3" Pipe** (Orifice Controls 0.50 cfs @ 10.26 fps)
    - **1=grate (36" half-circle)** (Passes 0.50 cfs of 2.71 cfs potential flow)
  - **3=riser slits** (Orifice Controls 1.72 cfs @ 1.29 fps)
- **5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

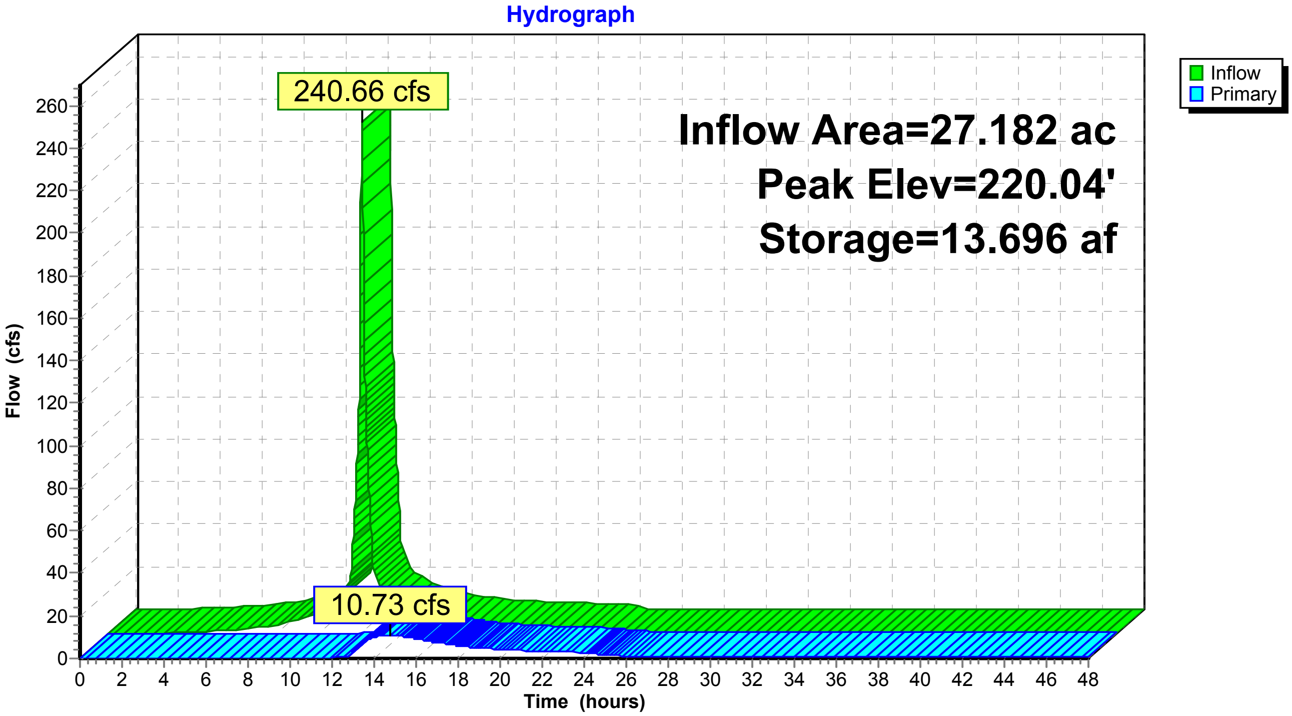
Pond 60P: Pond 3



Summary for Pond 65P: Pond 6

```
Inflow Area =      27.182 ac, 17.12% Impervious, Inflow Depth =  8.14"   for 25 yr 24 hr event
Inflow      =     240.66 cfs @  12.09 hrs, Volume=        18.441 af
Outflow     =      10.73 cfs @  14.72 hrs, Volume=         6.864 af, Atten= 96%, Lag= 158.1 min
Primary     =      10.73 cfs @  14.72 hrs, Volume=         6.864 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 220.04' @ 14.72 hrs   Surf.Area= 2.603 ac   Storage= 13.696 af

Plug-Flow detention time= 579.4 min calculated for 6.862 af (37% of inflow)
Center-of-Mass det. time= 436.1 min ( 1,210.2 - 774.0 )

Volume      Invert   Avail.Storage   Storage Description
   #1      214.00'       24.939 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation     Surf.Area        Inc.Store        Cum.Store
    (feet)       (acres)      (acre-feet)      (acre-feet)
    214.00         1.929            0.000            0.000
    216.00         2.159            4.088            4.088
    218.00         2.377            4.536            8.624
    220.00         2.599            4.976           13.600
    222.00         2.834            5.433           19.033
    224.00         3.072            5.906           24.939

Device   Routing          Invert   Outlet Devices
   #1    Device 2        214.00'   0.5" Vert. grate (36" half-circle) X 32.00 columns
                                   X 6 rows with 3.0" cc spacing C= 0.600
   #2    Device 4        215.00'   3.0" Vert. 3" Pipe   C= 0.600
   #3    Device 4        219.50'   24.7" W x 6.0" H Vert. riser slits X 4.00  C= 0.600
   #4    Primary         214.00'   24.0"  Round 24" culvert
                                   L= 100.0'   CMP, projecting, no headwall,  Ke= 0.900
                                   Inlet / Outlet Invert= 214.00' / 213.50'   S= 0.0050 '/'   Cc= 0.900
                                   n= 0.013  Corrugated PE, smooth interior,  Flow Area= 3.14 sf
   #5    Primary         221.00'   157.4 deg x 20.0' long x 3.00' rise Sharp-Crested Vee/Trap Weir
                                   Cv= 2.47 (C= 3.09)

Primary OutFlow  Max=10.73 cfs @ 14.72 hrs  HW=220.04'   (Free Discharge)
↑
├─4=24" culvert  (Passes 10.73 cfs of 26.80 cfs potential flow)
│  ↑
│  ├─2=3" Pipe  (Orifice Controls 0.52 cfs @ 10.67 fps)
│  │  ↑
│  │  └─1=grate (36" half-circle)  (Passes 0.52 cfs of 2.82 cfs potential flow)
│  └─3=riser slits  (Orifice Controls 10.21 cfs @ 2.48 fps)
└─5=Sharp-Crested Vee/Trap Weir ( Controls 0.00 cfs)
```

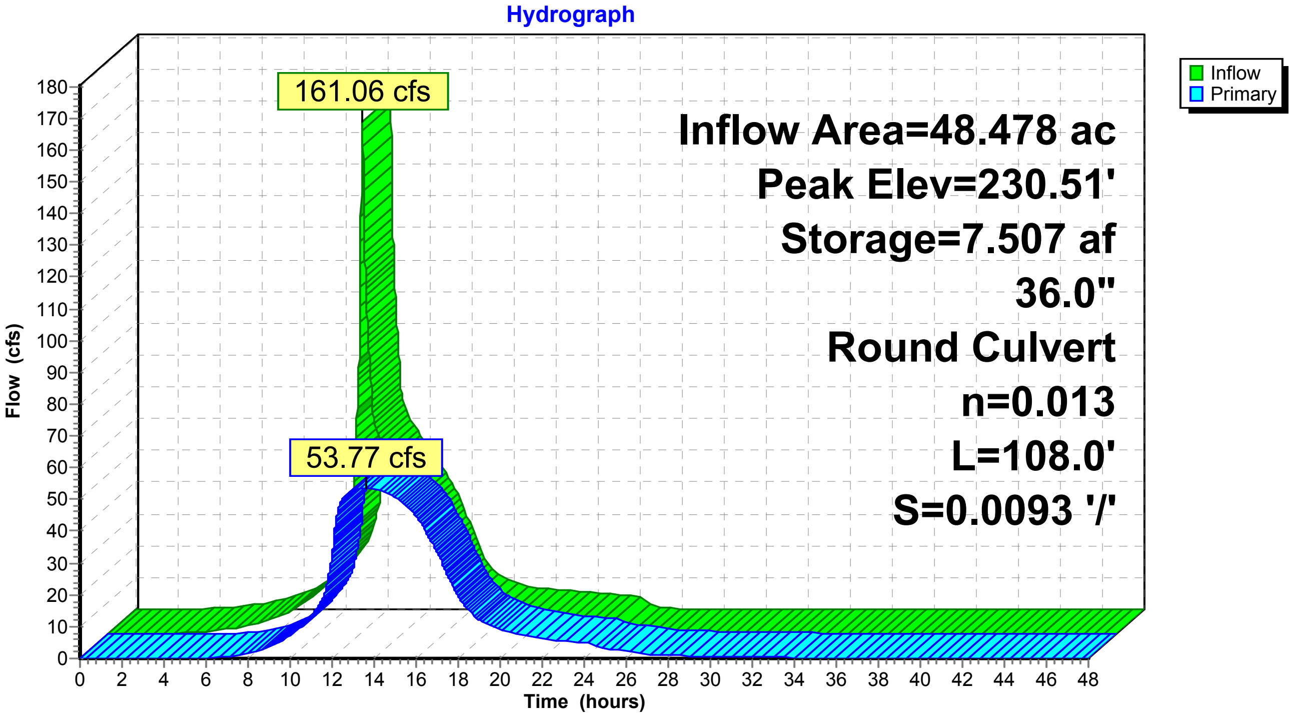
Pond 65P: Pond 6



Summary for Pond 69P: Pond 4

```
Inflow Area =      48.478 ac,   5.80% Impervious,  Inflow Depth =   7.65"   for  25 yr 24 hr event
Inflow      =     161.06 cfs @  12.11 hrs,  Volume=         30.898 af
Outflow     =      53.77 cfs @  13.65 hrs,  Volume=         30.790 af,  Atten= 67%,  Lag= 92.6 min
Primary     =      53.77 cfs @  13.65 hrs,  Volume=         30.790 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 230.51' @ 13.65 hrs   Surf.Area= 1.571 ac   Storage= 7.507 af

Plug-Flow detention time= 109.3 min calculated for 30.784 af (100% of inflow)
Center-of-Mass det. time= 107.0 min ( 934.7 - 827.7 )

Volume       Invert   Avail.Storage   Storage Description
   #1       225.00'       21.581 af   Custom Stage Data (Prismatic)Listed below (Recalc)

 Elevation      Surf.Area        Inc.Store        Cum.Store
    (feet)        (acres)      (acre-feet)      (acre-feet)
    225.00          1.164            0.000            0.000
    226.00          1.234            1.199            1.199
    227.00          1.306            1.270            2.469
    228.00          1.380            1.343            3.812
    229.00          1.455            1.418            5.230
    230.00          1.532            1.493            6.723
    231.00          1.610            1.571            8.294
    232.00          1.690            1.650            9.944
    233.00          1.771            1.730           11.674
    234.00          1.853            1.812           13.486
    235.00          1.937            1.895           15.381
    236.00          2.023            1.980           17.361
    237.00          2.109            2.066           19.427
    238.00          2.198            2.153           21.581

Device    Routing            Invert   Outlet Devices
   #1     Primary           225.00'   36.0"  Round 36" culvert
                                      L= 108.0'   CMP, projecting, no headwall,  Ke= 0.900
                                      Inlet / Outlet Invert= 225.00' / 224.00'   S= 0.0093 '/'   Cc= 0.900
                                      n= 0.013  Corrugated PE, smooth interior,  Flow Area= 7.07 sf

Primary OutFlow  Max=53.77 cfs @ 13.65 hrs  HW=230.51'   (Free Discharge)
  1=36" culvert  (Inlet Controls 53.77 cfs @ 7.61 fps)
```

Pond 69P: Pond 4



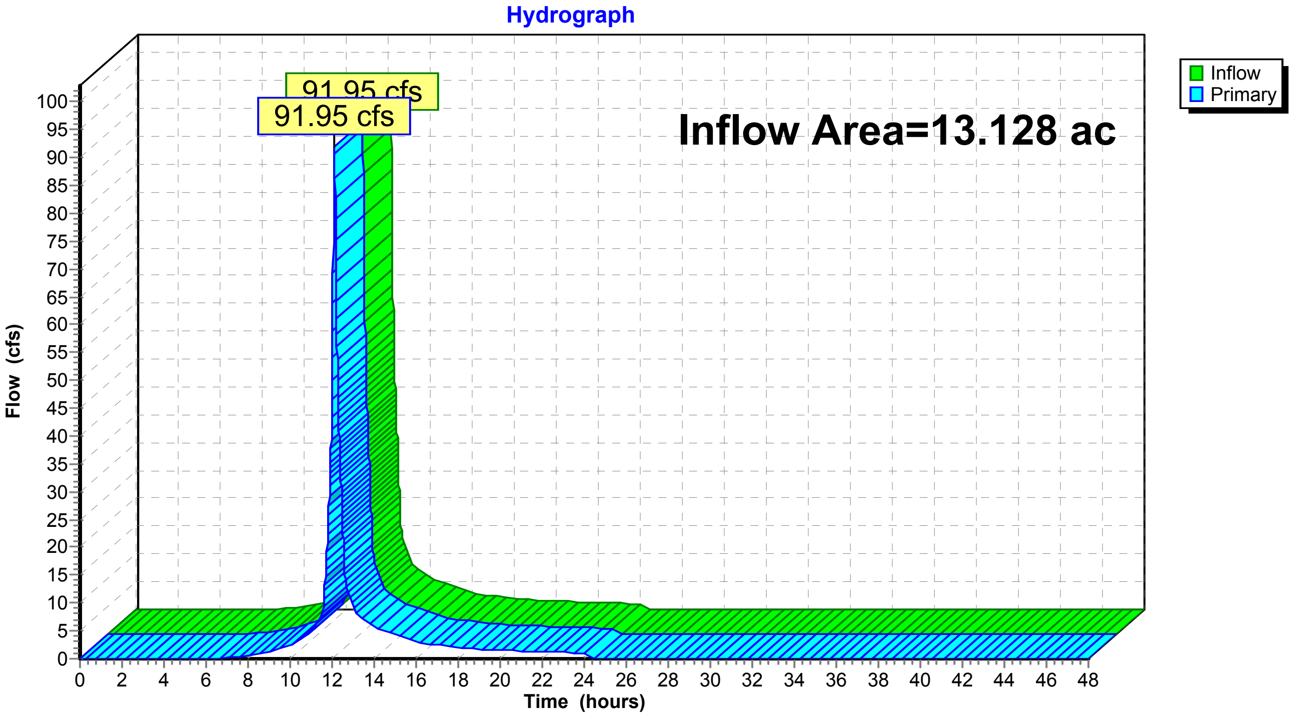
Summary for Pond 78P: C-6

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      13.128 ac,   0.00% Impervious,  Inflow Depth =   6.38"    for  25 yr 24 hr event
Inflow      =      91.95 cfs @   12.11 hrs,  Volume=          6.978 af
Primary     =      91.95 cfs @   12.11 hrs,  Volume=          6.978 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 78P: C-6



Summary for Pond 92P: Temp Pond 4 (EC-7)

Inflow Area = 32.540 ac, 0.00% Impervious, Inflow Depth = 8.01" for 25 yr 24 hr event
Inflow = 288.01 cfs @ 12.08 hrs, Volume= 21.731 af
Outflow = 50.92 cfs @ 12.54 hrs, Volume= 21.729 af, Atten= 82%, Lag= 27.2 min
Primary = 50.92 cfs @ 12.54 hrs, Volume= 21.729 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 237.54' @ 12.54 hrs Surf.Area= 2.373 ac Storage= 7.504 af

Plug-Flow detention time= 63.0 min calculated for 21.729 af (100% of inflow)
Center-of-Mass det. time= 62.9 min (842.2 - 779.3)

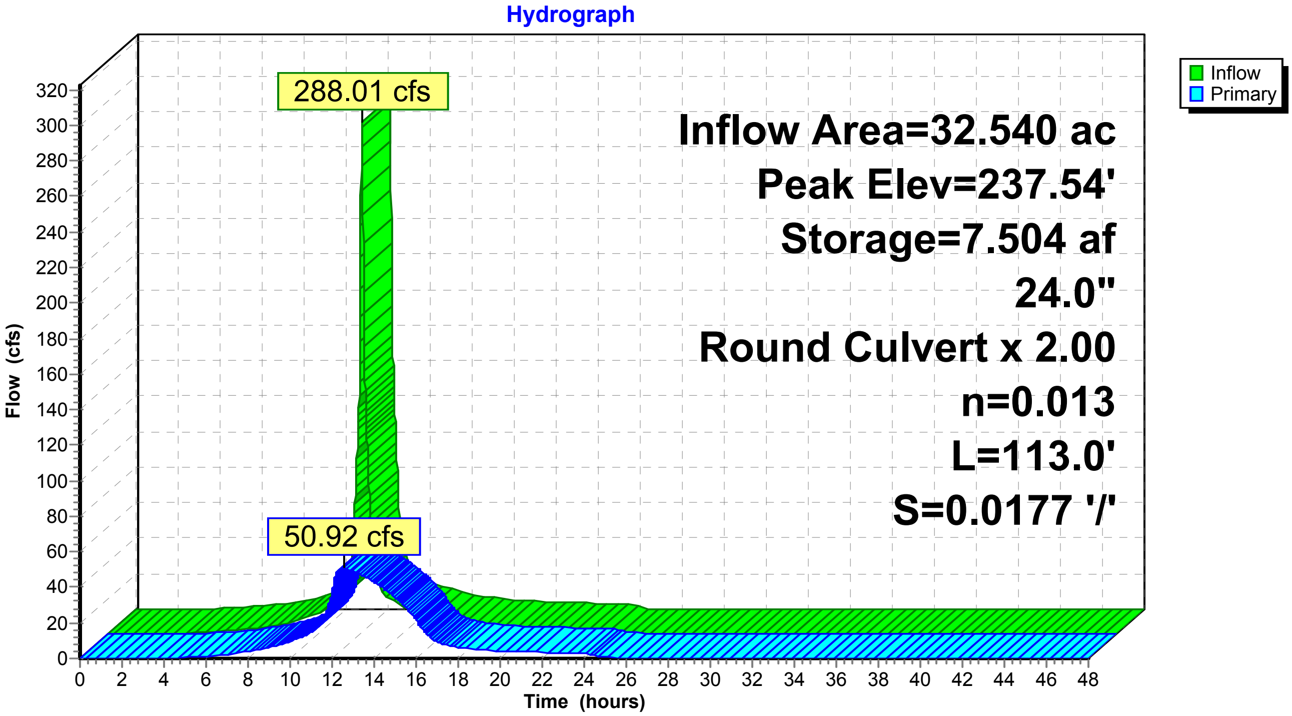
Volume	Invert	Avail.Storage	Storage Description
#1	232.00'	14.078 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
232.00	0.183	0.000	0.000
234.00	0.994	1.177	1.177
236.00	1.975	2.969	4.146
238.00	2.490	4.465	8.611
240.00	2.977	5.467	14.078

Device	Routing	Invert	Outlet Devices
#1	Primary	232.00'	**24.0" Round 36" culvert X 2.00** L= 113.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.00' / 230.00' S= 0.0177 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=50.92 cfs @ 12.54 hrs HW=237.54' TW=230.05' (Dynamic Tailwater)
↳**1=36" culvert** (Inlet Controls 50.92 cfs @ 8.10 fps)

Pond 92P: Temp Pond 4 (EC-7)

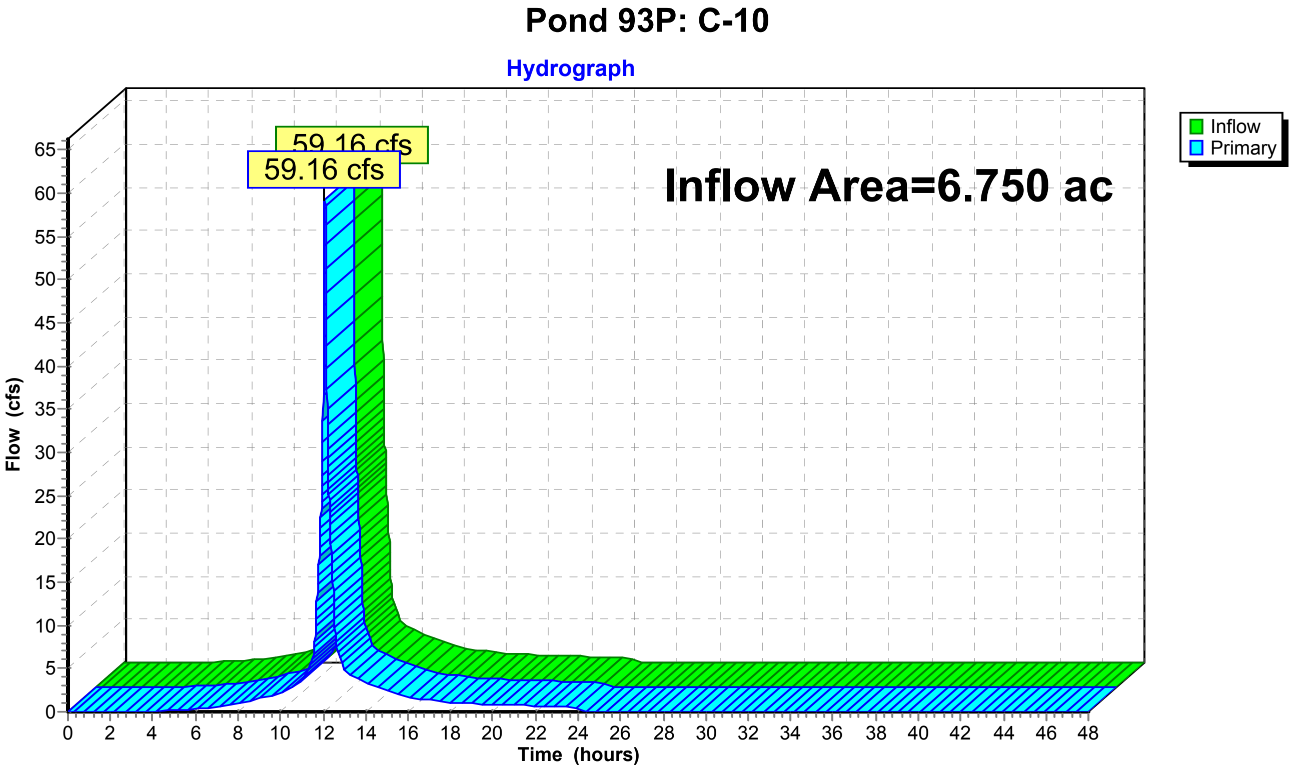


Summary for Pond 93P: C-10

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 0.00% Impervious, Inflow Depth = 7.89" for 25 yr 24 hr event
Inflow = 59.16 cfs @ 12.08 hrs, Volume= 4.438 af
Primary = 59.16 cfs @ 12.08 hrs, Volume= 4.438 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



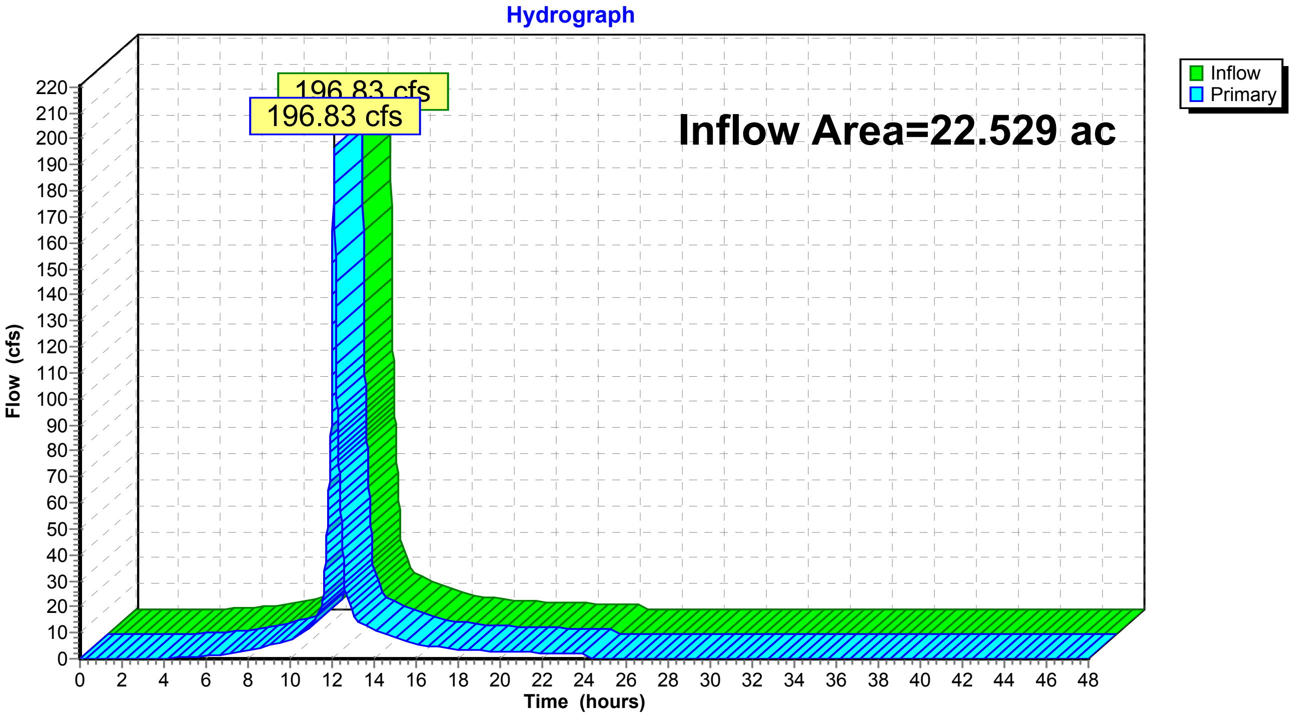
Summary for Pond 101P: C-9

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 22.529 ac, 0.00% Impervious, Inflow Depth = 7.89" for 25 yr 24 hr event
Inflow = 196.83 cfs @ 12.09 hrs, Volume= 14.812 af
Primary = 196.83 cfs @ 12.09 hrs, Volume= 14.812 af, Atten= 0%, Lag= 0.0 min

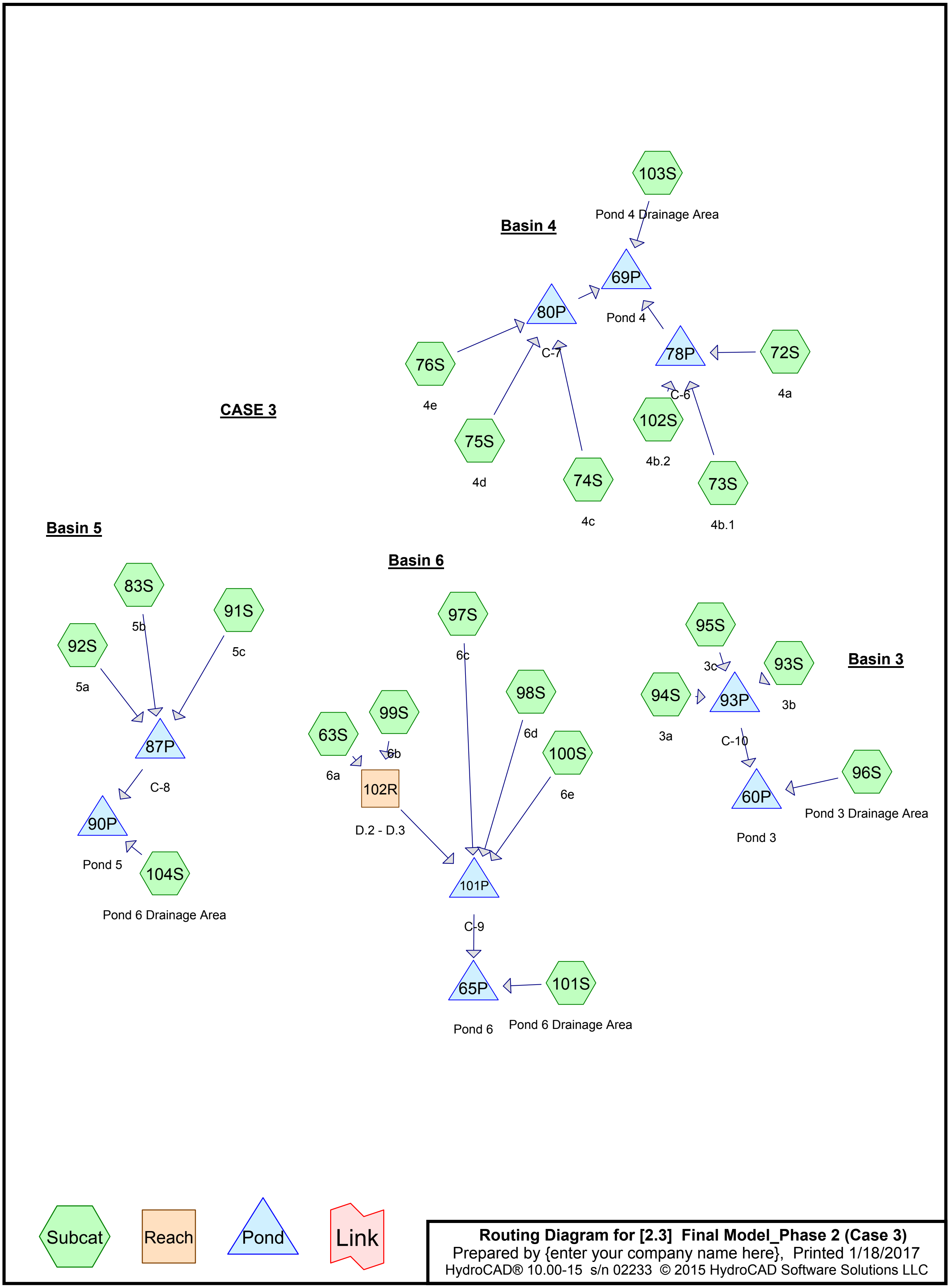
Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 101P: C-9



Appendix 1

HydroCAD Output – Case 3



Routing Diagram for [2.3] Final Model_Phase 2 (Case 3)
Prepared by {enter your company name here}, Printed 1/18/2017
HydroCAD® 10.00-15 s/n 02233 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.686	79	Pasture/grassland/range, Good, HSG C (63S, 99S)
40.227	74	Pasture/grassland/range, Good, HSG C (72S, 73S, 93S, 94S, 95S, 97S, 98S, 100S, 102S)
28.123	86	Pasture/grassland/range, Good, HSG C (74S, 75S, 76S, 83S, 91S, 92S)
11.100	98	Water Surface, HSG A (96S, 101S, 103S, 104S)
86.136	**81**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
11.100	HSG A	96S, 101S, 103S, 104S
0.000	HSG B	
75.036	HSG C	63S, 72S, 73S, 74S, 75S, 76S, 83S, 91S, 92S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S
0.000	HSG D	
0.000	Other	
86.136		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	75.036	0.000	0.000	75.036	Pasture/grassland/range, Good	63S, 72S, 73S, 74S, 75S, 76S, 83S, 91S, 92S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S
11.100	0.000	0.000	0.000	0.000	11.100	Water Surface	96S, 101S, 103S, 104S

Ground Covers (all nodes) (continued)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
11.100	**0.000**	**75.036**	**0.000**	**0.000**	**86.136**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	73S	0.00	0.00	813.0	0.2424	0.020	18.0	0.0	0.0
2	74S	0.00	0.00	594.0	0.2424	0.020	18.0	0.0	0.0
3	75S	0.00	0.00	540.0	0.1954	0.020	18.0	0.0	0.0
4	83S	0.00	0.00	437.0	0.2194	0.020	18.0	0.0	0.0
5	91S	0.00	0.00	594.0	0.2424	0.020	18.0	0.0	0.0
6	95S	0.00	0.00	655.0	0.2366	0.020	18.0	0.0	0.0
7	97S	0.00	0.00	726.0	0.2449	0.020	18.0	0.0	0.0
8	98S	0.00	0.00	189.0	0.1793	0.020	18.0	0.0	0.0
9	99S	0.00	0.00	438.0	0.2457	0.020	18.0	0.0	0.0
10	60P	211.00	210.00	100.0	0.0100	0.013	12.0	0.0	0.0
11	65P	214.00	213.50	100.0	0.0050	0.013	24.0	0.0	0.0
12	69P	225.00	224.00	108.0	0.0093	0.013	36.0	0.0	0.0
13	90P	252.00	251.00	80.0	0.0125	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 63S: 6a Runoff Area=0.306 ac 0.00% Impervious Runoff Depth=7.01"
Flow Length=37' Slope=0.2500 '/' Tc=6.0 min CN=79 Runoff=2.46 cfs 0.179 af

Subcatchment 72S: 4a Runoff Area=0.328 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=18' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=2.43 cfs 0.174 af

Subcatchment 73S: 4b.1 Runoff Area=15.830 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,200' Tc=7.7 min CN=74 Runoff=110.71 cfs 8.414 af

Subcatchment 74S: 4c Runoff Area=10.679 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=1,002' Tc=6.0 min CN=86 Runoff=93.59 cfs 7.021 af

Subcatchment 75S: 4d Runoff Area=6.396 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=831' Tc=6.0 min CN=86 Runoff=56.06 cfs 4.205 af

Subcatchment 76S: 4e Runoff Area=0.866 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=71' Slope=0.2500 '/' Tc=6.0 min CN=86 Runoff=7.59 cfs 0.569 af

Subcatchment 83S: 5b Runoff Area=7.368 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=1,001' Tc=6.0 min CN=86 Runoff=64.58 cfs 4.844 af

Subcatchment 91S: 5c Runoff Area=1.322 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=1,002' Tc=6.0 min CN=86 Runoff=11.59 cfs 0.869 af

Subcatchment 92S: 5a Runoff Area=1.492 ac 0.00% Impervious Runoff Depth=7.89"
Flow Length=81' Slope=0.2500 '/' Tc=6.0 min CN=86 Runoff=13.08 cfs 0.981 af

Subcatchment 93S: 3b Runoff Area=0.400 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=80' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=2.97 cfs 0.213 af

Subcatchment 94S: 3a Runoff Area=0.590 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=85' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=4.37 cfs 0.314 af

Subcatchment 95S: 3c Runoff Area=5.760 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=980' Tc=6.0 min CN=74 Runoff=42.71 cfs 3.062 af

Subcatchment 96S: Pond 3 Drainage Area Runoff Area=1.359 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=12.82 cfs 1.060 af

Subcatchment 97S: 6c Runoff Area=12.080 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,019' Tc=7.1 min CN=74 Runoff=86.19 cfs 6.421 af

Subcatchment 98S: 6d Runoff Area=3.837 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=575' Tc=6.0 min CN=74 Runoff=28.45 cfs 2.040 af

Subcatchment 99S: 6b Runoff Area=6.380 ac 0.00% Impervious Runoff Depth=7.01"
Flow Length=837' Tc=6.0 min CN=79 Runoff=51.29 cfs 3.728 af

Subcatchment 100S: 6e Runoff Area=0.932 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=79' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=6.91 cfs 0.495 af

Subcatchment 101S: Pond 6 Drainage Area Runoff Area=4.653 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=43.89 cfs 3.629 af

Subcatchment 102S: 4b.2 Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=47' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=3.48 cfs 0.250 af

Subcatchment 103S: Pond 4 Drainage Area Runoff Area=2.810 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=26.50 cfs 2.192 af

Subcatchment 104S: Pond 6 Drainage Area Runoff Area=2.278 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=21.49 cfs 1.777 af

Reach 102R: D.2 - D.3 Avg. Flow Depth=1.10' Max Vel=4.98 fps Inflow=53.75 cfs 3.907 af
n=0.027 L=230.0' S=0.0100 '/' Capacity=242.37 cfs Outflow=53.34 cfs 3.907 af

Pond 60P: Pond 3 Peak Elev=216.38' Storage=4.183 af Inflow=62.86 cfs 4.648 af
Outflow=0.49 cfs 1.366 af

Pond 65P: Pond 6 Peak Elev=219.87' Storage=13.261 af Inflow=217.34 cfs 16.492 af
Outflow=6.48 cfs 4.934 af

Pond 69P: Pond 4 Peak Elev=231.51' Storage=9.128 af Inflow=297.64 cfs 22.826 af
36.0" Round Culvert n=0.013 L=108.0' S=0.0093 '/' Outflow=60.15 cfs 22.736 af

Pond 78P: C-6 Inflow=116.43 cfs 8.838 af
Primary=116.43 cfs 8.838 af

Pond 80P: C-7 Inflow=157.24 cfs 11.796 af
Primary=157.24 cfs 11.796 af

Pond 87P: C-8 Inflow=89.24 cfs 6.694 af
Primary=89.24 cfs 6.694 af

Pond 90P: Pond 5 Peak Elev=257.04' Storage=4.289 af Inflow=110.72 cfs 8.471 af
Outflow=24.00 cfs 6.978 af

Pond 93P: C-10 Inflow=50.05 cfs 3.588 af
Primary=50.05 cfs 3.588 af

Pond 101P: C-9 Inflow=174.19 cfs 12.863 af
Primary=174.19 cfs 12.863 af

Total Runoff Area = 86.136 ac Runoff Volume = 52.437 af Average Runoff Depth = 7.31"
87.11% Pervious = 75.036 ac 12.89% Impervious = 11.100 ac

Summary for Subcatchment 63S: 6a

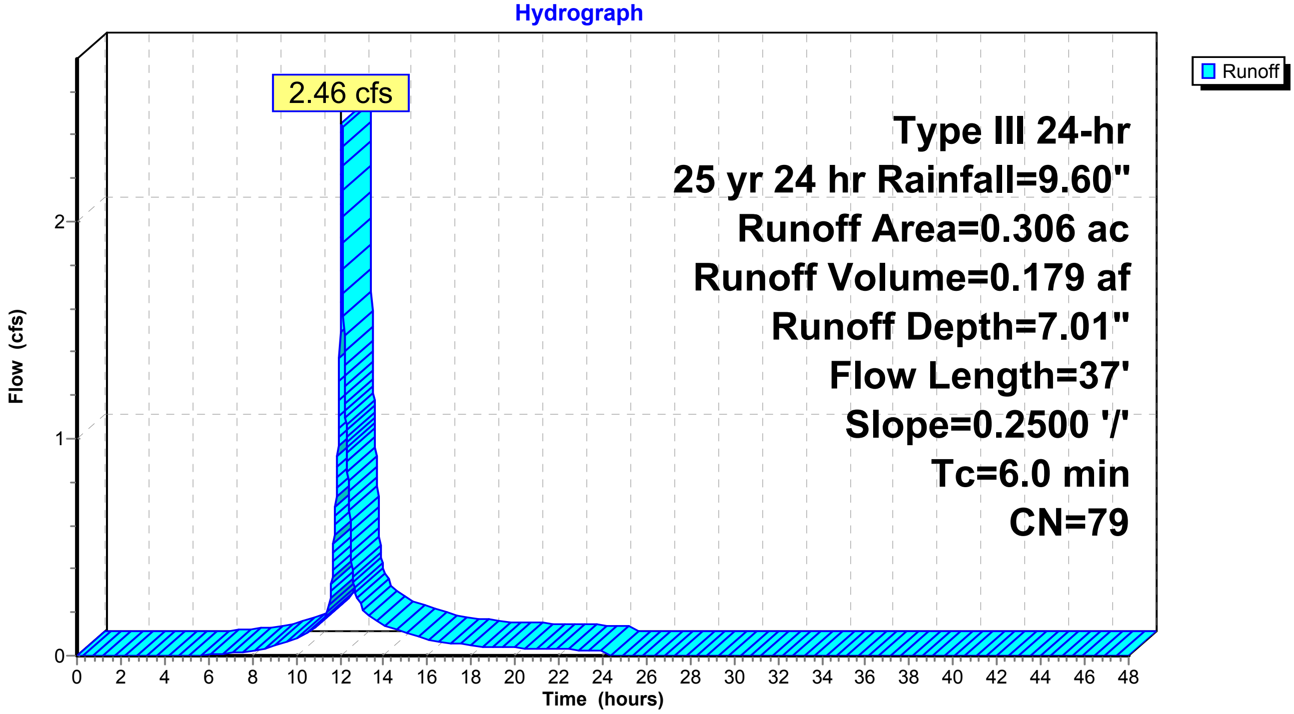
Runoff = 2.46 cfs @ 12.09 hrs, Volume= 0.179 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.306	79	Pasture/grassland/range, Good, HSG C
	0.306		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	37	0.2500	0.54		**Sheet Flow,** n= 0.136 P2= 5.40"
1.1	37	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 63S: 6a



Summary for Subcatchment 72S: 4a

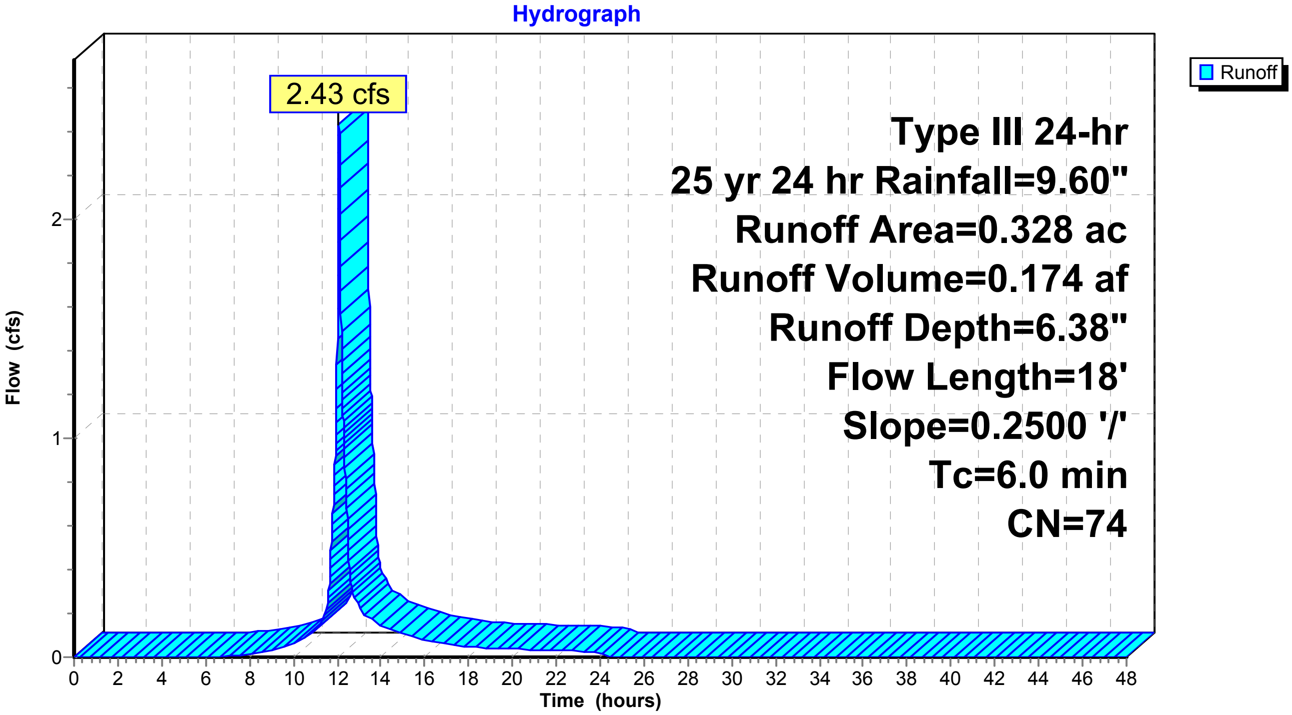
Runoff = 2.43 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.328	74	Pasture/grassland/range, Good, HSG C
0.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	18	0.2500	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.6	18	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 72S: 4a



Summary for Subcatchment 73S: 4b.1

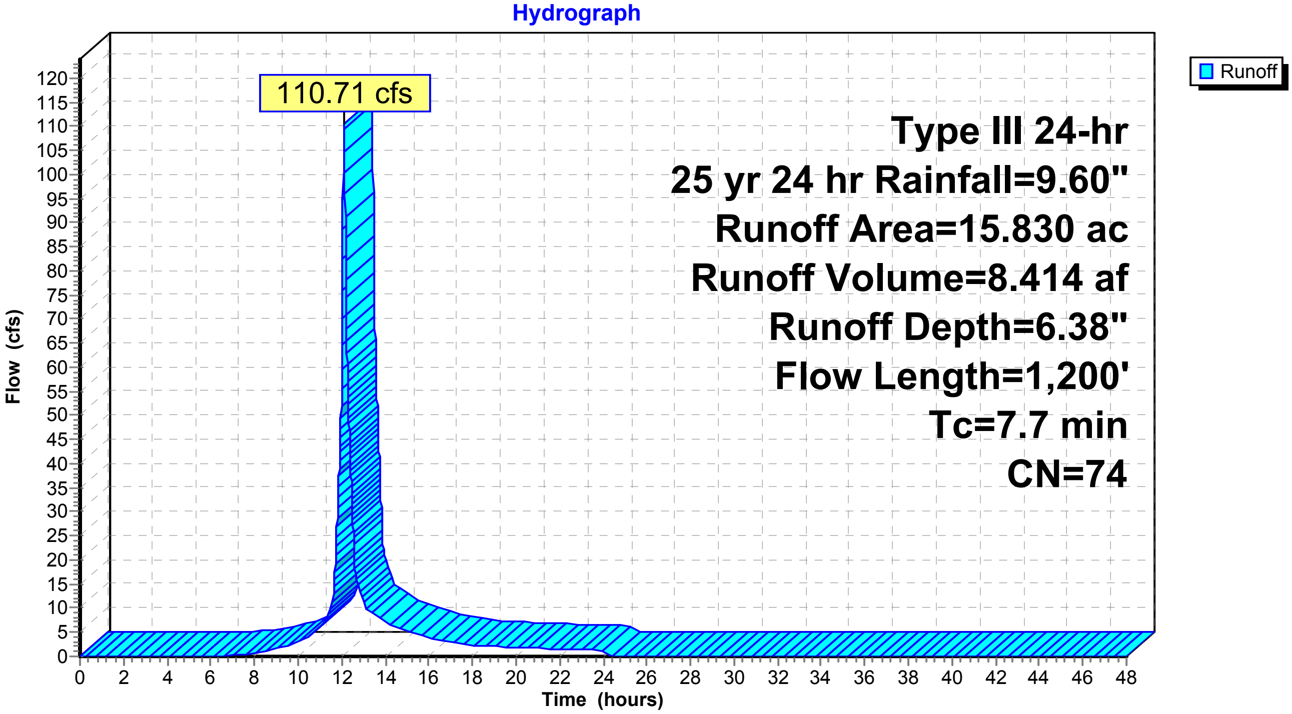
Runoff = 110.71 cfs @ 12.11 hrs, Volume= 8.414 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
15.830	74	Pasture/grassland/range, Good, HSG C
15.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	187	0.0802	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.4	200	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.7	813	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.7	1,200	Total			

Subcatchment 73S: 4b.1



Summary for Subcatchment 74S: 4c

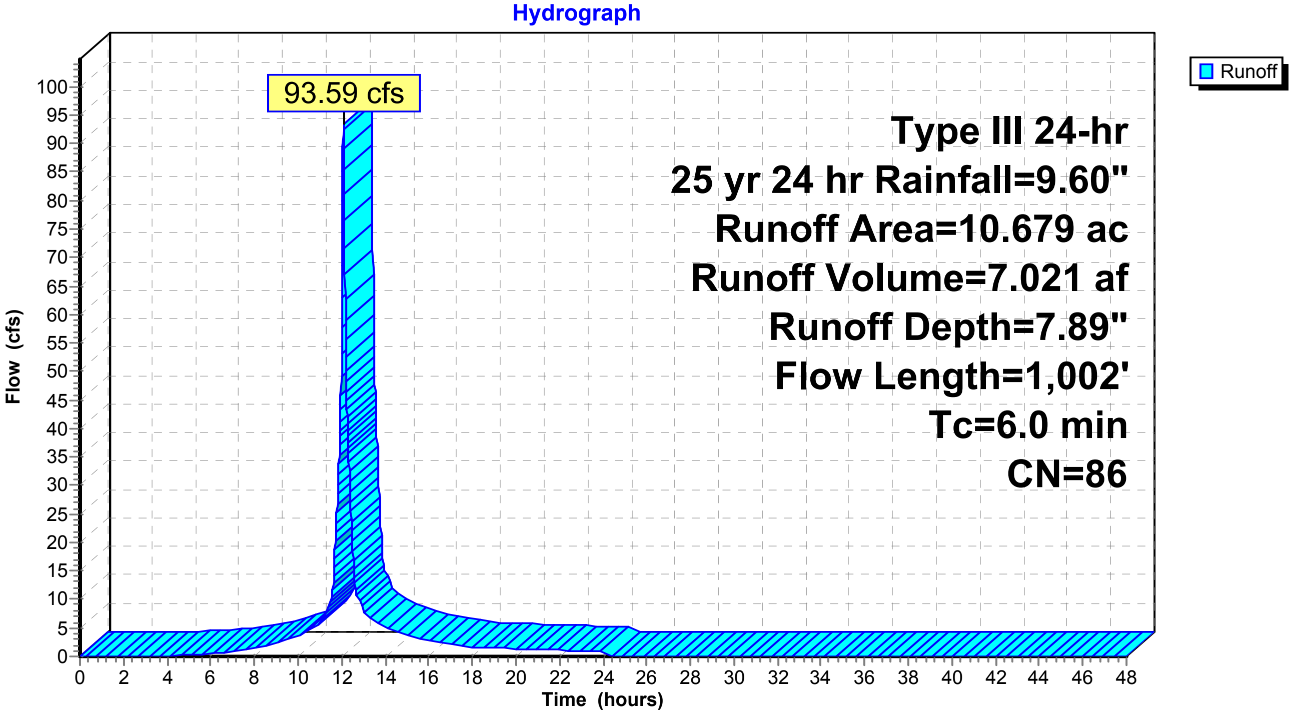
Runoff = 93.59 cfs @ 12.08 hrs, Volume= 7.021 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	10.679	86	Pasture/grassland/range, Good, HSG C
	10.679		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	107	0.1878	1.26		**Sheet Flow,** n= 0.053 P2= 5.40"
0.7	301	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	594	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
2.6	1,002	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 74S: 4c



Summary for Subcatchment 75S: 4d

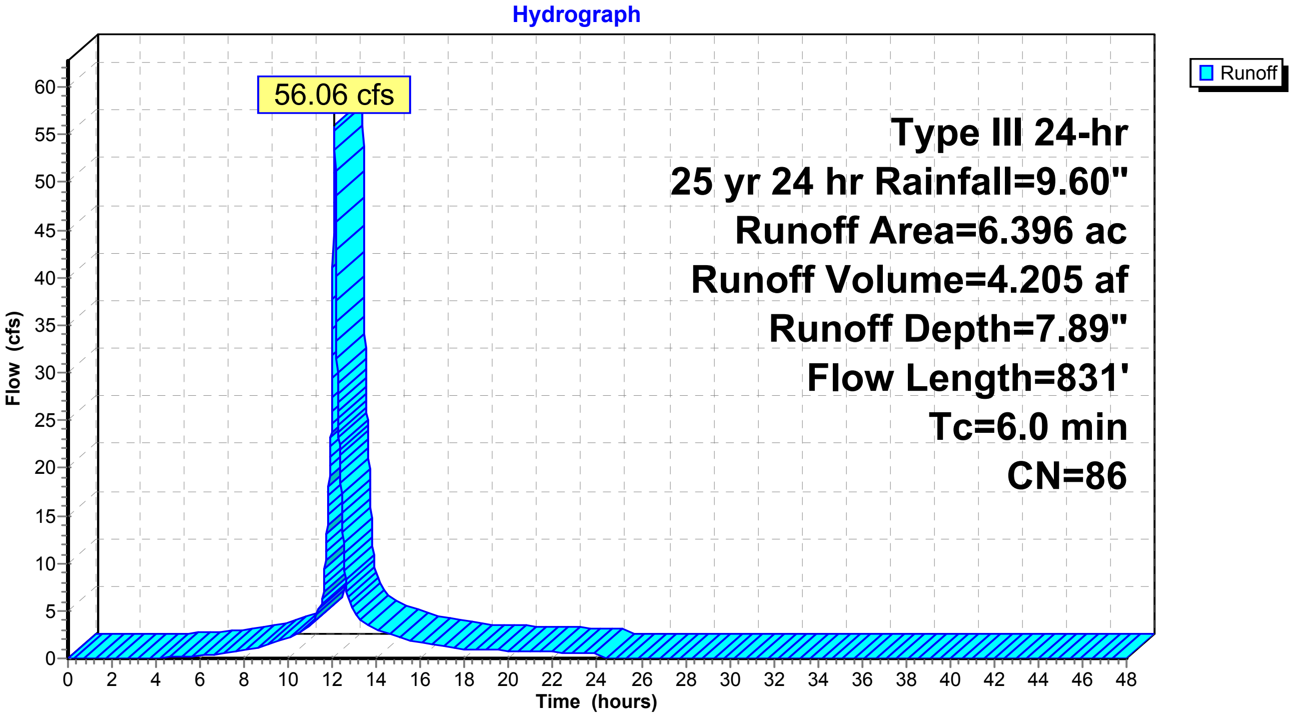
Runoff = 56.06 cfs @ 12.08 hrs, Volume= 4.205 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	6.396	86	Pasture/grassland/range, Good, HSG C
	6.396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	67	0.0598	0.73		**Sheet Flow,** n= 0.053 P2= 5.40"
0.5	224	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	540	0.1954	17.08	30.18	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
2.5	831	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 75S: 4d



Summary for Subcatchment 76S: 4e

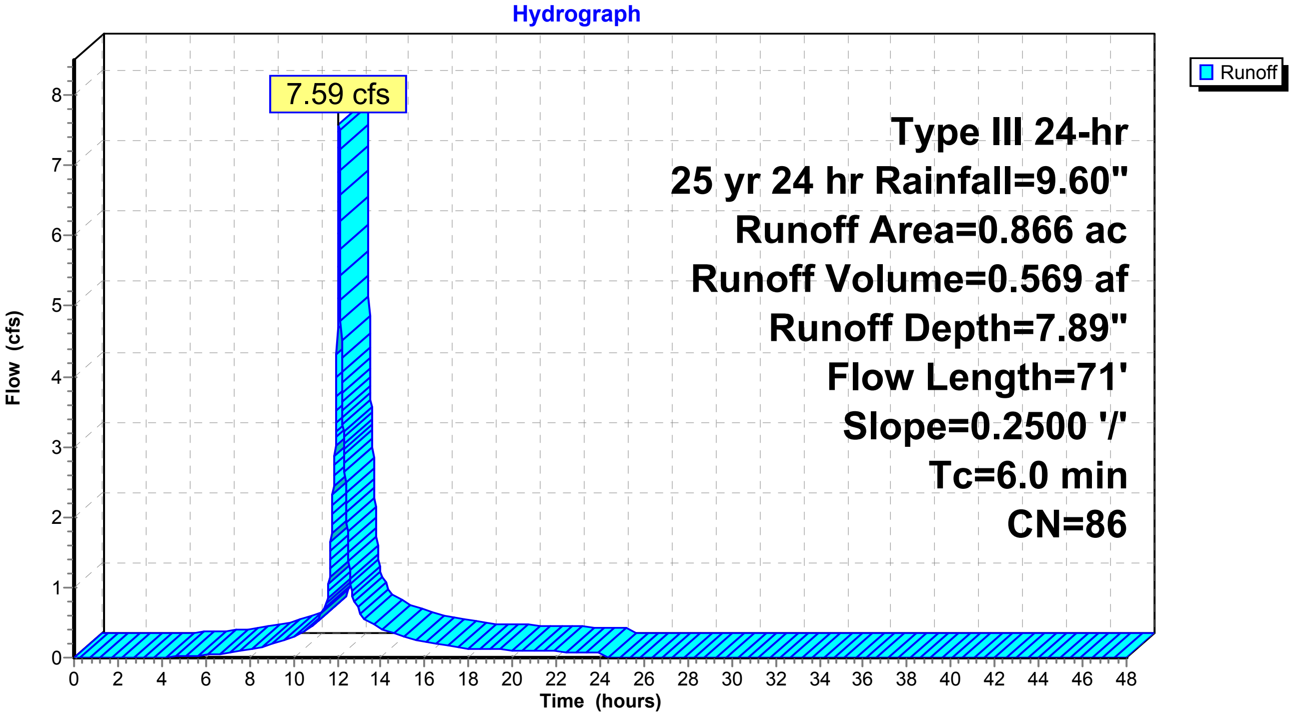
Runoff = 7.59 cfs @ 12.08 hrs, Volume= 0.569 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.866	86	Pasture/grassland/range, Good, HSG C
	0.866		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	71	0.2500	1.25		**Sheet Flow,** n= 0.056 P2= 5.40"
0.9	71	Total,	Increased to minimum Tc = 6.0 min		

Subcatchment 76S: 4e



Summary for Subcatchment 83S: 5b

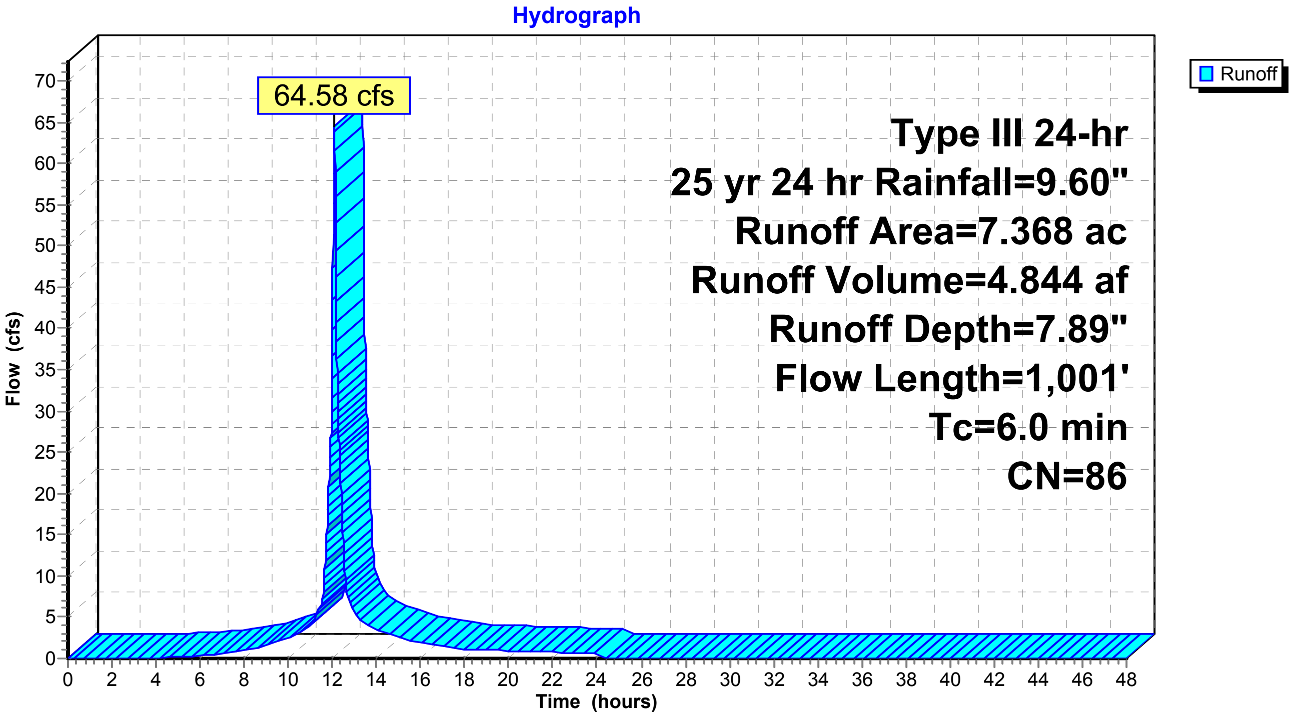
Runoff = 64.58 cfs @ 12.08 hrs, Volume= 4.844 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	7.368	86	Pasture/grassland/range, Good, HSG C
	7.368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	102	0.1961	1.27		**Sheet Flow,** n= 0.053 P2= 5.40"
1.0	462	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.4	437	0.2194	18.10	31.98	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
2.7	1,001	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 83S: 5b



Summary for Subcatchment 91S: 5c

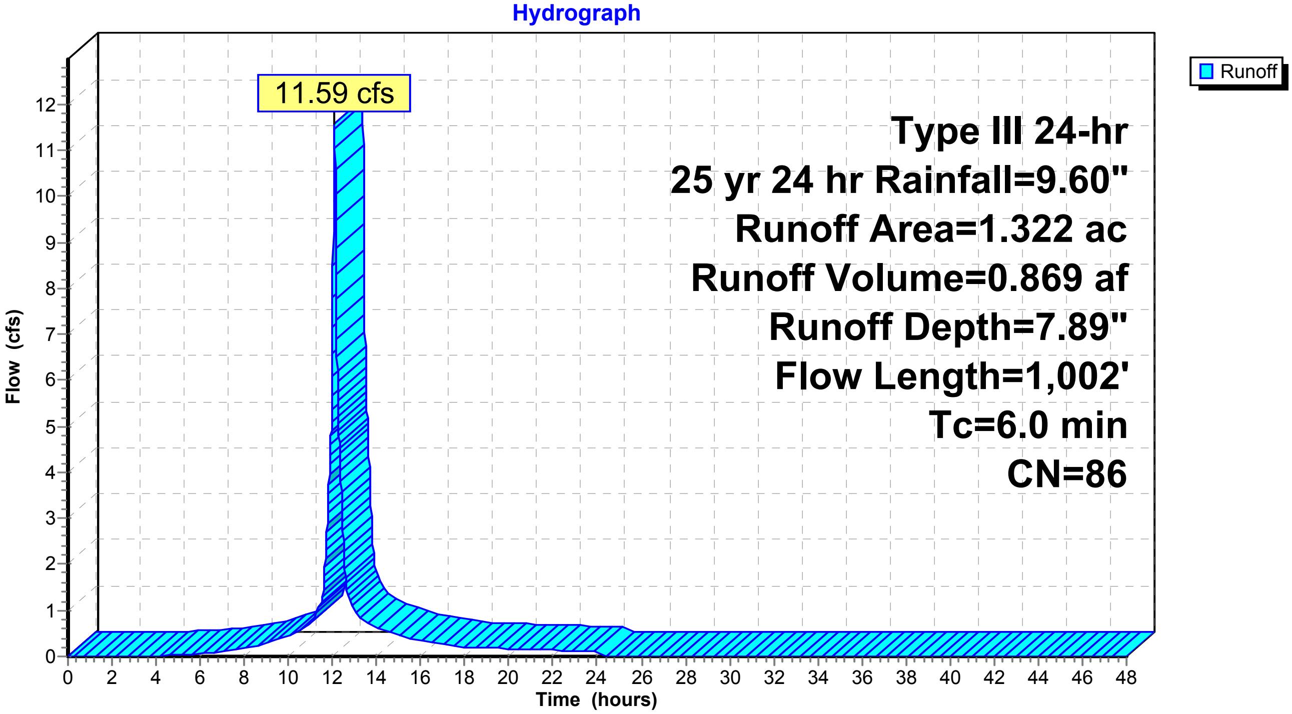
Runoff = 11.59 cfs @ 12.08 hrs, Volume= 0.869 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	1.322	86	Pasture/grassland/range, Good, HSG C
	1.322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	107	0.1878	1.26		**Sheet Flow,** n= 0.053 P2= 5.40"
0.7	301	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	594	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
2.6	1,002	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 91S: 5c



Summary for Subcatchment 92S: 5a

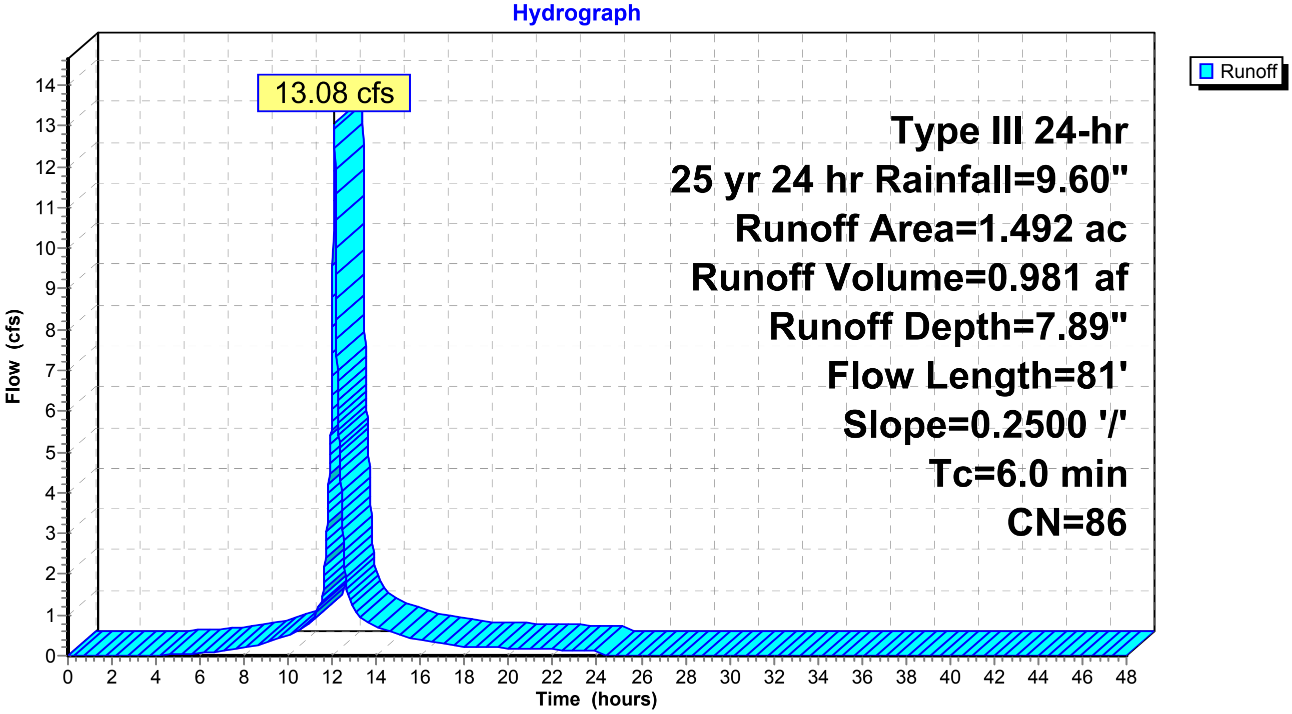
Runoff = 13.08 cfs @ 12.08 hrs, Volume= 0.981 af, Depth= 7.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	1.492	86	Pasture/grassland/range, Good, HSG C
	1.492		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	81	0.2500	1.34		**Sheet Flow,** n= 0.053 P2= 5.40"
1.0	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 92S: 5a



Summary for Subcatchment 93S: 3b

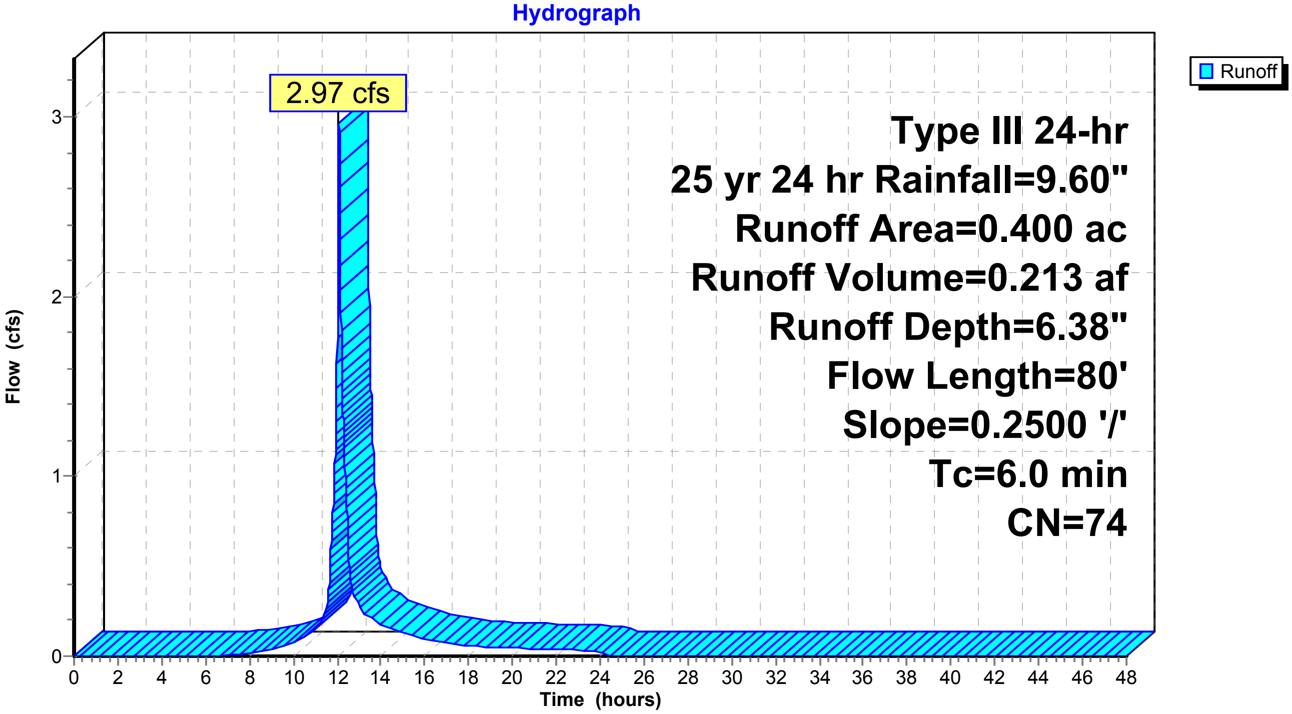
Runoff = 2.97 cfs @ 12.09 hrs, Volume= 0.213 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.400	74	Pasture/grassland/range, Good, HSG C
	0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	80	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 93S: 3b



Summary for Subcatchment 94S: 3a

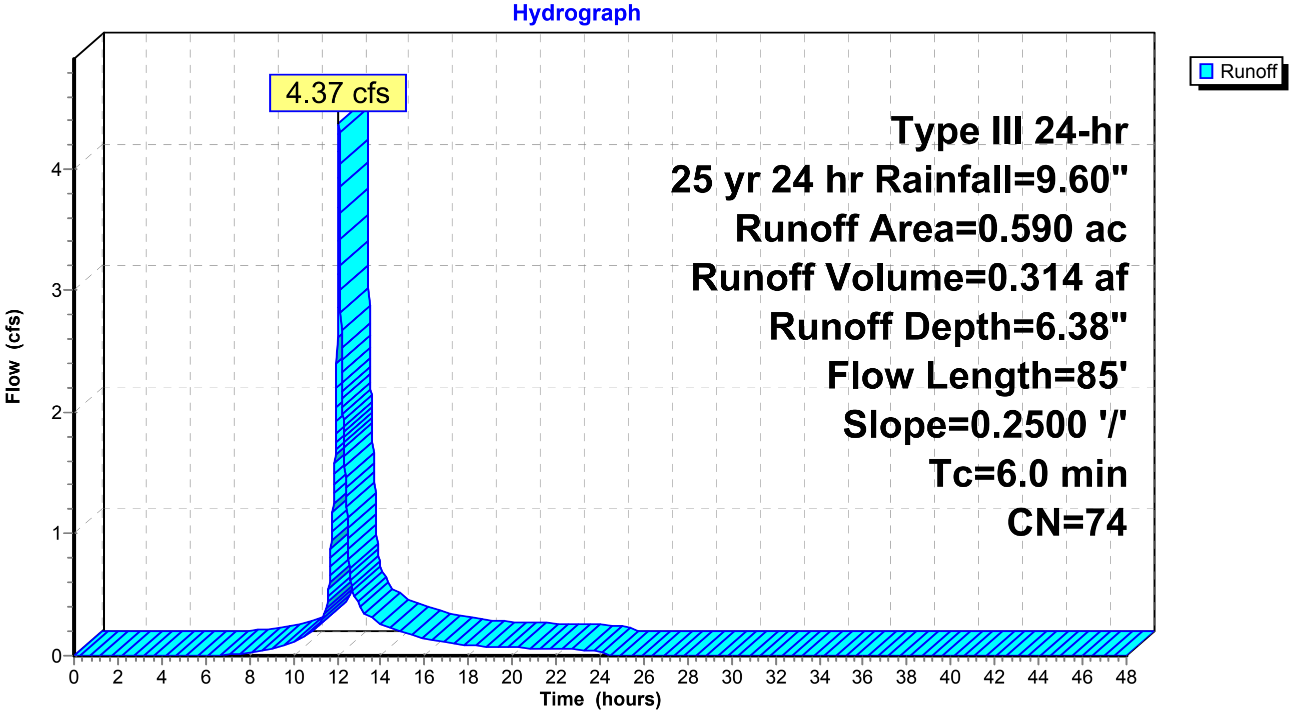
Runoff = 4.37 cfs @ 12.09 hrs, Volume= 0.314 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.590	74	Pasture/grassland/range, Good, HSG C
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	85	0.2500	0.64		**Sheet Flow,** n= 0.136 P2= 5.40"
2.2	85	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 94S: 3a



Summary for Subcatchment 95S: 3c

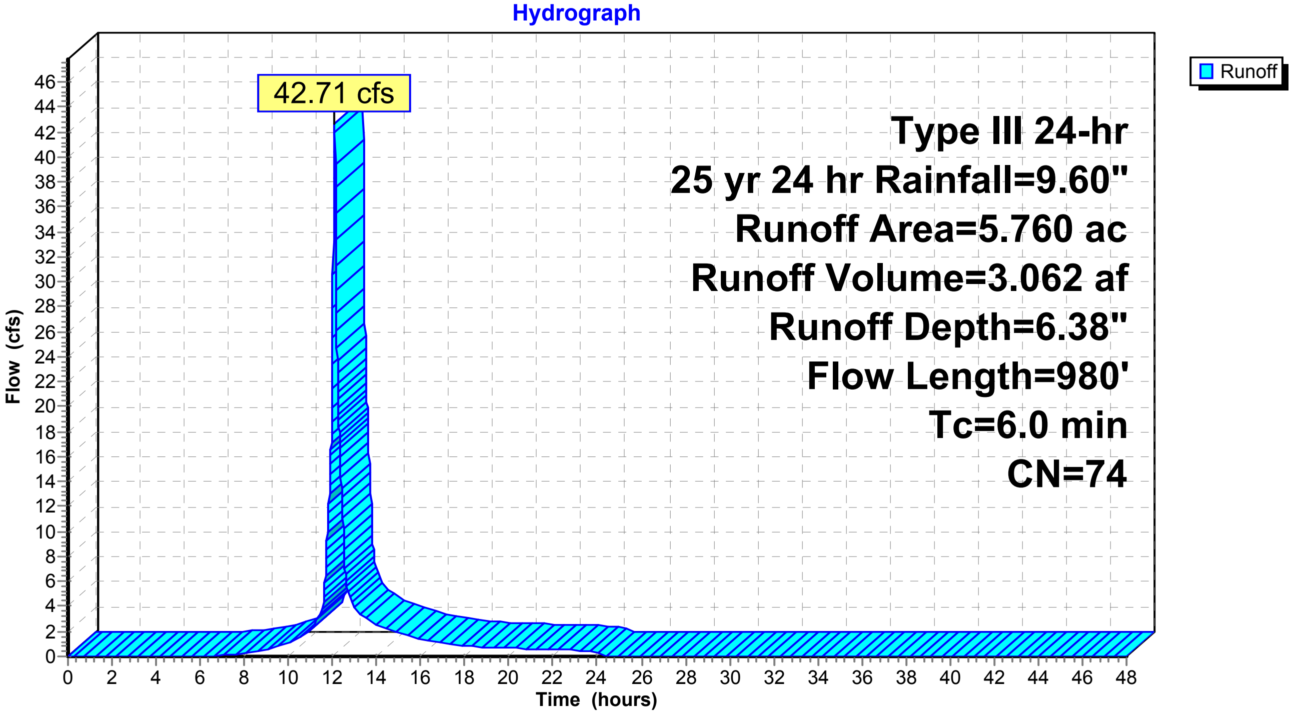
Runoff = 42.71 cfs @ 12.09 hrs, Volume= 3.062 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	5.760	74	Pasture/grassland/range, Good, HSG C
	5.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.5	245	0.0204	7.64	51.21	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	655	0.2366	18.79	33.21	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.2	980	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 95S: 3c



Summary for Subcatchment 96S: Pond 3 Drainage Area

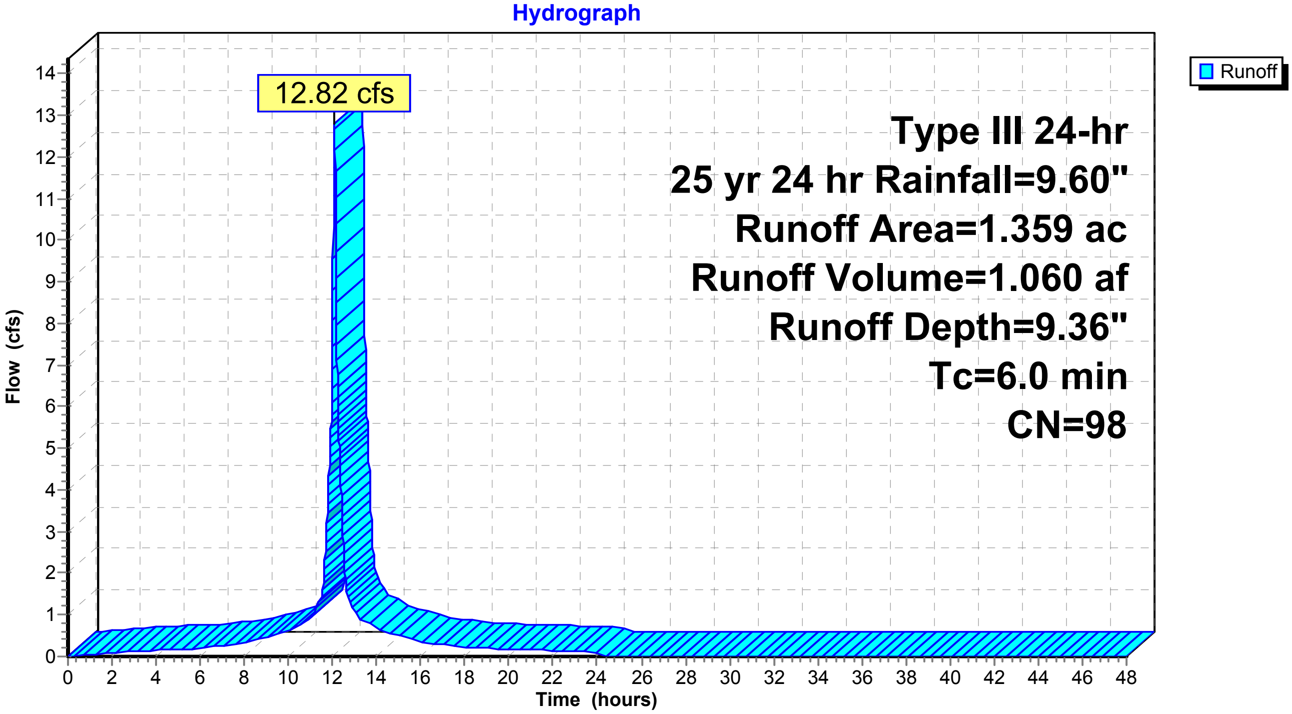
Runoff = 12.82 cfs @ 12.08 hrs, Volume= 1.060 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
1.359	98	Water Surface, HSG A
1.359		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 96S: Pond 3 Drainage Area



Summary for Subcatchment 97S: 6c

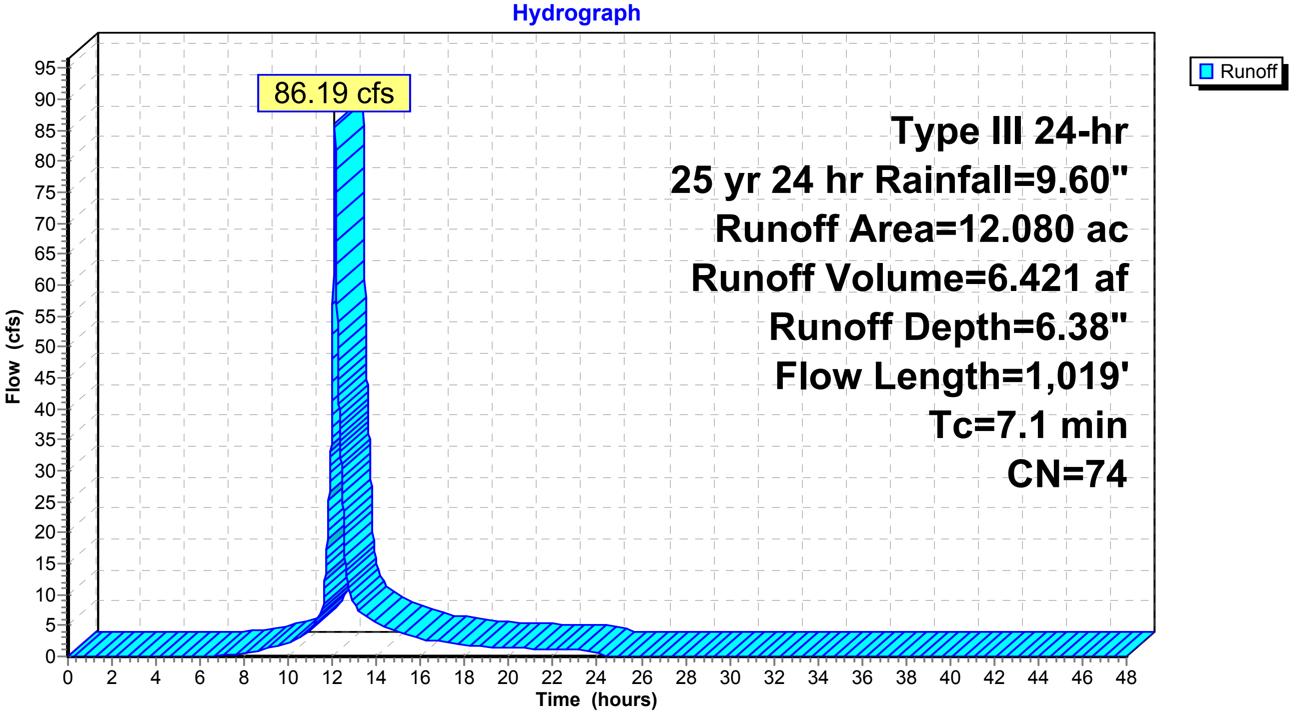
Runoff = 86.19 cfs @ 12.10 hrs, Volume= 6.421 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
12.080	74	Pasture/grassland/range, Good, HSG C
12.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	180	0.0833	0.48		**Sheet Flow,** n= 0.136 P2= 5.40"
0.2	113	0.0199	7.55	50.58	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	726	0.2449	19.12	33.79	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.1	1,019	Total			

Subcatchment 97S: 6c



Summary for Subcatchment 98S: 6d

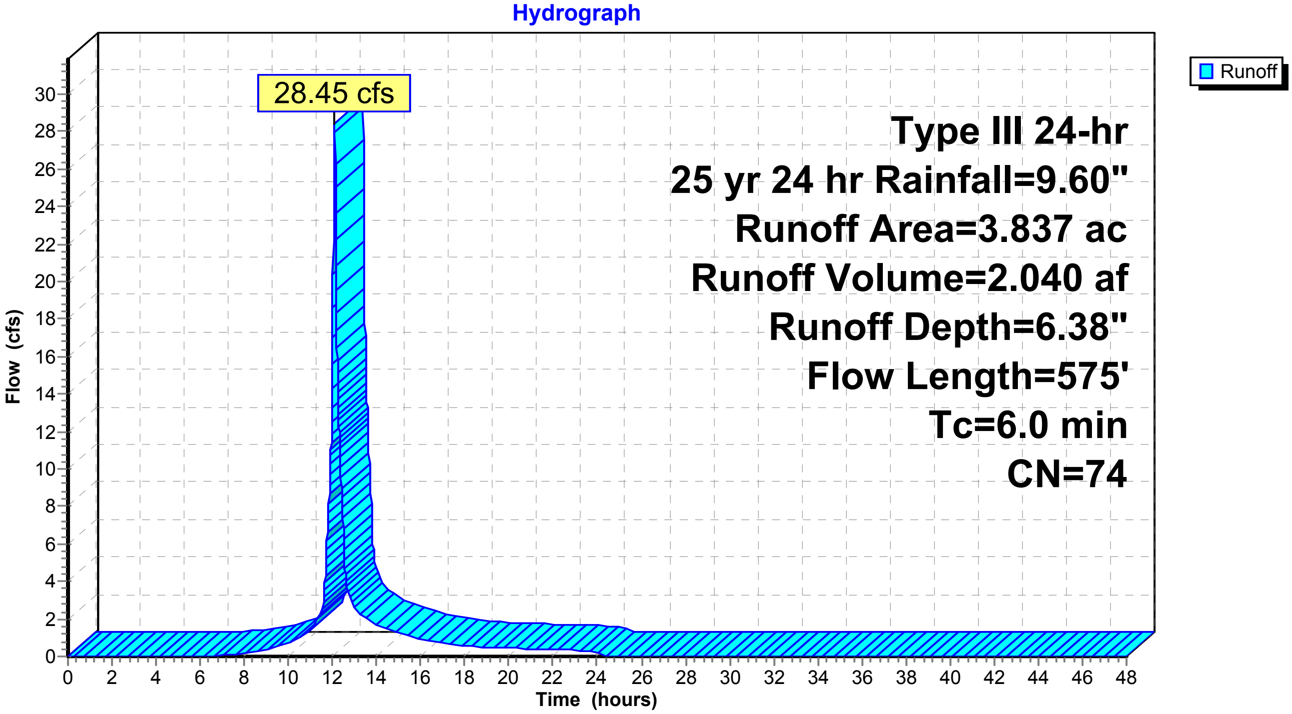
Runoff = 28.45 cfs @ 12.09 hrs, Volume= 2.040 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
3.837	74	Pasture/grassland/range, Good, HSG C
3.837		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	306	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.2	189	0.1793	16.36	28.91	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.0	575	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 98S: 6d



Summary for Subcatchment 99S: 6b

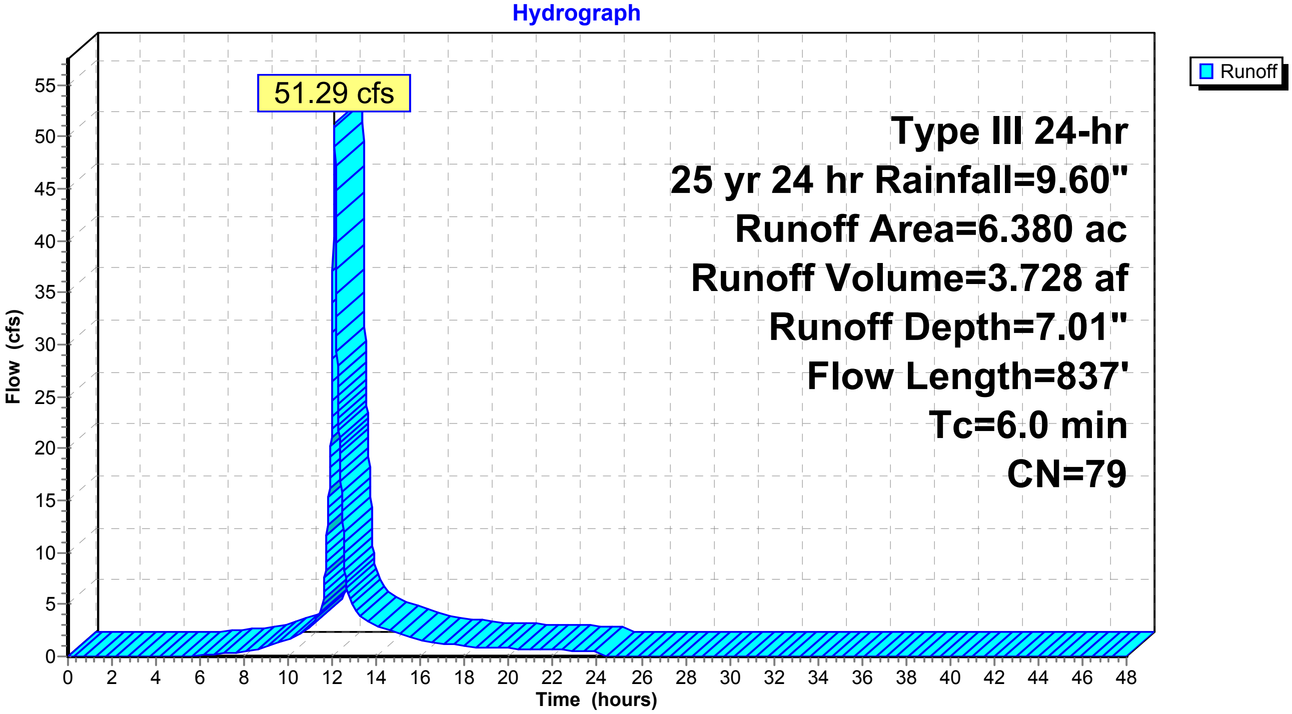
Runoff = 51.29 cfs @ 12.09 hrs, Volume= 3.728 af, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	6.380	79	Pasture/grassland/range, Good, HSG C
	6.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	81	0.2480	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	318	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.4	438	0.2457	19.15	33.84	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.3	837	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 99S: 6b



Summary for Subcatchment 100S: 6e

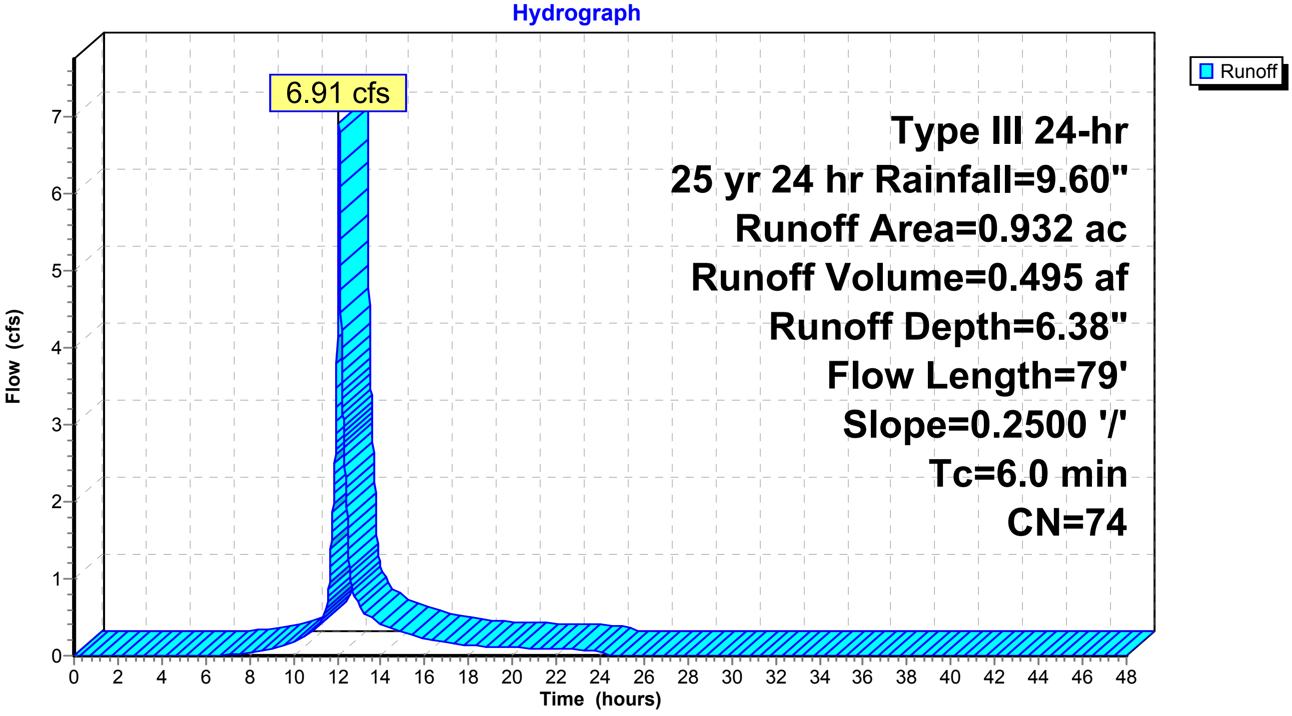
Runoff = 6.91 cfs @ 12.09 hrs, Volume= 0.495 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.932	74	Pasture/grassland/range, Good, HSG C
0.932		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	79	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	79	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 100S: 6e



Summary for Subcatchment 101S: Pond 6 Drainage Area

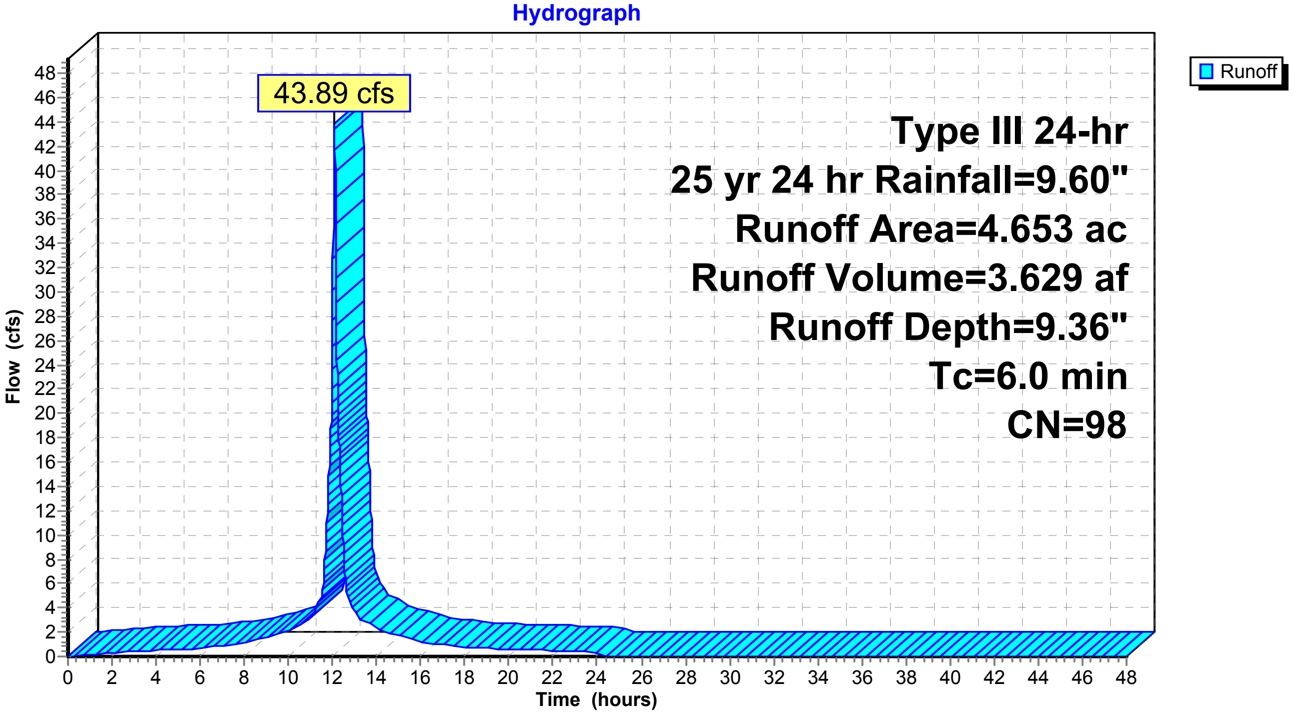
Runoff = 43.89 cfs @ 12.08 hrs, Volume= 3.629 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
4.653	98	Water Surface, HSG A
4.653		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 101S: Pond 6 Drainage Area



Summary for Subcatchment 102S: 4b.2

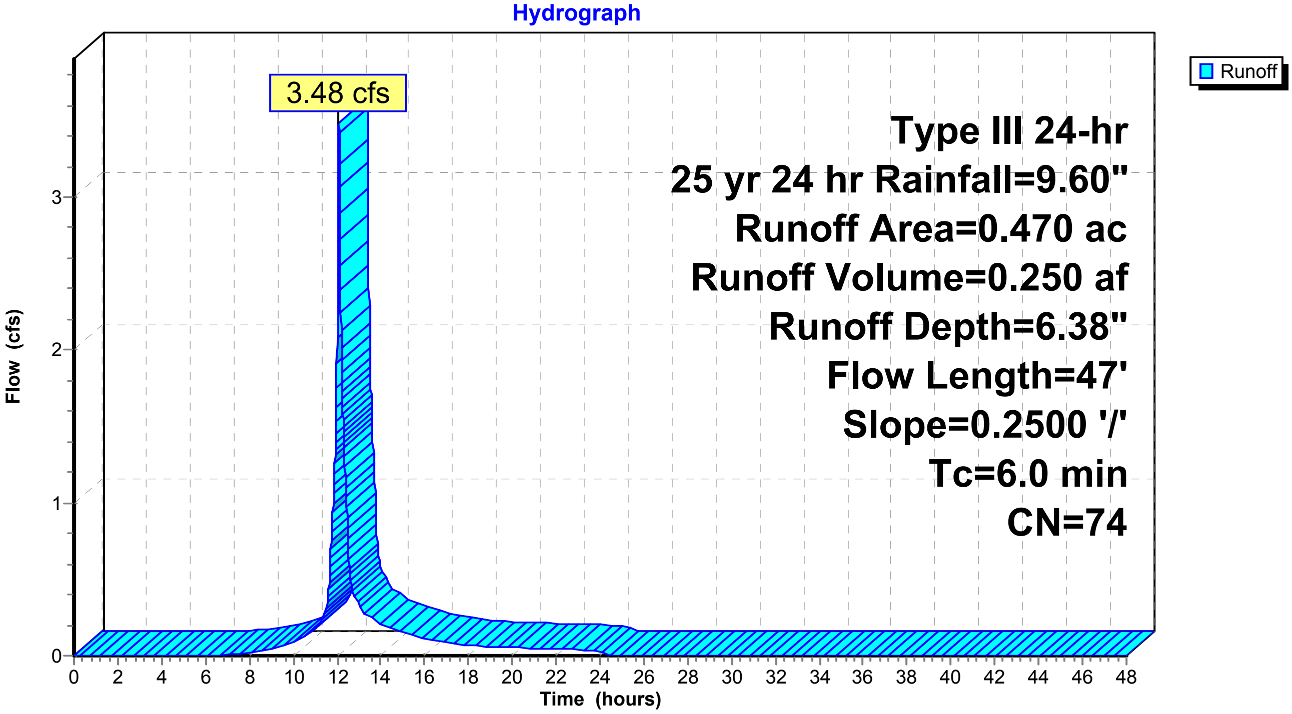
Runoff = 3.48 cfs @ 12.09 hrs, Volume= 0.250 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.470	74	Pasture/grassland/range, Good, HSG C
0.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	47	0.2500	0.56		**Sheet Flow,** n= 0.136 P2= 5.40"
1.4	47	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 102S: 4b.2



Summary for Subcatchment 103S: Pond 4 Drainage Area

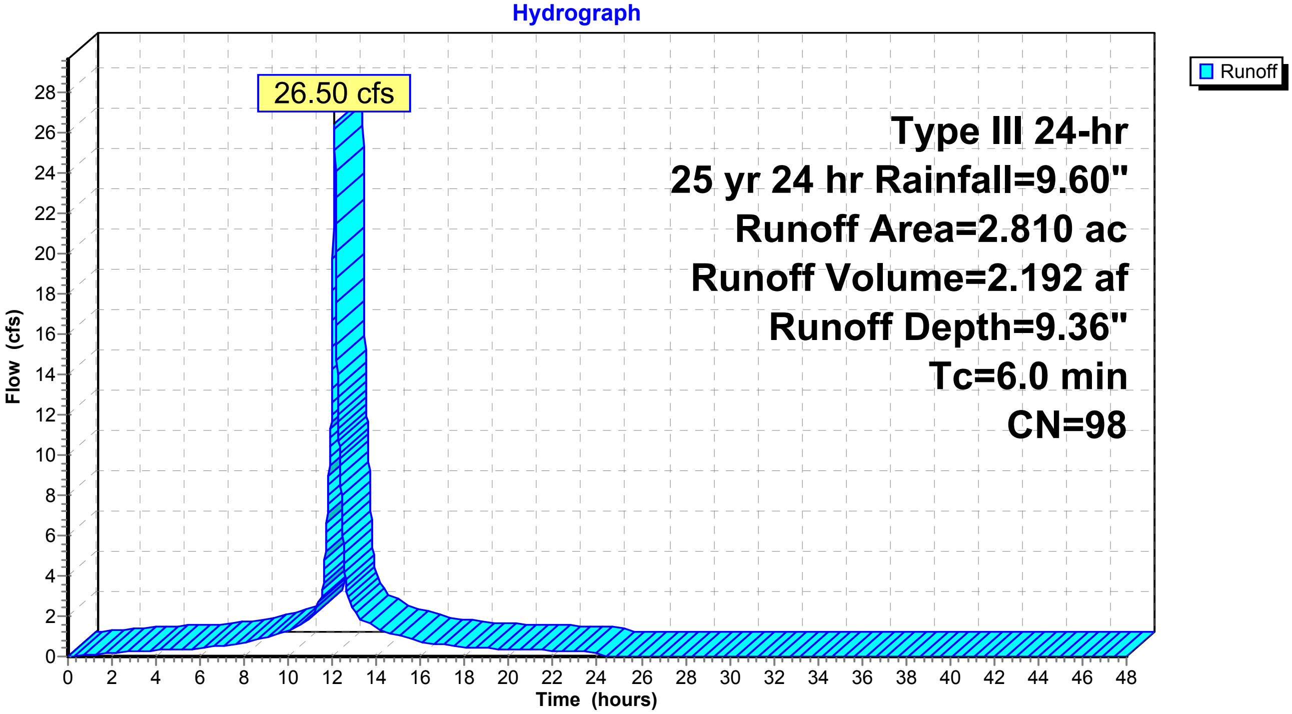
Runoff = 26.50 cfs @ 12.08 hrs, Volume= 2.192 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
2.810	98	Water Surface, HSG A
2.810		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 103S: Pond 4 Drainage Area



Summary for Subcatchment 104S: Pond 6 Drainage Area

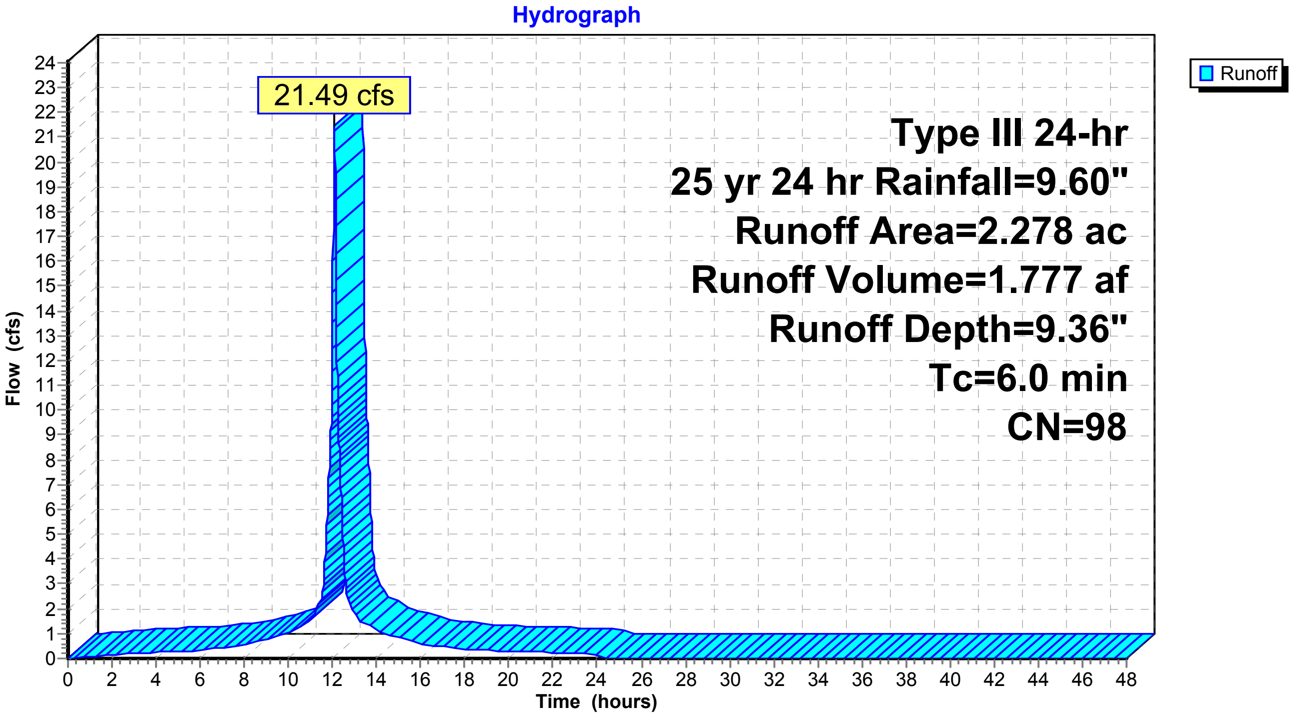
Runoff = 21.49 cfs @ 12.08 hrs, Volume= 1.777 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
2.278	98	Water Surface, HSG A
2.278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 104S: Pond 6 Drainage Area



Summary for Reach 102R: D.2 - D.3

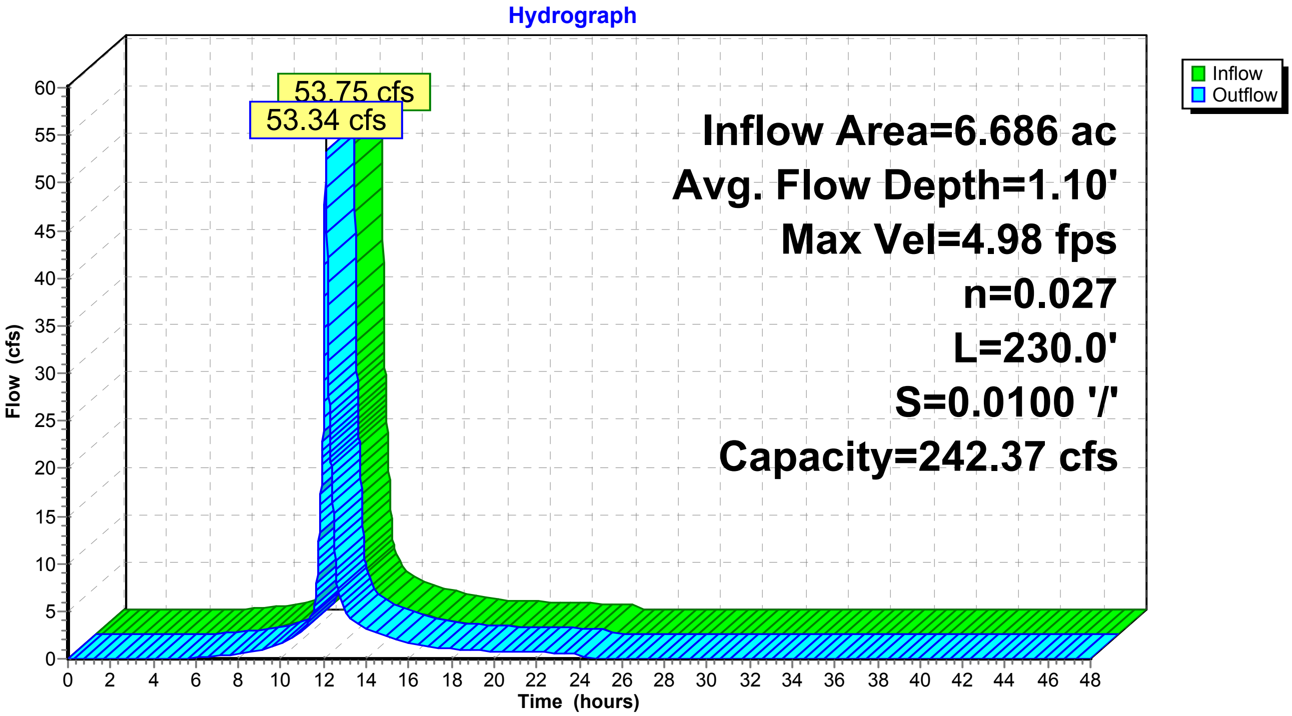
Inflow Area = 6.686 ac, 0.00% Impervious, Inflow Depth = 7.01" for 25 yr 24 hr event
Inflow = 53.75 cfs @ 12.09 hrs, Volume= 3.907 af
Outflow = 53.34 cfs @ 12.11 hrs, Volume= 3.907 af, Atten= 1%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.98 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 2.9 min

Peak Storage= 2,465 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.10'
Bank-Full Depth= 2.50' Flow Area= 31.3 sf, Capacity= 242.37 cfs

7.50' x 2.50' deep channel, n= 0.027
Side Slope Z-value= 2.0 '/' Top Width= 17.50'
Length= 230.0' Slope= 0.0100 '/'
Inlet Invert= 226.09', Outlet Invert= 223.79'

Reach 102R: D.2 - D.3



Summary for Pond 60P: Pond 3

```
Inflow Area =       8.109 ac, 16.76% Impervious, Inflow Depth =  6.88"   for 25 yr 24 hr event
Inflow      =      62.86 cfs @  12.09 hrs, Volume=          4.648 af
Outflow     =       0.49 cfs @  24.06 hrs, Volume=          1.366 af, Atten= 99%, Lag= 718.4 min
Primary     =       0.49 cfs @  24.06 hrs, Volume=          1.366 af
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 216.38' @ 24.06 hrs Surf.Area= 0.899 ac Storage= 4.183 af

Plug-Flow detention time= 1,149.9 min calculated for 1.366 af (29% of inflow)
Center-of-Mass det. time= 995.4 min (1,788.4 - 793.0)

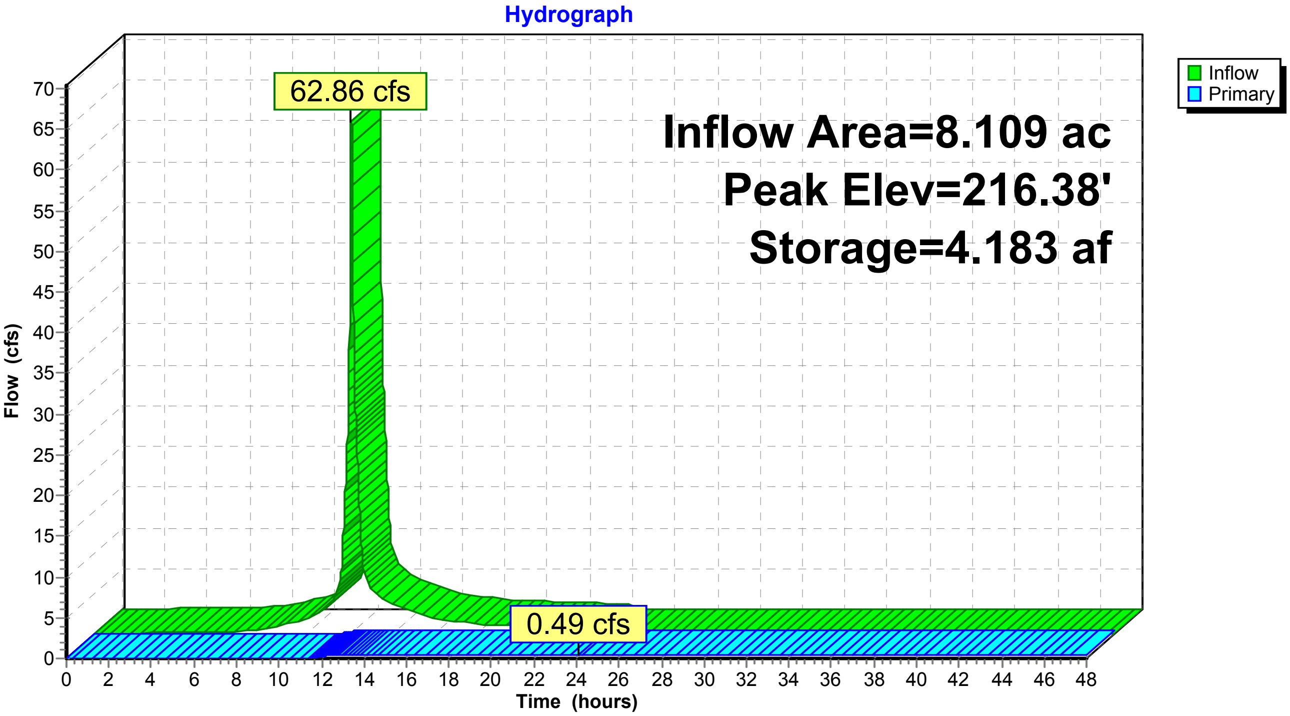
Volume	Invert	Avail.Storage	Storage Description
#1	211.00'	6.719 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
211.00	0.634	0.000	0.000
212.00	0.728	0.681	0.681
214.00	0.777	1.505	2.186
215.00	0.827	0.802	2.988
216.00	0.879	0.853	3.841
217.00	0.932	0.906	4.746
218.00	0.986	0.959	5.705
219.00	1.042	1.014	6.719

Device	Routing	Invert	Outlet Devices
#1	Device 2	211.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	212.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	216.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	211.00'	**12.0" Round 12" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 211.00' / 210.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#5	Primary	217.50'	**143.1 deg x 20.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow  Max=0.49 cfs @ 24.06 hrs  HW=216.38'   (Free Discharge)
↑
└─4=12" culvert  (Passes 0.49 cfs of 6.51 cfs potential flow)
   ↑
   ├─2=3" Pipe  (Orifice Controls 0.49 cfs @ 9.94 fps)
   │  ↑
   │  └─1=grate (36" half-circle)  (Passes 0.49 cfs of 2.62 cfs potential flow)
   └─3=riser slits  ( Controls 0.00 cfs)
└─5=Sharp-Crested Vee/Trap Weir  ( Controls 0.00 cfs)
```

Pond 60P: Pond 3



Summary for Pond 65P: Pond 6

Inflow Area = 28.188 ac, 16.51% Impervious, Inflow Depth = 7.02" for 25 yr 24 hr event
Inflow = 217.34 cfs @ 12.10 hrs, Volume= 16.492 af
Outflow = 6.48 cfs @ 16.19 hrs, Volume= 4.934 af, Atten= 97%, Lag= 245.9 min
Primary = 6.48 cfs @ 16.19 hrs, Volume= 4.934 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 219.87' @ 16.19 hrs Surf.Area= 2.584 ac Storage= 13.261 af

Plug-Flow detention time= 699.3 min calculated for 4.933 af (30% of inflow)
Center-of-Mass det. time= 545.6 min (1,337.7 - 792.1)

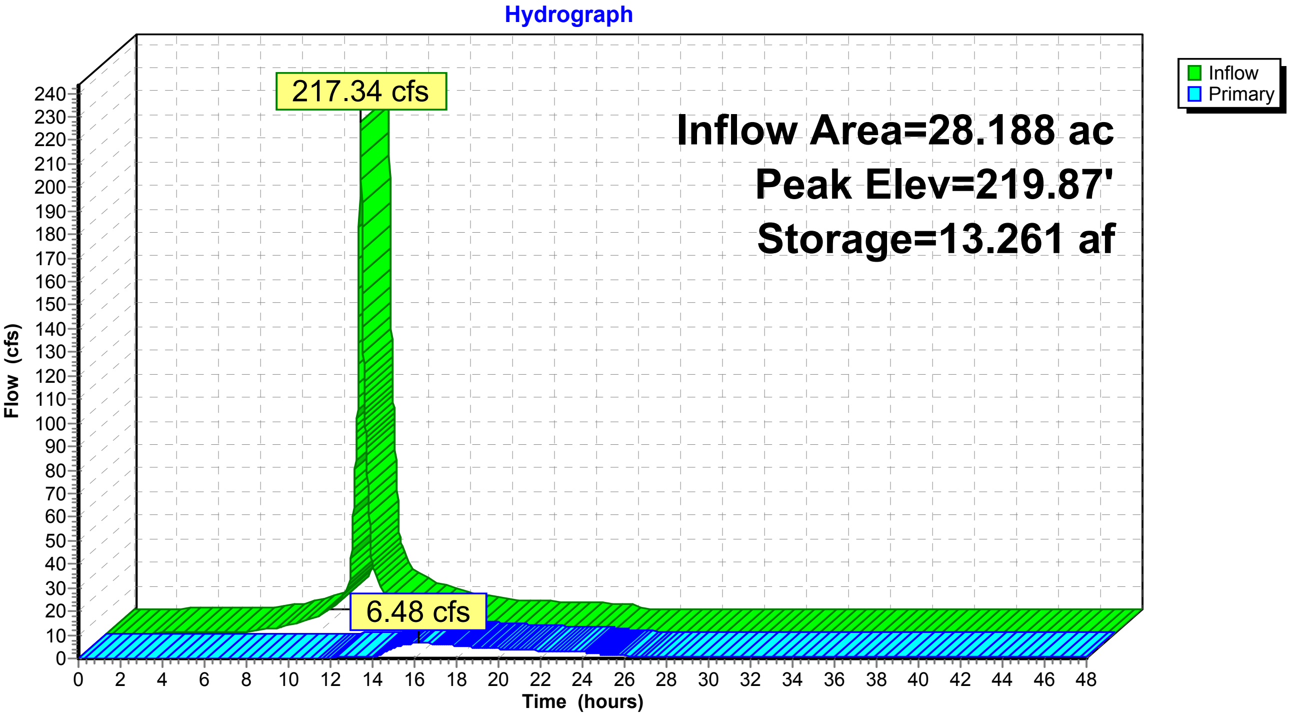
Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	24.939 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
214.00	1.929	0.000	0.000
216.00	2.159	4.088	4.088
218.00	2.377	4.536	8.624
220.00	2.599	4.976	13.600
222.00	2.834	5.433	19.033
224.00	3.072	5.906	24.939

Device	Routing	Invert	Outlet Devices
#1	Device 2	214.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	215.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	219.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	214.00'	**24.0" Round 24" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	221.00'	**157.4 deg x 20.0' long x 3.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=6.44 cfs @ 16.19 hrs HW=219.87' (Free Discharge)
```
↑
├─4=24" culvert (Passes 6.44 cfs of 26.35 cfs potential flow)
│  ↑
│  ├─2=3" Pipe (Orifice Controls 0.51 cfs @ 10.49 fps)
│  │  ↑
│  │  └─1=grate (36" half-circle) (Passes 0.51 cfs of 2.77 cfs potential flow)
│  └─3=riser slits (Orifice Controls 5.93 cfs @ 1.95 fps)
└─5=Sharp-Crested Vee/Trap Weir ( Controls 0.00 cfs)
```

Pond 65P: Pond 6



Summary for Pond 69P: Pond 4

Inflow Area = 37.379 ac, 7.52% Impervious, Inflow Depth = 7.33" for 25 yr 24 hr event
Inflow = 297.64 cfs @ 12.09 hrs, Volume= 22.826 af
Outflow = 60.15 cfs @ 12.53 hrs, Volume= 22.736 af, Atten= 80%, Lag= 26.4 min
Primary = 60.15 cfs @ 12.53 hrs, Volume= 22.736 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 231.51' @ 12.53 hrs Surf.Area= 1.651 ac Storage= 9.128 af

Plug-Flow detention time= 117.1 min calculated for 22.736 af (100% of inflow)
Center-of-Mass det. time= 114.6 min (903.4 - 788.9)

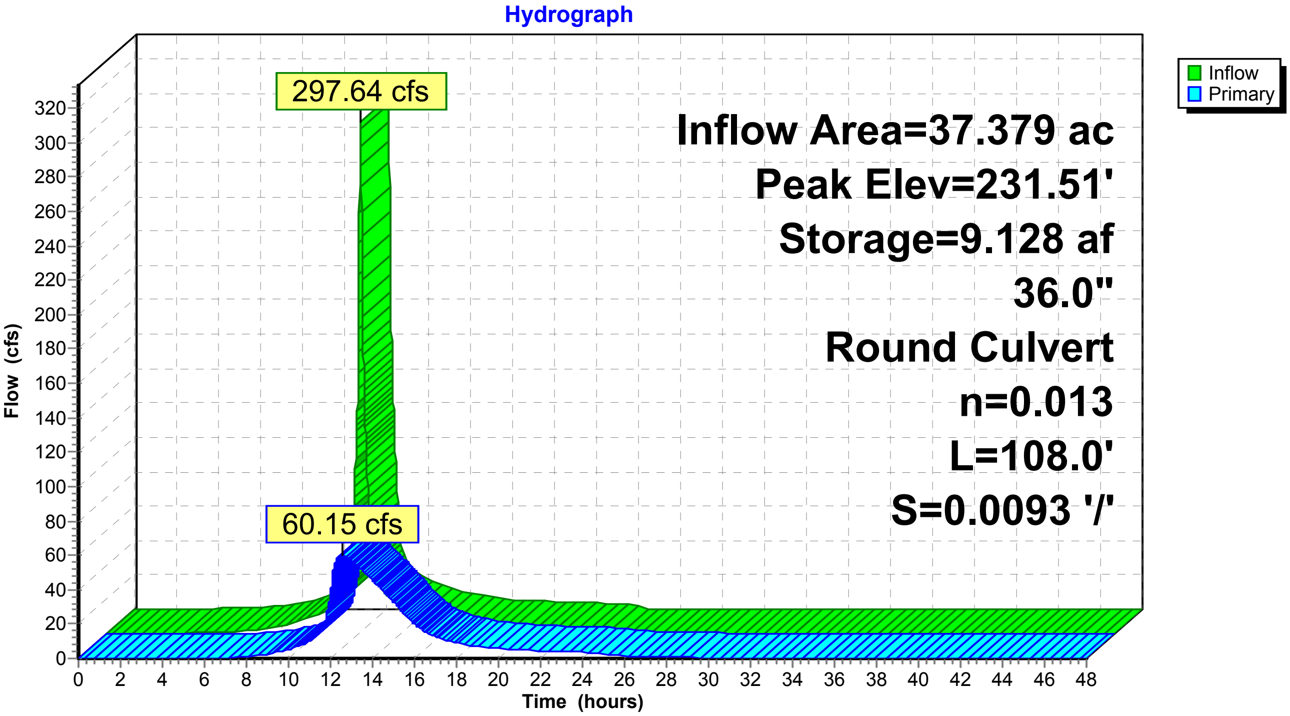
Volume	Invert	Avail.Storage	Storage Description
#1	225.00'	21.581 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
225.00	1.164	0.000	0.000
226.00	1.234	1.199	1.199
227.00	1.306	1.270	2.469
228.00	1.380	1.343	3.812
229.00	1.455	1.418	5.230
230.00	1.532	1.493	6.723
231.00	1.610	1.571	8.294
232.00	1.690	1.650	9.944
233.00	1.771	1.730	11.674
234.00	1.853	1.812	13.486
235.00	1.937	1.895	15.381
236.00	2.023	1.980	17.361
237.00	2.109	2.066	19.427
238.00	2.198	2.153	21.581

Device	Routing	Invert	Outlet Devices
#1	Primary	225.00'	**36.0" Round 36" culvert** L= 108.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0093 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=60.15 cfs @ 12.53 hrs HW=231.51' (Free Discharge)
↑—**1=36" culvert** (Inlet Controls 60.15 cfs @ 8.51 fps)

Pond 69P: Pond 4

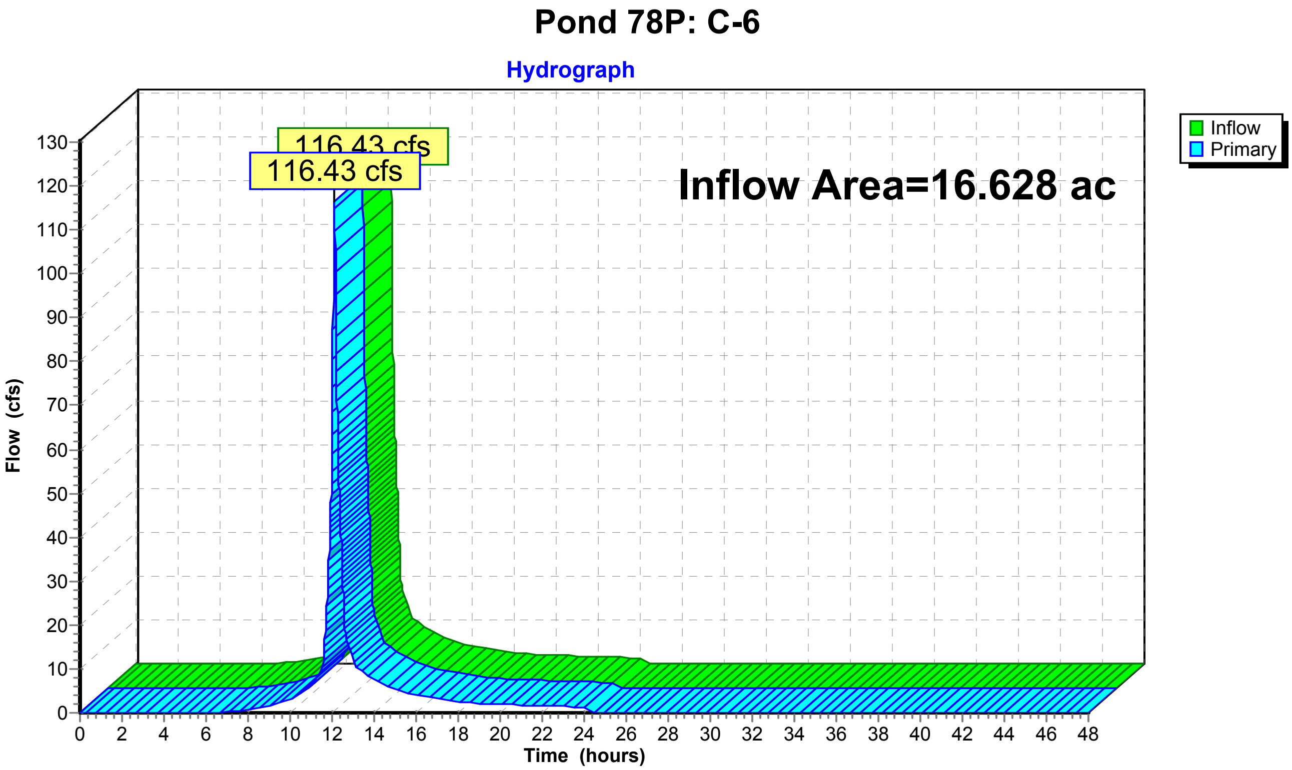


Summary for Pond 78P: C-6

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	16.628 ac,	0.00% Impervious, Inflow Depth = 6.38"	for 25 yr 24 hr event	
Inflow =	116.43 cfs @	12.11 hrs, Volume=	8.838 af	
Primary =	116.43 cfs @	12.11 hrs, Volume=	8.838 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



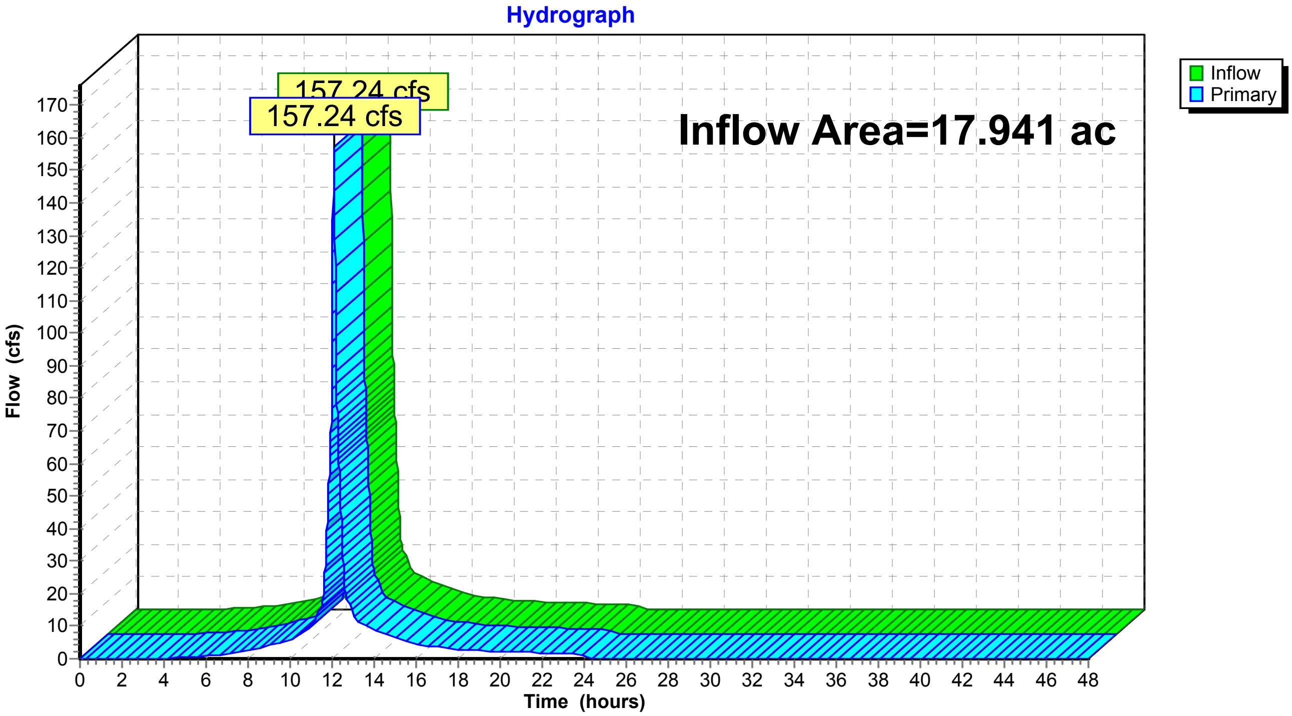
Summary for Pond 80P: C-7

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 17.941 ac, 0.00% Impervious, Inflow Depth = 7.89" for 25 yr 24 hr event
Inflow = 157.24 cfs @ 12.08 hrs, Volume= 11.796 af
Primary = 157.24 cfs @ 12.08 hrs, Volume= 11.796 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 80P: C-7

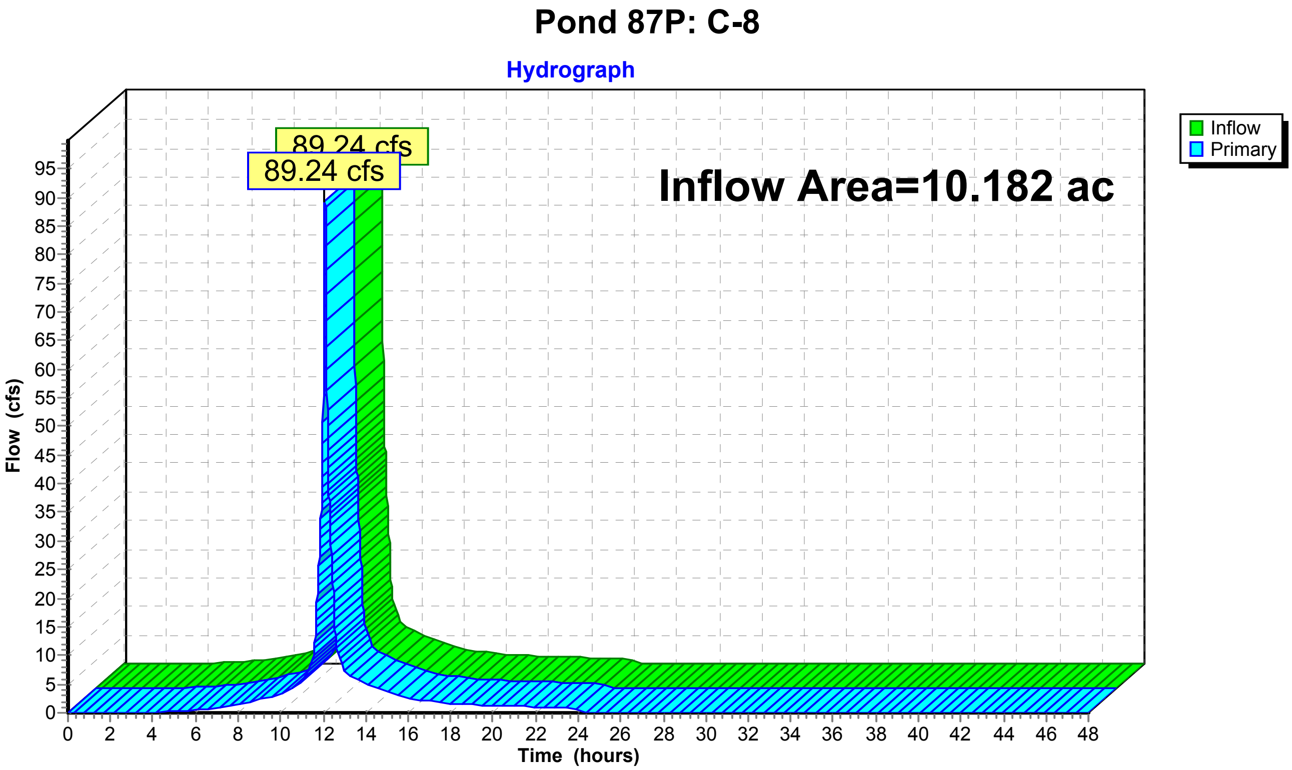


Summary for Pond 87P: C-8

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.182 ac, 0.00% Impervious, Inflow Depth = 7.89" for 25 yr 24 hr event
Inflow = 89.24 cfs @ 12.08 hrs, Volume= 6.694 af
Primary = 89.24 cfs @ 12.08 hrs, Volume= 6.694 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Summary for Pond 90P: Pond 5

```
Inflow Area =       12.460 ac,  18.28% Impervious,  Inflow Depth =   8.16"    for  25 yr 24 hr event
Inflow      =      110.72 cfs @   12.08 hrs,  Volume=            8.471 af
Outflow     =       24.00 cfs @   12.49 hrs,  Volume=            6.978 af,  Atten= 78%,  Lag= 24.6 min
Primary     =       24.00 cfs @   12.49 hrs,  Volume=            6.978 af
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 257.04' @ 12.49 hrs Surf.Area= 1.003 ac Storage= 4.289 af

Plug-Flow detention time= 263.0 min calculated for 6.977 af (82% of inflow)
Center-of-Mass det. time= 192.6 min (965.6 - 772.9)

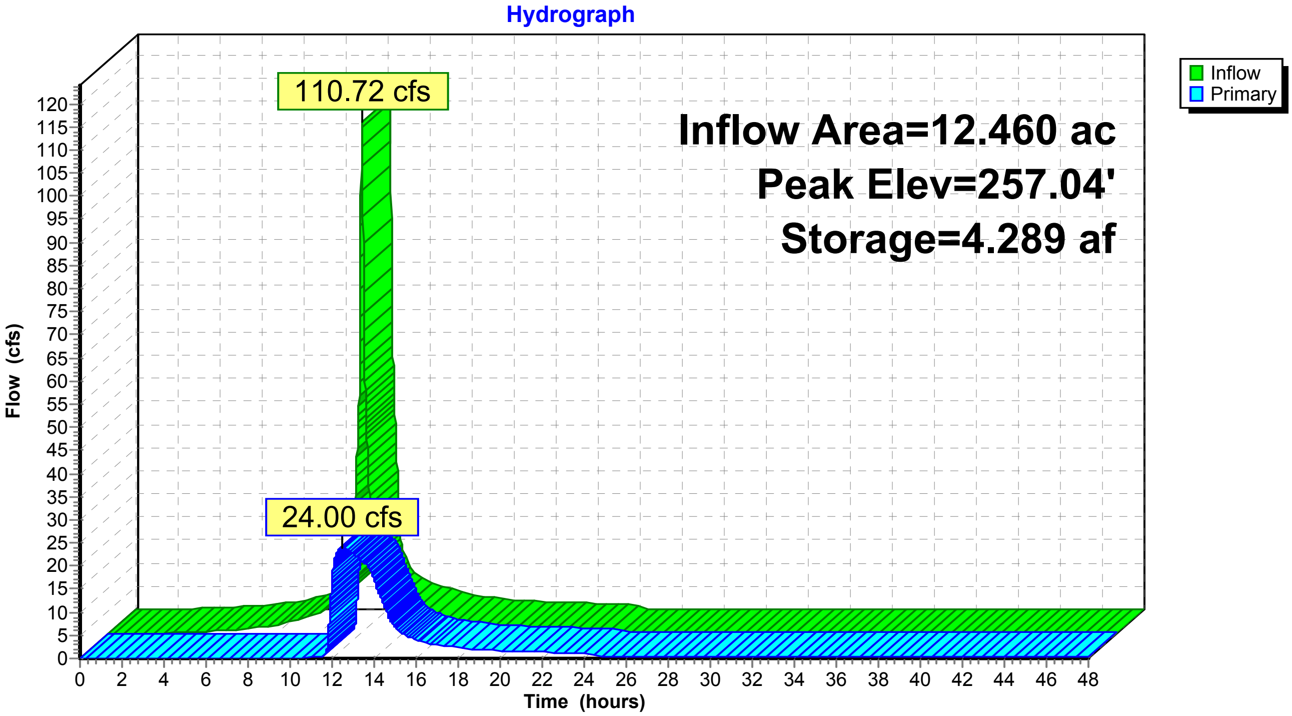
Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	5.284 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
252.00	0.706	0.000	0.000
254.00	0.819	1.525	1.525
256.00	0.938	1.757	3.282
258.00	1.064	2.002	5.284

Device	Routing	Invert	Outlet Devices
#1	Device 2	252.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	253.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	254.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	252.00'	**24.0" Round 24" culvert** L= 80.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 252.00' / 251.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	257.00'	**143.1 deg x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow  Max=24.00 cfs @ 12.49 hrs  HW=257.04'   (Free Discharge)
↑
├─4=24" culvert  (Inlet Controls 24.00 cfs @ 7.64 fps)
│  ↑
│  ├─2=3" Pipe  (Passes < 0.47 cfs potential flow)
│  │  ↑
│  │  └─1=grate (36" half-circle)  (Passes < 2.52 cfs potential flow)
│  └─3=riser slits  (Passes < 29.96 cfs potential flow)
└─5=Sharp-Crested Vee/Trap Weir  (Weir Controls 0.00 cfs @ 0.48 fps)
```

Pond 90P: Pond 5



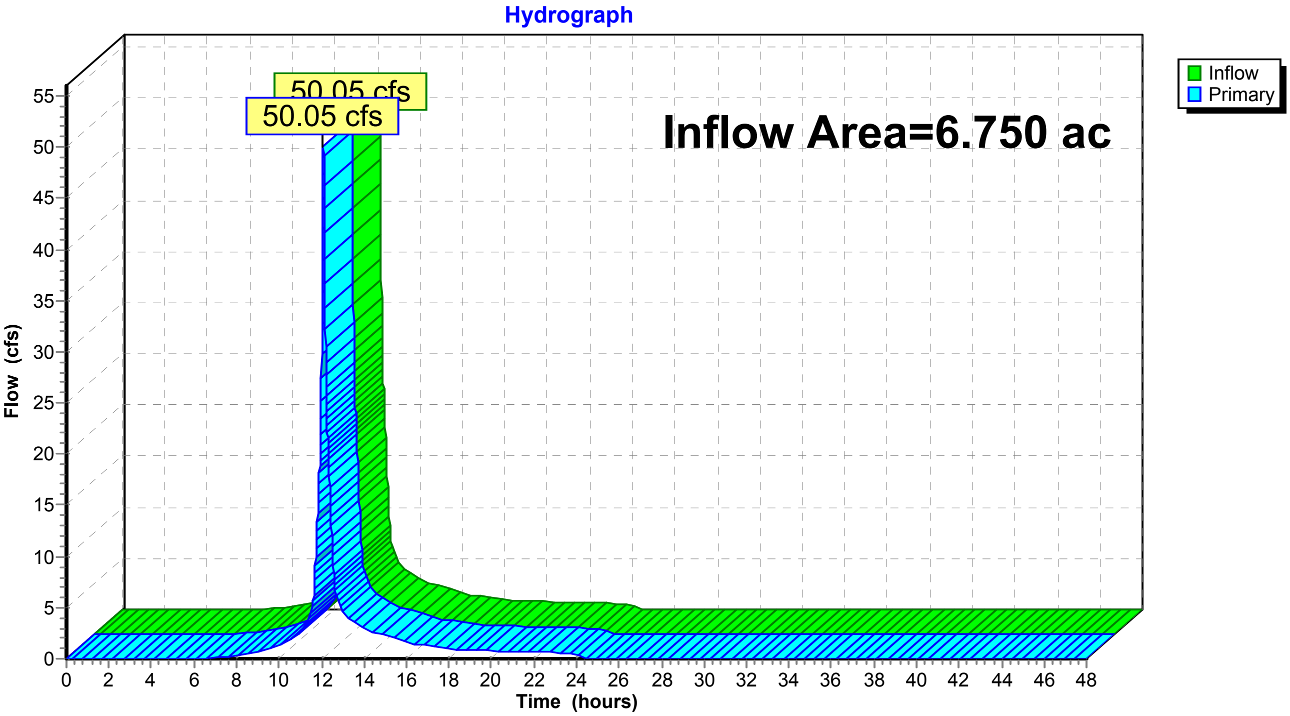
Summary for Pond 93P: C-10

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 6.750 ac, 0.00% Impervious, Inflow Depth = 6.38" for 25 yr 24 hr event
Inflow = 50.05 cfs @ 12.09 hrs, Volume= 3.588 af
Primary = 50.05 cfs @ 12.09 hrs, Volume= 3.588 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 93P: C-10



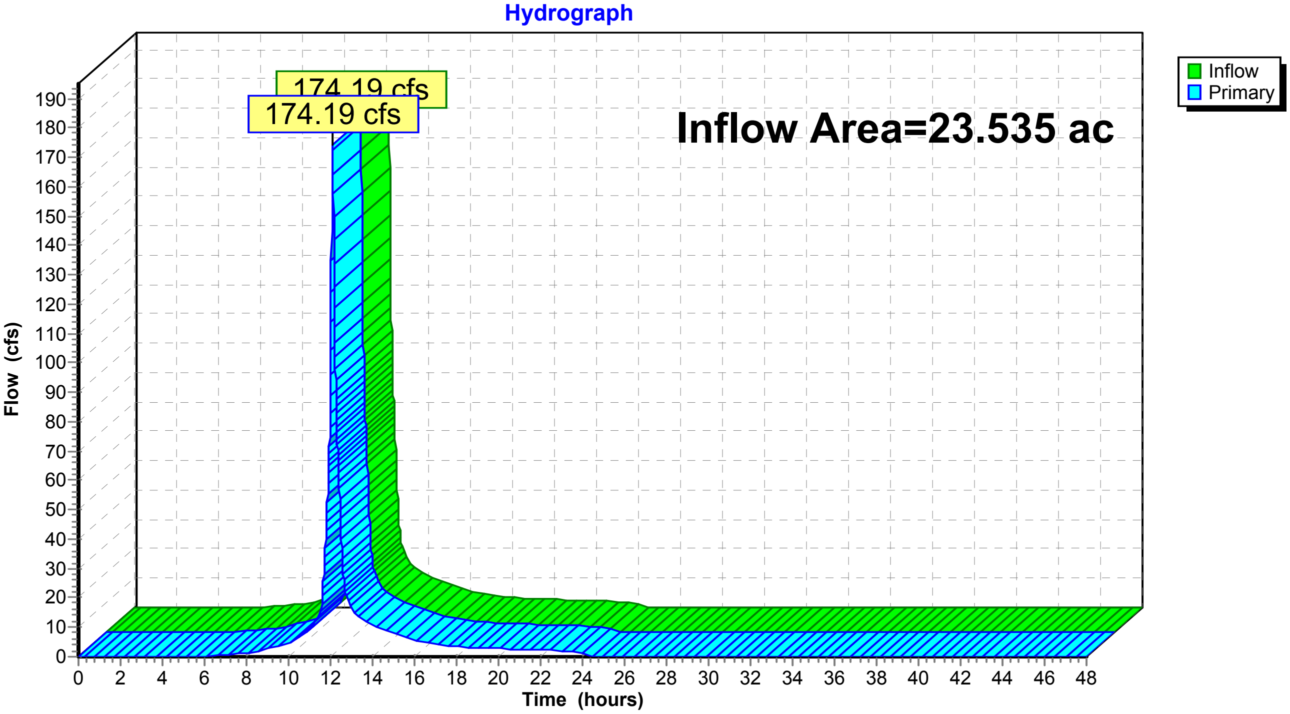
Summary for Pond 101P: C-9

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 23.535 ac, 0.00% Impervious, Inflow Depth = 6.56" for 25 yr 24 hr event
Inflow = 174.19 cfs @ 12.10 hrs, Volume= 12.863 af
Primary = 174.19 cfs @ 12.10 hrs, Volume= 12.863 af, Atten= 0%, Lag= 0.0 min

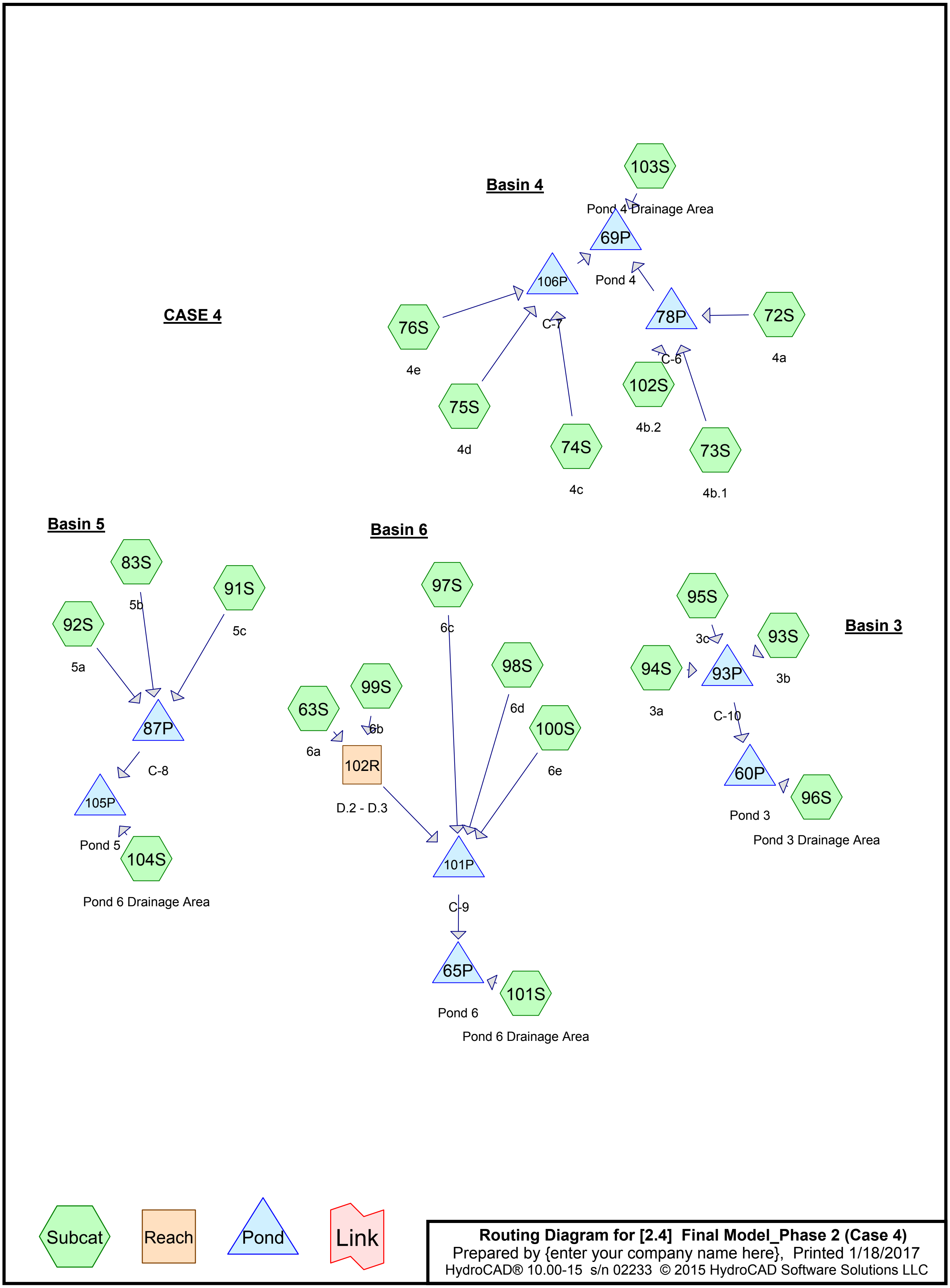
Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 101P: C-9



Appendix 1

HydroCAD Output – Case 4



Routing Diagram for [2.4] Final Model_Phase 2 (Case 4)
Prepared by {enter your company name here}, Printed 1/18/2017
HydroCAD® 10.00-15 s/n 02233 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
75.039	74	Pasture/grassland/range, Good, HSG C (63S, 72S, 73S, 74S, 75S, 76S, 83S, 91S, 92S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S)
11.100	98	Water Surface, HSG A (96S, 101S, 103S, 104S)
86.139	**77**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
11.100	HSG A	96S, 101S, 103S, 104S
0.000	HSG B	
75.039	HSG C	63S, 72S, 73S, 74S, 75S, 76S, 83S, 91S, 92S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S
0.000	HSG D	
0.000	Other	
86.139		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	75.039	0.000	0.000	75.039	Pasture/grassland/range, Good	63S, 72S, 73S, 74S, 75S, 76S, 83S, 91S, 92S, 93S, 94S, 95S, 97S, 98S, 99S, 100S, 102S
11.100	0.000	0.000	0.000	0.000	11.100	Water Surface	96S, 101S, 103S, 104S

Ground Covers (all nodes) (continued)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
11.100	**0.000**	**75.039**	**0.000**	**0.000**	**86.139**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	73S	0.00	0.00	813.0	0.2424	0.020	18.0	0.0	0.0
2	74S	0.00	0.00	594.0	0.2424	0.020	18.0	0.0	0.0
3	75S	0.00	0.00	540.0	0.1950	0.020	18.0	0.0	0.0
4	83S	0.00	0.00	437.0	0.2194	0.020	18.0	0.0	0.0
5	91S	0.00	0.00	594.0	0.2424	0.020	18.0	0.0	0.0
6	95S	0.00	0.00	655.0	0.2366	0.020	18.0	0.0	0.0
7	97S	0.00	0.00	726.0	0.2449	0.020	18.0	0.0	0.0
8	98S	0.00	0.00	189.0	0.1793	0.020	18.0	0.0	0.0
9	99S	0.00	0.00	438.0	0.2457	0.020	18.0	0.0	0.0
10	60P	211.00	210.00	100.0	0.0100	0.013	12.0	0.0	0.0
11	65P	214.00	213.50	100.0	0.0050	0.013	24.0	0.0	0.0
12	69P	225.00	224.00	108.0	0.0093	0.013	36.0	0.0	0.0
13	105P	252.00	251.00	80.0	0.0125	0.013	24.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 63S: 6a Runoff Area=0.306 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=37' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=2.27 cfs 0.163 af

Subcatchment 72S: 4a Runoff Area=0.328 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=18' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=2.43 cfs 0.174 af

Subcatchment 73S: 4b.1 Runoff Area=15.830 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,200' Tc=7.7 min CN=74 Runoff=110.71 cfs 8.414 af

Subcatchment 74S: 4c Runoff Area=10.679 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,002' Tc=6.0 min CN=74 Runoff=79.18 cfs 5.676 af

Subcatchment 75S: 4d Runoff Area=6.396 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=831' Tc=6.0 min CN=74 Runoff=47.43 cfs 3.400 af

Subcatchment 76S: 4e Runoff Area=0.866 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=71' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=6.42 cfs 0.460 af

Subcatchment 83S: 5b Runoff Area=7.368 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,001' Tc=6.0 min CN=74 Runoff=54.63 cfs 3.916 af

Subcatchment 91S: 5c Runoff Area=1.322 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,002' Tc=6.0 min CN=74 Runoff=9.80 cfs 0.703 af

Subcatchment 92S: 5a Runoff Area=1.492 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=81' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=11.06 cfs 0.793 af

Subcatchment 93S: 3b Runoff Area=0.400 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=80' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=2.97 cfs 0.213 af

Subcatchment 94S: 3a Runoff Area=0.590 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=85' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=4.37 cfs 0.314 af

Subcatchment 95S: 3c Runoff Area=5.760 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=980' Tc=6.0 min CN=74 Runoff=42.71 cfs 3.062 af

Subcatchment 96S: Pond 3 Drainage Area Runoff Area=1.359 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=12.82 cfs 1.060 af

Subcatchment 97S: 6c Runoff Area=12.083 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=1,019' Tc=7.1 min CN=74 Runoff=86.21 cfs 6.423 af

Subcatchment 98S: 6d Runoff Area=3.837 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=575' Tc=6.0 min CN=74 Runoff=28.45 cfs 2.040 af

Subcatchment 99S: 6b Runoff Area=6.380 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=837' Tc=6.0 min CN=74 Runoff=47.31 cfs 3.391 af

Subcatchment 100S: 6e Runoff Area=0.932 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=79' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=6.91 cfs 0.495 af

Subcatchment 101S: Pond 6 Drainage Area Runoff Area=4.653 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=43.89 cfs 3.629 af

Subcatchment 102S: 4b.2 Runoff Area=0.470 ac 0.00% Impervious Runoff Depth=6.38"
Flow Length=47' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=3.48 cfs 0.250 af

Subcatchment 103S: Pond 4 Drainage Area Runoff Area=2.810 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=26.50 cfs 2.192 af

Subcatchment 104S: Pond 6 Drainage Area Runoff Area=2.278 ac 100.00% Impervious Runoff Depth=9.36"
Tc=6.0 min CN=98 Runoff=21.49 cfs 1.777 af

Reach 102R: D.2 - D.3 Avg. Flow Depth=1.05' Max Vel=4.86 fps Inflow=49.58 cfs 3.554 af
n=0.027 L=230.0' S=0.0100 '/' Capacity=242.37 cfs Outflow=49.18 cfs 3.554 af

Pond 60P: Pond 3 Peak Elev=216.38' Storage=4.183 af Inflow=62.86 cfs 4.648 af
Outflow=0.49 cfs 1.366 af

Pond 65P: Pond 6 Peak Elev=219.84' Storage=13.180 af Inflow=213.09 cfs 16.140 af
Outflow=5.75 cfs 4.582 af

Pond 69P: Pond 4 Peak Elev=230.96' Storage=8.237 af Inflow=273.91 cfs 20.566 af
36.0" Round Culvert n=0.013 L=108.0' S=0.0093 '/' Outflow=56.77 cfs 20.477 af

Pond 78P: C-6 Inflow=116.43 cfs 8.838 af
Primary=116.43 cfs 8.838 af

Pond 87P: C-8 Inflow=75.50 cfs 5.412 af
Primary=75.50 cfs 5.412 af

Pond 93P: C-10 Inflow=50.05 cfs 3.588 af
Primary=50.05 cfs 3.588 af

Pond 101P: C-9 Inflow=169.97 cfs 12.511 af
Primary=169.97 cfs 12.511 af

Pond 105P: Pond 5 Peak Elev=256.29' Storage=3.554 af Inflow=96.97 cfs 7.189 af
Outflow=21.65 cfs 5.697 af

Pond 106P: C-7 Inflow=133.03 cfs 9.536 af
Primary=133.03 cfs 9.536 af

Total Runoff Area = 86.139 ac Runoff Volume = 48.544 af Average Runoff Depth = 6.76"
87.11% Pervious = 75.039 ac 12.89% Impervious = 11.100 ac

Summary for Subcatchment 63S: 6a

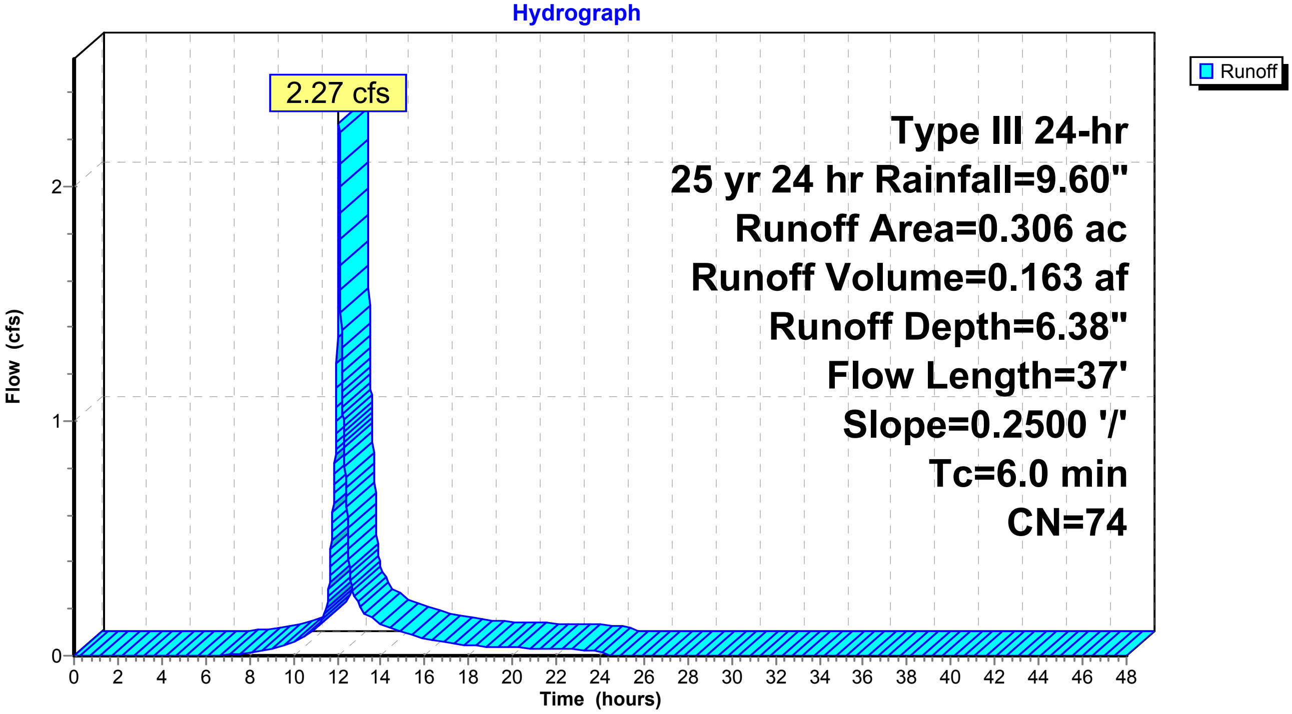
Runoff = 2.27 cfs @ 12.09 hrs, Volume= 0.163 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.306	74	Pasture/grassland/range, Good, HSG C
	0.306		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	37	0.2500	0.54		**Sheet Flow,** n= 0.136 P2= 5.40"
1.1	37	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 63S: 6a



Summary for Subcatchment 72S: 4a

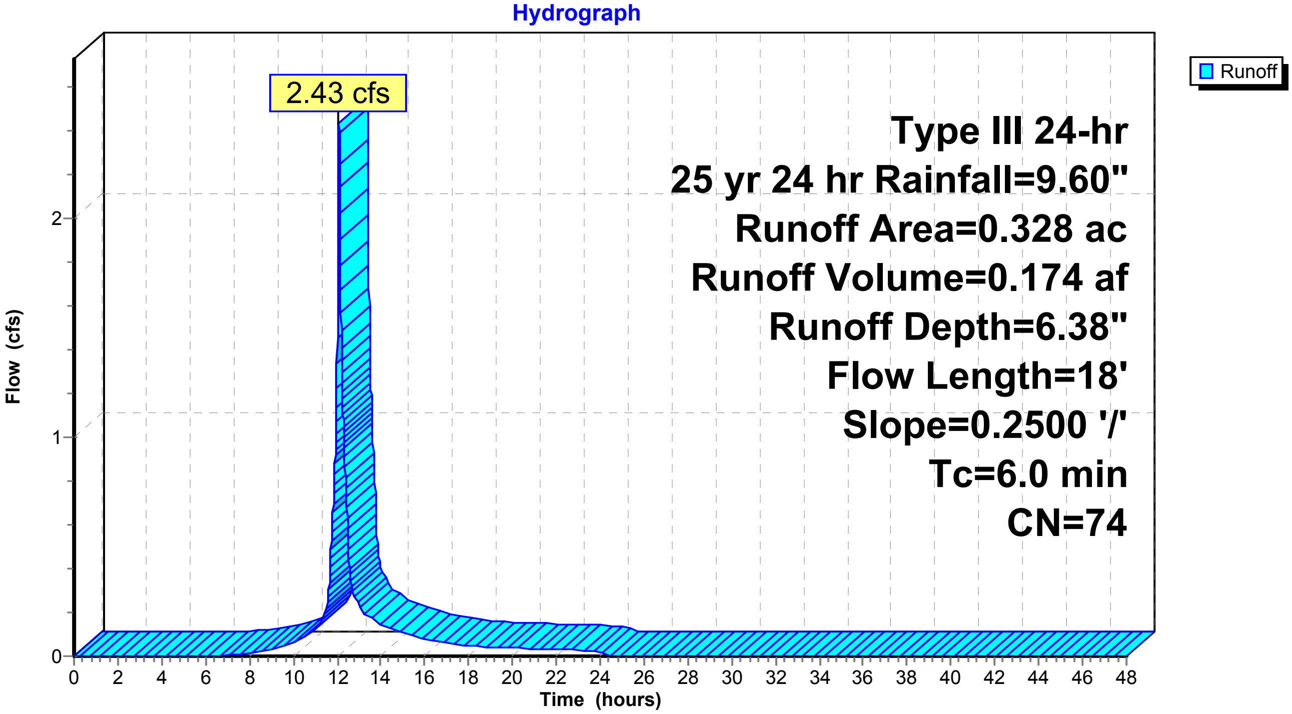
Runoff = 2.43 cfs @ 12.09 hrs, Volume= 0.174 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.328	74	Pasture/grassland/range, Good, HSG C
0.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	18	0.2500	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.6	18	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 72S: 4a



Summary for Subcatchment 73S: 4b.1

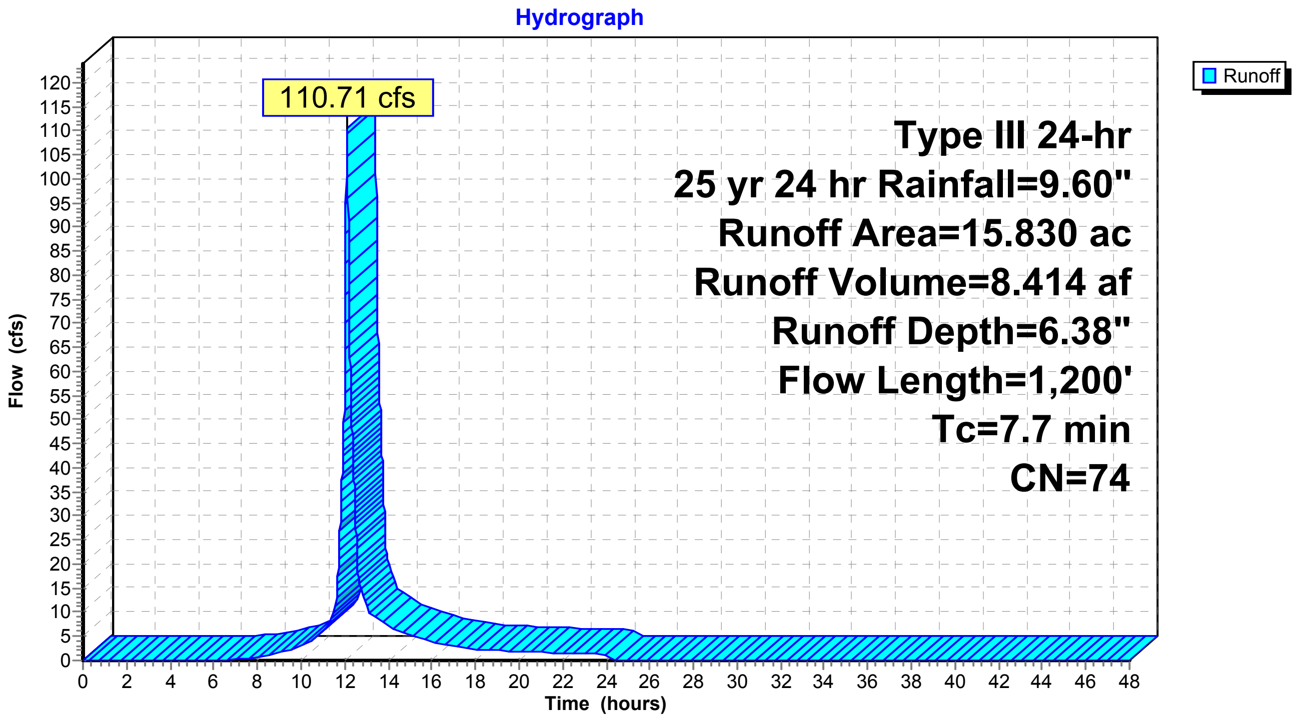
Runoff = 110.71 cfs @ 12.11 hrs, Volume= 8.414 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
15.830	74	Pasture/grassland/range, Good, HSG C
15.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	187	0.0802	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.4	200	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.7	813	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.7	1,200	Total			

Subcatchment 73S: 4b.1



Summary for Subcatchment 74S: 4c

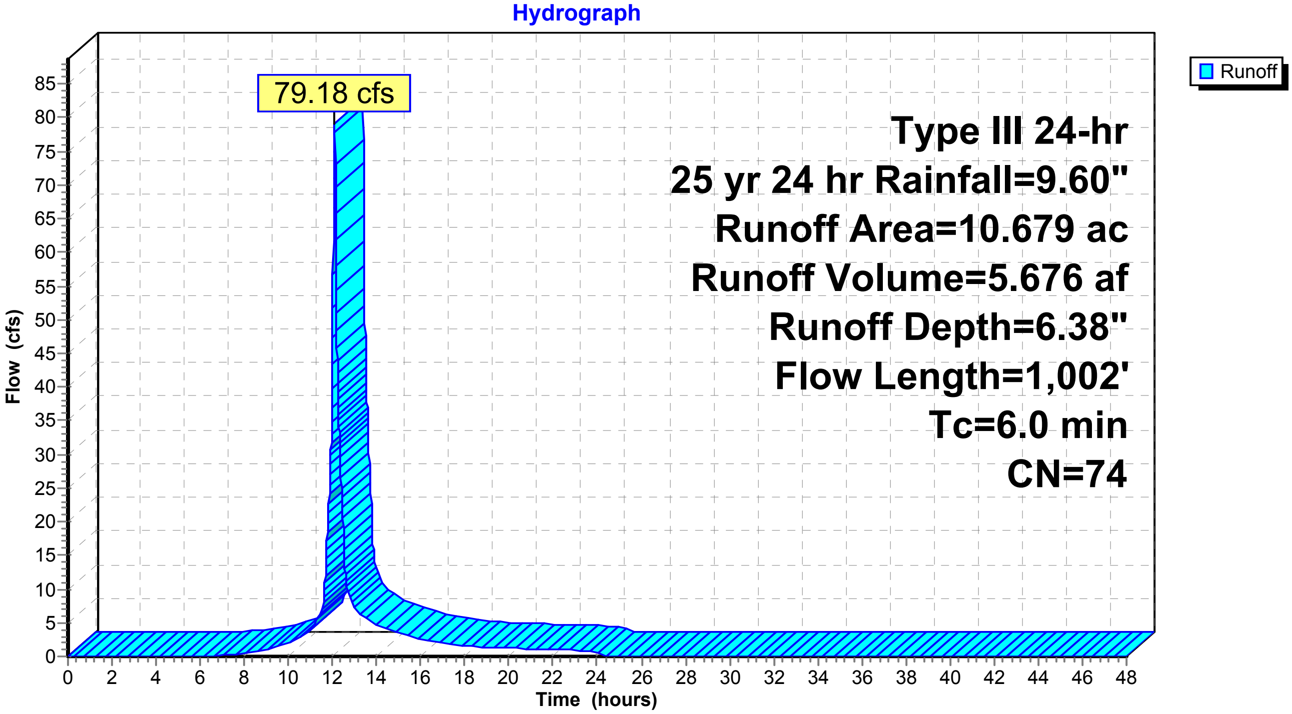
Runoff = 79.18 cfs @ 12.09 hrs, Volume= 5.676 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	10.679	74	Pasture/grassland/range, Good, HSG C
	10.679		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	107	0.1878	0.59		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	301	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	594	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.2	1,002	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 74S: 4c



Summary for Subcatchment 75S: 4d

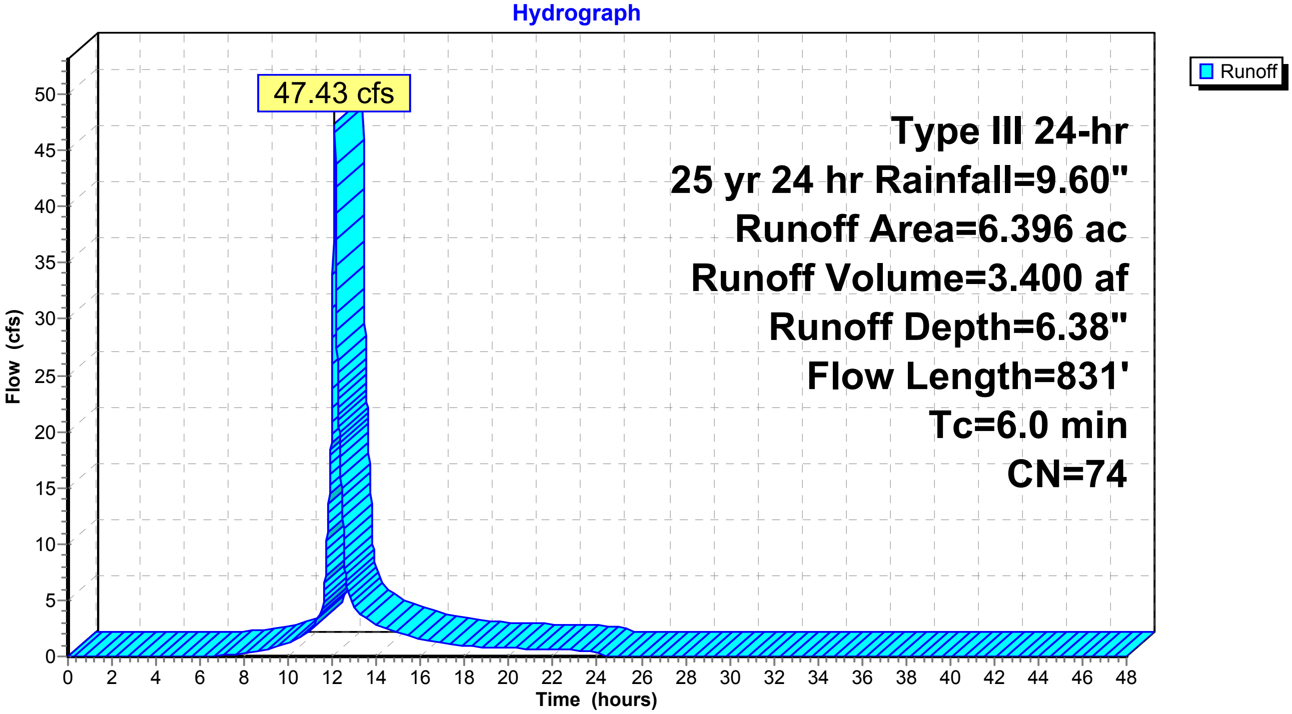
Runoff = 47.43 cfs @ 12.09 hrs, Volume= 3.400 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	6.396	74	Pasture/grassland/range, Good, HSG C
	6.396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	67	0.0598	0.34		**Sheet Flow,** n= 0.136 P2= 5.40"
0.5	224	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	540	0.1950	17.06	30.15	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.3	831	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 75S: 4d



Summary for Subcatchment 76S: 4e

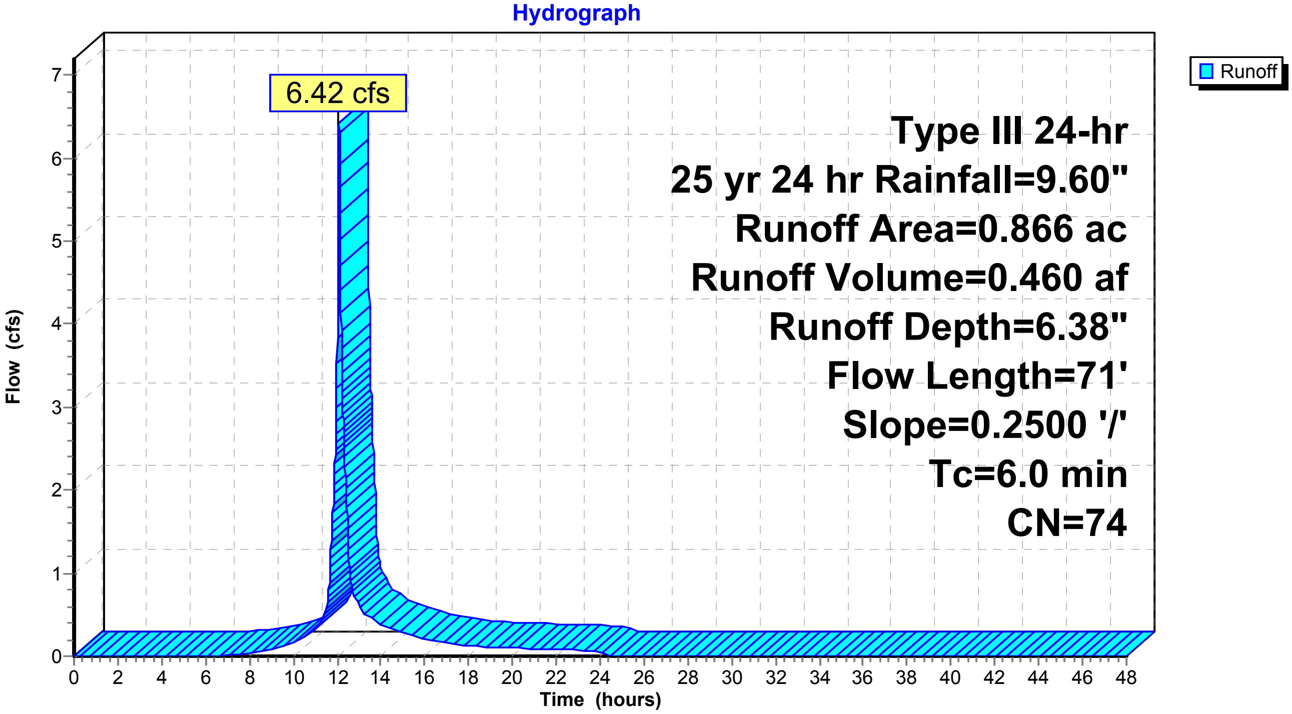
Runoff = 6.42 cfs @ 12.09 hrs, Volume= 0.460 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.866	74	Pasture/grassland/range, Good, HSG C
	0.866		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	71	0.2500	0.61		**Sheet Flow,** n= 0.136 P2= 5.40"
1.9	71	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 76S: 4e



Summary for Subcatchment 83S: 5b

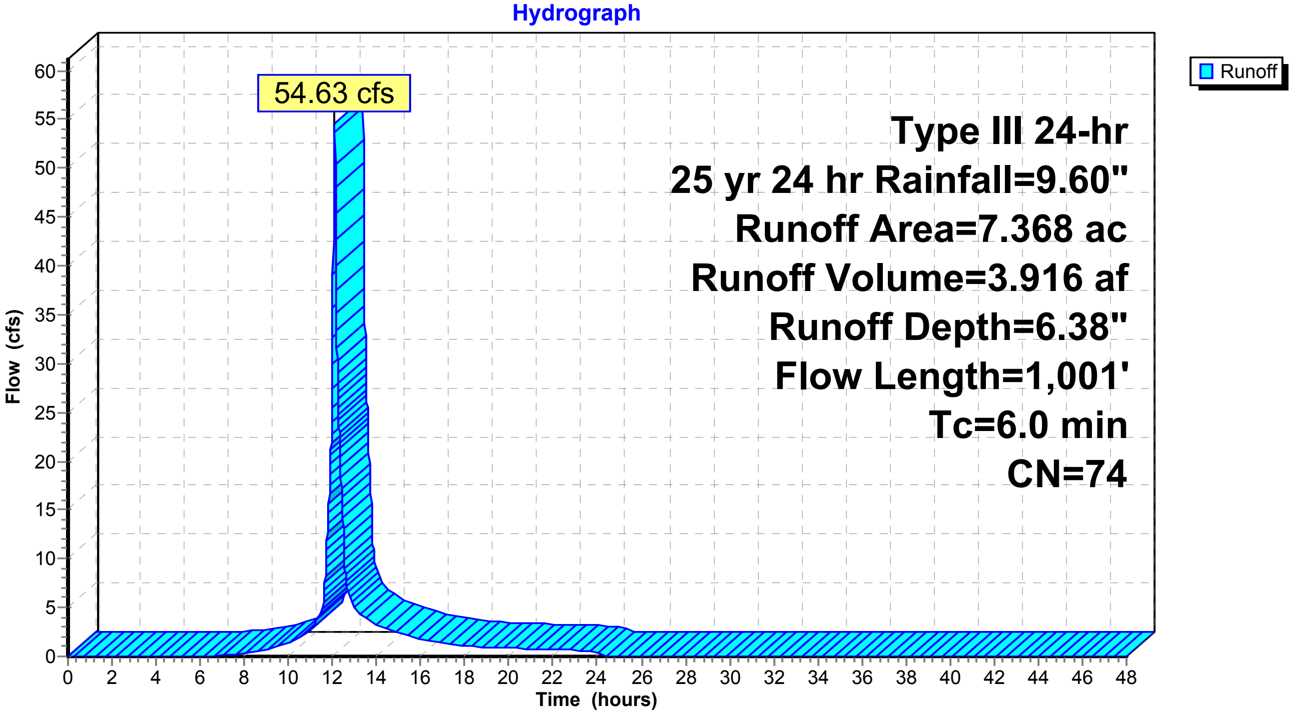
Runoff = 54.63 cfs @ 12.09 hrs, Volume= 3.916 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	7.368	74	Pasture/grassland/range, Good, HSG C
	7.368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	102	0.1961	0.60		**Sheet Flow,** n= 0.136 P2= 5.40"
1.0	462	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.4	437	0.2194	18.10	31.98	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.2	1,001	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 83S: 5b



Summary for Subcatchment 91S: 5c

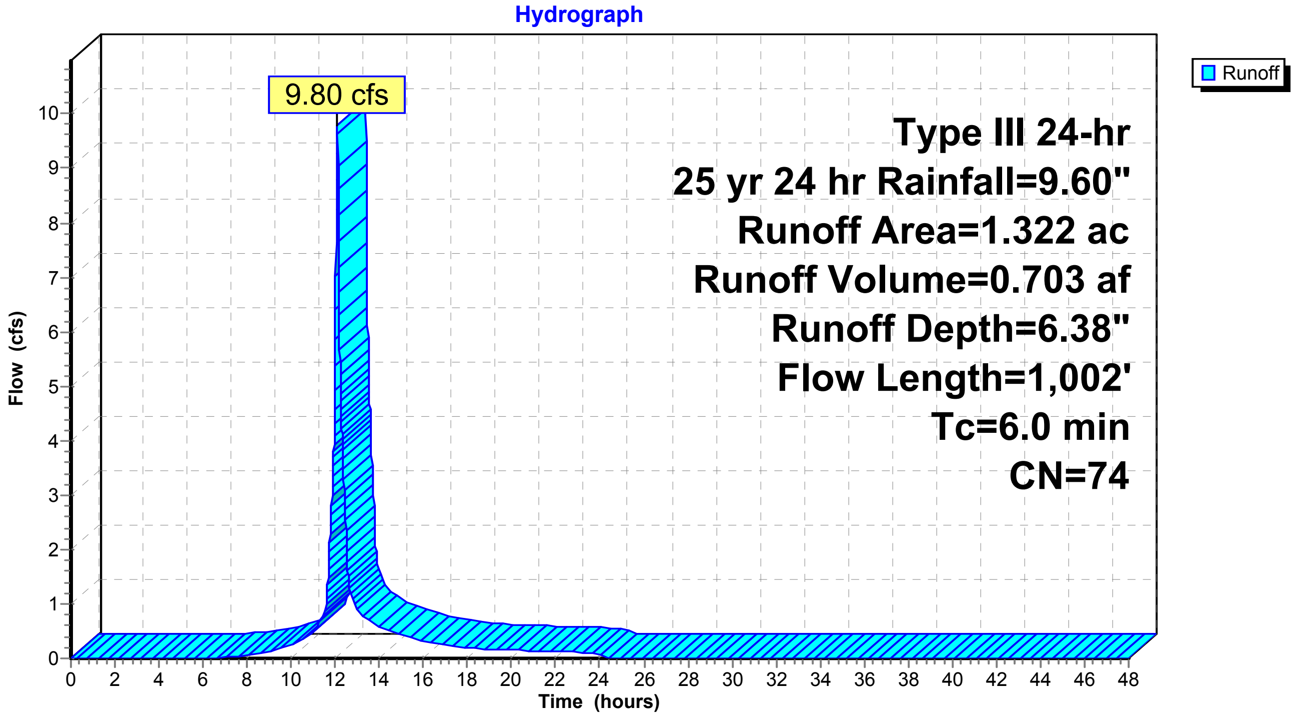
Runoff = 9.80 cfs @ 12.09 hrs, Volume= 0.703 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	1.322	74	Pasture/grassland/range, Good, HSG C
	1.322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	107	0.1878	0.59		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	301	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	594	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.2	1,002	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 91S: 5c



Summary for Subcatchment 92S: 5a

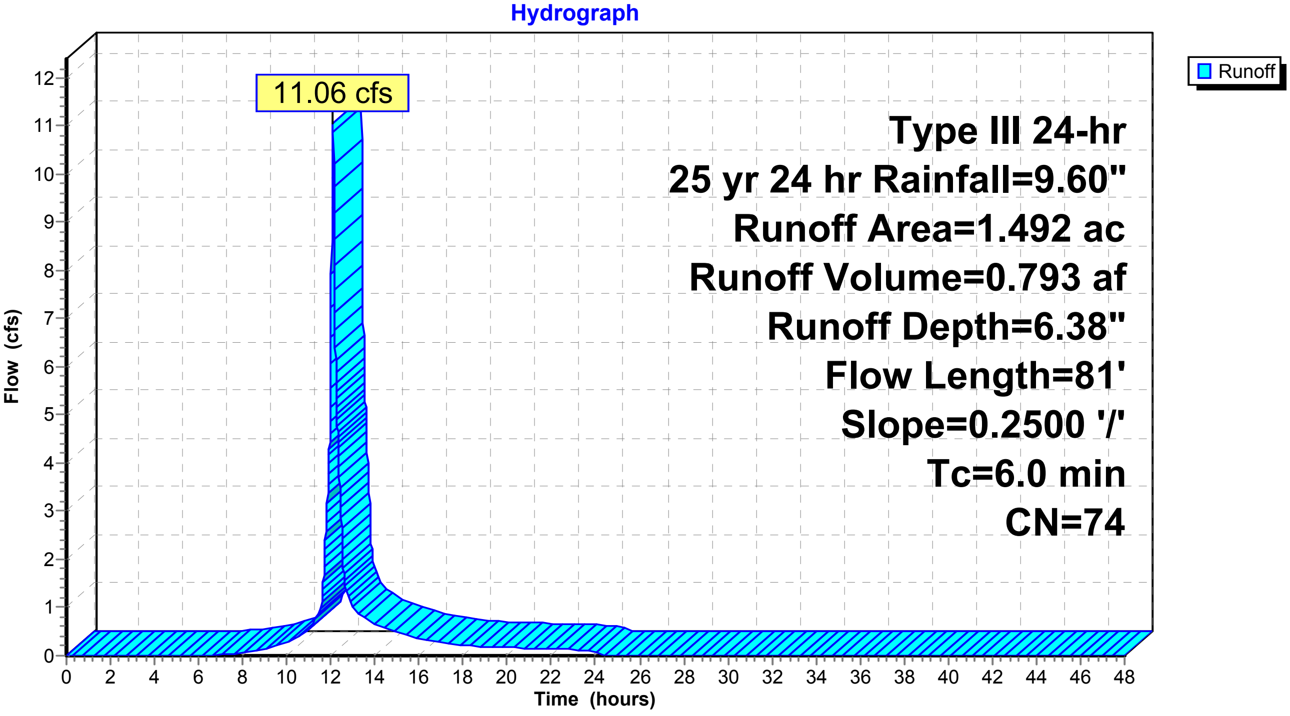
Runoff = 11.06 cfs @ 12.09 hrs, Volume= 0.793 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	1.492	74	Pasture/grassland/range, Good, HSG C
	1.492		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	81	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 92S: 5a



Summary for Subcatchment 93S: 3b

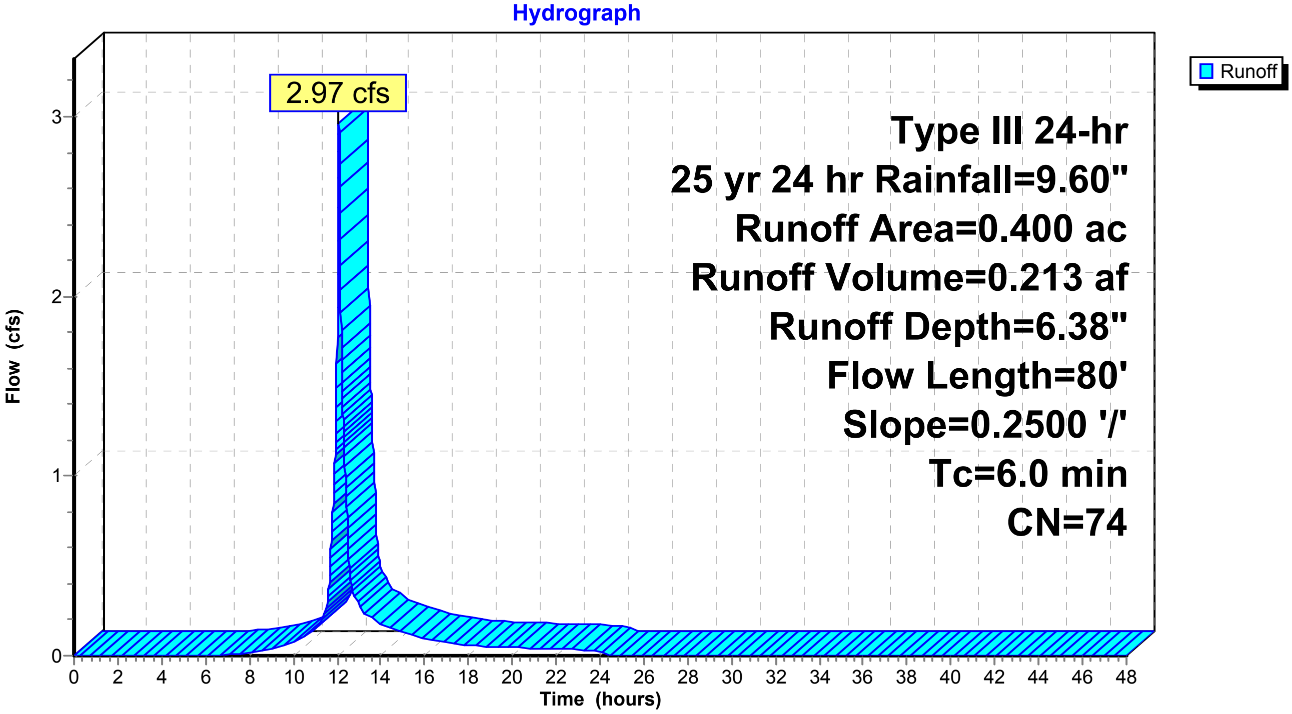
Runoff = 2.97 cfs @ 12.09 hrs, Volume= 0.213 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.400	74	Pasture/grassland/range, Good, HSG C
	0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	80	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 93S: 3b



Summary for Subcatchment 94S: 3a

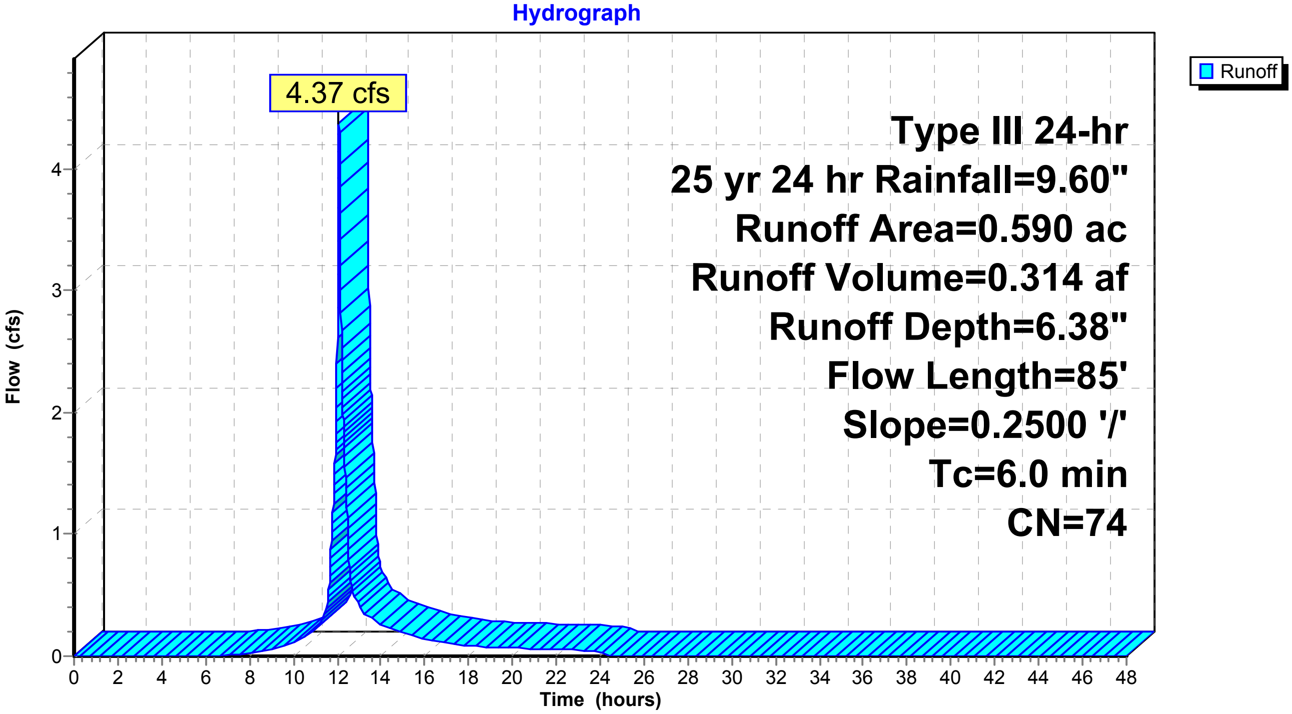
Runoff = 4.37 cfs @ 12.09 hrs, Volume= 0.314 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	0.590	74	Pasture/grassland/range, Good, HSG C
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	85	0.2500	0.64		**Sheet Flow,** n= 0.136 P2= 5.40"
2.2	85	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 94S: 3a



Summary for Subcatchment 95S: 3c

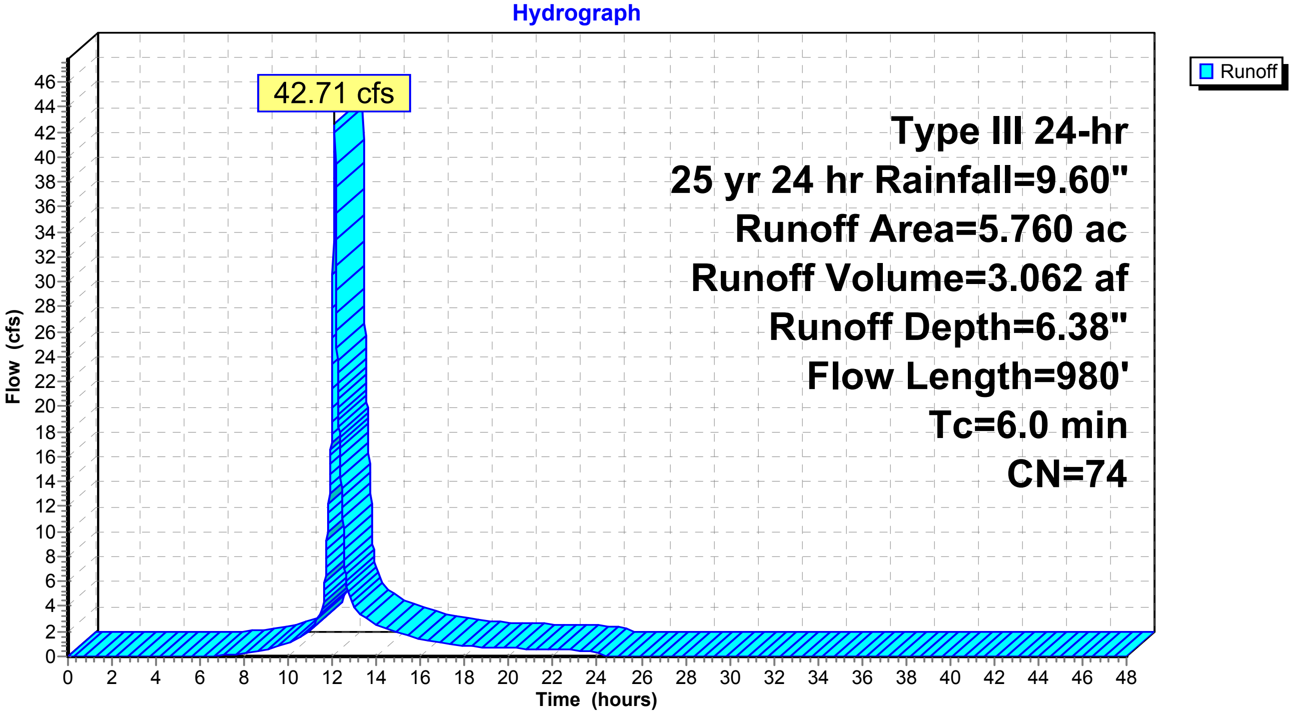
Runoff = 42.71 cfs @ 12.09 hrs, Volume= 3.062 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	5.760	74	Pasture/grassland/range, Good, HSG C
	5.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.5	245	0.0204	7.64	51.21	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	655	0.2366	18.79	33.21	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.2	980	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 95S: 3c



Summary for Subcatchment 96S: Pond 3 Drainage Area

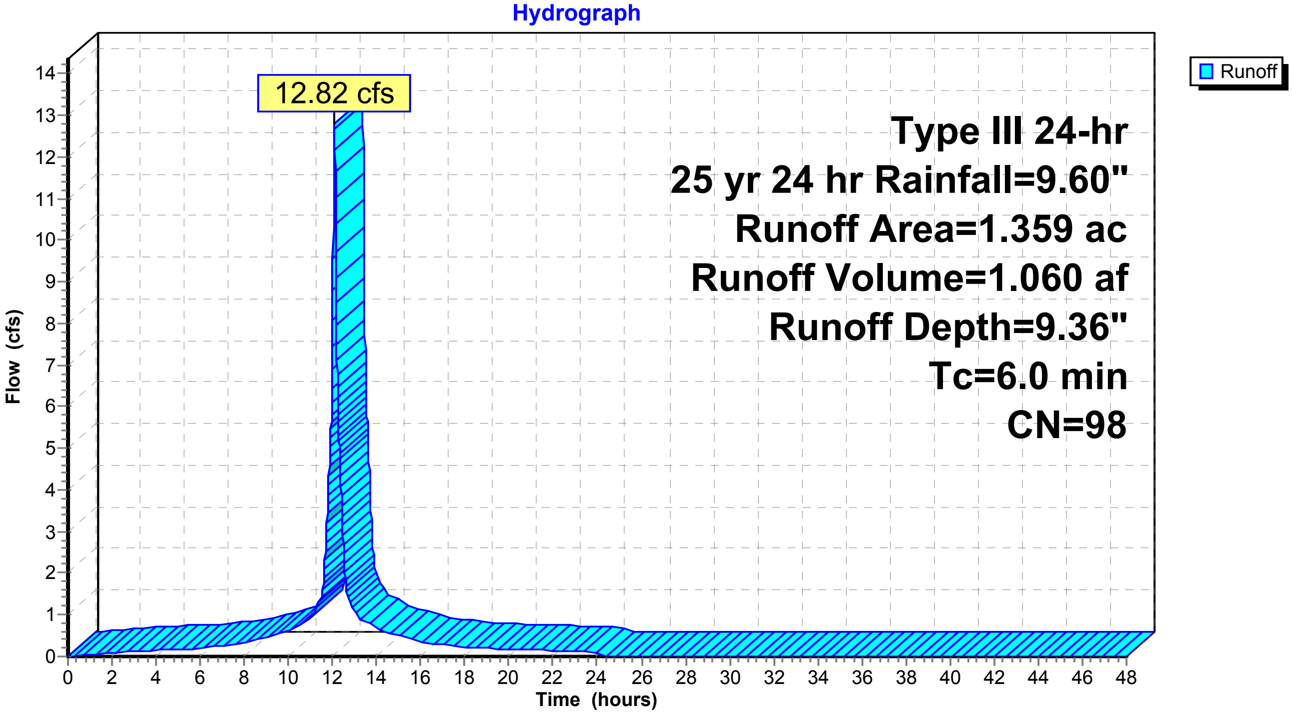
Runoff = 12.82 cfs @ 12.08 hrs, Volume= 1.060 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
1.359	98	Water Surface, HSG A
1.359		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 96S: Pond 3 Drainage Area



Summary for Subcatchment 97S: 6c

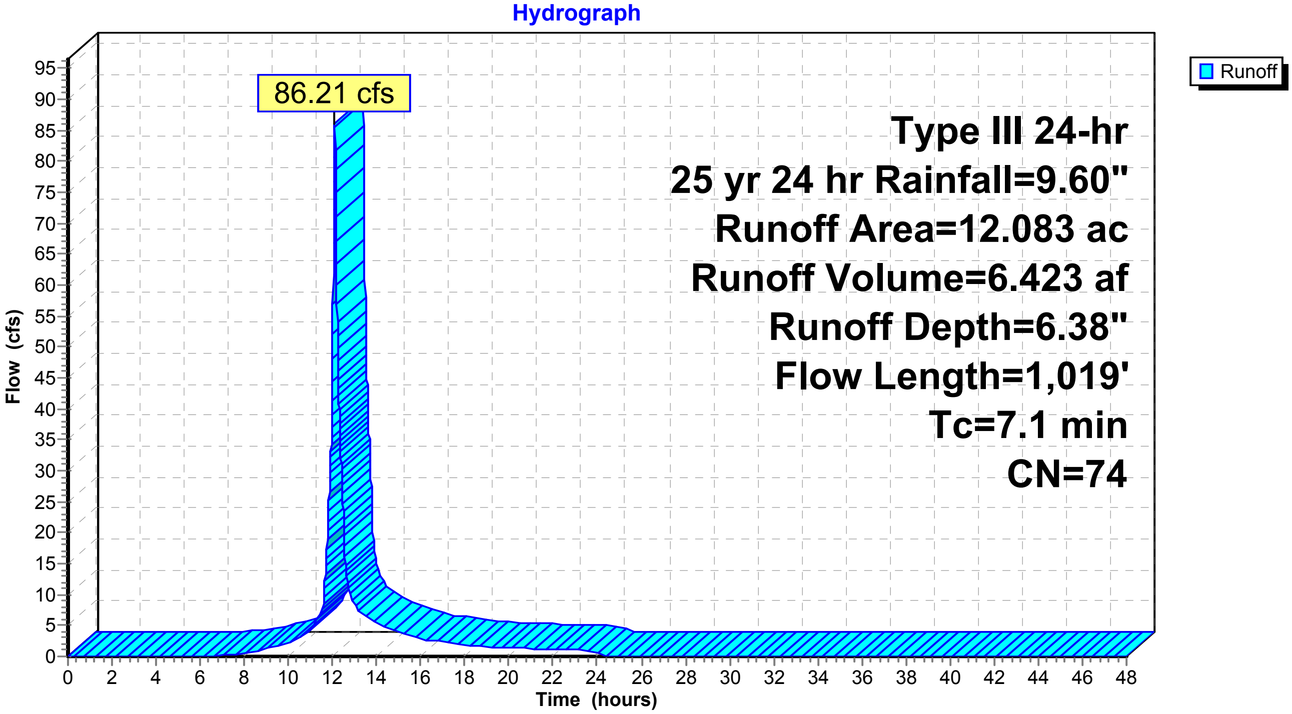
Runoff = 86.21 cfs @ 12.10 hrs, Volume= 6.423 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
12.083	74	Pasture/grassland/range, Good, HSG C
12.083		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	180	0.0833	0.48		**Sheet Flow,** n= 0.136 P2= 5.40"
0.2	113	0.0199	7.55	50.58	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	726	0.2449	19.12	33.79	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.1	1,019	Total			

Subcatchment 97S: 6c



Summary for Subcatchment 98S: 6d

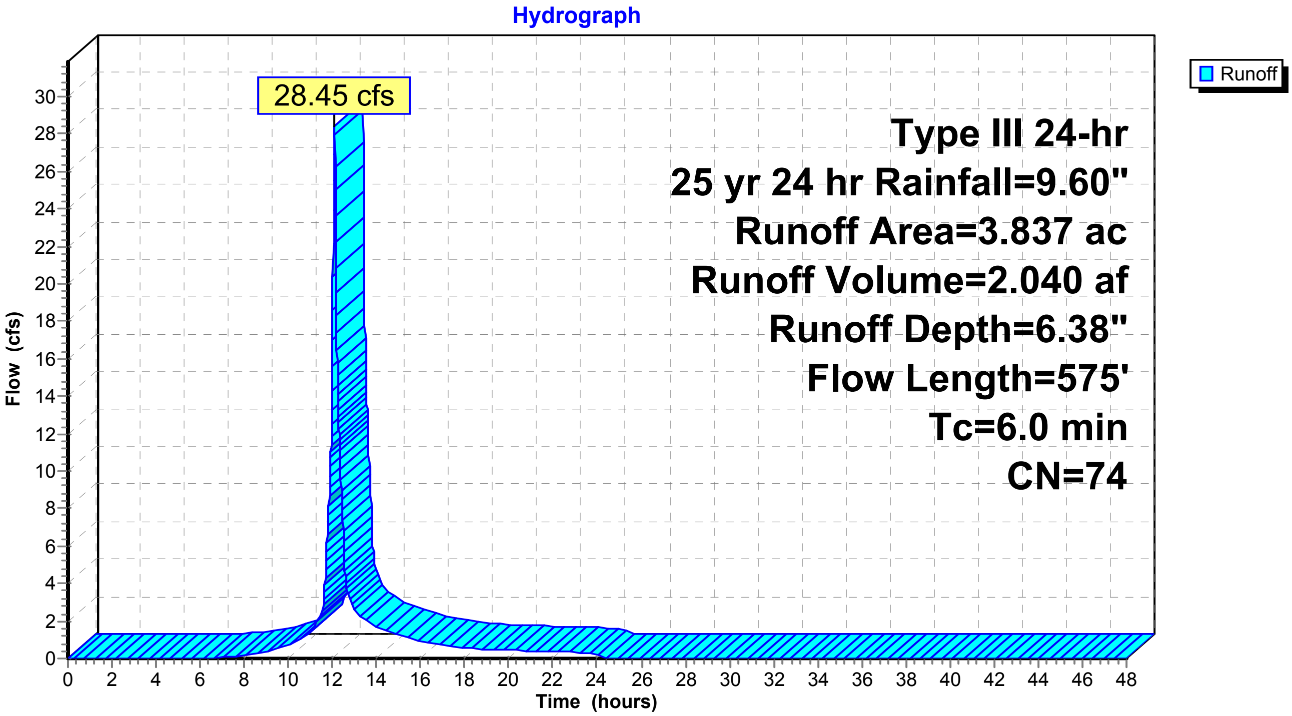
Runoff = 28.45 cfs @ 12.09 hrs, Volume= 2.040 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
3.837	74	Pasture/grassland/range, Good, HSG C
3.837		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	306	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.2	189	0.1793	16.36	28.91	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.0	575	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 98S: 6d



Summary for Subcatchment 99S: 6b

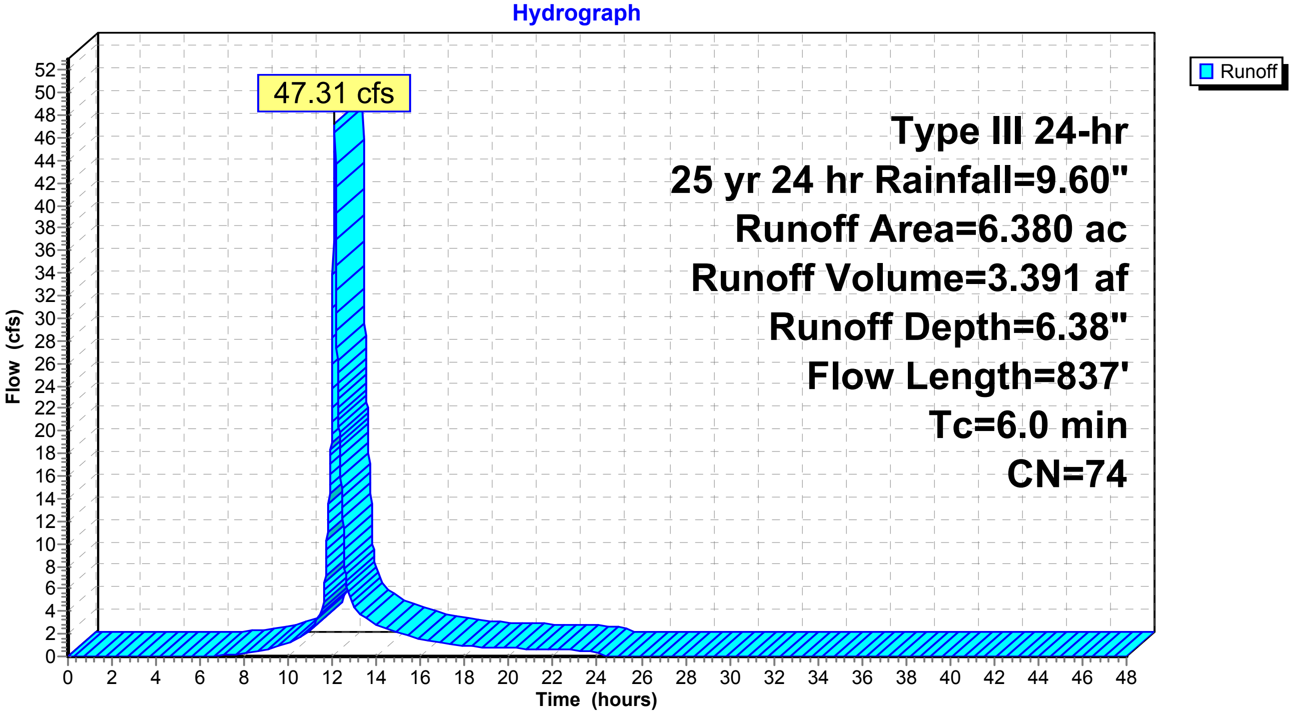
Runoff = 47.31 cfs @ 12.09 hrs, Volume= 3.391 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

	Area (ac)	CN	Description
*	6.380	74	Pasture/grassland/range, Good, HSG C
	6.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	81	0.2480	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	318	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.4	438	0.2457	19.15	33.84	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.3	837	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 99S: 6b



Summary for Subcatchment 100S: 6e

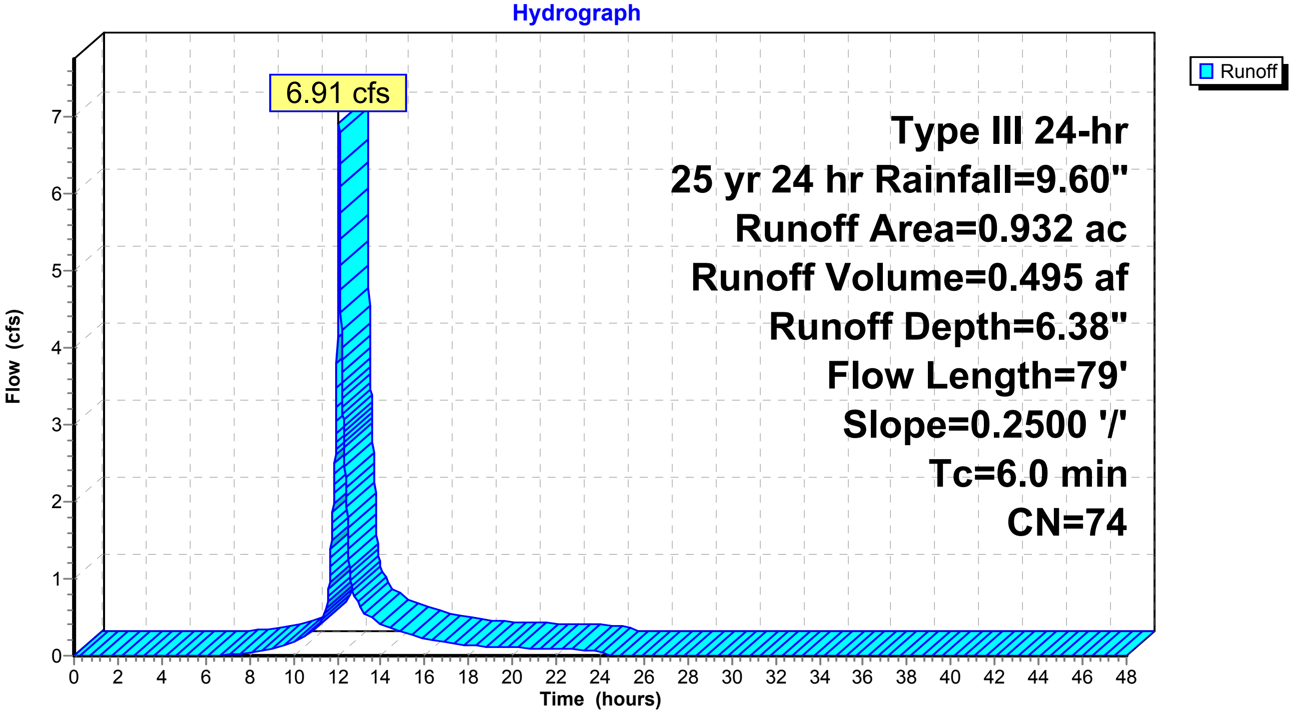
Runoff = 6.91 cfs @ 12.09 hrs, Volume= 0.495 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.932	74	Pasture/grassland/range, Good, HSG C
0.932		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	79	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	79	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 100S: 6e



Summary for Subcatchment 101S: Pond 6 Drainage Area

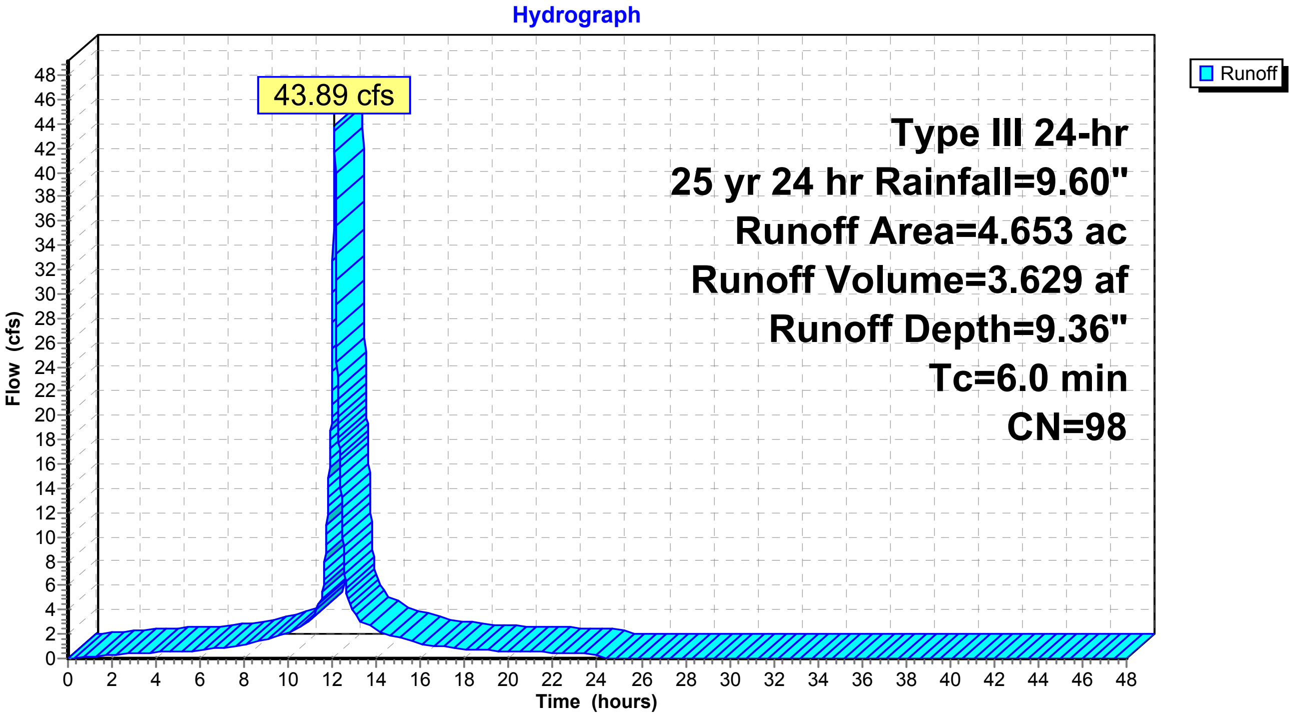
Runoff = 43.89 cfs @ 12.08 hrs, Volume= 3.629 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
4.653	98	Water Surface, HSG A
4.653		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 101S: Pond 6 Drainage Area



Summary for Subcatchment 102S: 4b.2

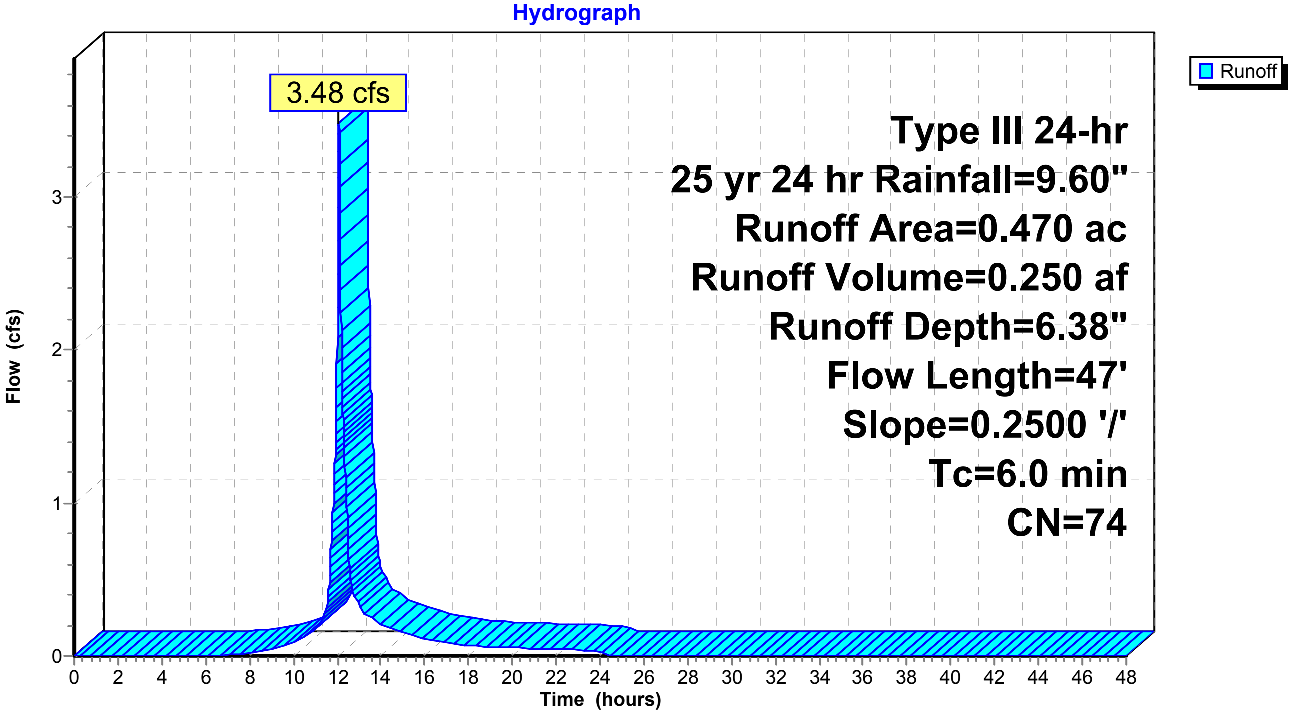
Runoff = 3.48 cfs @ 12.09 hrs, Volume= 0.250 af, Depth= 6.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
0.470	74	Pasture/grassland/range, Good, HSG C
0.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	47	0.2500	0.56		**Sheet Flow,** n= 0.136 P2= 5.40"
1.4	47	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 102S: 4b.2



Summary for Subcatchment 103S: Pond 4 Drainage Area

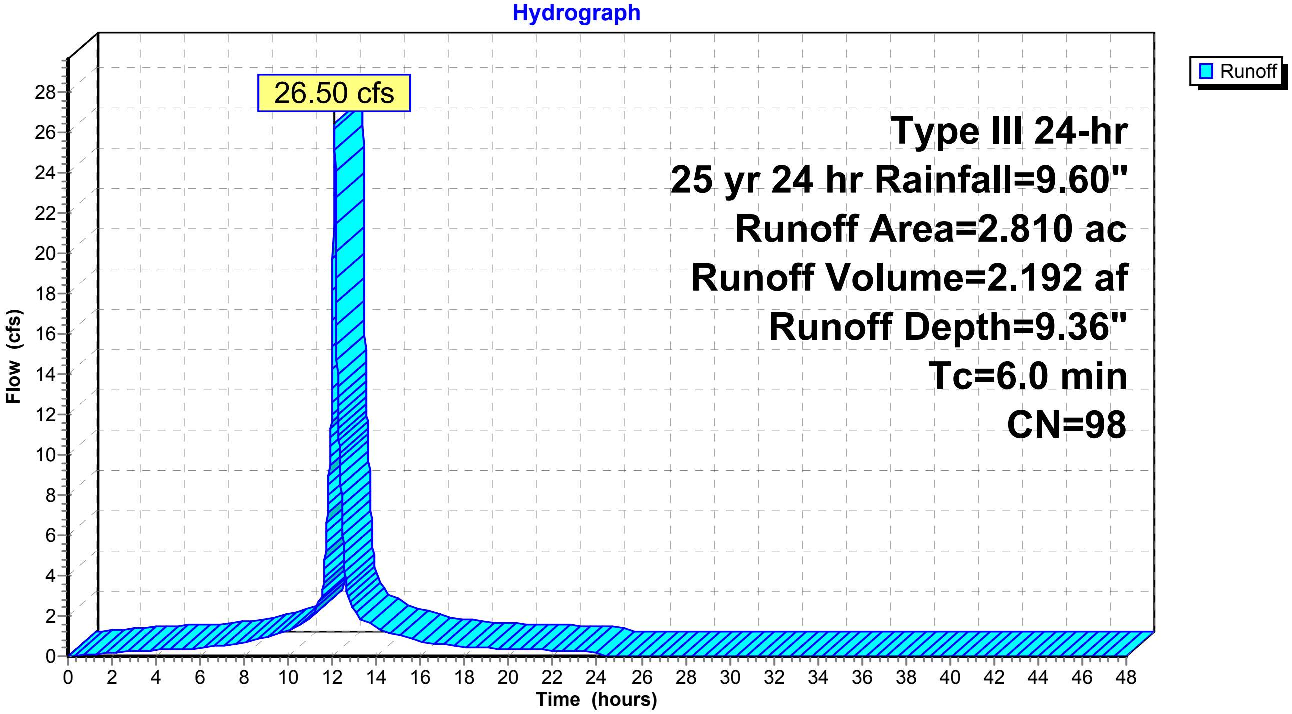
Runoff = 26.50 cfs @ 12.08 hrs, Volume= 2.192 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
2.810	98	Water Surface, HSG A
2.810		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 103S: Pond 4 Drainage Area



Summary for Subcatchment 104S: Pond 6 Drainage Area

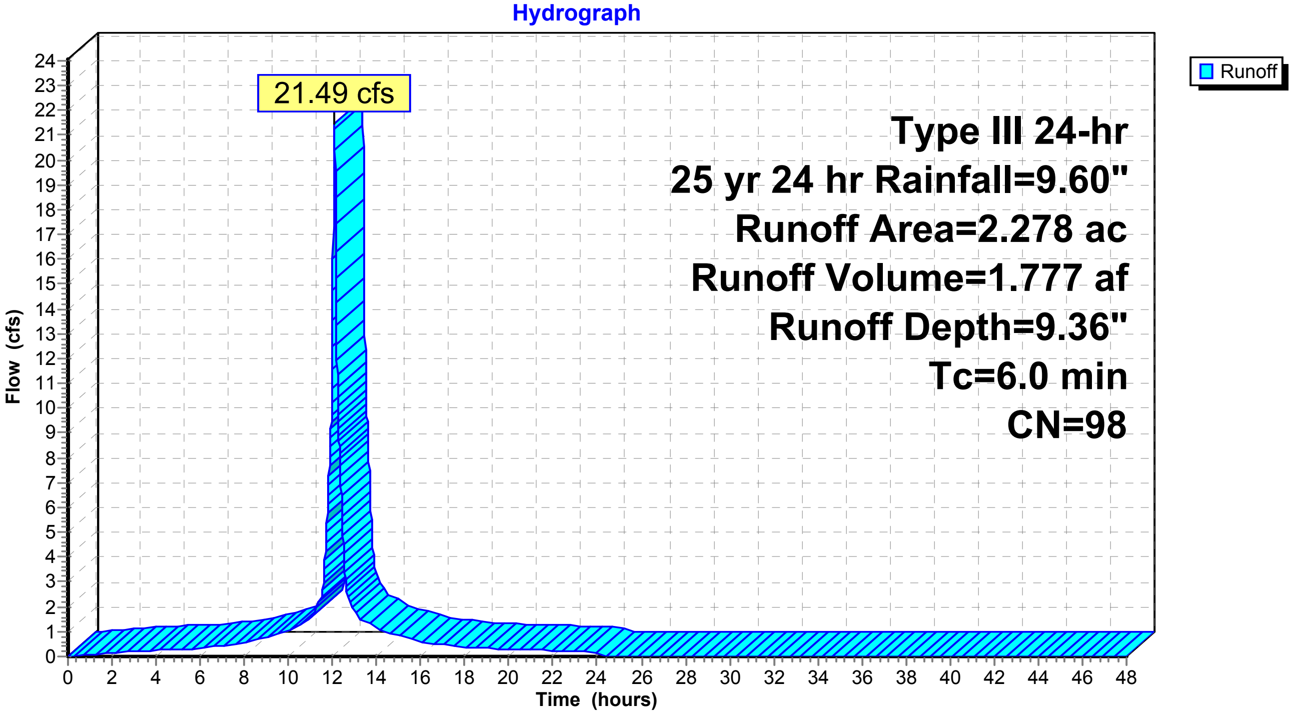
Runoff = 21.49 cfs @ 12.08 hrs, Volume= 1.777 af, Depth= 9.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr 24 hr Rainfall=9.60"

Area (ac)	CN	Description
2.278	98	Water Surface, HSG A
2.278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 104S: Pond 6 Drainage Area



Summary for Reach 102R: D.2 - D.3

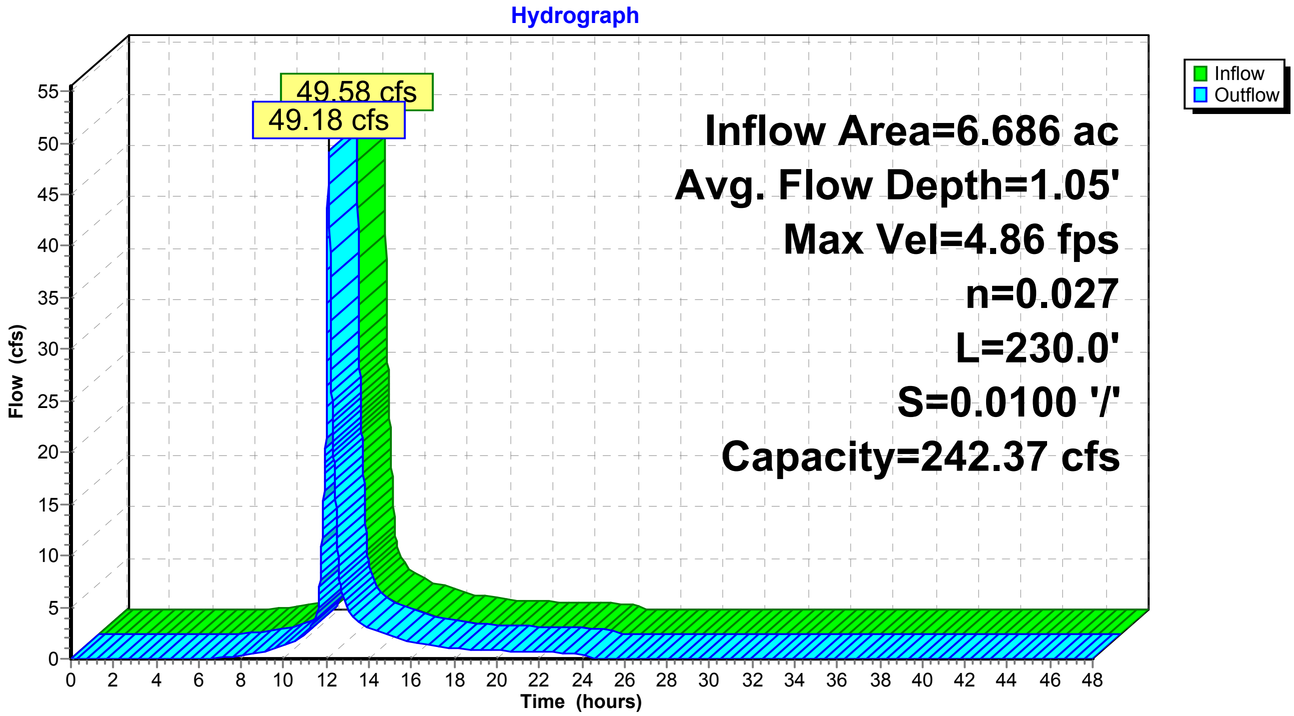
Inflow Area = 6.686 ac, 0.00% Impervious, Inflow Depth = 6.38" for 25 yr 24 hr event
Inflow = 49.58 cfs @ 12.09 hrs, Volume= 3.554 af
Outflow = 49.18 cfs @ 12.11 hrs, Volume= 3.554 af, Atten= 1%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.32 fps, Avg. Travel Time= 2.9 min

Peak Storage= 2,331 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.05'
Bank-Full Depth= 2.50' Flow Area= 31.3 sf, Capacity= 242.37 cfs

7.50' x 2.50' deep channel, n= 0.027
Side Slope Z-value= 2.0 '/' Top Width= 17.50'
Length= 230.0' Slope= 0.0100 '/'
Inlet Invert= 226.09', Outlet Invert= 223.79'

Reach 102R: D.2 - D.3



Summary for Pond 60P: Pond 3

Inflow Area = 8.109 ac, 16.76% Impervious, Inflow Depth = 6.88" for 25 yr 24 hr event
Inflow = 62.86 cfs @ 12.09 hrs, Volume= 4.648 af
Outflow = 0.49 cfs @ 24.06 hrs, Volume= 1.366 af, Atten= 99%, Lag= 718.4 min
Primary = 0.49 cfs @ 24.06 hrs, Volume= 1.366 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 216.38' @ 24.06 hrs Surf.Area= 0.899 ac Storage= 4.183 af

Plug-Flow detention time= 1,149.9 min calculated for 1.366 af (29% of inflow)
Center-of-Mass det. time= 995.4 min (1,788.4 - 793.0)

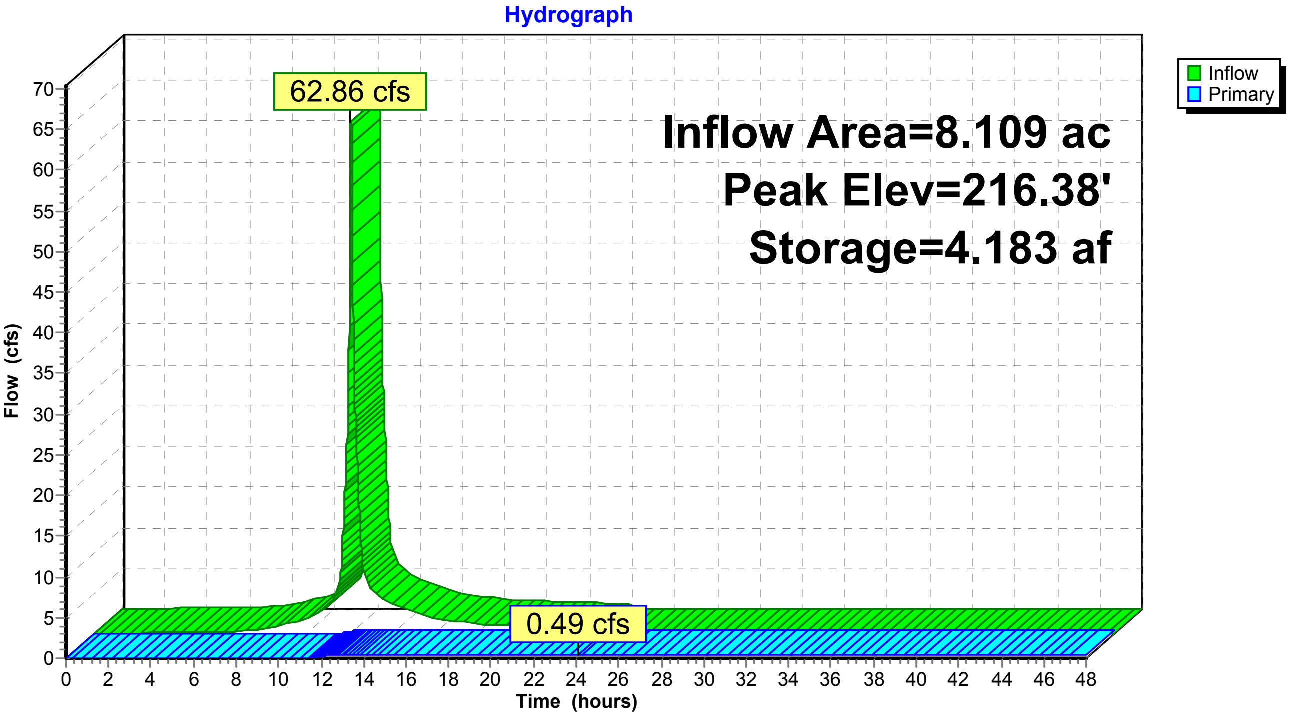
Volume	Invert	Avail.Storage	Storage Description
#1	211.00'	6.719 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
211.00	0.634	0.000	0.000
212.00	0.728	0.681	0.681
214.00	0.777	1.505	2.186
215.00	0.827	0.802	2.988
216.00	0.879	0.853	3.841
217.00	0.932	0.906	4.746
218.00	0.986	0.959	5.705
219.00	1.042	1.014	6.719

Device	Routing	Invert	Outlet Devices
#1	Device 2	211.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	212.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	216.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	211.00'	**12.0" Round 12" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 211.00' / 210.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#5	Primary	217.50'	**143.1 deg x 20.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=0.49 cfs @ 24.06 hrs HW=216.38' (Free Discharge)
↑—**4=12" culvert** (Passes 0.49 cfs of 6.51 cfs potential flow)
  ↑—**2=3" Pipe** (Orifice Controls 0.49 cfs @ 9.94 fps)
    ↑—**1=grate (36" half-circle)** (Passes 0.49 cfs of 2.62 cfs potential flow)
  └—**3=riser slits** (Controls 0.00 cfs)
└—**5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 60P: Pond 3



Summary for Pond 65P: Pond 6

```
Inflow Area =        28.191 ac,  16.51% Impervious,  Inflow Depth =   6.87"    for  25 yr 24 hr event
Inflow       =      213.09 cfs @   12.10 hrs,  Volume=           16.140 af
Outflow      =        5.75 cfs @   16.74 hrs,  Volume=            4.582 af,  Atten= 97%,  Lag= 278.6 min
Primary      =        5.75 cfs @   16.74 hrs,  Volume=            4.582 af
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 219.84' @ 16.74 hrs Surf.Area= 2.581 ac Storage= 13.180 af

Plug-Flow detention time= 729.5 min calculated for 4.582 af (28% of inflow)
Center-of-Mass det. time= 572.1 min (1,366.3 - 794.2)

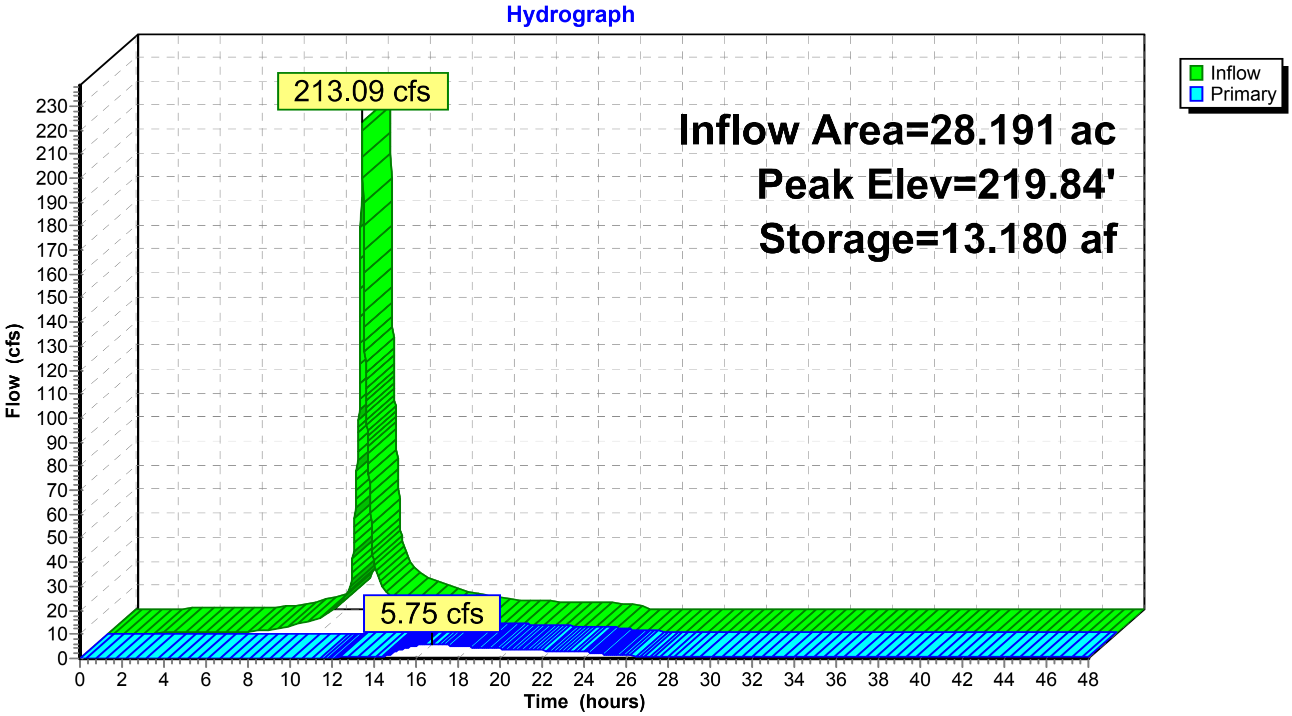
Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	24.939 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
214.00	1.929	0.000	0.000
216.00	2.159	4.088	4.088
218.00	2.377	4.536	8.624
220.00	2.599	4.976	13.600
222.00	2.834	5.433	19.033
224.00	3.072	5.906	24.939

Device	Routing	Invert	Outlet Devices
#1	Device 2	214.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	215.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	219.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	214.00'	**24.0" Round 24" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	221.00'	**157.4 deg x 20.0' long x 3.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow  Max=5.71 cfs @ 16.74 hrs  HW=219.84'   (Free Discharge)
↑
├──4=24" culvert  (Passes 5.71 cfs of 26.27 cfs potential flow)
│  ↑
│  ├──2=3" Pipe  (Orifice Controls 0.51 cfs @ 10.45 fps)
│  │  ↑
│  │  └──1=grate (36" half-circle)  (Passes 0.51 cfs of 2.76 cfs potential flow)
│  └──3=riser slits  (Orifice Controls 5.19 cfs @ 1.87 fps)
└──5=Sharp-Crested Vee/Trap Weir ( Controls 0.00 cfs)
```

Pond 65P: Pond 6



Summary for Pond 69P: Pond 4

```
Inflow Area =      37.379 ac,   7.52% Impervious,  Inflow Depth =   6.60"    for  25 yr 24 hr event
Inflow       =     273.91 cfs @  12.09 hrs,  Volume=         20.566 af
Outflow      =      56.77 cfs @  12.53 hrs,  Volume=         20.477 af,  Atten= 79%,  Lag= 26.4 min
Primary      =      56.77 cfs @  12.53 hrs,  Volume=         20.477 af
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 230.96' @ 12.53 hrs Surf.Area= 1.607 ac Storage= 8.237 af

Plug-Flow detention time= 117.2 min calculated for 20.477 af (100% of inflow)
Center-of-Mass det. time= 114.4 min (916.6 - 802.1)

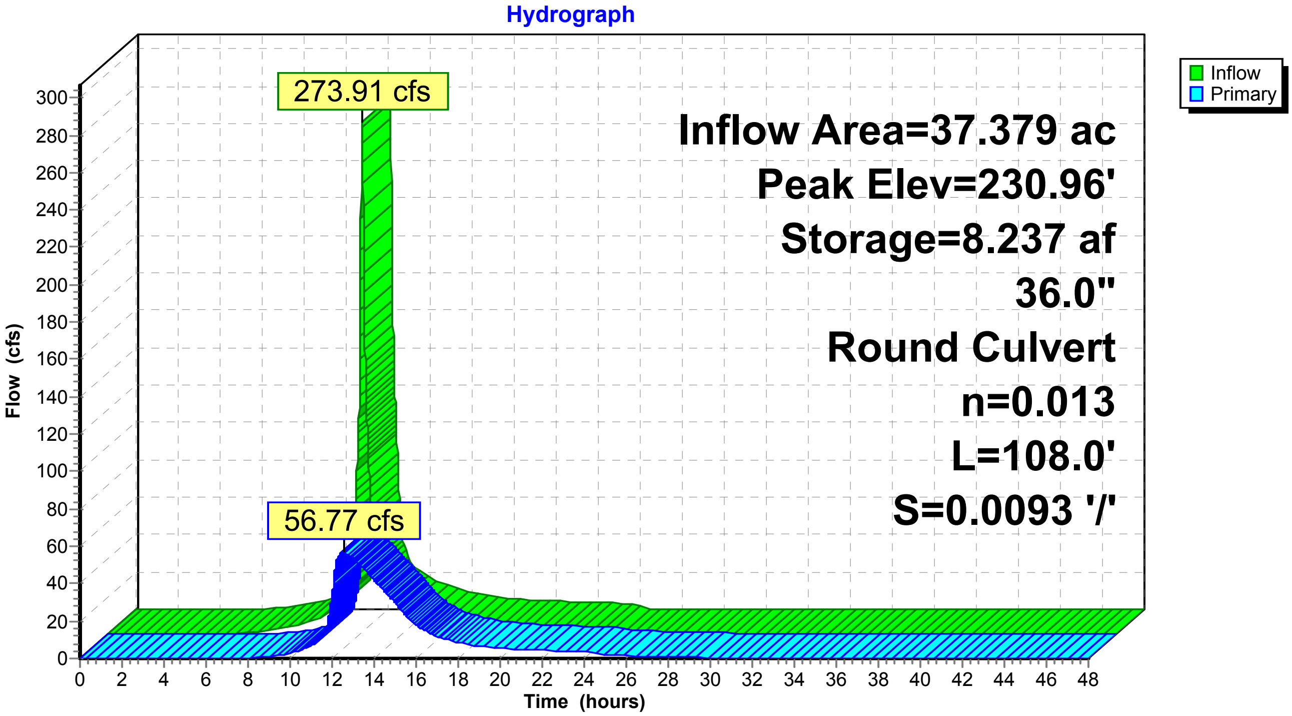
Volume	Invert	Avail.Storage	Storage Description
#1	225.00'	21.581 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
225.00	1.164	0.000	0.000
226.00	1.234	1.199	1.199
227.00	1.306	1.270	2.469
228.00	1.380	1.343	3.812
229.00	1.455	1.418	5.230
230.00	1.532	1.493	6.723
231.00	1.610	1.571	8.294
232.00	1.690	1.650	9.944
233.00	1.771	1.730	11.674
234.00	1.853	1.812	13.486
235.00	1.937	1.895	15.381
236.00	2.023	1.980	17.361
237.00	2.109	2.066	19.427
238.00	2.198	2.153	21.581

Device	Routing	Invert	Outlet Devices
#1	Primary	225.00'	**36.0" Round 36" culvert** L= 108.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0093 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=56.77 cfs @ 12.53 hrs HW=230.96' (Free Discharge)
↑—**1=36" culvert** (Inlet Controls 56.77 cfs @ 8.03 fps)

Pond 69P: Pond 4



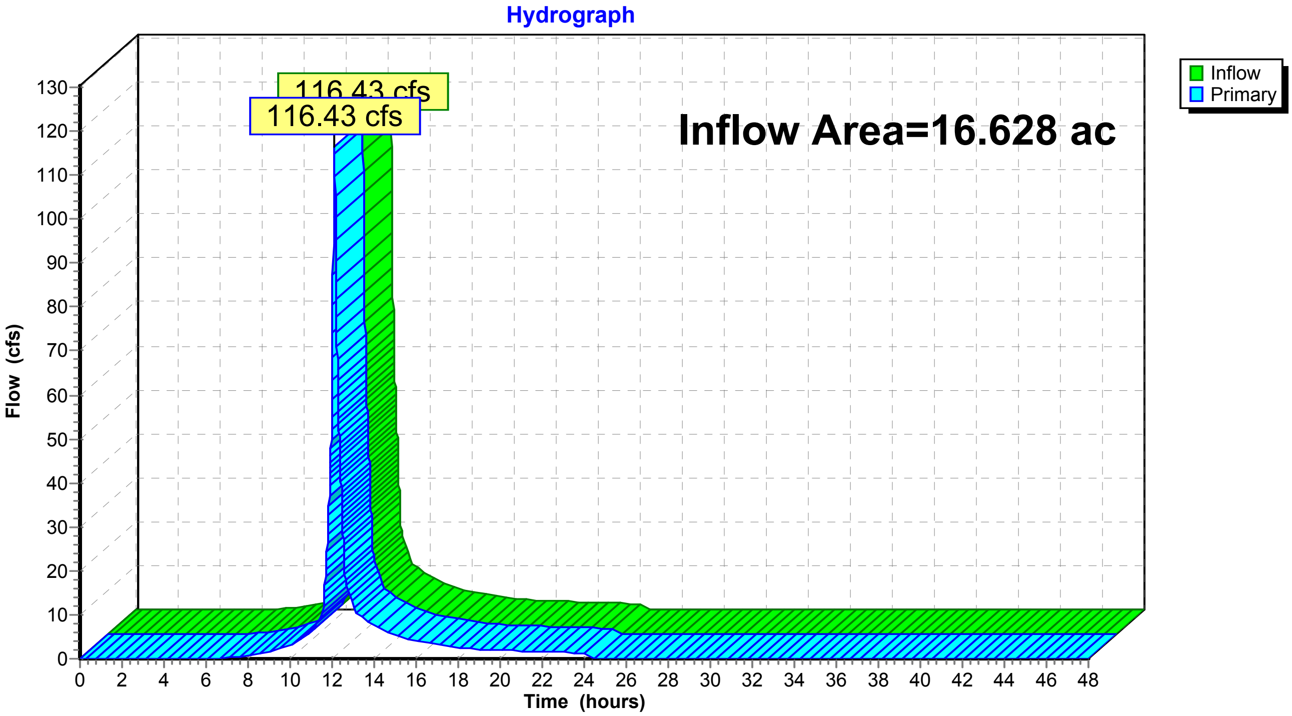
Summary for Pond 78P: C-6

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 16.628 ac, 0.00% Impervious, Inflow Depth = 6.38" for 25 yr 24 hr event
Inflow = 116.43 cfs @ 12.11 hrs, Volume= 8.838 af
Primary = 116.43 cfs @ 12.11 hrs, Volume= 8.838 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 78P: C-6

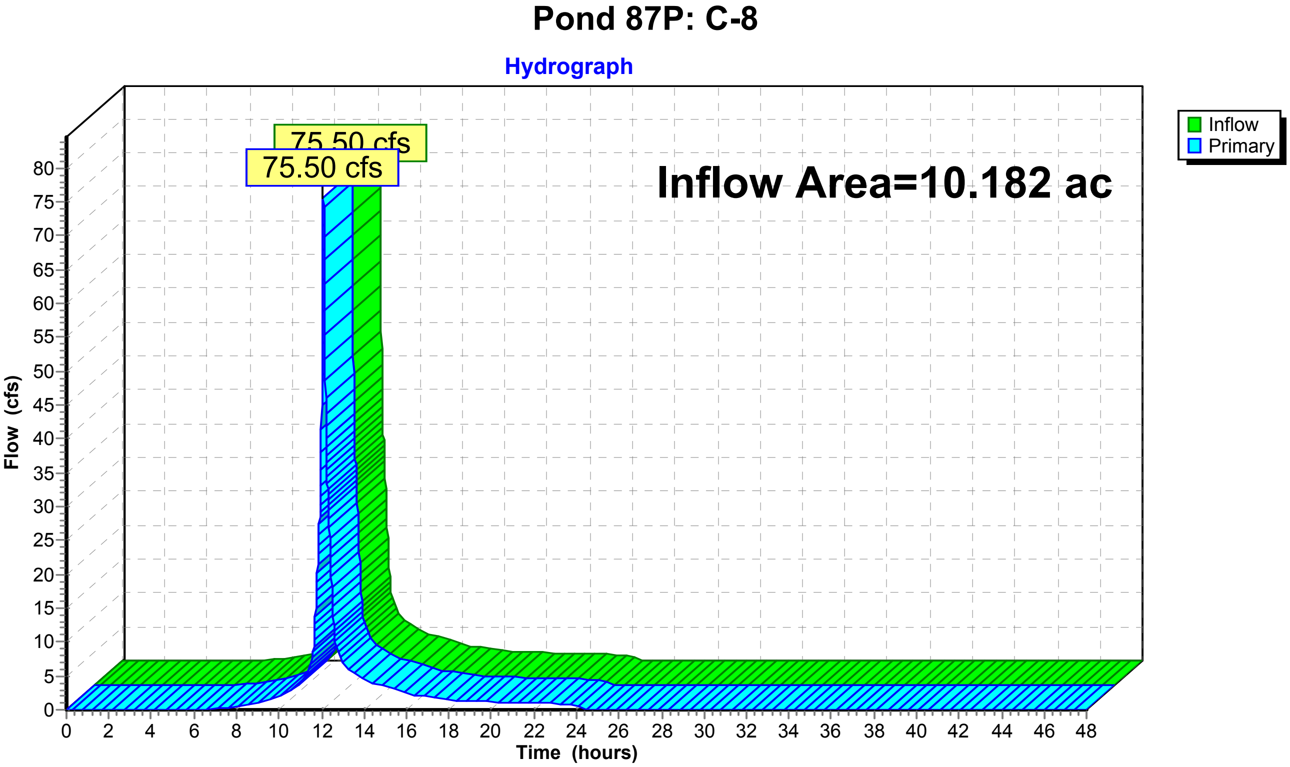


Summary for Pond 87P: C-8

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	10.182 ac,	0.00% Impervious,	Inflow Depth = 6.38"	for 25 yr 24 hr event	
Inflow =	75.50 cfs @	12.09 hrs,	Volume=	5.412 af	
Primary =	75.50 cfs @	12.09 hrs,	Volume=	5.412 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



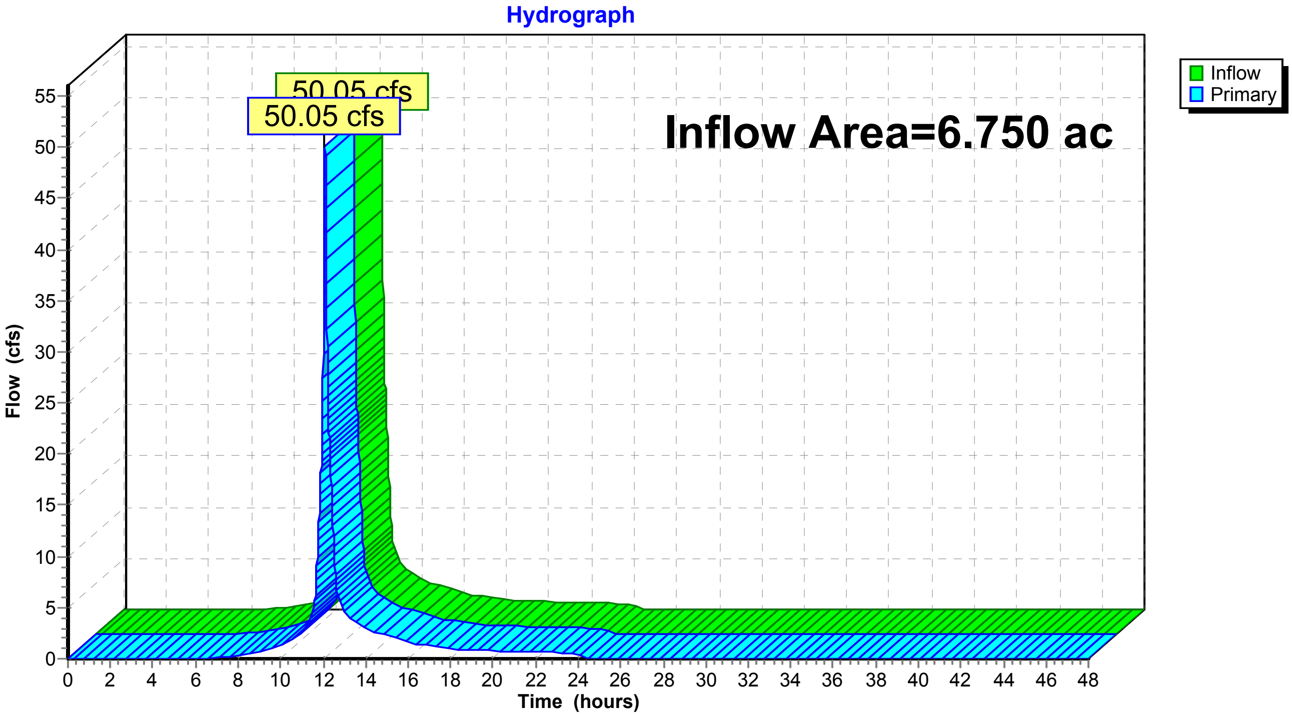
Summary for Pond 93P: C-10

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =        6.750 ac,   0.00% Impervious,  Inflow Depth =   6.38"    for  25 yr 24 hr event
Inflow      =       50.05 cfs @   12.09 hrs,  Volume=            3.588 af
Primary     =       50.05 cfs @   12.09 hrs,  Volume=            3.588 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 93P: C-10

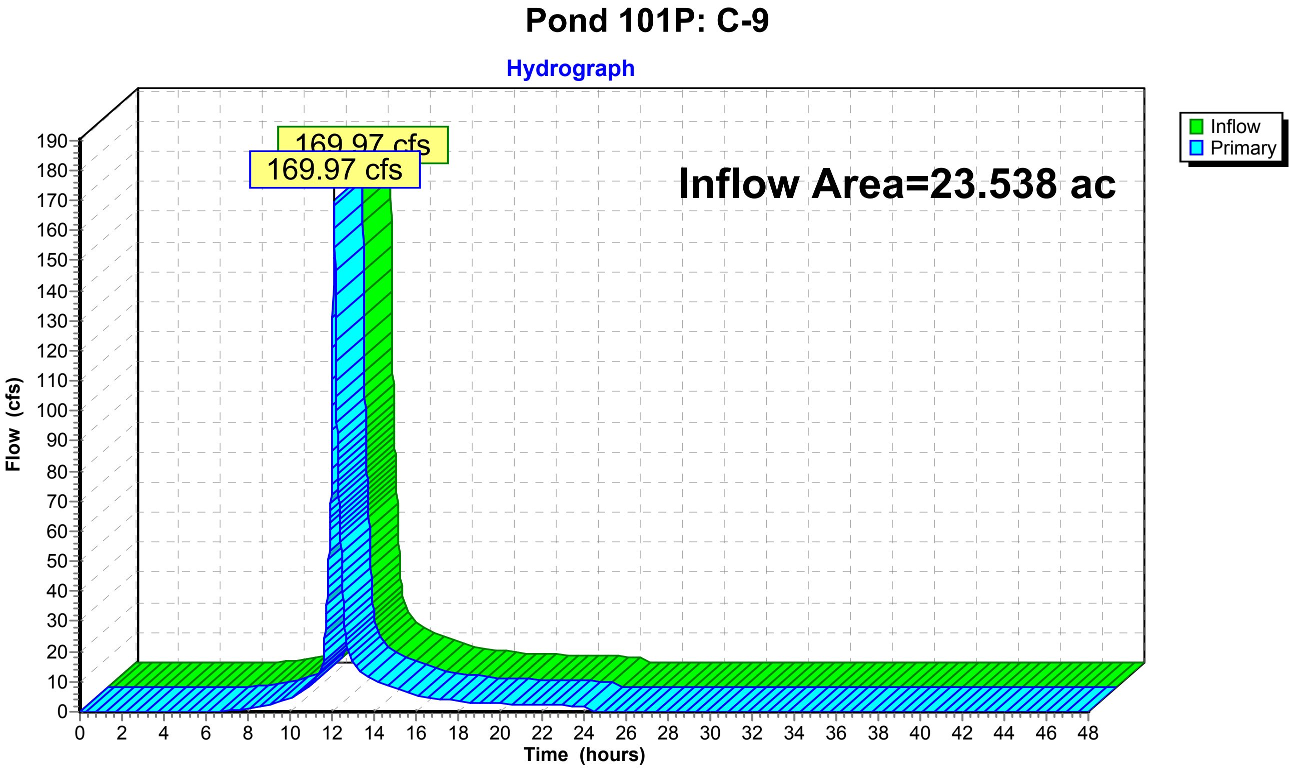


Summary for Pond 101P: C-9

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 23.538 ac, 0.00% Impervious, Inflow Depth = 6.38" for 25 yr 24 hr event
Inflow = 169.97 cfs @ 12.10 hrs, Volume= 12.511 af
Primary = 169.97 cfs @ 12.10 hrs, Volume= 12.511 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Summary for Pond 105P: Pond 5

Inflow Area = 12.460 ac, 18.28% Impervious, Inflow Depth = 6.92" for 25 yr 24 hr event
Inflow = 96.97 cfs @ 12.09 hrs, Volume= 7.189 af
Outflow = 21.65 cfs @ 12.50 hrs, Volume= 5.697 af, Atten= 78%, Lag= 24.7 min
Primary = 21.65 cfs @ 12.50 hrs, Volume= 5.697 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 256.29' @ 12.50 hrs Surf.Area= 0.956 ac Storage= 3.554 af

Plug-Flow detention time= 284.7 min calculated for 5.695 af (79% of inflow)
Center-of-Mass det. time= 206.3 min (998.0 - 791.7)

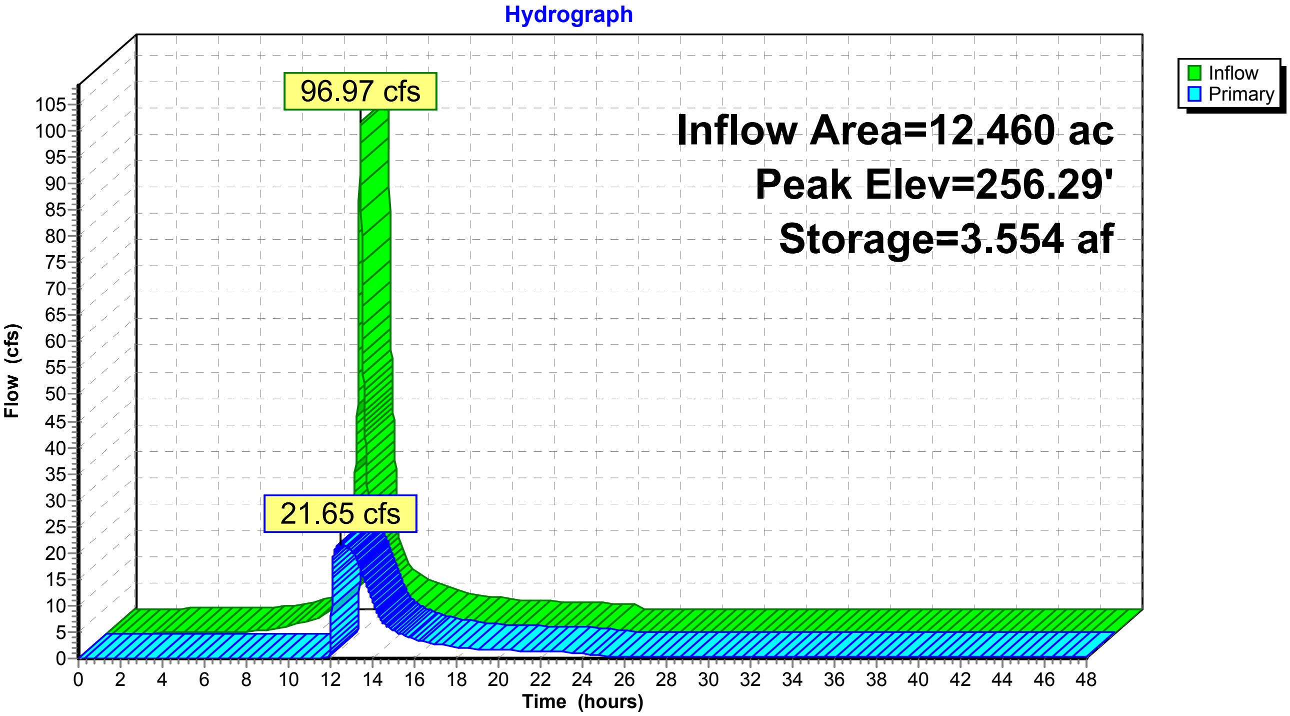
Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	5.284 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
252.00	0.706	0.000	0.000
254.00	0.819	1.525	1.525
256.00	0.938	1.757	3.282
258.00	1.064	2.002	5.284

Device	Routing	Invert	Outlet Devices
#1	Device 2	252.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	253.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	254.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	252.00'	**24.0" Round 24" culvert** L= 80.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 252.00' / 251.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	257.00'	**143.1 deg x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow Max=21.65 cfs @ 12.50 hrs  HW=256.29'  (Free Discharge)
↑—4=24" culvert (Inlet Controls 21.65 cfs @ 6.89 fps)
│ ↑—2=3" Pipe (Passes < 0.42 cfs potential flow)
│ │ ↑—1=grate (36" half-circle) (Passes < 2.27 cfs potential flow)
│ └—3=riser slits (Passes < 24.55 cfs potential flow)
└—5=Sharp-Crested Vee/Trap Weir ( Controls 0.00 cfs)
```

Pond 105P: Pond 5

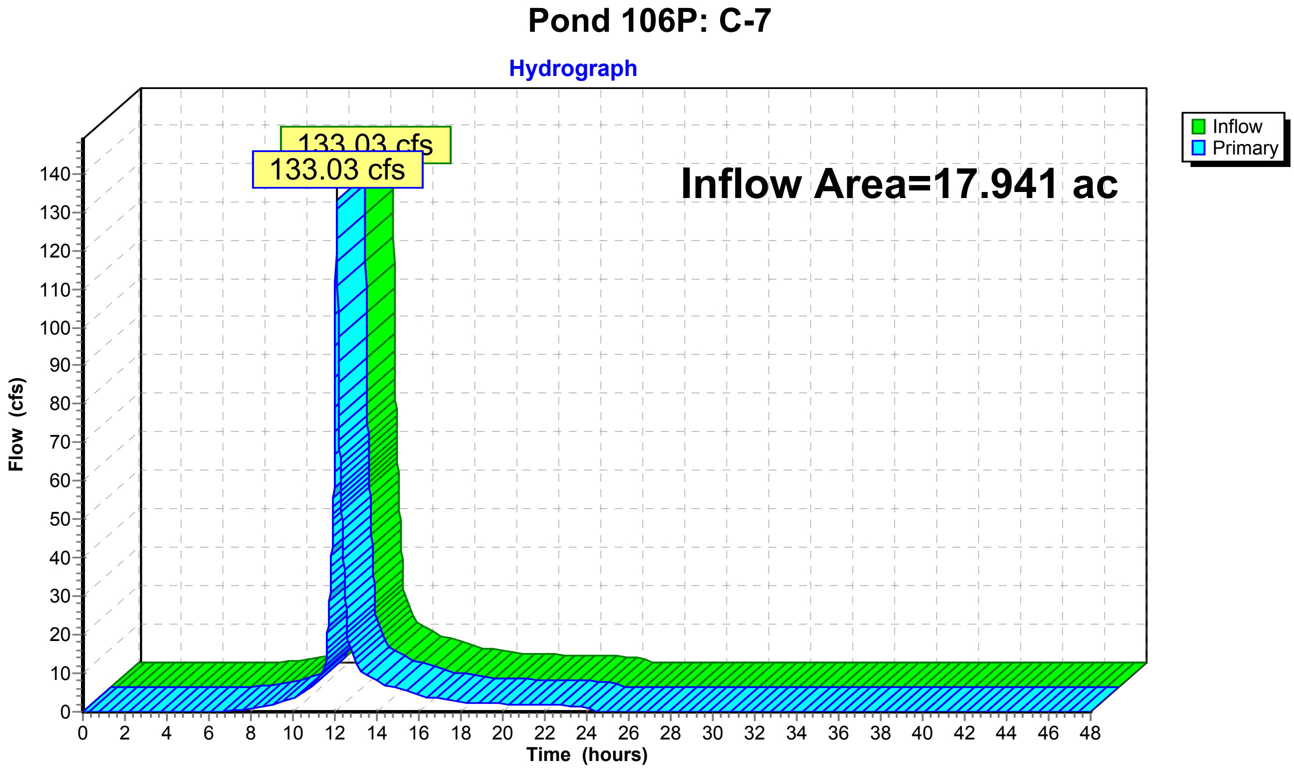


Summary for Pond 106P: C-7

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =       17.941 ac,    0.00% Impervious,  Inflow Depth =   6.38"    for  25 yr 24 hr event
Inflow       =      133.03 cfs @   12.09 hrs,  Volume=             9.536 af
Primary      =      133.03 cfs @   12.09 hrs,  Volume=             9.536 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 63S: 6a Runoff Area=0.306 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=37' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=3.06 cfs 0.222 af

Subcatchment 72S: 4a Runoff Area=0.328 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=18' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=3.28 cfs 0.238 af

Subcatchment 73S: 4b.1 Runoff Area=15.830 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=1,200' Tc=7.7 min CN=74 Runoff=149.56 cfs 11.492 af

Subcatchment 74S: 4c Runoff Area=10.679 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=1,002' Tc=6.0 min CN=74 Runoff=106.93 cfs 7.753 af

Subcatchment 75S: 4d Runoff Area=6.396 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=831' Tc=6.0 min CN=74 Runoff=64.05 cfs 4.643 af

Subcatchment 76S: 4e Runoff Area=0.866 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=71' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=8.67 cfs 0.629 af

Subcatchment 83S: 5b Runoff Area=7.368 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=1,001' Tc=6.0 min CN=74 Runoff=73.78 cfs 5.349 af

Subcatchment 91S: 5c Runoff Area=1.322 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=1,002' Tc=6.0 min CN=74 Runoff=13.24 cfs 0.960 af

Subcatchment 92S: 5a Runoff Area=1.492 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=81' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=14.94 cfs 1.083 af

Subcatchment 93S: 3b Runoff Area=0.400 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=80' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=4.01 cfs 0.290 af

Subcatchment 94S: 3a Runoff Area=0.590 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=85' Slope=0.2500 '/' Tc=6.0 min CN=74 Runoff=5.91 cfs 0.428 af

Subcatchment 95S: 3c Runoff Area=5.760 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=980' Tc=6.0 min CN=74 Runoff=57.68 cfs 4.182 af

Subcatchment 96S: Pond 3 Drainage Area Runoff Area=1.359 ac 100.00% Impervious Runoff Depth=11.86"
Tc=6.0 min CN=98 Runoff=16.17 cfs 1.343 af

Subcatchment 97S: 6c Runoff Area=12.083 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=1,019' Tc=7.1 min CN=74 Runoff=116.45 cfs 8.772 af

Subcatchment 98S: 6d Runoff Area=3.837 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=575' Tc=6.0 min CN=74 Runoff=38.42 cfs 2.786 af

Subcatchment 99S: 6b Runoff Area=6.380 ac 0.00% Impervious Runoff Depth=8.71"
Flow Length=837' Tc=6.0 min CN=74 Runoff=63.89 cfs 4.632 af

```
Subcatchment 100S: 6e                     Runoff Area=0.932 ac   0.00% Impervious   Runoff Depth=8.71"
                       Flow Length=79'   Slope=0.2500 '/'   Tc=6.0 min   CN=74   Runoff=9.33 cfs  0.677 af

Subcatchment 101S: Pond 6 Drainage     Runoff Area=4.653 ac   100.00% Impervious   Runoff Depth=11.86"
                                                   Tc=6.0 min   CN=98   Runoff=55.35 cfs  4.598 af

Subcatchment 102S: 4b.2                   Runoff Area=0.470 ac   0.00% Impervious   Runoff Depth=8.71"
                       Flow Length=47'   Slope=0.2500 '/'   Tc=6.0 min   CN=74   Runoff=4.71 cfs  0.341 af

Subcatchment 103S: Pond 4 Drainage     Runoff Area=2.810 ac   100.00% Impervious   Runoff Depth=11.86"
                                                   Tc=6.0 min   CN=98   Runoff=33.43 cfs  2.777 af

Subcatchment 104S: Pond 6 Drainage     Runoff Area=2.278 ac   100.00% Impervious   Runoff Depth=11.86"
                                                   Tc=6.0 min   CN=98   Runoff=27.10 cfs  2.251 af

Reach 102R: D.2 - D.3                  Avg. Flow Depth=1.25'   Max Vel=5.33 fps   Inflow=66.95 cfs  4.854 af
                       n=0.027   L=230.0'   S=0.0100 '/'   Capacity=242.37 cfs   Outflow=66.51 cfs  4.854 af

Pond 60P: Pond 3                      Peak Elev=216.77'  Storage=4.531 af   Inflow=83.75 cfs  6.243 af
                                                                          Outflow=4.17 cfs  2.837 af

Pond 65P: Pond 6                     Peak Elev=220.39'  Storage=14.628 af   Inflow=284.35 cfs  21.686 af
                                                                         Outflow=16.32 cfs  10.112 af

Pond 69P: Pond 4                     Peak Elev=232.82'  Storage=11.349 af   Inflow=367.70 cfs  27.873 af
                       36.0"  Round Culvert  n=0.013  L=108.0'  S=0.0093 '/'   Outflow=67.52 cfs  27.782 af

Pond 78P: C-6                                                            Inflow=157.28 cfs  12.072 af
                                                                        Primary=157.28 cfs  12.072 af

Pond 87P: C-8                                                            Inflow=101.96 cfs  7.392 af
                                                                        Primary=101.96 cfs  7.392 af

Pond 93P: C-10                                                            Inflow=67.59 cfs  4.900 af
                                                                         Primary=67.59 cfs  4.900 af

Pond 101P: C-9                                                           Inflow=229.82 cfs  17.088 af
                                                                        Primary=229.82 cfs  17.088 af

Pond 105P: Pond 5                     Peak Elev=257.49'  Storage=4.748 af   Inflow=129.04 cfs  9.643 af
                                                                          Outflow=26.55 cfs  8.147 af

Pond 106P: C-7                                                           Inflow=179.65 cfs  13.025 af
                                                                        Primary=179.65 cfs  13.025 af

        Total Runoff Area = 86.139 ac   Runoff Volume = 65.445 af   Average Runoff Depth = 9.12"
                                   87.11% Pervious = 75.039 ac     12.89% Impervious = 11.100 ac
```

Summary for Subcatchment 63S: 6a

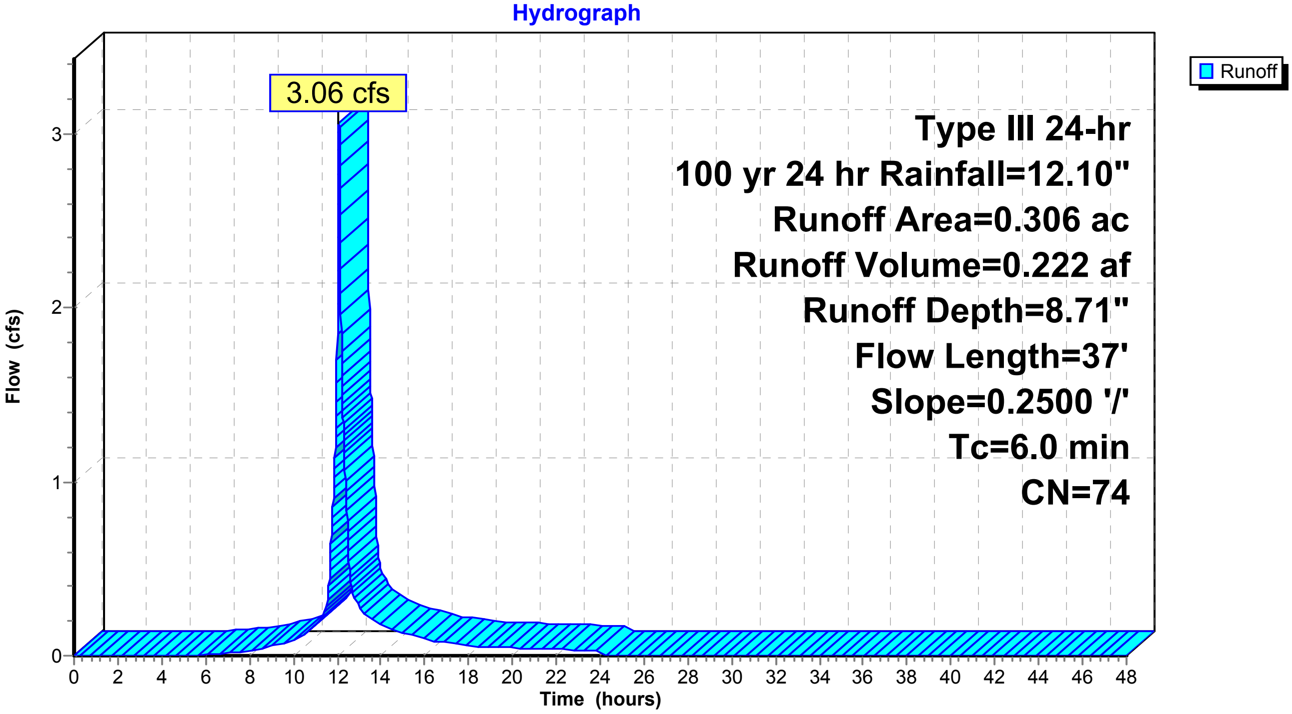
Runoff = 3.06 cfs @ 12.09 hrs, Volume= 0.222 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	0.306	74	Pasture/grassland/range, Good, HSG C
	0.306		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	37	0.2500	0.54		**Sheet Flow,** n= 0.136 P2= 5.40"
1.1	37	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 63S: 6a



Summary for Subcatchment 72S: 4a

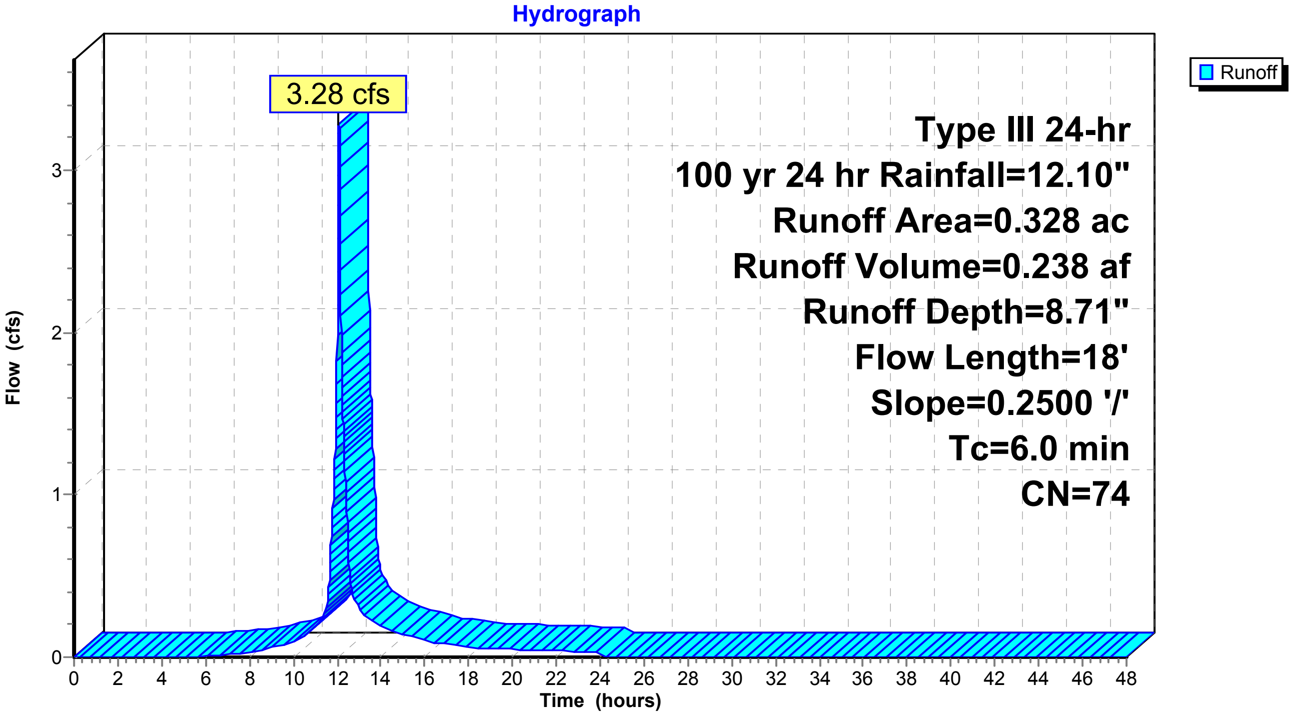
Runoff = 3.28 cfs @ 12.09 hrs, Volume= 0.238 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
0.328	74	Pasture/grassland/range, Good, HSG C
0.328		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	18	0.2500	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.6	18	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 72S: 4a



Summary for Subcatchment 73S: 4b.1

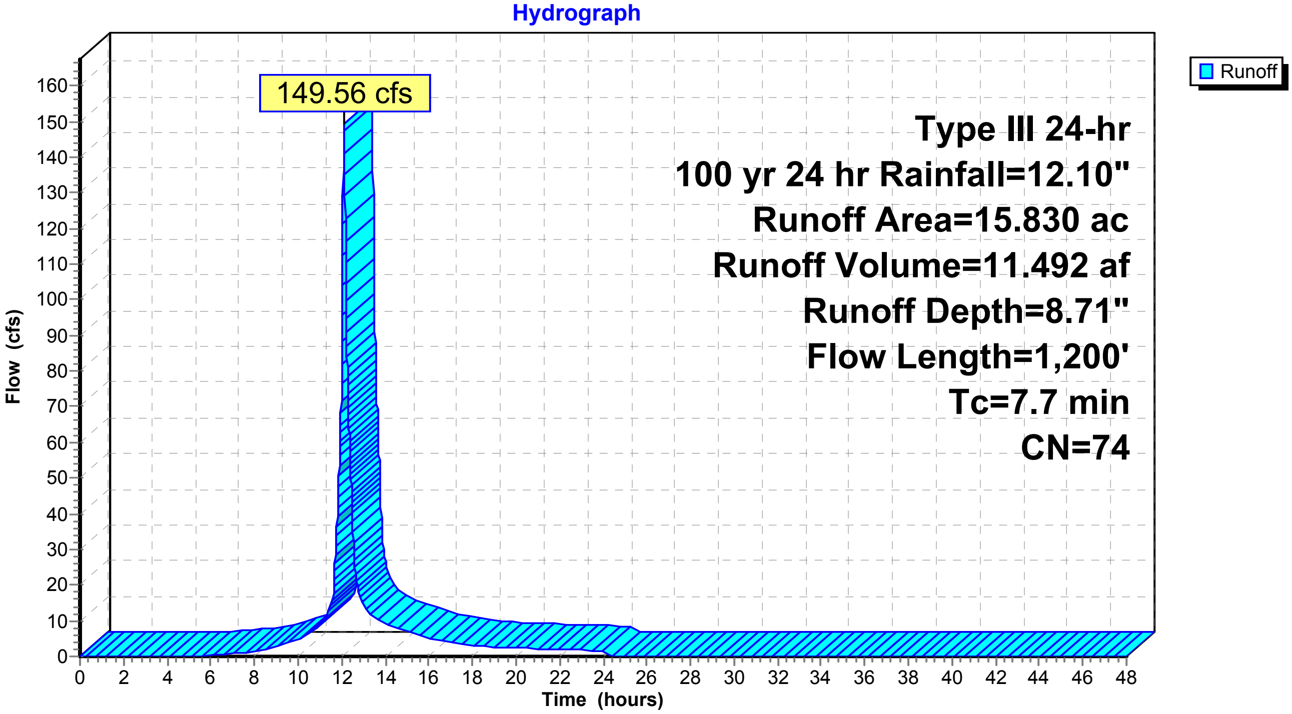
Runoff = 149.56 cfs @ 12.11 hrs, Volume= 11.492 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
15.830	74	Pasture/grassland/range, Good, HSG C
15.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.6	187	0.0802	0.47		**Sheet Flow,** n= 0.136 P2= 5.40"
0.4	200	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.7	813	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.7	1,200	Total			

Subcatchment 73S: 4b.1



Summary for Subcatchment 74S: 4c

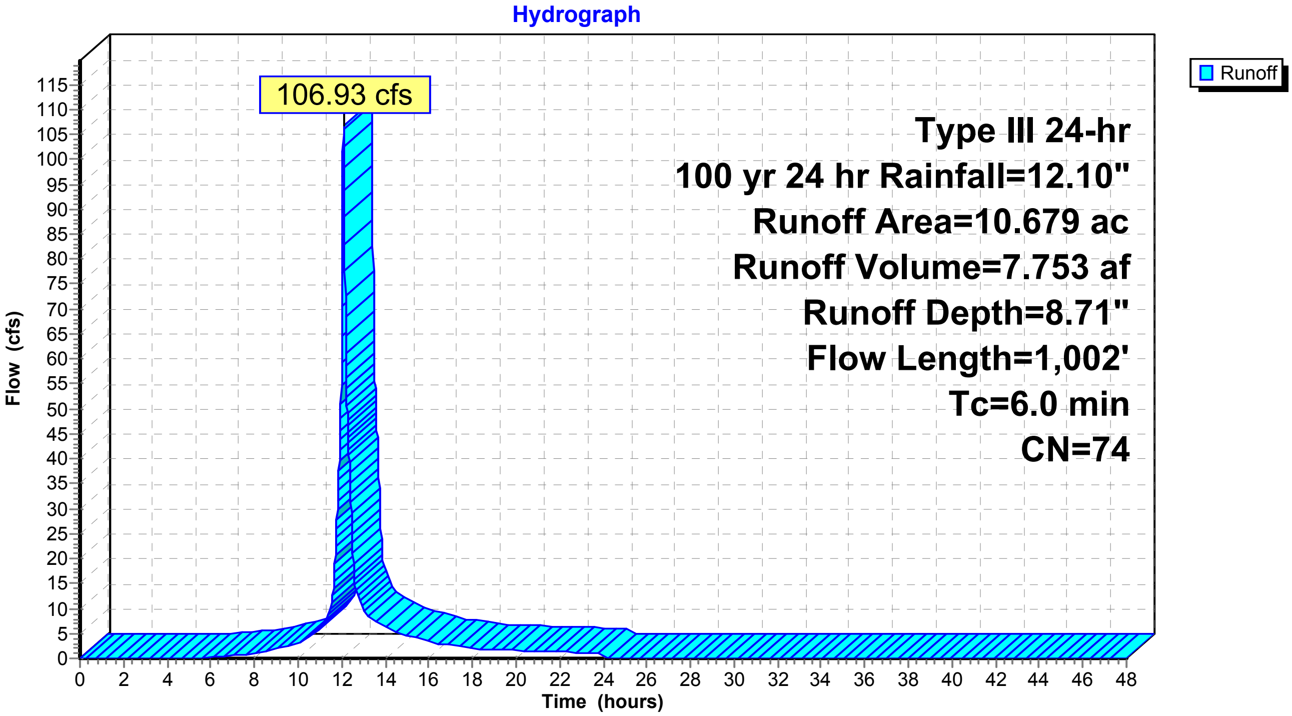
Runoff = 106.93 cfs @ 12.09 hrs, Volume= 7.753 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	10.679	74	Pasture/grassland/range, Good, HSG C
	10.679		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	107	0.1878	0.59		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	301	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	594	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.2	1,002	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 74S: 4c



Summary for Subcatchment 75S: 4d

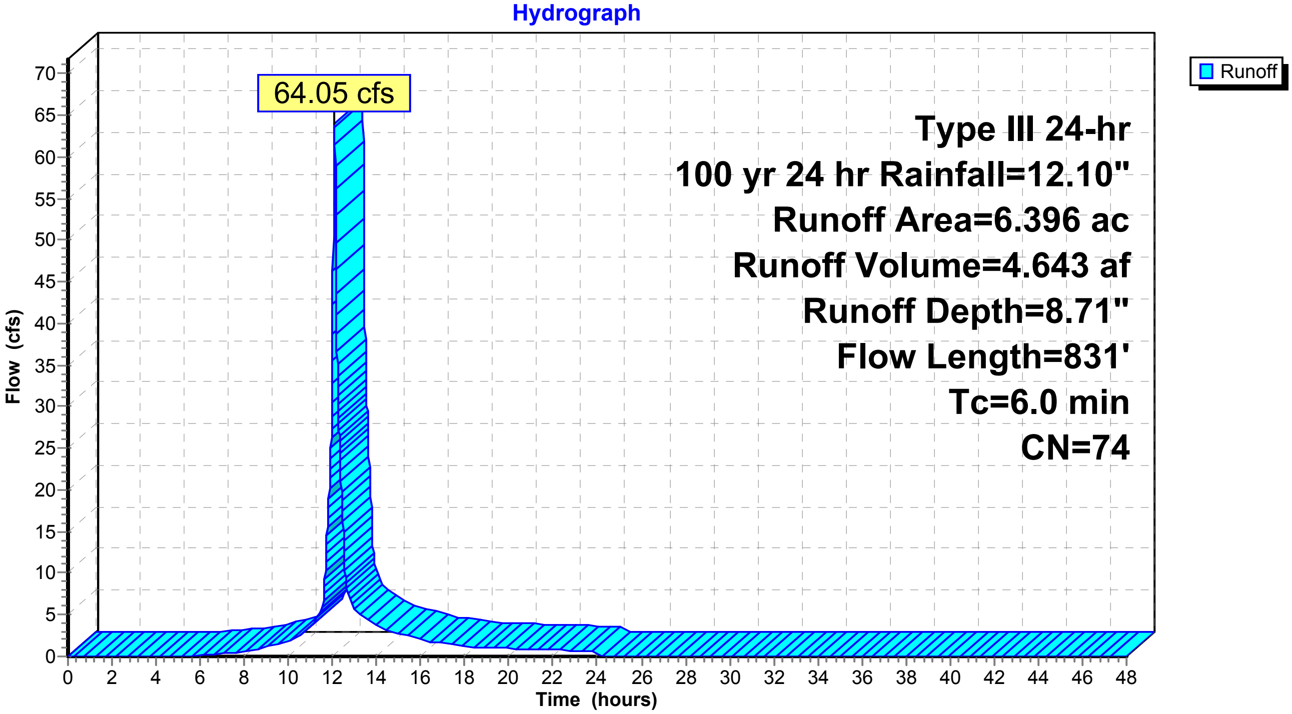
Runoff = 64.05 cfs @ 12.09 hrs, Volume= 4.643 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	6.396	74	Pasture/grassland/range, Good, HSG C
	6.396		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.3	67	0.0598	0.34		**Sheet Flow,** n= 0.136 P2= 5.40"
0.5	224	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	540	0.1950	17.06	30.15	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.3	831	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 75S: 4d



Summary for Subcatchment 76S: 4e

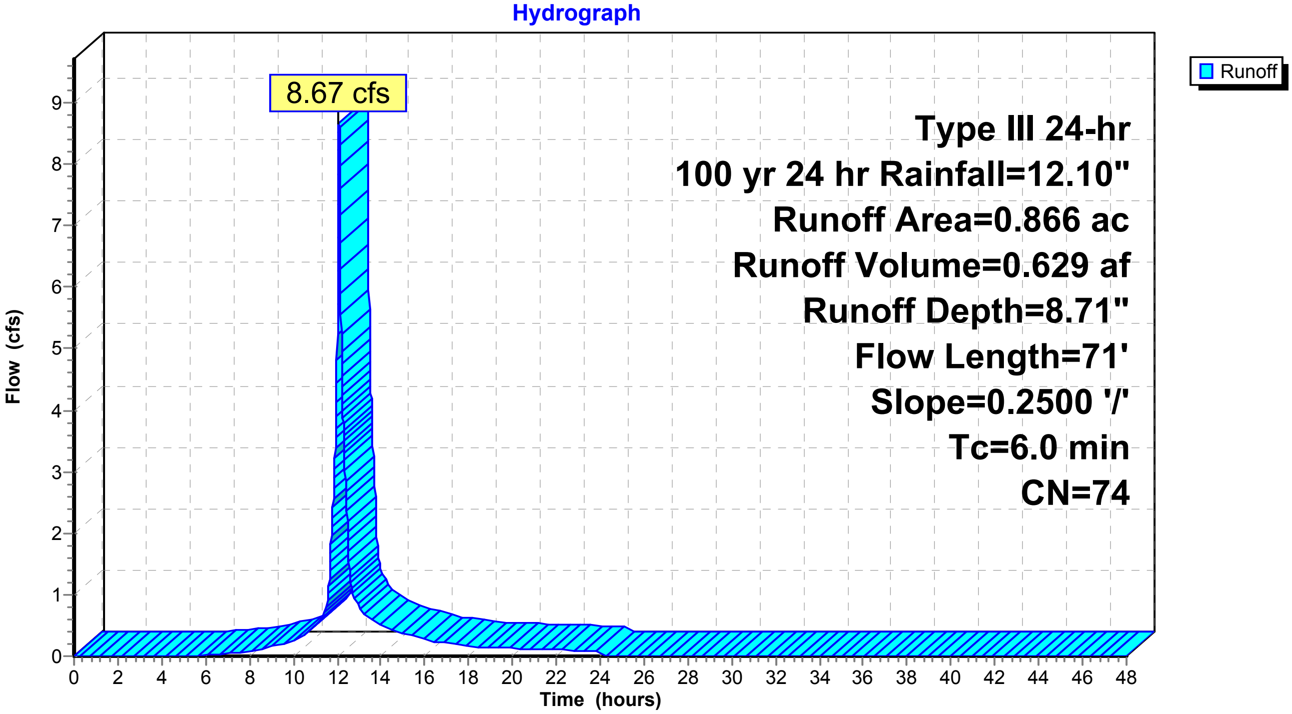
Runoff = 8.67 cfs @ 12.09 hrs, Volume= 0.629 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	0.866	74	Pasture/grassland/range, Good, HSG C
	0.866		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	71	0.2500	0.61		**Sheet Flow,** n= 0.136 P2= 5.40"
1.9	71	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 76S: 4e



Summary for Subcatchment 83S: 5b

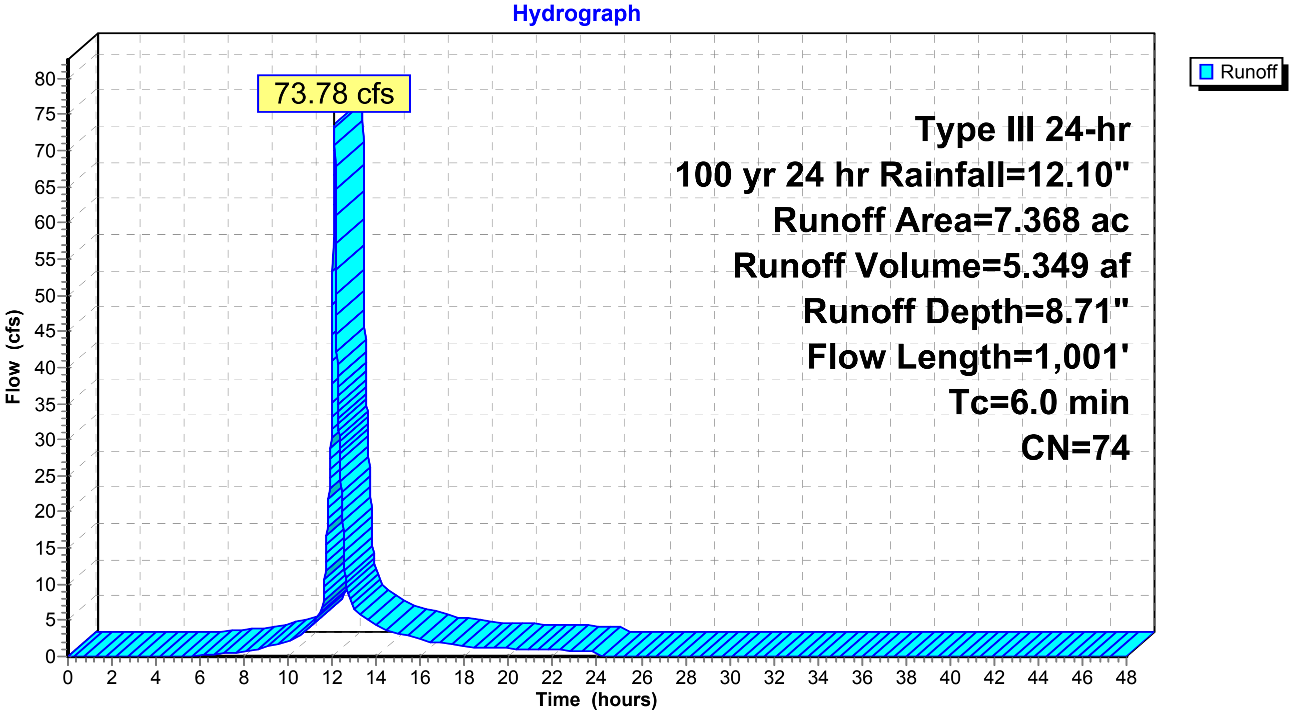
Runoff = 73.78 cfs @ 12.09 hrs, Volume= 5.349 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	7.368	74	Pasture/grassland/range, Good, HSG C
	7.368		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	102	0.1961	0.60		**Sheet Flow,** n= 0.136 P2= 5.40"
1.0	462	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.4	437	0.2194	18.10	31.98	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.2	1,001	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 83S: 5b



Summary for Subcatchment 91S: 5c

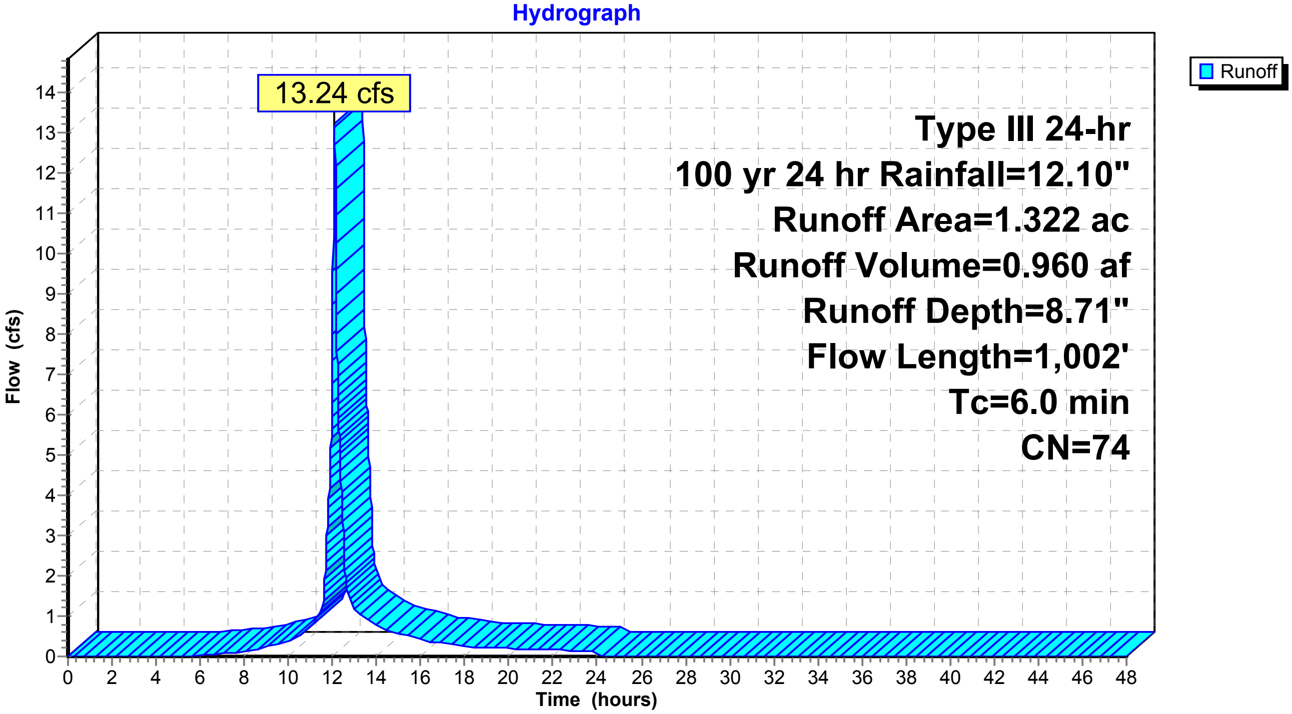
Runoff = 13.24 cfs @ 12.09 hrs, Volume= 0.960 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	1.322	74	Pasture/grassland/range, Good, HSG C
	1.322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	107	0.1878	0.59		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	301	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.5	594	0.2424	19.02	33.62	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
4.2	1,002	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 91S: 5c



Summary for Subcatchment 92S: 5a

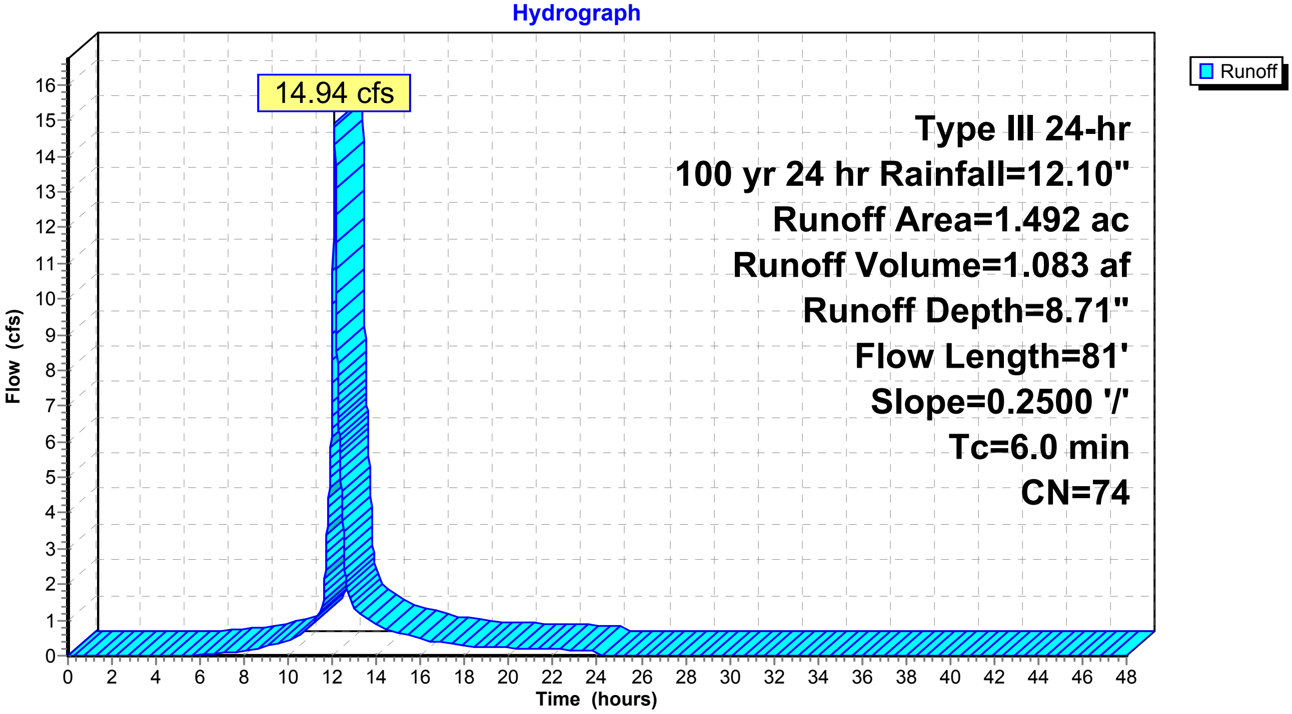
Runoff = 14.94 cfs @ 12.09 hrs, Volume= 1.083 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	1.492	74	Pasture/grassland/range, Good, HSG C
	1.492		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	81	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	81	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 92S: 5a



Summary for Subcatchment 93S: 3b

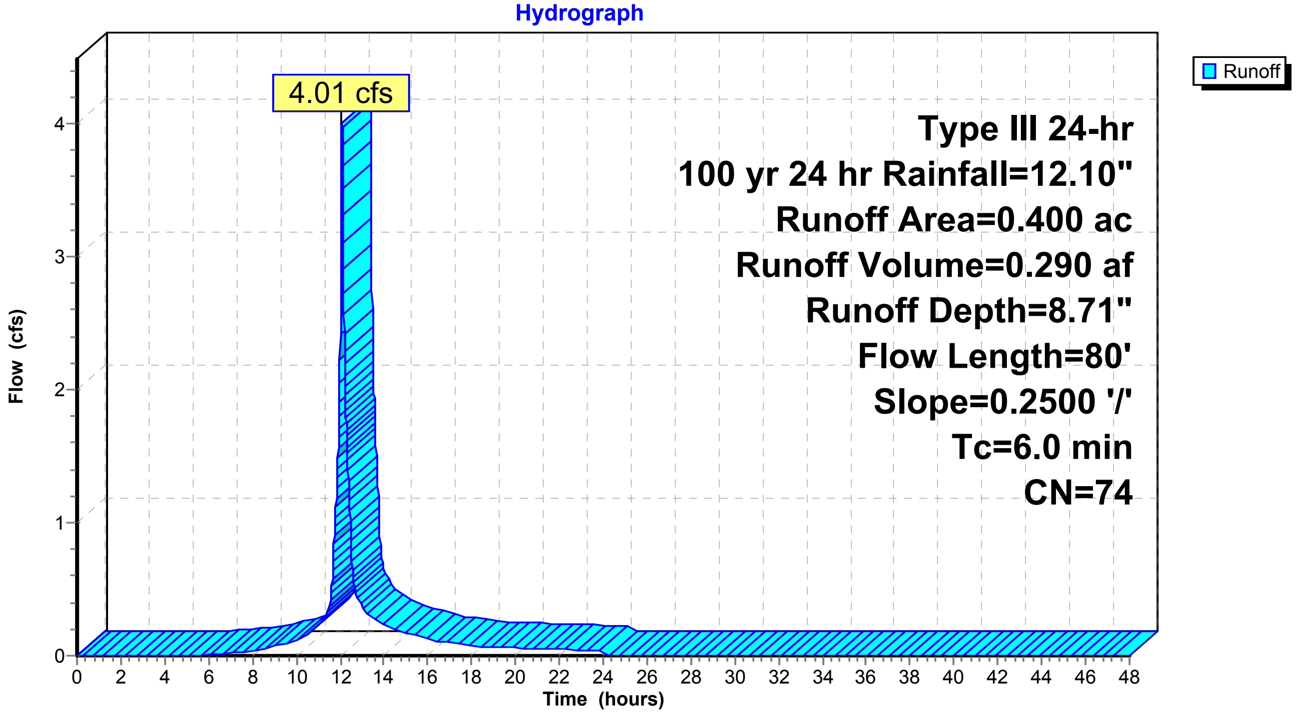
Runoff = 4.01 cfs @ 12.09 hrs, Volume= 0.290 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	0.400	74	Pasture/grassland/range, Good, HSG C
	0.400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	80	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 93S: 3b



Summary for Subcatchment 94S: 3a

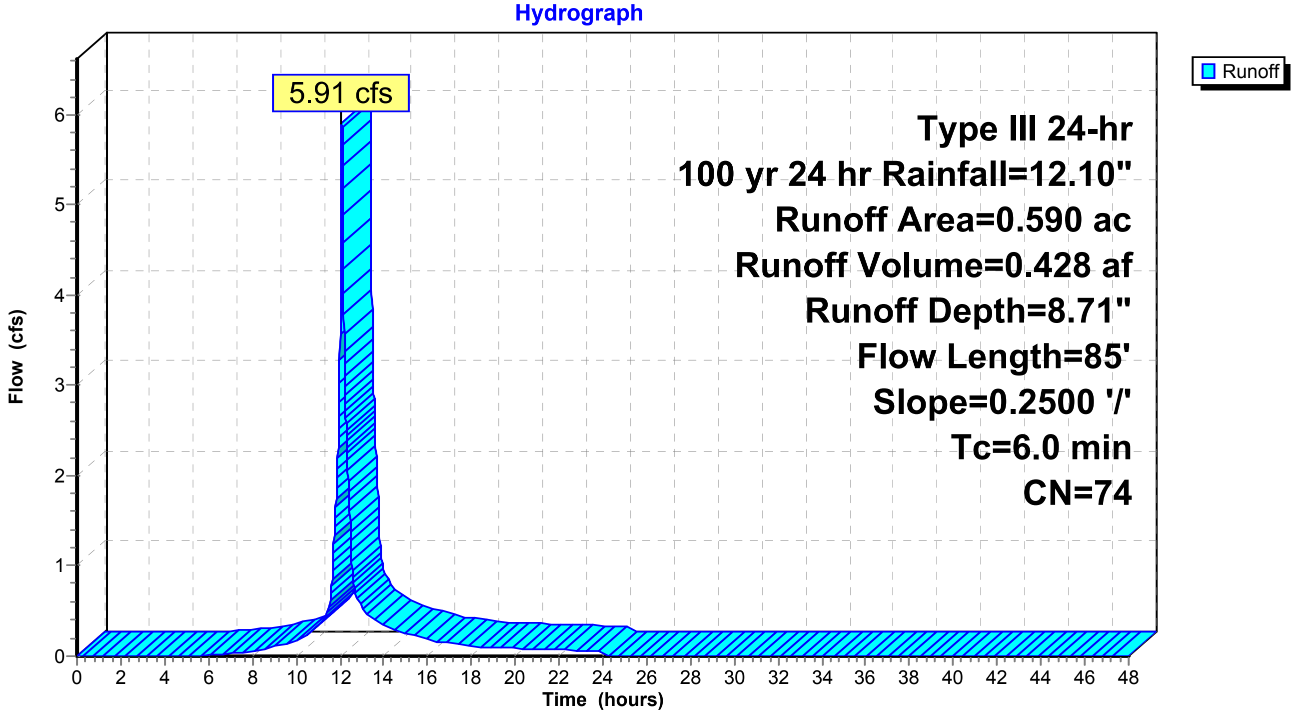
Runoff = 5.91 cfs @ 12.09 hrs, Volume= 0.428 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	0.590	74	Pasture/grassland/range, Good, HSG C
	0.590		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	85	0.2500	0.64		**Sheet Flow,** n= 0.136 P2= 5.40"
2.2	85	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 94S: 3a



Summary for Subcatchment 95S: 3c

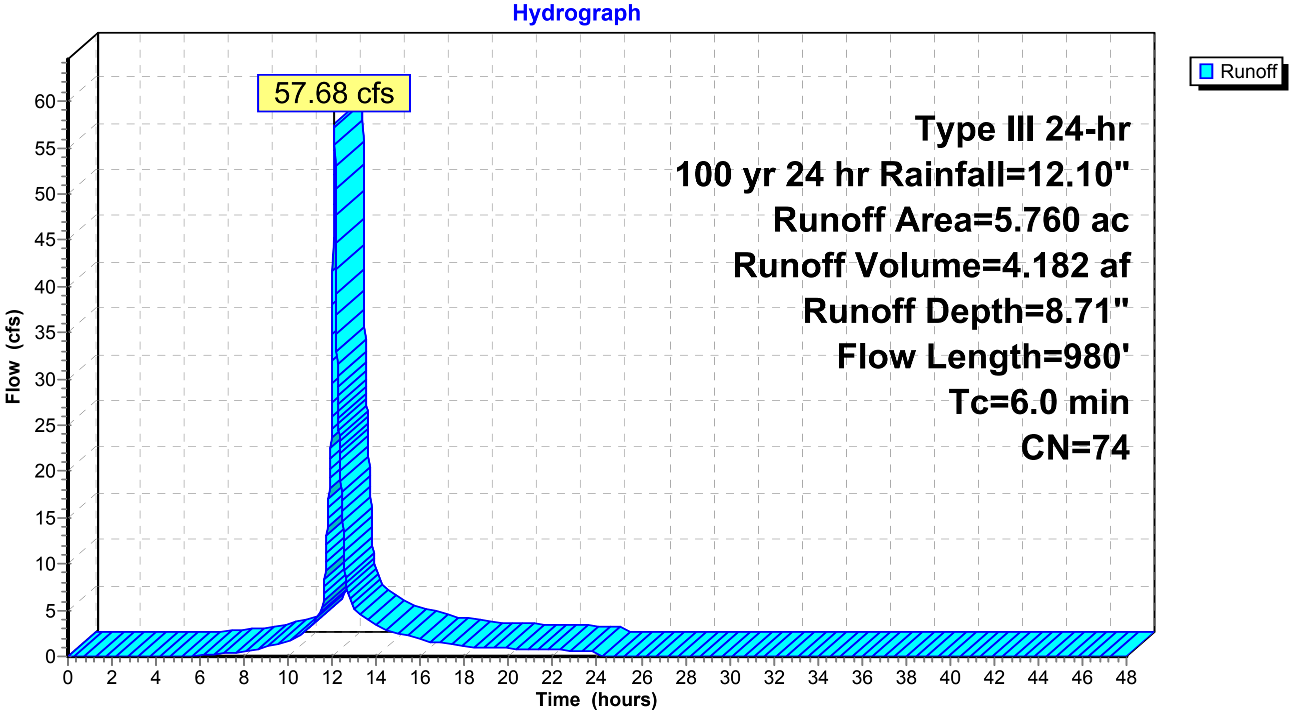
Runoff = 57.68 cfs @ 12.09 hrs, Volume= 4.182 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	5.760	74	Pasture/grassland/range, Good, HSG C
	5.760		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.5	245	0.0204	7.64	51.21	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	655	0.2366	18.79	33.21	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.2	980	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 95S: 3c



Summary for Subcatchment 96S: Pond 3 Drainage Area

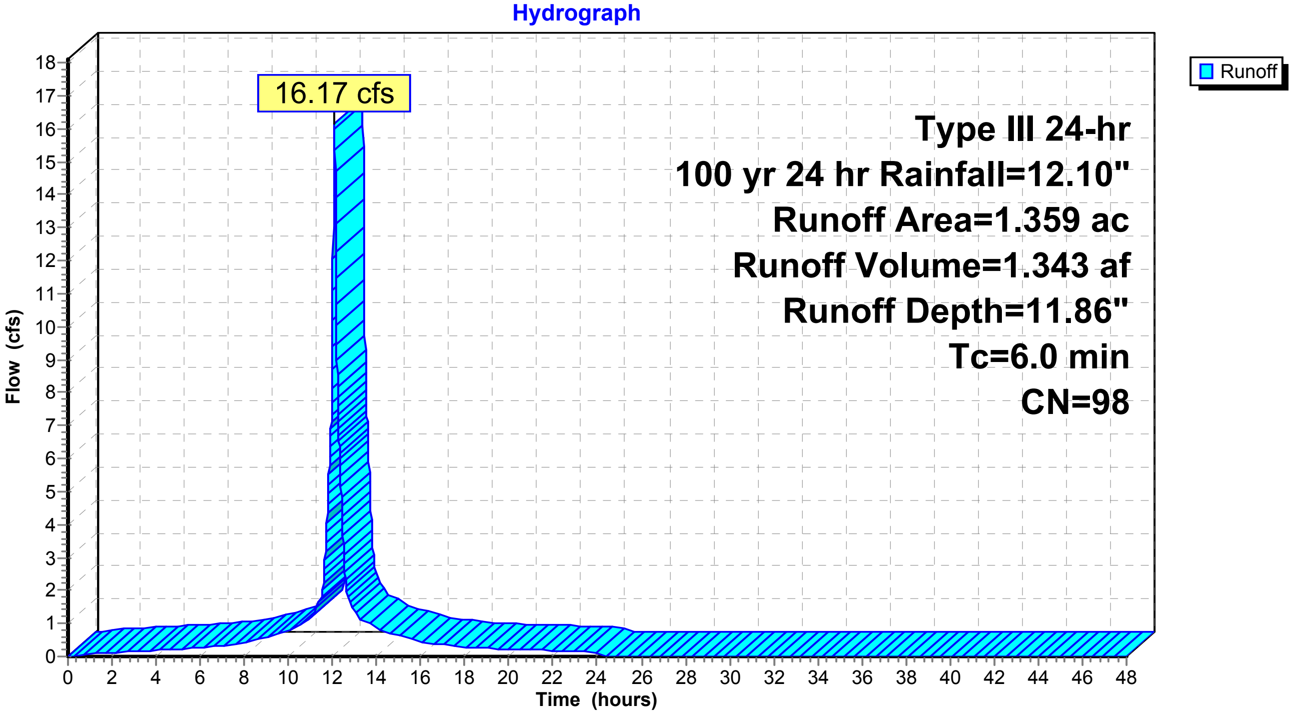
Runoff = 16.17 cfs @ 12.08 hrs, Volume= 1.343 af, Depth=11.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
1.359	98	Water Surface, HSG A
1.359		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 96S: Pond 3 Drainage Area



Summary for Subcatchment 97S: 6c

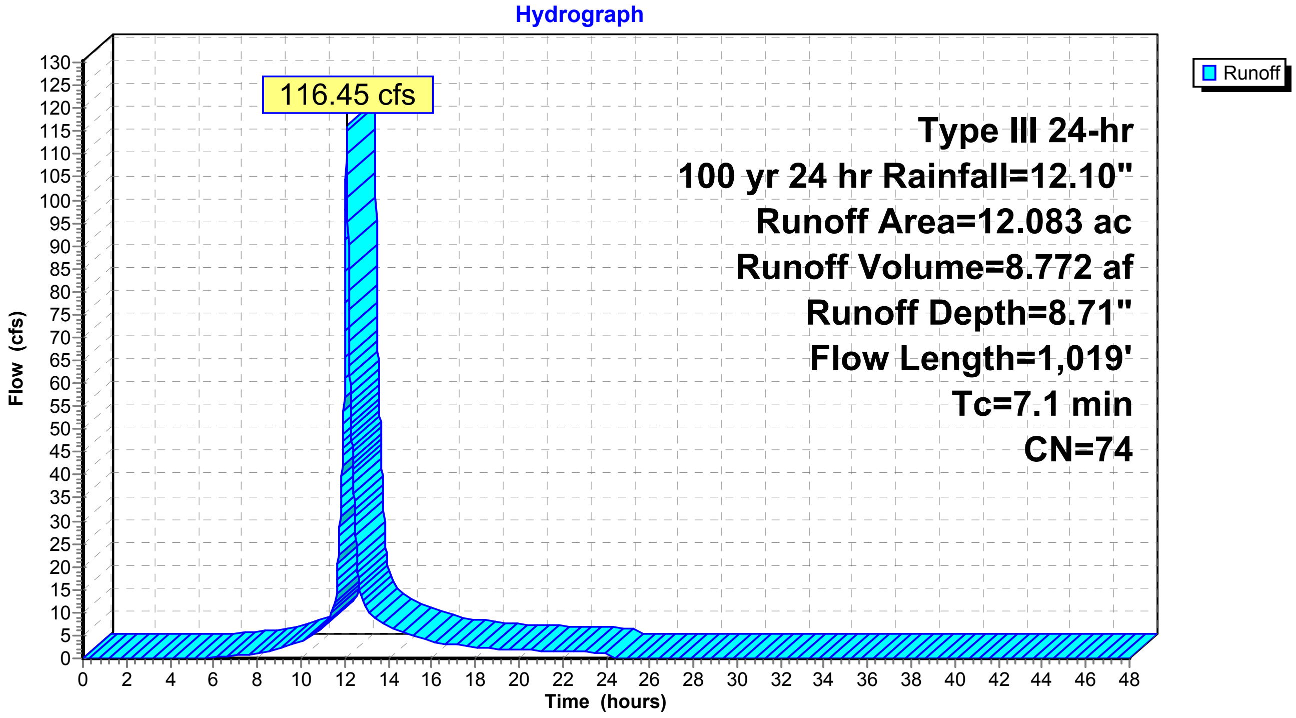
Runoff = 116.45 cfs @ 12.10 hrs, Volume= 8.772 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
12.083	74	Pasture/grassland/range, Good, HSG C
12.083		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	180	0.0833	0.48		**Sheet Flow,** n= 0.136 P2= 5.40"
0.2	113	0.0199	7.55	50.58	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.6	726	0.2449	19.12	33.79	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
7.1	1,019	Total			

Subcatchment 97S: 6c



Summary for Subcatchment 98S: 6d

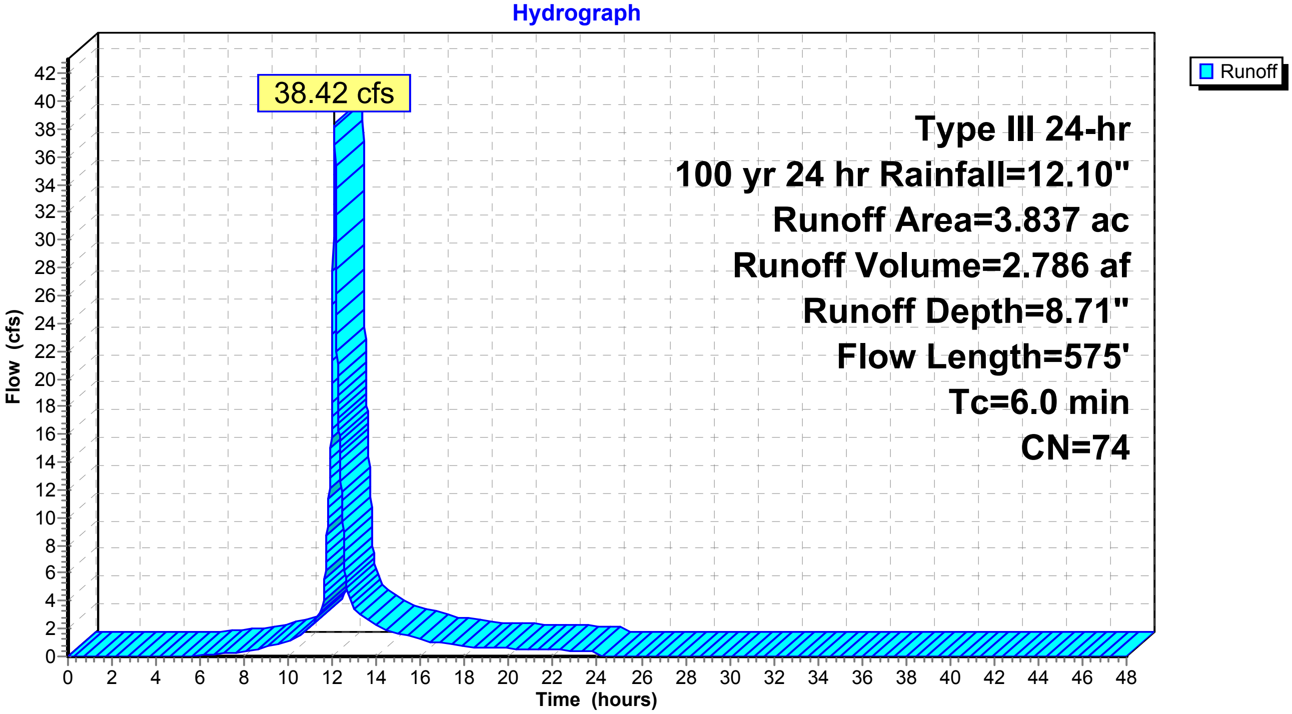
Runoff = 38.42 cfs @ 12.09 hrs, Volume= 2.786 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
3.837	74	Pasture/grassland/range, Good, HSG C
3.837		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	80	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	306	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.2	189	0.1793	16.36	28.91	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.0	575	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 98S: 6d



Summary for Subcatchment 99S: 6b

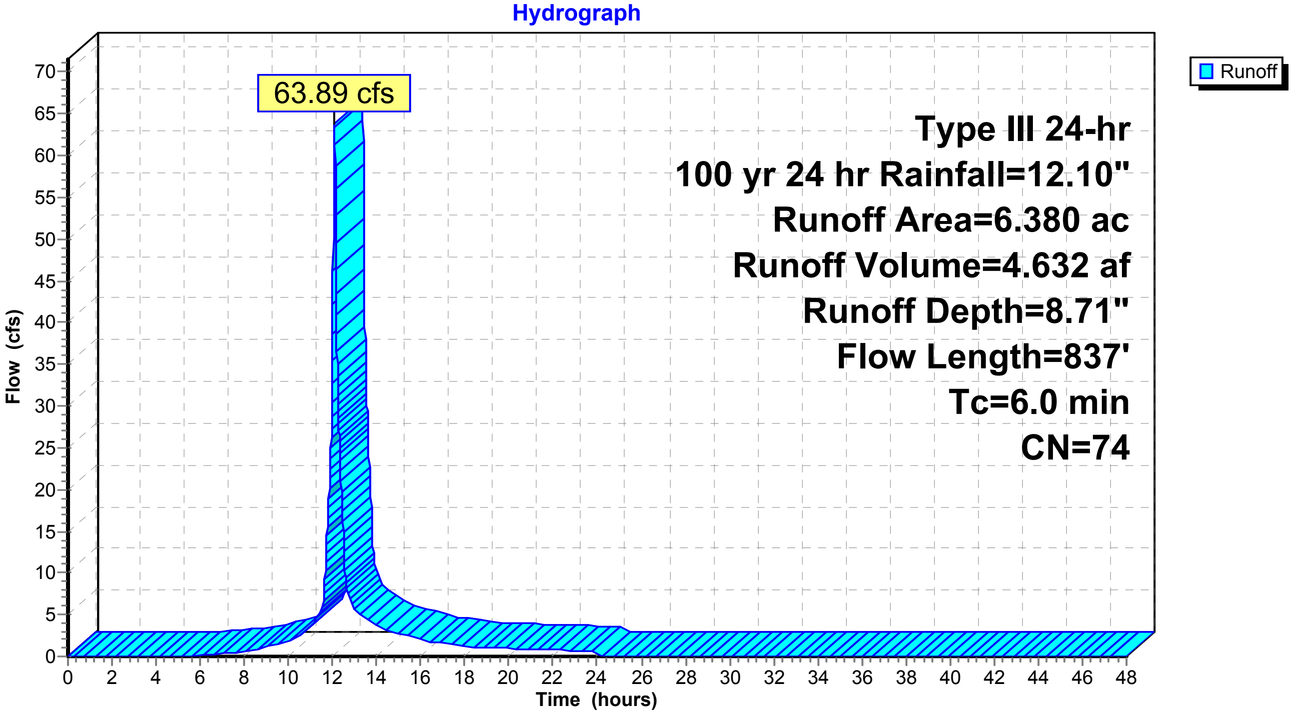
Runoff = 63.89 cfs @ 12.09 hrs, Volume= 4.632 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

	Area (ac)	CN	Description
*	6.380	74	Pasture/grassland/range, Good, HSG C
	6.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	81	0.2480	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
0.7	318	0.0200	7.57	50.71	**Channel Flow, SSDT Flow** Area= 6.7 sf Perim= 9.5' r= 0.71' n= 0.022 Earth, clean & straight
0.4	438	0.2457	19.15	33.84	**Pipe Channel, DDP Flow** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.020
3.3	837	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 99S: 6b



Summary for Subcatchment 100S: 6e

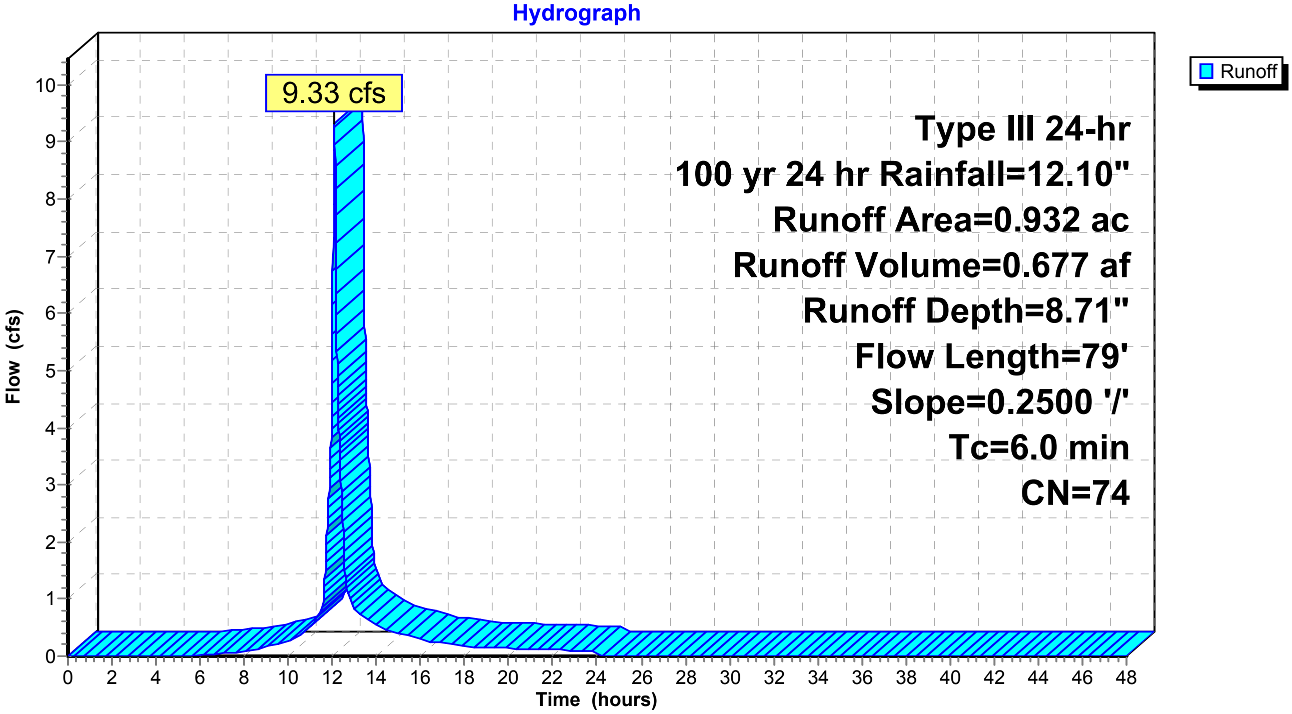
Runoff = 9.33 cfs @ 12.09 hrs, Volume= 0.677 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
0.932	74	Pasture/grassland/range, Good, HSG C
0.932		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	79	0.2500	0.63		**Sheet Flow,** n= 0.136 P2= 5.40"
2.1	79	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 100S: 6e



Summary for Subcatchment 101S: Pond 6 Drainage Area

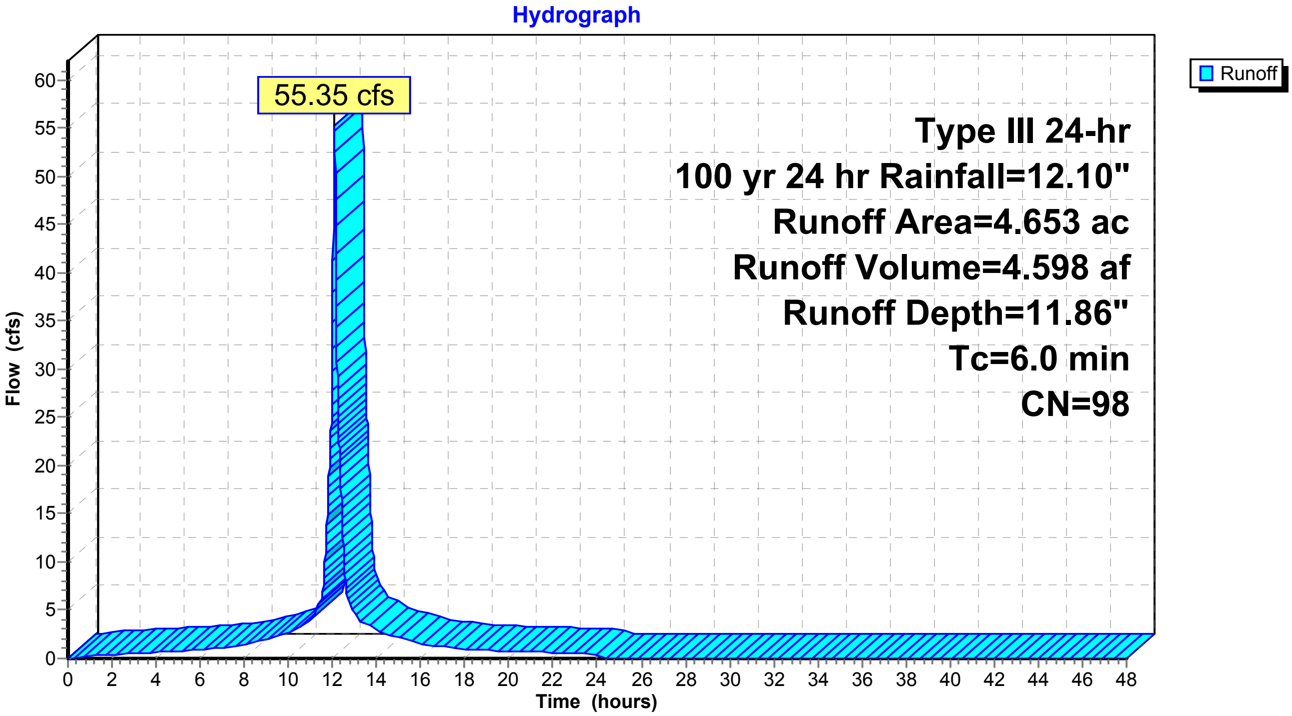
Runoff = 55.35 cfs @ 12.08 hrs, Volume= 4.598 af, Depth=11.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
4.653	98	Water Surface, HSG A
4.653		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 101S: Pond 6 Drainage Area



Summary for Subcatchment 102S: 4b.2

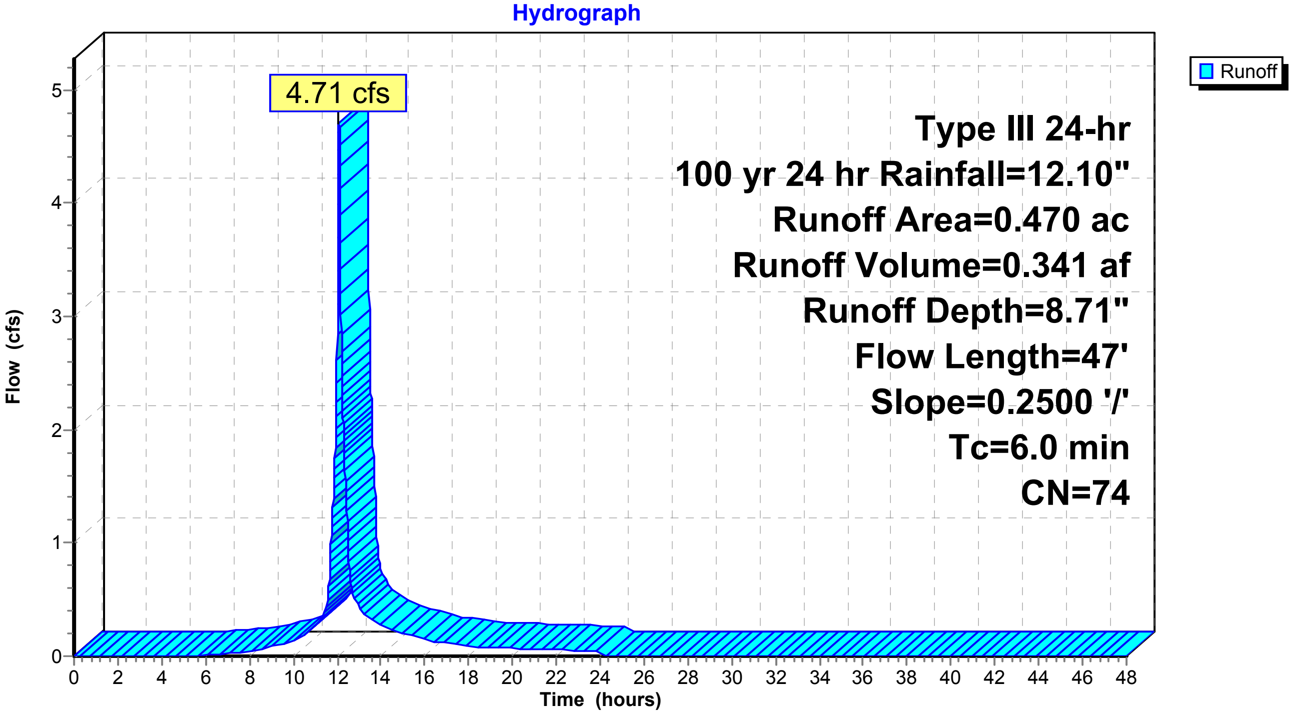
Runoff = 4.71 cfs @ 12.09 hrs, Volume= 0.341 af, Depth= 8.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
0.470	74	Pasture/grassland/range, Good, HSG C
0.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	47	0.2500	0.56		**Sheet Flow,** n= 0.136 P2= 5.40"
1.4	47	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 102S: 4b.2



Summary for Subcatchment 103S: Pond 4 Drainage Area

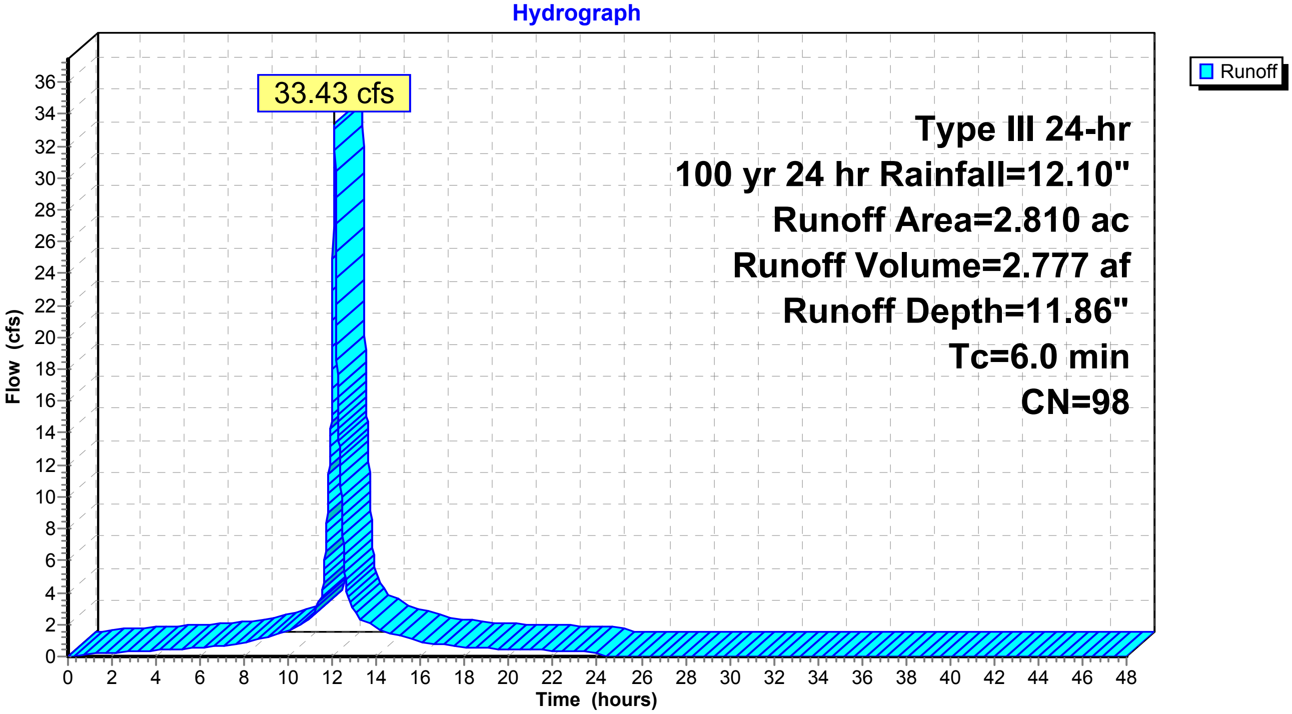
Runoff = 33.43 cfs @ 12.08 hrs, Volume= 2.777 af, Depth=11.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
2.810	98	Water Surface, HSG A
2.810		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 103S: Pond 4 Drainage Area



Summary for Subcatchment 104S: Pond 6 Drainage Area

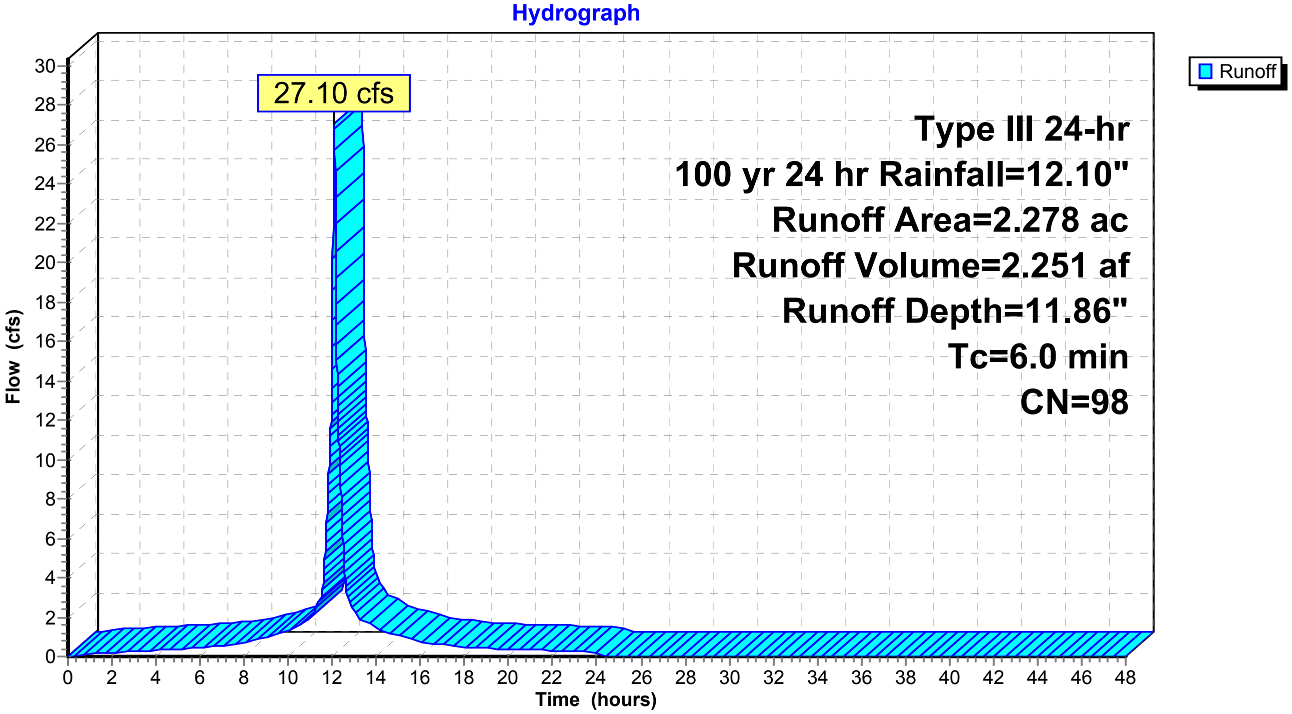
Runoff = 27.10 cfs @ 12.08 hrs, Volume= 2.251 af, Depth=11.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr 24 hr Rainfall=12.10"

Area (ac)	CN	Description
2.278	98	Water Surface, HSG A
2.278		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 104S: Pond 6 Drainage Area



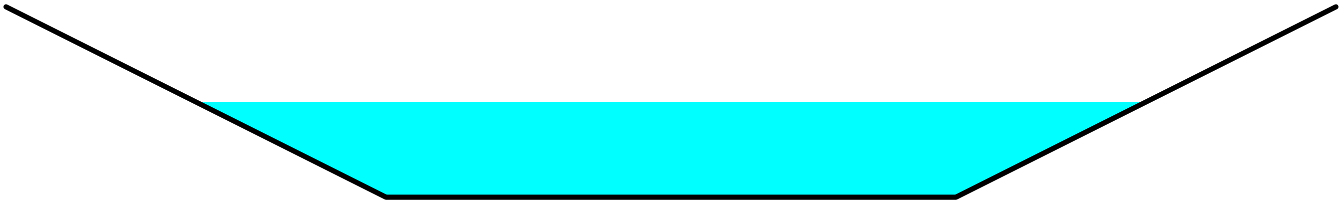
Summary for Reach 102R: D.2 - D.3

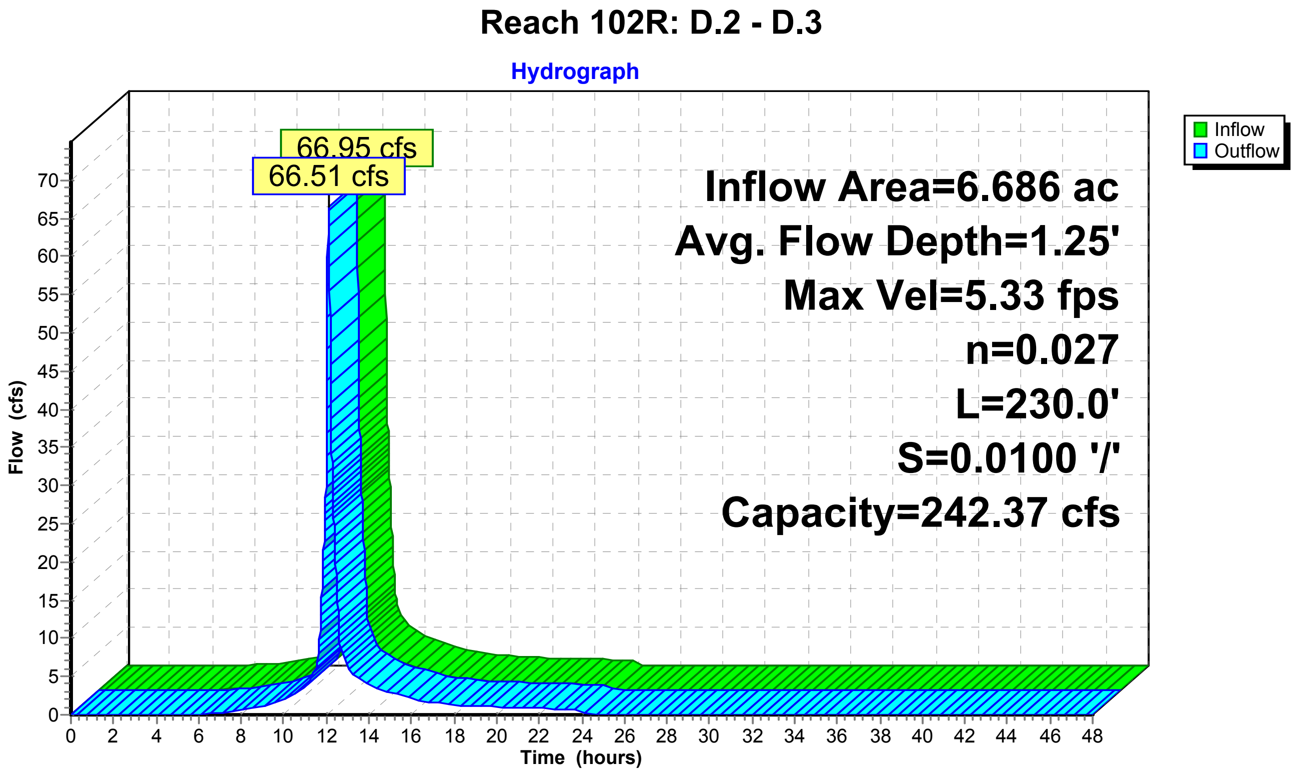
Inflow Area = 6.686 ac, 0.00% Impervious, Inflow Depth = 8.71" for 100 yr 24 hr event
Inflow = 66.95 cfs @ 12.09 hrs, Volume= 4.854 af
Outflow = 66.51 cfs @ 12.11 hrs, Volume= 4.854 af, Atten= 1%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.33 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.44 fps, Avg. Travel Time= 2.7 min

Peak Storage= 2,871 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 2.50' Flow Area= 31.3 sf, Capacity= 242.37 cfs

7.50' x 2.50' deep channel, n= 0.027
Side Slope Z-value= 2.0 '/' Top Width= 17.50'
Length= 230.0' Slope= 0.0100 '/'
Inlet Invert= 226.09', Outlet Invert= 223.79'





Summary for Pond 60P: Pond 3

Inflow Area = 8.109 ac, 16.76% Impervious, Inflow Depth = 9.24" for 100 yr 24 hr event
Inflow = 83.75 cfs @ 12.09 hrs, Volume= 6.243 af
Outflow = 4.17 cfs @ 14.45 hrs, Volume= 2.837 af, Atten= 95%, Lag= 141.7 min
Primary = 4.17 cfs @ 14.45 hrs, Volume= 2.837 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 216.77' @ 14.45 hrs Surf.Area= 0.920 ac Storage= 4.531 af

Plug-Flow detention time= 730.1 min calculated for 2.836 af (45% of inflow)
Center-of-Mass det. time= 606.2 min (1,392.7 - 786.5)

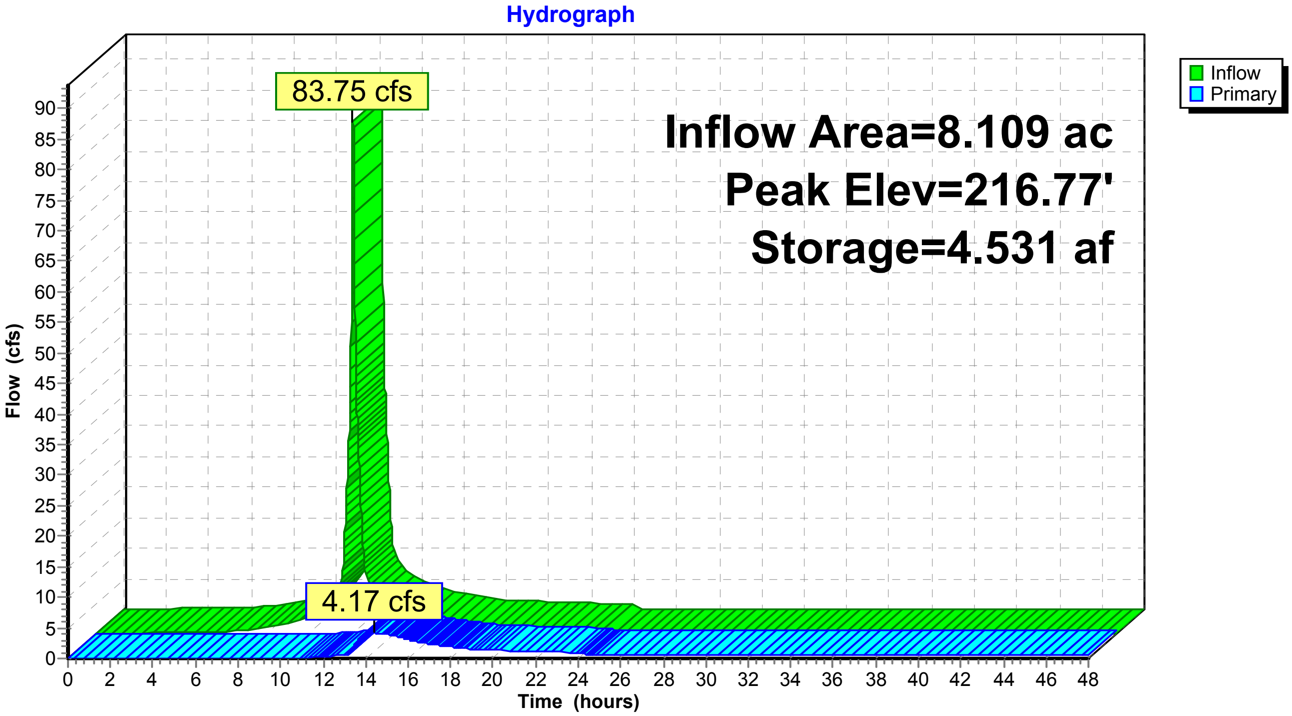
Volume	Invert	Avail.Storage	Storage Description
#1	211.00'	6.719 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
211.00	0.634	0.000	0.000
212.00	0.728	0.681	0.681
214.00	0.777	1.505	2.186
215.00	0.827	0.802	2.988
216.00	0.879	0.853	3.841
217.00	0.932	0.906	4.746
218.00	0.986	0.959	5.705
219.00	1.042	1.014	6.719

Device	Routing	Invert	Outlet Devices
#1	Device 2	211.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	212.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	216.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	211.00'	**12.0" Round 12" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 211.00' / 210.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#5	Primary	217.50'	**143.1 deg x 20.0' long x 1.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=4.16 cfs @ 14.45 hrs HW=216.77' (Free Discharge)
- **4=12" culvert** (Passes 4.16 cfs of 6.74 cfs potential flow)
  - **2=3" Pipe** (Orifice Controls 0.51 cfs @ 10.37 fps)
    - **1=grate (36" half-circle)** (Passes 0.51 cfs of 2.74 cfs potential flow)
  - **3=riser slits** (Orifice Controls 3.65 cfs @ 1.66 fps)
- **5=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Pond 60P: Pond 3



Summary for Pond 65P: Pond 6

Inflow Area = 28.191 ac, 16.51% Impervious, Inflow Depth = 9.23" for 100 yr 24 hr event
Inflow = 284.35 cfs @ 12.10 hrs, Volume= 21.686 af
Outflow = 16.32 cfs @ 14.03 hrs, Volume= 10.112 af, Atten= 94%, Lag= 116.3 min
Primary = 16.32 cfs @ 14.03 hrs, Volume= 10.112 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 220.39' @ 14.03 hrs Surf.Area= 2.645 ac Storage= 14.628 af

Plug-Flow detention time= 464.0 min calculated for 10.110 af (47% of inflow)
Center-of-Mass det. time= 341.8 min (1,129.5 - 787.7)

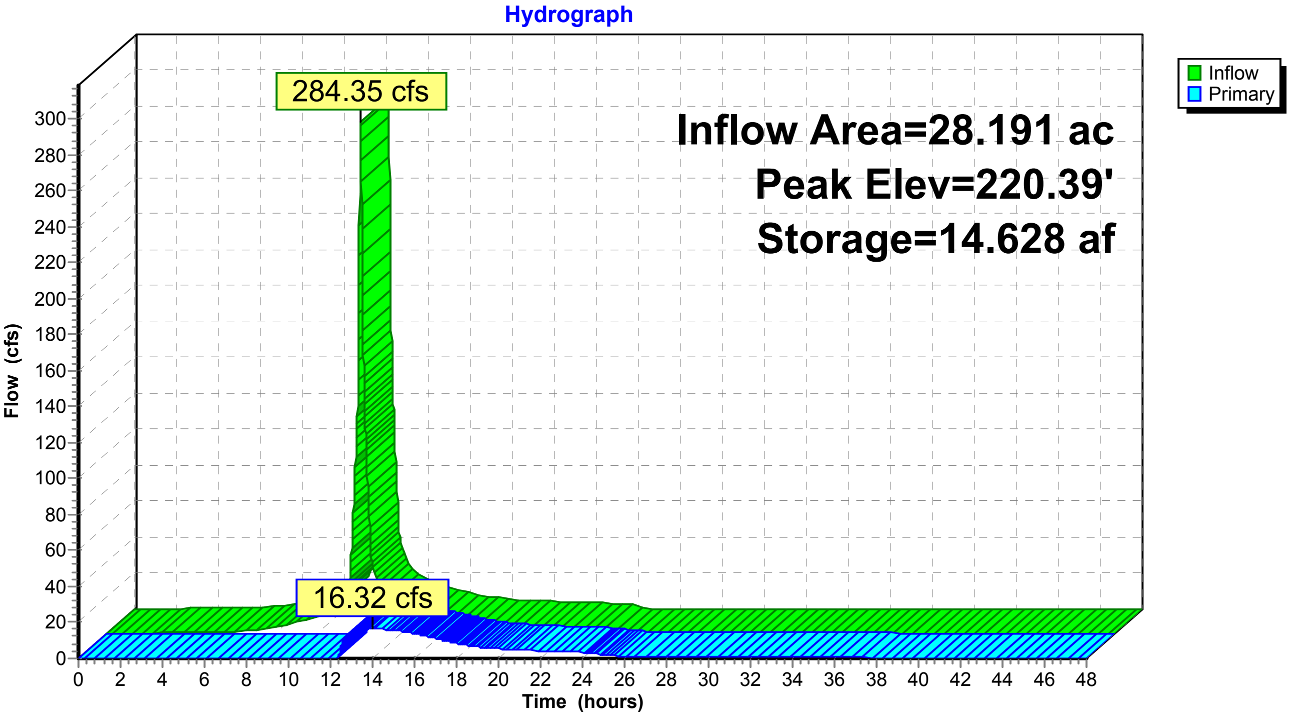
Volume	Invert	Avail.Storage	Storage Description
#1	214.00'	24.939 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
214.00	1.929	0.000	0.000
216.00	2.159	4.088	4.088
218.00	2.377	4.536	8.624
220.00	2.599	4.976	13.600
222.00	2.834	5.433	19.033
224.00	3.072	5.906	24.939

Device	Routing	Invert	Outlet Devices
#1	Device 2	214.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	215.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	219.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	214.00'	**24.0" Round 24" culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 214.00' / 213.50' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	221.00'	**157.4 deg x 20.0' long x 3.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow  Max=16.32 cfs @ 14.03 hrs  HW=220.39'   (Free Discharge)
↑
└─4=24" culvert  (Passes 16.32 cfs of 27.73 cfs potential flow)
  ↑
  ├─2=3" Pipe  (Orifice Controls 0.54 cfs @ 11.05 fps)
  │  ↑
  │  └─1=grate (36" half-circle)  (Passes 0.54 cfs of 2.91 cfs potential flow)
  └─3=riser slits  (Orifice Controls 15.78 cfs @ 3.83 fps)
└─5=Sharp-Crested Vee/Trap Weir ( Controls 0.00 cfs)
```

Pond 65P: Pond 6



Summary for Pond 69P: Pond 4

```
Inflow Area =      37.379 ac,   7.52% Impervious,  Inflow Depth =   8.95"    for  100 yr 24 hr event
Inflow      =    367.70 cfs @   12.09 hrs,  Volume=         27.873 af
Outflow     =     67.52 cfs @   12.56 hrs,  Volume=         27.782 af,  Atten= 82%,  Lag= 27.7 min
Primary     =     67.52 cfs @   12.56 hrs,  Volume=         27.782 af
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 232.82' @ 12.56 hrs Surf.Area= 1.756 ac Storage= 11.349 af

Plug-Flow detention time= 116.5 min calculated for 27.776 af (100% of inflow)
Center-of-Mass det. time= 114.6 min (909.1 - 794.5)

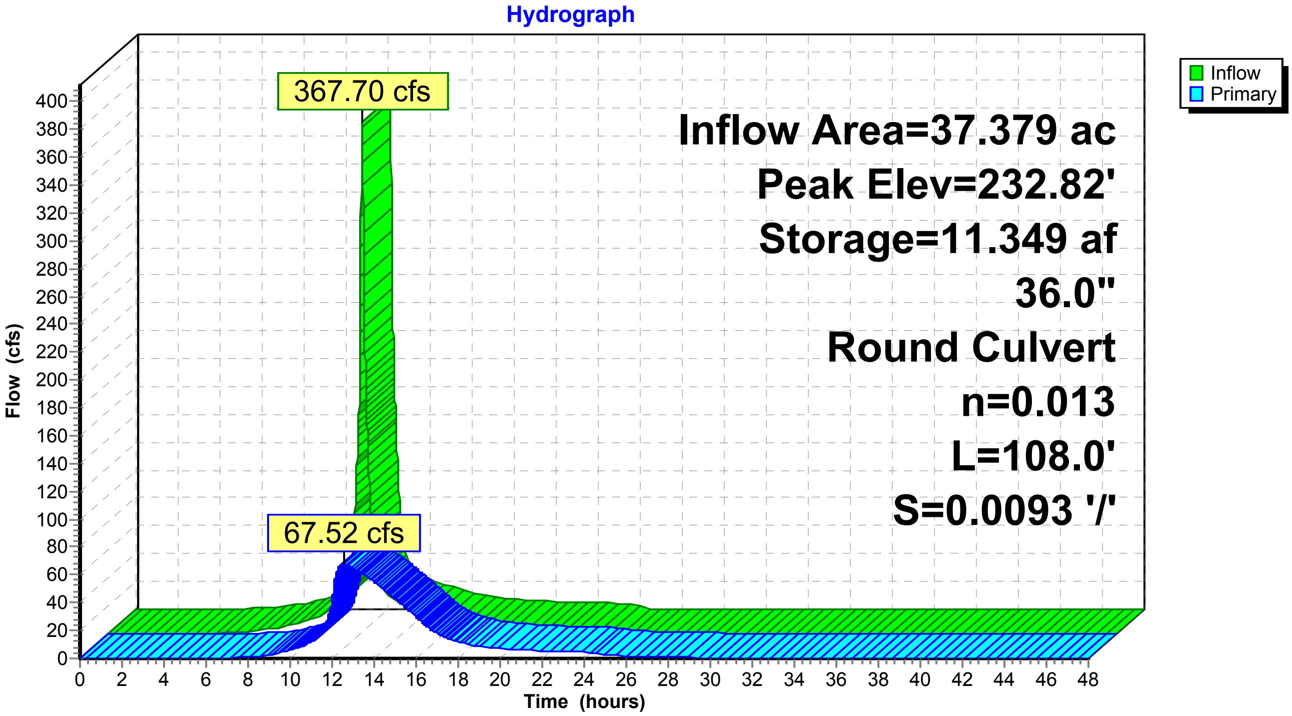
Volume	Invert	Avail.Storage	Storage Description
#1	225.00'	21.581 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
225.00	1.164	0.000	0.000
226.00	1.234	1.199	1.199
227.00	1.306	1.270	2.469
228.00	1.380	1.343	3.812
229.00	1.455	1.418	5.230
230.00	1.532	1.493	6.723
231.00	1.610	1.571	8.294
232.00	1.690	1.650	9.944
233.00	1.771	1.730	11.674
234.00	1.853	1.812	13.486
235.00	1.937	1.895	15.381
236.00	2.023	1.980	17.361
237.00	2.109	2.066	19.427
238.00	2.198	2.153	21.581

Device	Routing	Invert	Outlet Devices
#1	Primary	225.00'	**36.0" Round 36" culvert** L= 108.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 225.00' / 224.00' S= 0.0093 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 7.07 sf

Primary OutFlow Max=67.52 cfs @ 12.56 hrs HW=232.82' (Free Discharge)
↑—**1=36" culvert** (Inlet Controls 67.52 cfs @ 9.55 fps)

Pond 69P: Pond 4



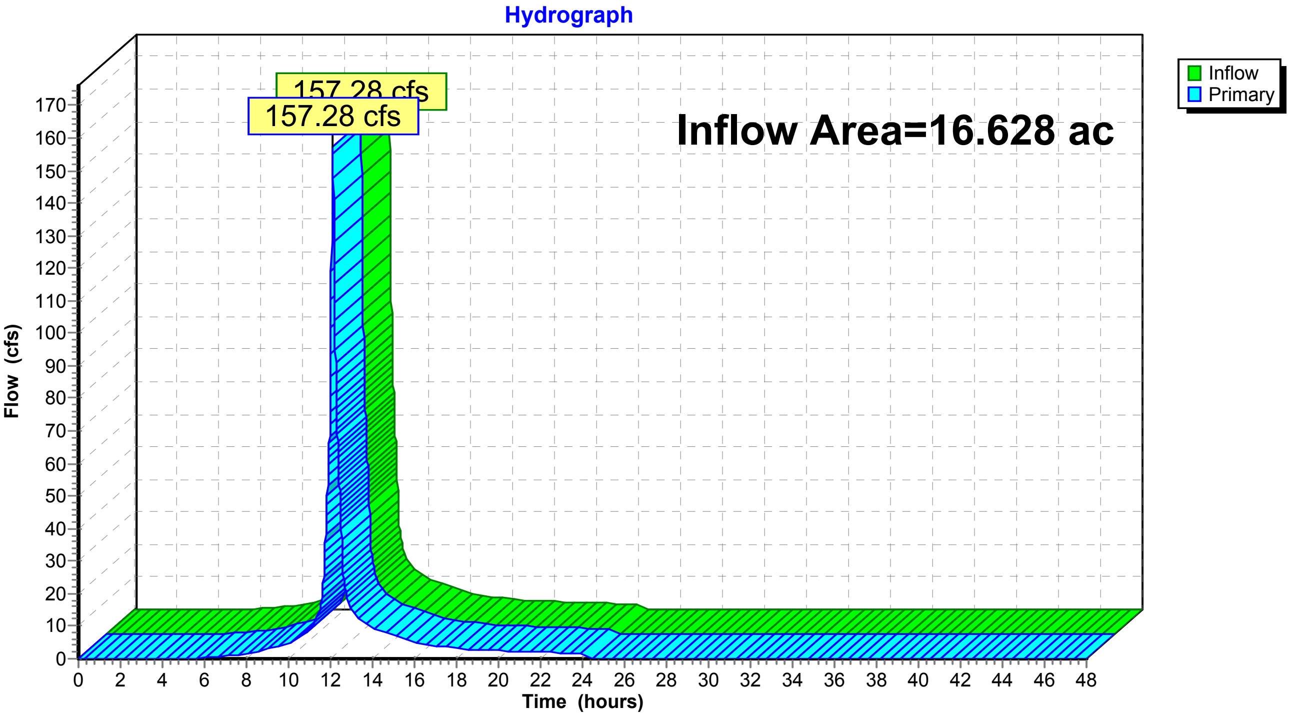
Summary for Pond 78P: C-6

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 16.628 ac, 0.00% Impervious, Inflow Depth = 8.71" for 100 yr 24 hr event
Inflow = 157.28 cfs @ 12.11 hrs, Volume= 12.072 af
Primary = 157.28 cfs @ 12.11 hrs, Volume= 12.072 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 78P: C-6



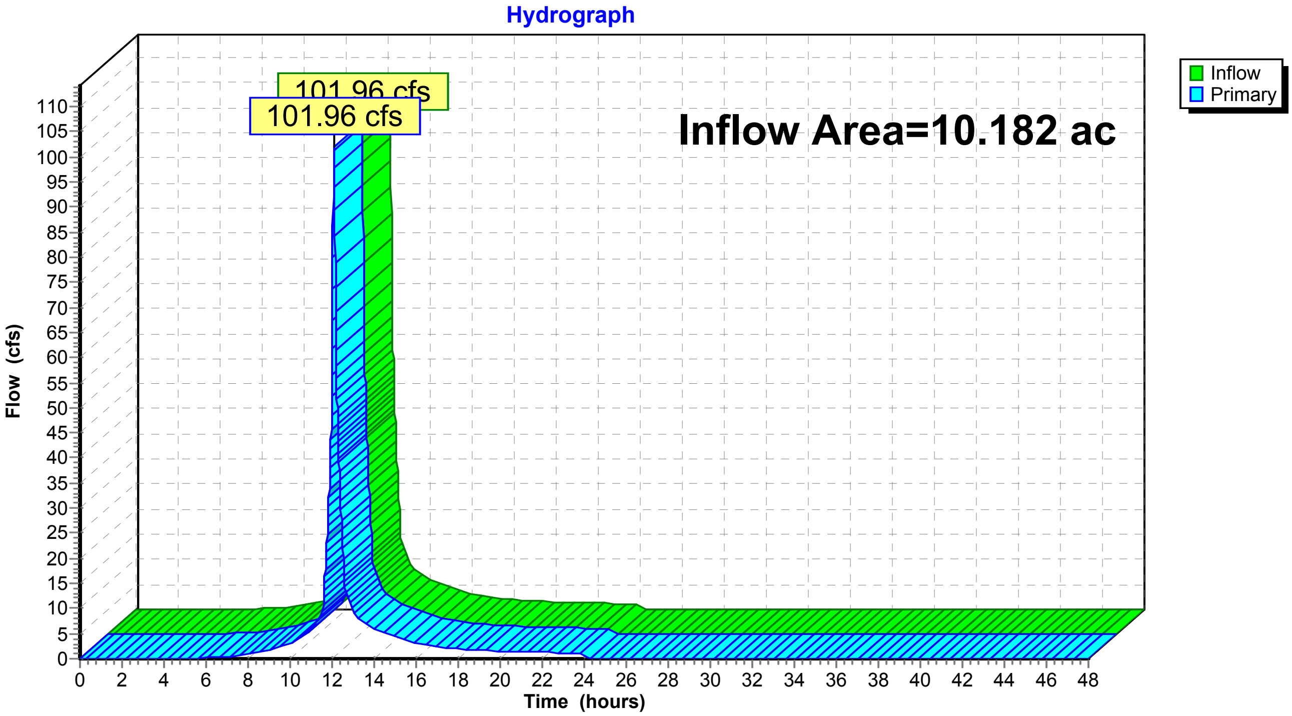
Summary for Pond 87P: C-8

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.182 ac, 0.00% Impervious, Inflow Depth = 8.71" for 100 yr 24 hr event
Inflow = 101.96 cfs @ 12.09 hrs, Volume= 7.392 af
Primary = 101.96 cfs @ 12.09 hrs, Volume= 7.392 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 87P: C-8

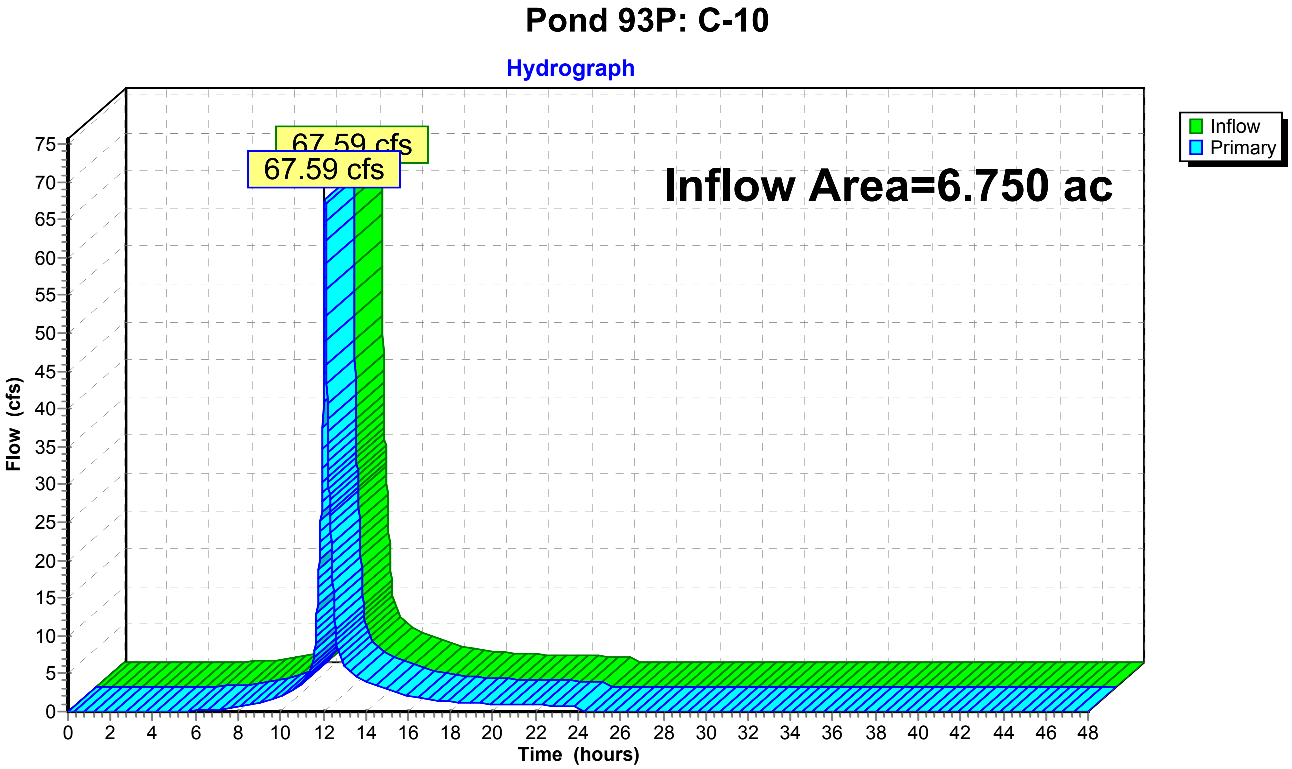


Summary for Pond 93P: C-10

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	6.750 ac,	0.00% Impervious,	Inflow Depth = 8.71"	for 100 yr 24 hr event	
Inflow =	67.59 cfs @	12.09 hrs,	Volume=	4.900 af	
Primary =	67.59 cfs @	12.09 hrs,	Volume=	4.900 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

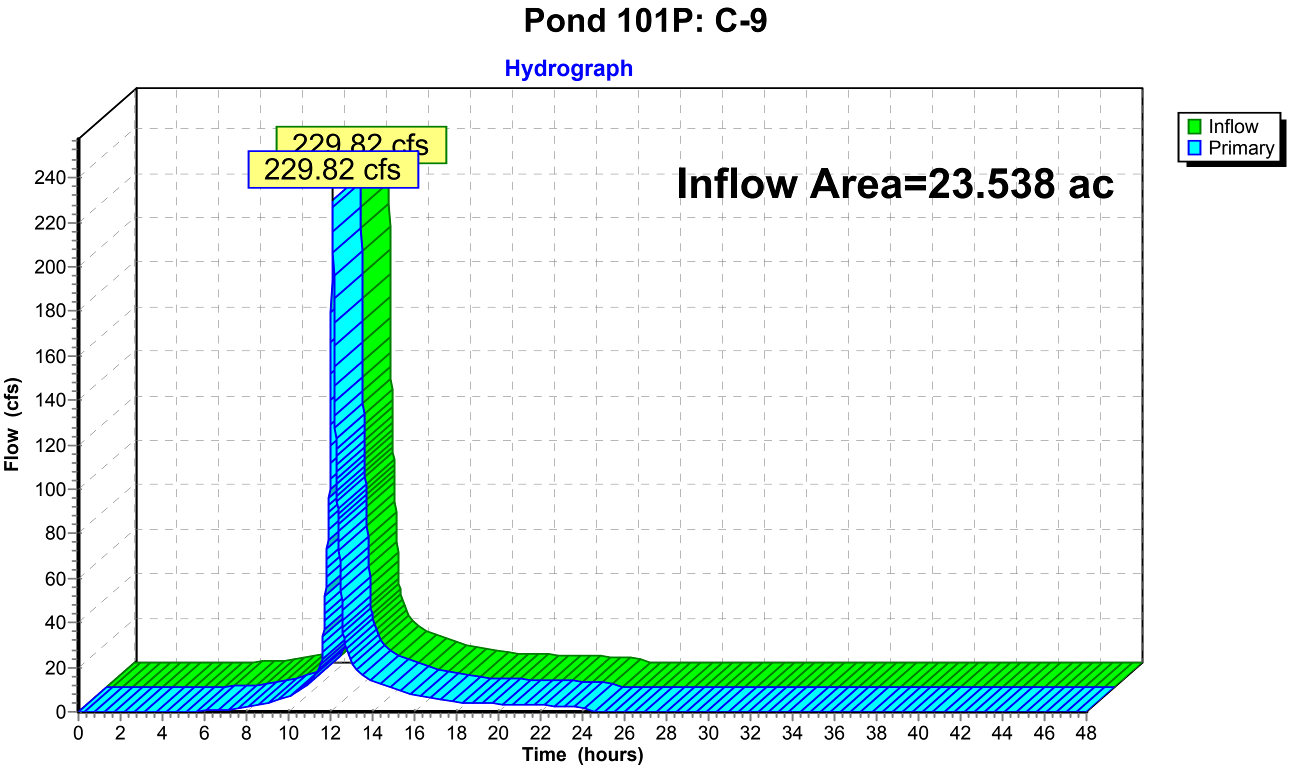


Summary for Pond 101P: C-9

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	23.538 ac,	0.00% Impervious, Inflow Depth = 8.71"	for 100 yr 24 hr event
Inflow =	229.82 cfs @	12.10 hrs, Volume=	17.088 af
Primary =	229.82 cfs @	12.10 hrs, Volume=	17.088 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Summary for Pond 105P: Pond 5

Inflow Area = 12.460 ac, 18.28% Impervious, Inflow Depth = 9.29" for 100 yr 24 hr event
Inflow = 129.04 cfs @ 12.09 hrs, Volume= 9.643 af
Outflow = 26.55 cfs @ 12.51 hrs, Volume= 8.147 af, Atten= 79%, Lag= 25.6 min
Primary = 26.55 cfs @ 12.51 hrs, Volume= 8.147 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 257.49' @ 12.51 hrs Surf.Area= 1.032 ac Storage= 4.748 af

Plug-Flow detention time= 241.3 min calculated for 8.147 af (84% of inflow)
Center-of-Mass det. time= 175.3 min (960.6 - 785.4)

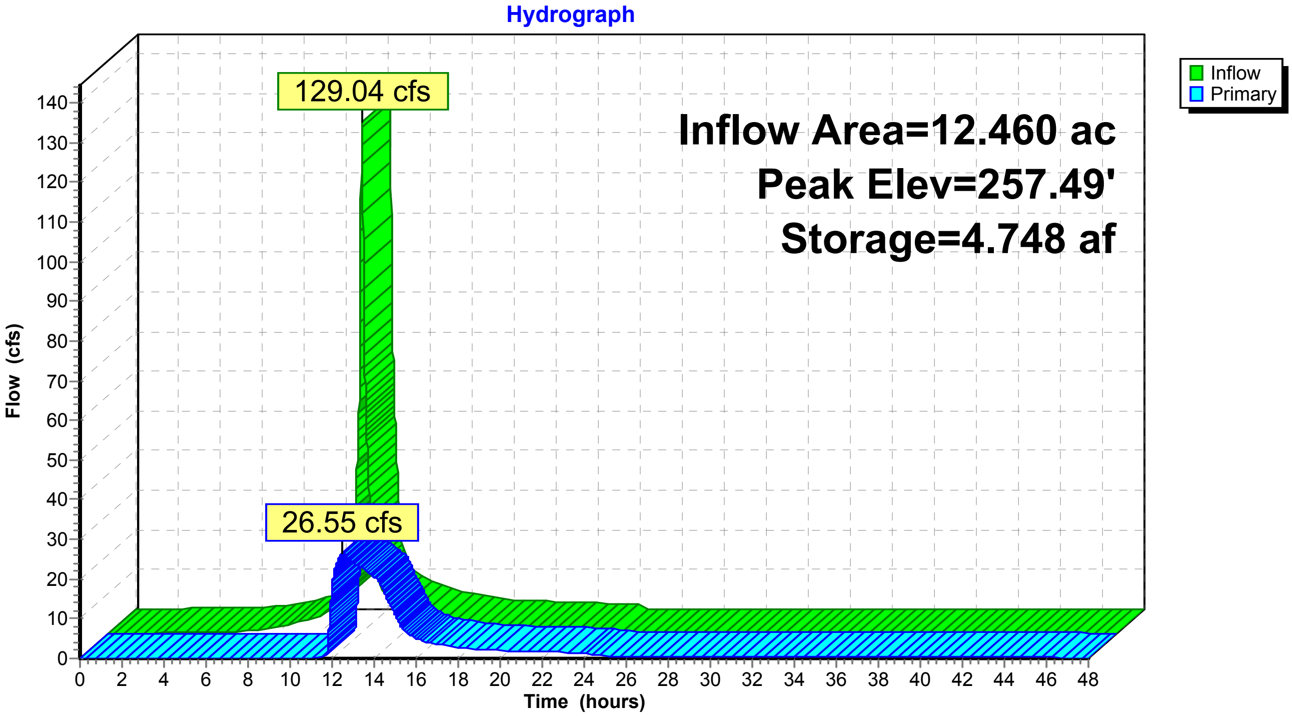
Volume	Invert	Avail.Storage	Storage Description
#1	252.00'	5.284 af	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
252.00	0.706	0.000	0.000
254.00	0.819	1.525	1.525
256.00	0.938	1.757	3.282
258.00	1.064	2.002	5.284

Device	Routing	Invert	Outlet Devices
#1	Device 2	252.00'	**0.5" Vert. grate (36" half-circle) X 32.00 columns** X 6 rows with 3.0" cc spacing C= 0.600
#2	Device 4	253.00'	**3.0" Vert. 3" Pipe** C= 0.600
#3	Device 4	254.50'	**24.7" W x 6.0" H Vert. riser slits X 4.00** C= 0.600
#4	Primary	252.00'	**24.0" Round 24" culvert** L= 80.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 252.00' / 251.00' S= 0.0125 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#5	Primary	257.00'	**143.1 deg x 1.00' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

```
Primary OutFlow Max=26.54 cfs @ 12.51 hrs  HW=257.49'   (Free Discharge)
↑—4=24" culvert  (Inlet Controls 25.30 cfs @ 8.05 fps)
│  ↑—2=3" Pipe  (Passes < 0.49 cfs potential flow)
│  │  ↑└—1=grate (36" half-circle) (Passes < 2.66 cfs potential flow)
│  └—3=riser slits  (Passes < 32.79 cfs potential flow)
└—5=Sharp-Crested Vee/Trap Weir (Weir Controls 1.24 cfs @ 1.73 fps)
```

Pond 105P: Pond 5



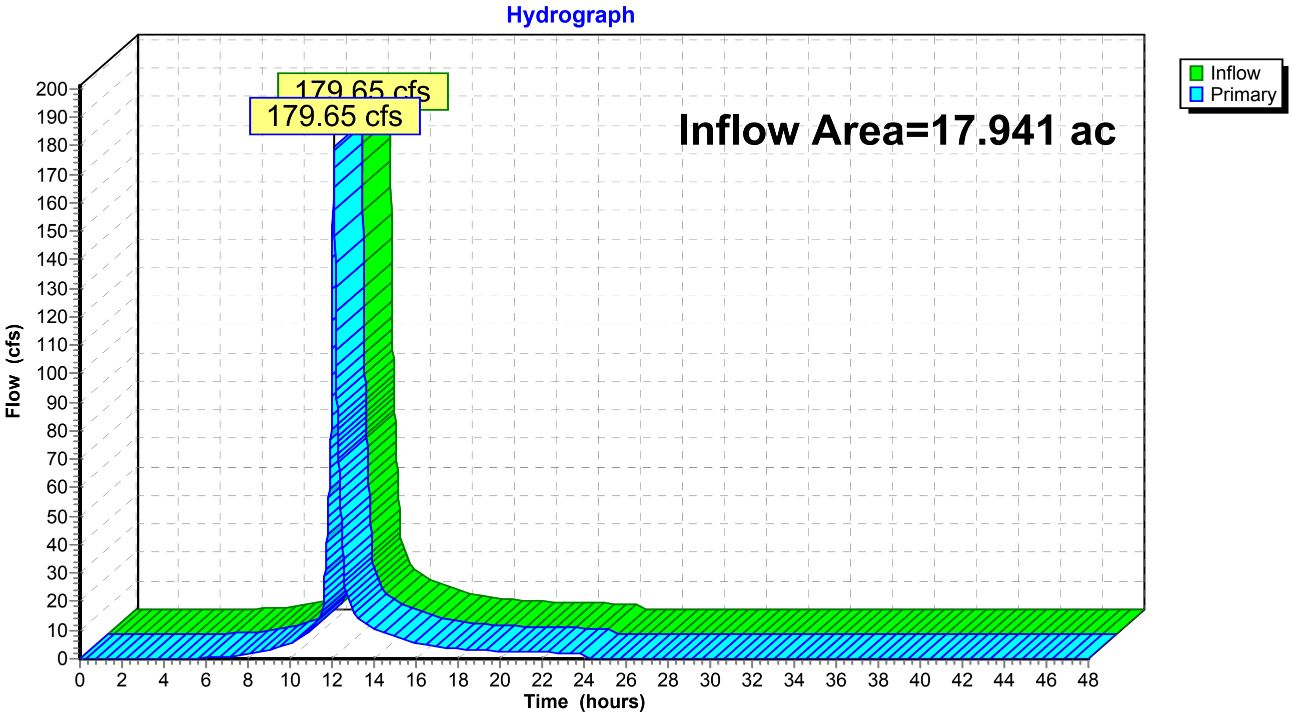
Summary for Pond 106P: C-7

[40] Hint: Not Described (Outflow=Inflow)

```
Inflow Area =      17.941 ac,   0.00% Impervious,  Inflow Depth =   8.71"    for  100 yr 24 hr event
Inflow      =     179.65 cfs @   12.09 hrs,  Volume=          13.025 af
Primary     =     179.65 cfs @   12.09 hrs,  Volume=          13.025 af,  Atten= 0%,  Lag= 0.0 min
```

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Pond 106P: C-7



Appendix 2

Manning's Equation Ditch Sizing Computations

Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

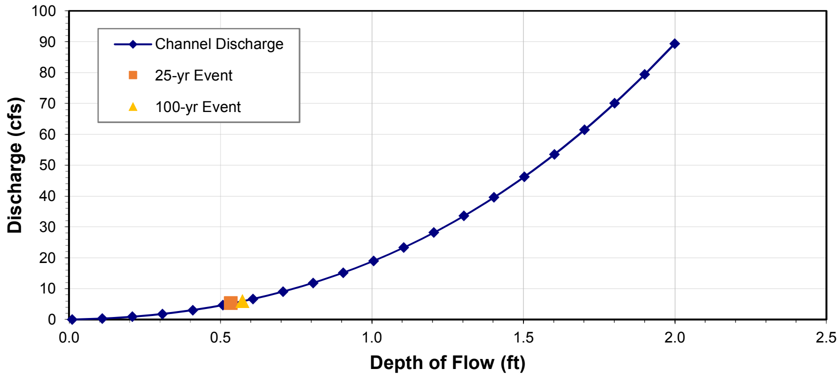
Project: IESI Travis County Landfill Expansion

Ditch ID: **F.1** **Design**

Peak Discharge, Q_{25} = 5.17 cfs (25-yr Event)
Peak Discharge, Q_{100} = 5.91 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 2.00 ft
Top Width, T = 14.00 ft
Manning's Roughness Coeff., n = 0.03
Longitudinal Channel Slope, S_o = 0.01 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.24	0.0	0.01	
0.11	0.25	2.69	0.09	1.09	0.3	0.05	
0.21	0.55	3.32	0.17	1.59	0.9	0.09	
0.31	0.90	3.95	0.23	1.97	1.8	0.13	
0.41	1.32	4.58	0.29	2.29	3.0	0.16	
0.51	1.79	5.21	0.34	2.58	4.6	0.20	
0.61	2.32	5.84	0.40	2.85	6.6	0.23	
0.71	2.91	6.47	0.45	3.09	9.0	0.26	
0.81	3.56	7.10	0.50	3.33	11.8	0.29	
0.91	4.27	7.73	0.55	3.55	15.2	0.31	
1.01	5.04	8.36	0.60	3.76	19.0	0.34	
1.10	5.87	8.99	0.65	3.97	23.3	0.37	
1.20	6.76	9.61	0.70	4.16	28.1	0.40	
1.30	7.70	10.24	0.75	4.36	33.6	0.43	
1.40	8.71	10.87	0.80	4.55	39.6	0.46	
1.50	9.78	11.50	0.85	4.73	46.2	0.48	
1.60	10.90	12.13	0.90	4.91	53.5	0.51	
1.70	12.09	12.76	0.95	5.08	61.4	0.54	
1.80	13.33	13.39	1.00	5.25	70.1	0.57	
1.90	14.64	14.02	1.04	5.42	79.4	0.59	
2.00	16.00	14.65	1.09	5.59	89.4	0.62	
0.54	1.93	5.39	0.36	2.66	5.13	0.20	Q (25-yr Event)
0.57	2.13	5.62	0.38	2.76	5.86	0.22	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

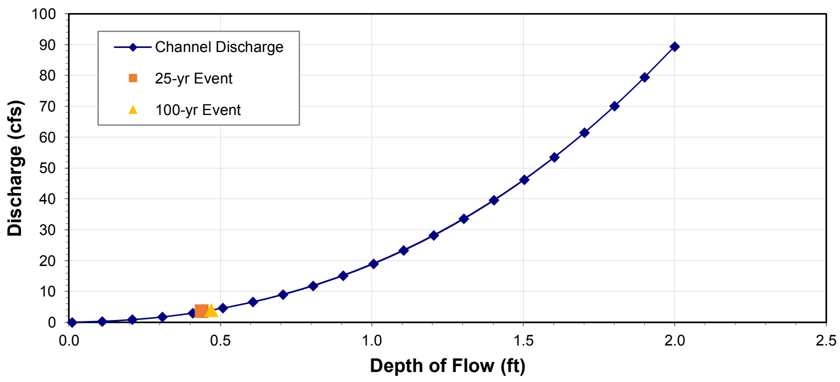
Project: IESI Travis County Landfill Expansion

Ditch ID: **F.2** **Design**

Peak Discharge, Q_{25} =	3.51	cfs (25-yr Event)
Peak Discharge, Q_{100} =	4.01	cfs (100-yr Event)
Bottom Width, B =	2.00	ft
Left Side Slope, Z_1 =	3.00	horizontal :1 vertical
Right Side Slope, Z_2 =	3.00	horizontal :1 vertical
Channel Depth, Y =	2.00	ft
Top Width, T =	14.00	ft
Manning's Roughness Coeff., n =	0.03	
Longitudinal Channel Slope, S_o =	0.01	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.24	0.0	0.01	
0.11	0.25	2.69	0.09	1.09	0.3	0.05	
0.21	0.55	3.32	0.17	1.59	0.9	0.09	
0.31	0.90	3.95	0.23	1.97	1.8	0.13	
0.41	1.32	4.58	0.29	2.29	3.0	0.16	
0.51	1.79	5.21	0.34	2.58	4.6	0.20	
0.61	2.32	5.84	0.40	2.85	6.6	0.23	
0.71	2.91	6.47	0.45	3.09	9.0	0.26	
0.81	3.56	7.10	0.50	3.33	11.8	0.29	
0.91	4.27	7.73	0.55	3.55	15.2	0.31	
1.01	5.04	8.36	0.60	3.76	19.0	0.34	
1.10	5.87	8.99	0.65	3.97	23.3	0.37	
1.20	6.76	9.61	0.70	4.16	28.1	0.40	
1.30	7.70	10.24	0.75	4.36	33.6	0.43	
1.40	8.71	10.87	0.80	4.55	39.6	0.46	
1.50	9.78	11.50	0.85	4.73	46.2	0.48	
1.60	10.90	12.13	0.90	4.91	53.5	0.51	
1.70	12.09	12.76	0.95	5.08	61.4	0.54	
1.80	13.33	13.39	1.00	5.25	70.1	0.57	
1.90	14.64	14.02	1.04	5.42	79.4	0.59	
2.00	16.00	14.65	1.09	5.59	89.4	0.62	
0.44	1.45	4.77	0.30	2.39	3.47	0.17	Q (25-yr Event)
0.47	1.60	4.97	0.32	2.48	3.97	0.18	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

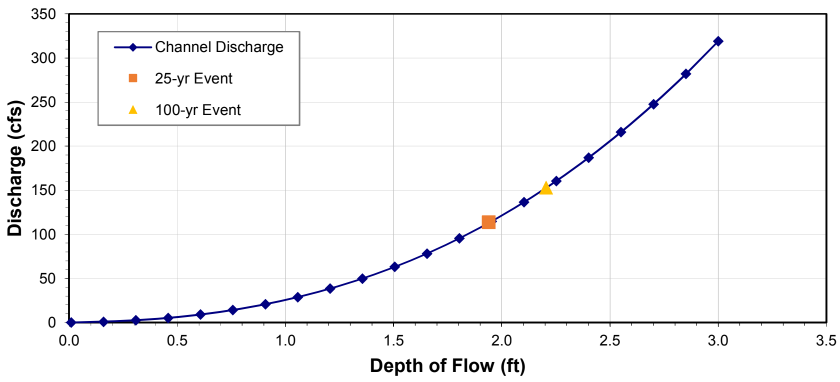
Project: IESI Travis County Landfill Expansion

Ditch ID: **L.1** **Design**

Peak Discharge, Q_{25} = 113.14 cfs (25-yr Event)
Peak Discharge, Q_{100} = 152.84 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 3.00 ft
Top Width, T = 20.00 ft
Manning's Roughness Coeff., n = 0.03
Longitudinal Channel Slope, S_o = 0.02 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.33	0.0	0.01	
0.16	0.40	3.01	0.13	1.85	0.7	0.14	
0.31	0.90	3.95	0.23	2.67	2.4	0.24	
0.46	1.55	4.90	0.32	3.31	5.1	0.33	
0.61	2.32	5.85	0.40	3.86	9.0	0.42	
0.76	3.24	6.79	0.48	4.36	14.1	0.50	
0.91	4.28	7.74	0.55	4.82	20.6	0.58	
1.06	5.46	8.68	0.63	5.25	28.7	0.66	
1.21	6.78	9.63	0.70	5.65	38.3	0.74	
1.36	8.22	10.57	0.78	6.04	49.7	0.81	
1.51	9.81	11.52	0.85	6.42	62.9	0.89	
1.65	11.52	12.46	0.92	6.78	78.1	0.97	
1.80	13.37	13.41	1.00	7.13	95.4	1.04	
1.95	15.36	14.36	1.07	7.48	114.8	1.12	
2.10	17.47	15.30	1.14	7.81	136.4	1.20	
2.25	19.73	16.25	1.21	8.13	160.5	1.27	
2.40	22.11	17.19	1.29	8.45	186.9	1.35	
2.55	24.63	18.14	1.36	8.77	215.9	1.42	
2.70	27.29	19.08	1.43	9.07	247.6	1.50	
2.85	30.08	20.03	1.50	9.37	281.9	1.57	
3.00	33.00	20.97	1.57	9.67	319.1	1.65	
1.94	15.18	14.27	1.06	7.45	113.05	1.11	Q (25-yr Event)
2.21	19.00	15.95	1.19	8.03	152.58	1.25	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

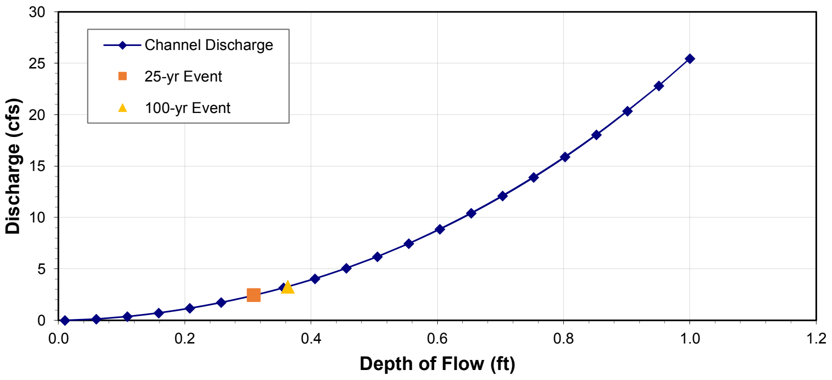
Project: IESI Travis County Landfill Expansion

Ditch ID: **L.2** **Design**

Peak Discharge, Q_{25} = 2.43 cfs (25-yr Event)
Peak Discharge, Q_{100} = 3.28 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 1.00 ft
Top Width, T = 8.00 ft
Manning's Roughness Coeff., n = 0.03
Longitudinal Channel Slope, S_o = 0.02 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.33	0.0	0.01	
0.06	0.13	2.38	0.05	1.03	0.1	0.06	
0.11	0.25	2.69	0.09	1.48	0.4	0.10	
0.16	0.39	3.00	0.13	1.84	0.7	0.14	
0.21	0.55	3.32	0.16	2.15	1.2	0.17	
0.26	0.71	3.63	0.20	2.42	1.7	0.21	
0.31	0.90	3.94	0.23	2.66	2.4	0.24	
0.36	1.09	4.25	0.26	2.89	3.2	0.27	
0.41	1.31	4.57	0.29	3.10	4.1	0.30	
0.46	1.53	4.88	0.31	3.30	5.1	0.33	
0.51	1.78	5.19	0.34	3.49	6.2	0.36	
0.55	2.03	5.51	0.37	3.67	7.5	0.39	
0.60	2.30	5.82	0.40	3.85	8.9	0.41	
0.65	2.59	6.13	0.42	4.02	10.4	0.44	
0.70	2.89	6.45	0.45	4.18	12.1	0.47	
0.75	3.20	6.76	0.47	4.34	13.9	0.50	
0.80	3.53	7.07	0.50	4.50	15.9	0.52	
0.85	3.88	7.39	0.53	4.65	18.0	0.55	
0.90	4.24	7.70	0.55	4.80	20.3	0.58	
0.95	4.61	8.01	0.58	4.94	22.8	0.60	
1.00	5.00	8.32	0.60	5.09	25.4	0.63	
0.31	0.91	3.96	0.23	2.68	2.43	0.24	Q (25-yr Event)
0.36	1.12	4.30	0.26	2.92	3.27	0.27	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

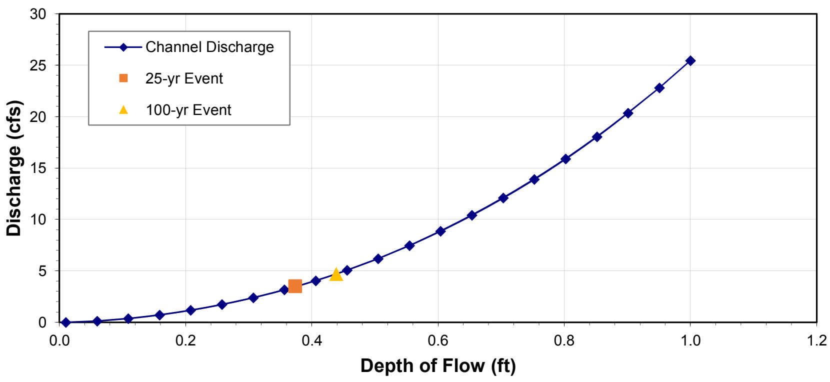
Project: IESI Travis County Landfill Expansion

Ditch ID: **M.1** **Design**

Peak Discharge, Q_{25} = 3.48 cfs (25-yr Event)
Peak Discharge, Q_{100} = 4.71 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 1.00 ft
Top Width, T = 8.00 ft
Manning's Roughness Coeff., n = 0.03
Longitudinal Channel Slope, S_o = 0.02 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.33	0.0	0.01	
0.06	0.13	2.38	0.05	1.03	0.1	0.06	
0.11	0.25	2.69	0.09	1.48	0.4	0.10	
0.16	0.39	3.00	0.13	1.84	0.7	0.14	
0.21	0.55	3.32	0.16	2.15	1.2	0.17	
0.26	0.71	3.63	0.20	2.42	1.7	0.21	
0.31	0.90	3.94	0.23	2.66	2.4	0.24	
0.36	1.09	4.25	0.26	2.89	3.2	0.27	
0.41	1.31	4.57	0.29	3.10	4.1	0.30	
0.46	1.53	4.88	0.31	3.30	5.1	0.33	
0.51	1.78	5.19	0.34	3.49	6.2	0.36	
0.55	2.03	5.51	0.37	3.67	7.5	0.39	
0.60	2.30	5.82	0.40	3.85	8.9	0.41	
0.65	2.59	6.13	0.42	4.02	10.4	0.44	
0.70	2.89	6.45	0.45	4.18	12.1	0.47	
0.75	3.20	6.76	0.47	4.34	13.9	0.50	
0.80	3.53	7.07	0.50	4.50	15.9	0.52	
0.85	3.88	7.39	0.53	4.65	18.0	0.55	
0.90	4.24	7.70	0.55	4.80	20.3	0.58	
0.95	4.61	8.01	0.58	4.94	22.8	0.60	
1.00	5.00	8.32	0.60	5.09	25.4	0.63	
0.37	1.17	4.37	0.27	2.97	3.47	0.28	Q (25-yr Event)
0.44	1.45	4.77	0.30	3.23	4.70	0.32	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

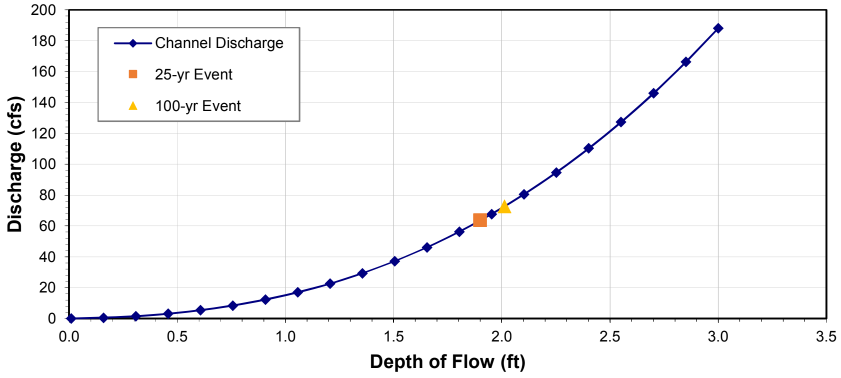
Project: IESI Travis County Landfill Expansion

Ditch ID: **A.2-A.3** **Design**

Peak Discharge, Q_{25} = 63.65 cfs (25-yr Event)
Peak Discharge, Q_{100} = 72.72 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 3.00 ft
Top Width, T = 20.00 ft
Manning's Roughness Coeff., n = 0.08
Longitudinal Channel Slope, S_o = 0.05 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.19	0.0	0.03	
0.16	0.40	3.01	0.13	1.09	0.4	0.40	
0.31	0.90	3.95	0.23	1.58	1.4	0.69	
0.46	1.55	4.90	0.32	1.95	3.0	0.96	
0.61	2.32	5.85	0.40	2.28	5.3	1.21	
0.76	3.24	6.79	0.48	2.57	8.3	1.45	
0.91	4.28	7.74	0.55	2.84	12.2	1.68	
1.06	5.46	8.68	0.63	3.09	16.9	1.91	
1.21	6.78	9.63	0.70	3.33	22.6	2.14	
1.36	8.22	10.57	0.78	3.56	29.3	2.36	
1.51	9.81	11.52	0.85	3.78	37.1	2.58	
1.65	11.52	12.46	0.92	4.00	46.1	2.81	
1.80	13.37	13.41	1.00	4.21	56.2	3.03	
1.95	15.36	14.36	1.07	4.41	67.7	3.25	
2.10	17.47	15.30	1.14	4.60	80.4	3.47	
2.25	19.73	16.25	1.21	4.80	94.6	3.69	
2.40	22.11	17.19	1.29	4.98	110.2	3.90	
2.55	24.63	18.14	1.36	5.17	127.3	4.12	
2.70	27.29	19.08	1.43	5.35	146.0	4.34	
2.85	30.08	20.03	1.50	5.53	166.2	4.56	
3.00	33.00	20.97	1.57	5.70	188.1	4.78	
1.90	14.64	14.02	1.04	4.34	63.50	3.17	Q (25-yr Event)
2.01	16.18	14.73	1.10	4.49	72.56	3.33	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

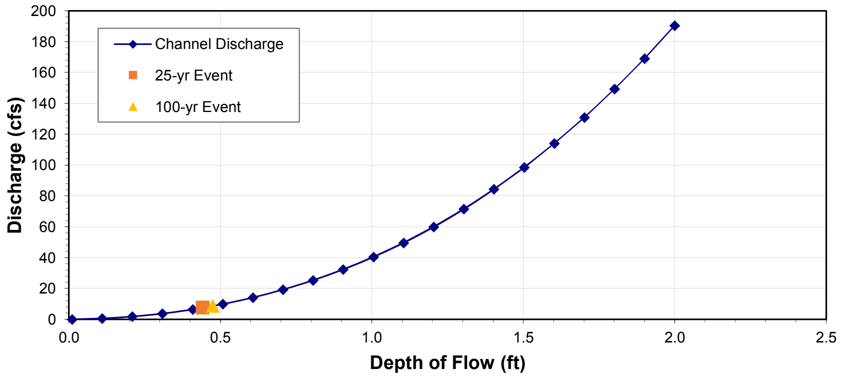
Project: IESI Travis County Landfill Expansion

Ditch ID: **A.1-A.2** **Design**

Peak Discharge, Q_{25} = 7.59 cfs (25-yr Event)
Peak Discharge, Q_{100} = 8.67 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 2.00 ft
Top Width, T = 14.00 ft
Manning's Roughness Coeff., n = 0.03
Longitudinal Channel Slope, S_o = 0.04 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.51	0.0	0.03	
0.11	0.25	2.69	0.09	2.33	0.6	0.24	
0.21	0.55	3.32	0.17	3.38	1.9	0.43	
0.31	0.90	3.95	0.23	4.19	3.8	0.59	
0.41	1.32	4.58	0.29	4.88	6.4	0.74	
0.51	1.79	5.21	0.34	5.50	9.8	0.89	
0.61	2.32	5.84	0.40	6.06	14.1	1.02	
0.71	2.91	6.47	0.45	6.59	19.2	1.16	
0.81	3.56	7.10	0.50	7.08	25.2	1.29	
0.91	4.27	7.73	0.55	7.56	32.3	1.43	
1.01	5.04	8.36	0.60	8.01	40.4	1.56	
1.10	5.87	8.99	0.65	8.45	49.6	1.69	
1.20	6.76	9.61	0.70	8.87	59.9	1.81	
1.30	7.70	10.24	0.75	9.28	71.5	1.94	
1.40	8.71	10.87	0.80	9.68	84.3	2.07	
1.50	9.78	11.50	0.85	10.07	98.5	2.19	
1.60	10.90	12.13	0.90	10.45	113.9	2.32	
1.70	12.09	12.76	0.95	10.82	130.8	2.44	
1.80	13.33	13.39	1.00	11.19	149.2	2.57	
1.90	14.64	14.02	1.04	11.55	169.0	2.69	
2.00	16.00	14.65	1.09	11.90	190.4	2.82	
0.44	1.47	4.80	0.31	5.10	7.50	0.79	Q (25-yr Event)
0.47	1.62	5.00	0.32	5.30	8.58	0.84	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

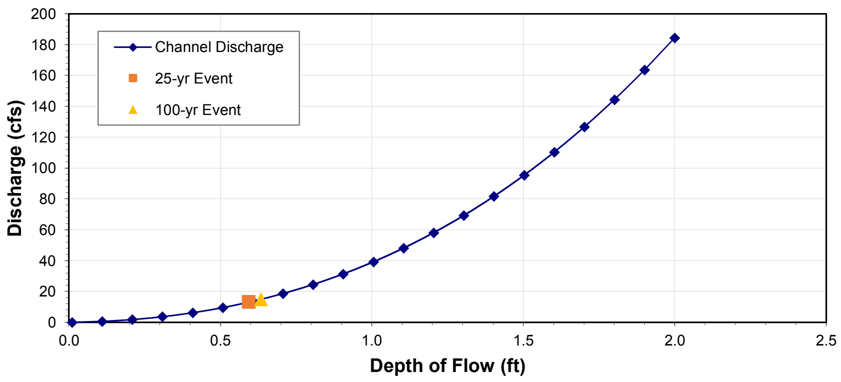
Project: IESI Travis County Landfill Expansion

Ditch ID: **B.1-B.2** **Design**

Peak Discharge, Q_{25} =	13.08	cfs (25-yr Event)
Peak Discharge, Q_{100} =	14.94	cfs (100-yr Event)
Bottom Width, B =	2.00	ft
Left Side Slope, Z_1 =	3.00	horizontal :1 vertical
Right Side Slope, Z_2 =	3.00	horizontal :1 vertical
Channel Depth, Y =	2.00	ft
Top Width, T =	14.00	ft
Manning's Roughness Coeff., n =	0.03	
Longitudinal Channel Slope, S_o =	0.04	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.50	0.0	0.02	
0.11	0.25	2.69	0.09	2.25	0.6	0.23	
0.21	0.55	3.32	0.17	3.27	1.8	0.40	
0.31	0.90	3.95	0.23	4.06	3.7	0.55	
0.41	1.32	4.58	0.29	4.73	6.2	0.69	
0.51	1.79	5.21	0.34	5.32	9.5	0.83	
0.61	2.32	5.84	0.40	5.87	13.6	0.96	
0.71	2.91	6.47	0.45	6.38	18.6	1.09	
0.81	3.56	7.10	0.50	6.86	24.4	1.21	
0.91	4.27	7.73	0.55	7.31	31.2	1.34	
1.01	5.04	8.36	0.60	7.75	39.1	1.46	
1.10	5.87	8.99	0.65	8.17	48.0	1.58	
1.20	6.76	9.61	0.70	8.58	58.0	1.70	
1.30	7.70	10.24	0.75	8.98	69.2	1.82	
1.40	8.71	10.87	0.80	9.37	81.6	1.94	
1.50	9.78	11.50	0.85	9.74	95.3	2.05	
1.60	10.90	12.13	0.90	10.11	110.3	2.17	
1.70	12.09	12.76	0.95	10.47	126.6	2.29	
1.80	13.33	13.39	1.00	10.83	144.4	2.41	
1.90	14.64	14.02	1.04	11.18	163.6	2.52	
2.00	16.00	14.65	1.09	11.52	184.3	2.64	
0.59	2.25	5.76	0.39	5.80	13.03	0.94	Q (25-yr Event)
0.63	2.47	6.01	0.41	6.01	14.85	0.99	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

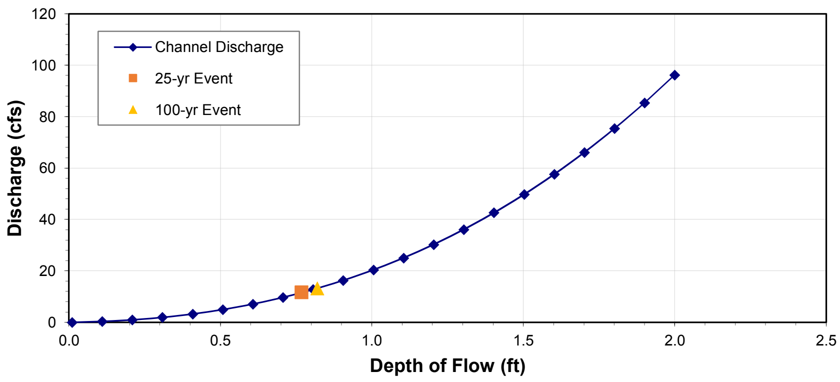
Project: IESI Travis County Landfill Expansion

Ditch ID: **C.1-C.2** **Design**

Peak Discharge, Q_{25} =	11.59	cfs (25-yr Event)
Peak Discharge, Q_{100} =	13.24	cfs (100-yr Event)
Bottom Width, B =	2.00	ft
Left Side Slope, Z_1 =	3.00	horizontal :1 vertical
Right Side Slope, Z_2 =	3.00	horizontal :1 vertical
Channel Depth, Y =	2.00	ft
Top Width, T =	14.00	ft
Manning's Roughness Coeff., n =	0.03	
Longitudinal Channel Slope, S_o =	0.01	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.26	0.0	0.01	
0.11	0.25	2.69	0.09	1.18	0.3	0.06	
0.21	0.55	3.32	0.17	1.71	0.9	0.11	
0.31	0.90	3.95	0.23	2.12	1.9	0.15	
0.41	1.32	4.58	0.29	2.47	3.2	0.19	
0.51	1.79	5.21	0.34	2.78	5.0	0.23	
0.61	2.32	5.84	0.40	3.06	7.1	0.26	
0.71	2.91	6.47	0.45	3.33	9.7	0.30	
0.81	3.56	7.10	0.50	3.58	12.7	0.33	
0.91	4.27	7.73	0.55	3.82	16.3	0.36	
1.01	5.04	8.36	0.60	4.05	20.4	0.40	
1.10	5.87	8.99	0.65	4.27	25.0	0.43	
1.20	6.76	9.61	0.70	4.48	30.3	0.46	
1.30	7.70	10.24	0.75	4.69	36.1	0.50	
1.40	8.71	10.87	0.80	4.89	42.6	0.53	
1.50	9.78	11.50	0.85	5.09	49.7	0.56	
1.60	10.90	12.13	0.90	5.28	57.6	0.59	
1.70	12.09	12.76	0.95	5.47	66.1	0.62	
1.80	13.33	13.39	1.00	5.65	75.4	0.66	
1.90	14.64	14.02	1.04	5.83	85.4	0.69	
2.00	16.00	14.65	1.09	6.01	96.2	0.72	
0.77	3.31	6.86	0.48	3.49	11.53	0.32	Q (25-yr Event)
0.82	3.66	7.19	0.51	3.61	13.21	0.34	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

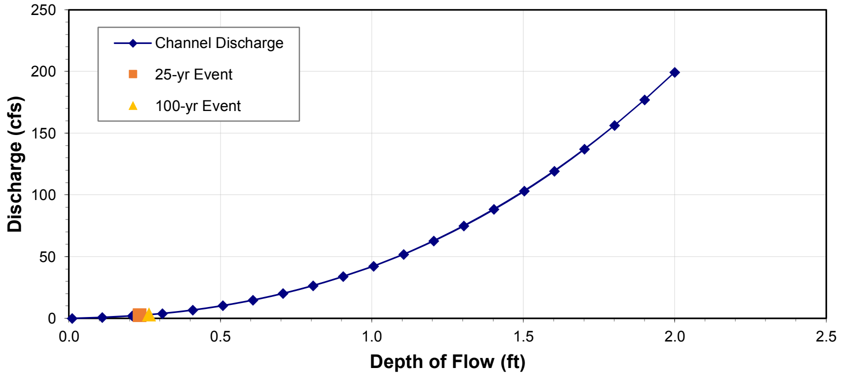
Project: IESI Travis County Landfill Expansion

Ditch ID: D.1-D.2 **Design**

Peak Discharge, Q_{25} =	2.46	cfs (25-yr Event)
Peak Discharge, Q_{100} =	3.06	cfs (100-yr Event)
Bottom Width, B =	2.00	ft
Left Side Slope, Z_1 =	3.00	horizontal :1 vertical
Right Side Slope, Z_2 =	3.00	horizontal :1 vertical
Channel Depth, Y =	2.00	ft
Top Width, T =	14.00	ft
Manning's Roughness Coeff., n =	0.03	
Longitudinal Channel Slope, S_o =	0.05	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.54	0.0	0.03	
0.11	0.25	2.69	0.09	2.44	0.6	0.27	
0.21	0.55	3.32	0.17	3.54	1.9	0.47	
0.31	0.90	3.95	0.23	4.39	4.0	0.65	
0.41	1.32	4.58	0.29	5.11	6.7	0.81	
0.51	1.79	5.21	0.34	5.76	10.3	0.97	
0.61	2.32	5.84	0.40	6.35	14.7	1.12	
0.71	2.91	6.47	0.45	6.90	20.1	1.27	
0.81	3.56	7.10	0.50	7.42	26.4	1.42	
0.91	4.27	7.73	0.55	7.91	33.8	1.56	
1.01	5.04	8.36	0.60	8.39	42.3	1.71	
1.10	5.87	8.99	0.65	8.84	51.9	1.85	
1.20	6.76	9.61	0.70	9.29	62.7	1.99	
1.30	7.70	10.24	0.75	9.72	74.9	2.13	
1.40	8.71	10.87	0.80	10.13	88.3	2.27	
1.50	9.78	11.50	0.85	10.54	103.1	2.40	
1.60	10.90	12.13	0.90	10.94	119.3	2.54	
1.70	12.09	12.76	0.95	11.33	137.0	2.68	
1.80	13.33	13.39	1.00	11.72	156.2	2.82	
1.90	14.64	14.02	1.04	12.09	177.0	2.95	
2.00	16.00	14.65	1.09	12.46	199.4	3.09	
0.23	0.63	3.48	0.18	3.77	2.39	0.51	Q (25-yr Event)
0.26	0.74	3.67	0.20	4.03	2.97	0.57	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

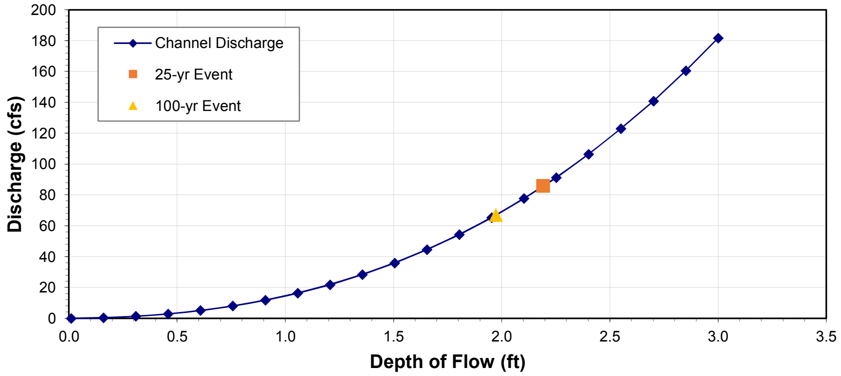
Project: IESI Travis County Landfill Expansion

Ditch ID: D.2-D.3 **Design**

Peak Discharge, Q_{25} = 85.80 cfs (25-yr Event)
Peak Discharge, Q_{100} = 66.94 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 3.00 ft
Top Width, T = 20.00 ft
Manning's Roughness Coeff., n = 0.08
Longitudinal Channel Slope, S_o = 0.05 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.19	0.0	0.03	
0.16	0.40	3.01	0.13	1.05	0.4	0.37	
0.31	0.90	3.95	0.23	1.52	1.4	0.65	
0.46	1.55	4.90	0.32	1.89	2.9	0.89	
0.61	2.32	5.85	0.40	2.20	5.1	1.12	
0.76	3.24	6.79	0.48	2.48	8.0	1.35	
0.91	4.28	7.74	0.55	2.74	11.7	1.57	
1.06	5.46	8.68	0.63	2.99	16.3	1.78	
1.21	6.78	9.63	0.70	3.22	21.8	1.99	
1.36	8.22	10.57	0.78	3.44	28.3	2.20	
1.51	9.81	11.52	0.85	3.65	35.8	2.41	
1.65	11.52	12.46	0.92	3.86	44.5	2.61	
1.80	13.37	13.41	1.00	4.06	54.3	2.82	
1.95	15.36	14.36	1.07	4.25	65.3	3.03	
2.10	17.47	15.30	1.14	4.44	77.6	3.23	
2.25	19.73	16.25	1.21	4.63	91.3	3.43	
2.40	22.11	17.19	1.29	4.81	106.4	3.64	
2.55	24.63	18.14	1.36	4.99	122.9	3.84	
2.70	27.29	19.08	1.43	5.16	140.9	4.04	
2.85	30.08	20.03	1.50	5.33	160.4	4.25	
3.00	33.00	20.97	1.57	5.50	181.6	4.45	
2.19	18.80	15.86	1.19	4.55	85.64	3.35	Q (25-yr Event)
1.97	15.63	14.48	1.08	4.28	66.87	3.05	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

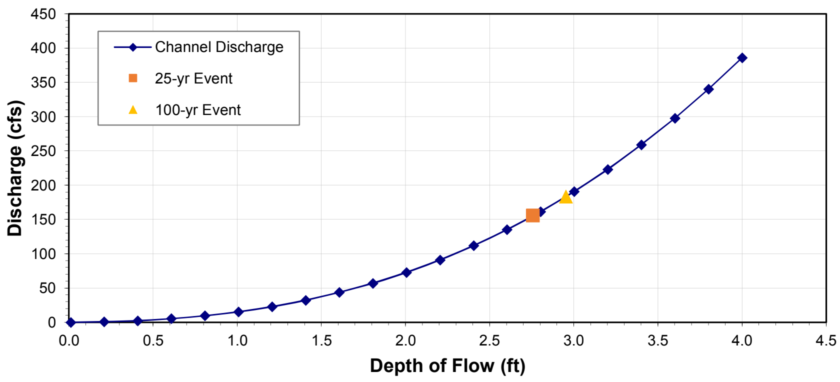
Project: IESI Travis County Landfill Expansion

Ditch ID: **D.3-D.4** **Design**

Peak Discharge, Q_{25} = 155.65 cfs (25-yr Event)
Peak Discharge, Q_{100} = 183.39 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 4.00 ft
Top Width, T = 26.00 ft
Manning's Roughness Coeff., n = 0.08
Longitudinal Channel Slope, S_o = 0.05 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.20	0.0	0.03	
0.21	0.55	3.32	0.17	1.29	0.7	0.52	
0.41	1.32	4.59	0.29	1.86	2.5	0.90	
0.61	2.33	5.85	0.40	2.31	5.4	1.24	
0.81	3.57	7.11	0.50	2.70	9.6	1.56	
1.01	5.06	8.37	0.60	3.05	15.4	1.88	
1.21	6.78	9.63	0.70	3.38	22.9	2.19	
1.41	8.75	10.90	0.80	3.68	32.2	2.50	
1.61	10.95	12.16	0.90	3.98	43.6	2.80	
1.81	13.39	13.42	1.00	4.26	57.0	3.11	
2.01	16.07	14.68	1.09	4.53	72.8	3.41	
2.20	18.99	15.94	1.19	4.79	91.0	3.71	
2.40	22.15	17.20	1.29	5.05	111.8	4.01	
2.60	25.54	18.47	1.38	5.30	135.3	4.30	
2.80	29.18	19.73	1.48	5.54	161.6	4.60	
3.00	33.05	20.99	1.57	5.77	190.8	4.90	
3.20	37.16	22.25	1.67	6.01	223.2	5.20	
3.40	41.51	23.51	1.77	6.23	258.7	5.49	
3.60	46.10	24.77	1.86	6.46	297.6	5.79	
3.80	50.93	26.04	1.96	6.67	339.9	6.09	
4.00	56.00	27.30	2.05	6.89	385.8	6.38	
2.76	28.34	19.44	1.46	5.48	155.40	4.54	Q (25-yr Event)
2.95	32.04	20.67	1.55	5.71	183.10	4.82	Q (100-yr Event)

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

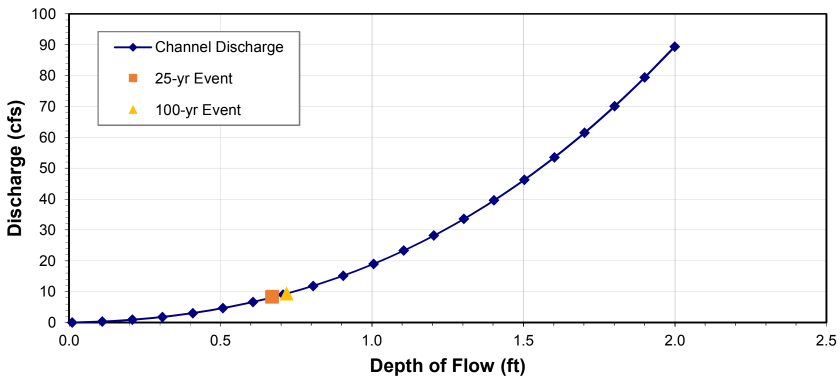
Project: IESI Travis County Landfill Expansion

Ditch ID: **E.1-E.2** **Design**

Peak Discharge, Q_{25} = 8.17 cfs (25-yr Event)
Peak Discharge, Q_{100} = 9.33 cfs (100-yr Event)
Bottom Width, B = 2.00 ft
Left Side Slope, Z_1 = 3.00 horizontal :1 vertical
Right Side Slope, Z_2 = 3.00 horizontal :1 vertical
Channel Depth, Y = 2.00 ft
Top Width, T = 14.00 ft
Manning's Roughness Coeff., n = 0.03
Longitudinal Channel Slope, S_o = 0.01 ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.02	2.06	0.01	0.24	0.0	0.01	
0.11	0.25	2.69	0.09	1.09	0.3	0.05	
0.21	0.55	3.32	0.17	1.59	0.9	0.09	
0.31	0.90	3.95	0.23	1.97	1.8	0.13	
0.41	1.32	4.58	0.29	2.29	3.0	0.16	
0.51	1.79	5.21	0.34	2.58	4.6	0.20	
0.61	2.32	5.84	0.40	2.85	6.6	0.23	
0.71	2.91	6.47	0.45	3.09	9.0	0.26	
0.81	3.56	7.10	0.50	3.33	11.8	0.29	
0.91	4.27	7.73	0.55	3.55	15.2	0.31	
1.01	5.04	8.36	0.60	3.76	19.0	0.34	
1.10	5.87	8.99	0.65	3.97	23.3	0.37	
1.20	6.76	9.61	0.70	4.16	28.1	0.40	
1.30	7.70	10.24	0.75	4.36	33.6	0.43	
1.40	8.71	10.87	0.80	4.55	39.6	0.46	
1.50	9.78	11.50	0.85	4.73	46.2	0.48	
1.60	10.90	12.13	0.90	4.91	53.5	0.51	
1.70	12.09	12.76	0.95	5.08	61.4	0.54	
1.80	13.33	13.39	1.00	5.25	70.1	0.57	
1.90	14.64	14.02	1.04	5.42	79.4	0.59	
2.00	16.00	14.65	1.09	5.59	89.4	0.62	
0.67	2.70	6.25	0.43	3.01	8.12	0.25	Q (25-yr Event)
0.72	2.98	6.54	0.46	3.12	9.31	0.26	Q (100-yr Event)

Discharge versus Depth Relationship



Appendix 3

HY-8 Output – Cases 1 through 4

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 27.23 cfs

Maximum Flow: 27.23 cfs

Table 1 - Summary of Culvert Flows at Crossing: EC-6, 25-yr (Case 1)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
239.93	1.00	1.00	0.00	1
240.33	3.62	3.62	0.00	1
240.60	6.25	6.25	0.00	1
240.85	8.87	8.87	0.00	1
241.10	11.49	11.49	0.00	1
241.32	14.12	14.12	0.00	1
241.53	16.74	16.74	0.00	1
241.73	19.36	19.36	0.00	1
241.93	21.98	21.98	0.00	1
242.14	24.61	24.61	0.00	1
242.36	27.23	27.23	0.00	1
244.00	41.91	41.91	0.00	Overtopping

Rating Curve Plot for Crossing: EC-6, 25-yr (Case 1)

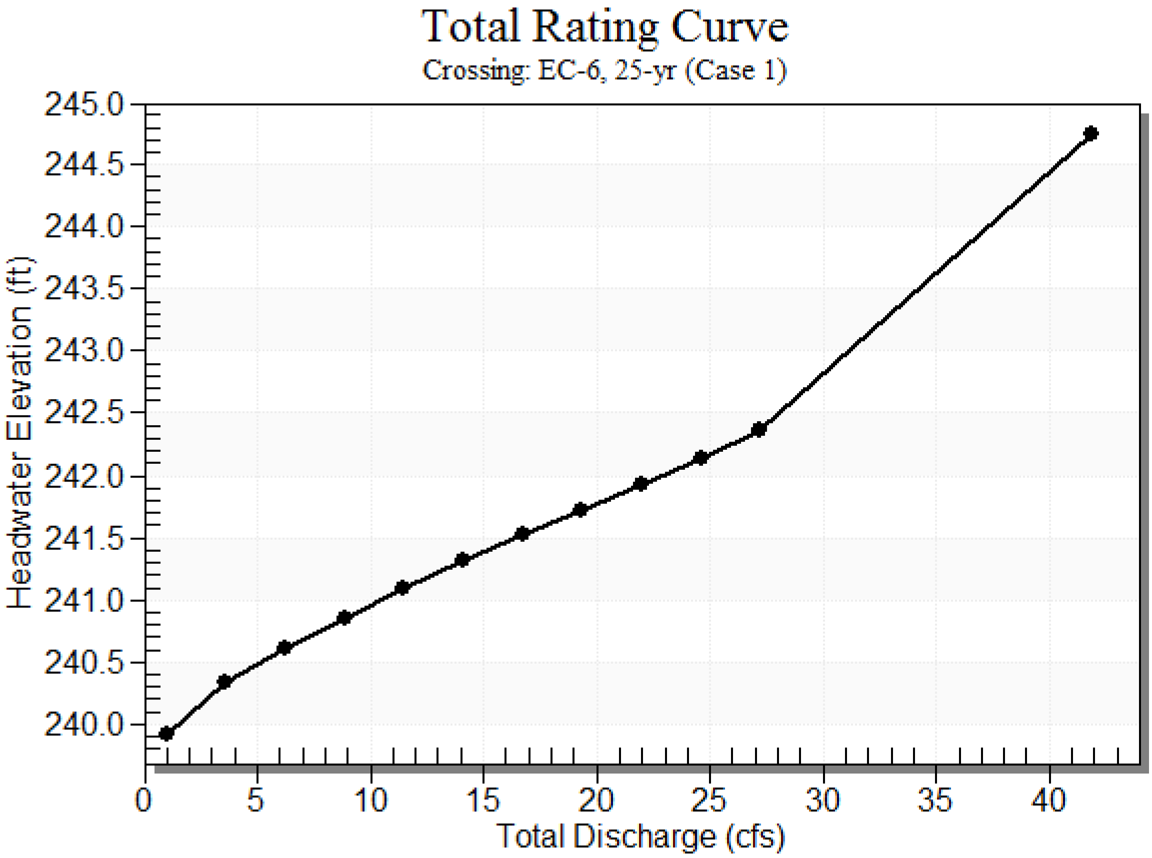


Table 2 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	239.93	0.426	0.0*	1-S2n	0.188	0.321	0.196	9.720	5.412	0.000
3.62	3.62	240.33	0.830	0.0*	1-S2n	0.347	0.622	0.366	9.720	7.939	0.000
6.25	6.25	240.60	1.105	0.0*	1-S2n	0.454	0.825	0.483	9.720	9.093	0.000
8.87	8.87	240.85	1.354	0.0*	1-S2n	0.539	0.987	0.586	9.720	9.758	0.000
11.49	11.49	241.10	1.600	0.0*	1-S2n	0.615	1.136	0.678	9.720	10.319	0.000
14.12	14.12	241.32	1.821	0.0*	1-S2n	0.682	1.265	0.759	9.720	10.813	0.000
16.74	16.74	241.53	2.027	0.0*	1-S2n	0.745	1.378	0.835	9.720	11.243	0.000
19.36	19.36	241.73	2.227	0.0*	1-S2n	0.804	1.488	0.912	9.720	11.537	0.000
21.98	21.98	241.93	2.429	0.202	1-S2n	0.860	1.591	0.982	9.720	11.861	0.000
24.61	24.61	242.14	2.640	0.450	5-S2n	0.913	1.685	1.051	9.720	12.138	0.000
27.23	27.23	242.36	2.863	0.713	5-S2n	0.965	1.777	1.117	9.720	12.397	0.000

* Full Flow Headwater elevation is below inlet invert.

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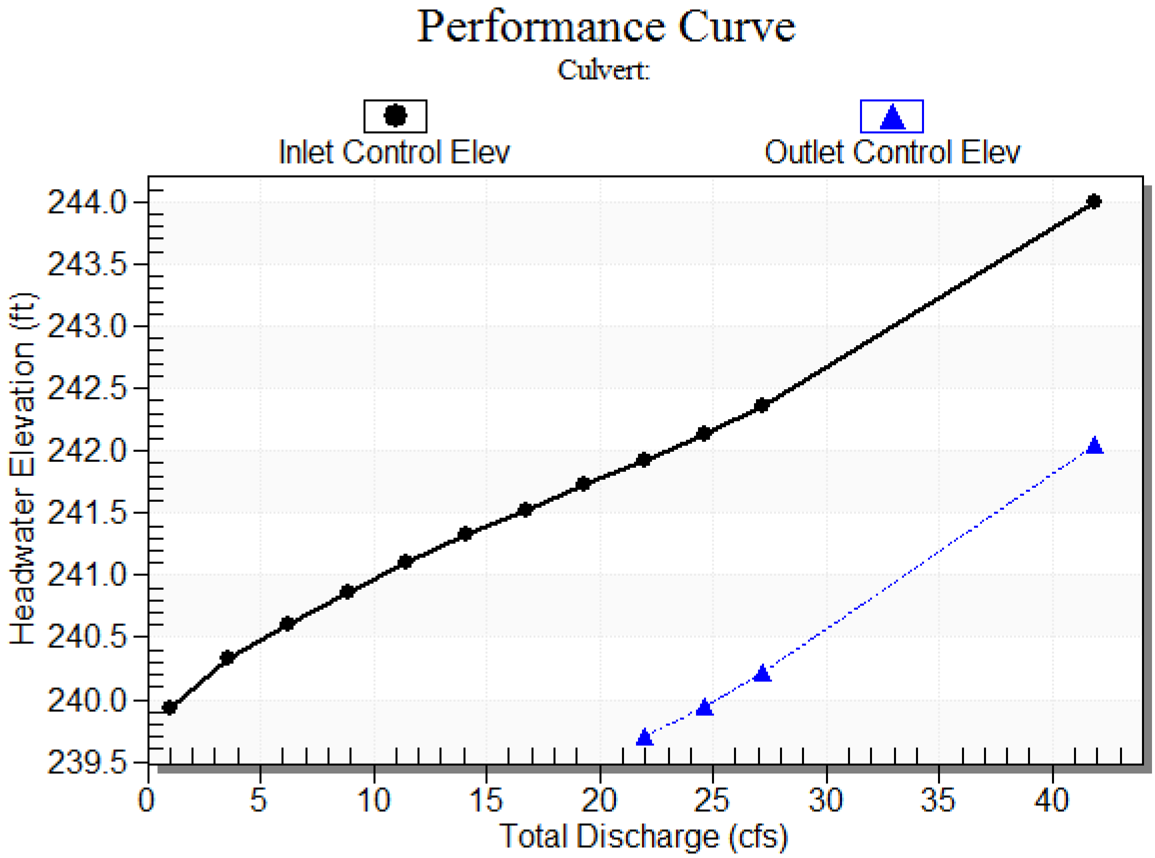
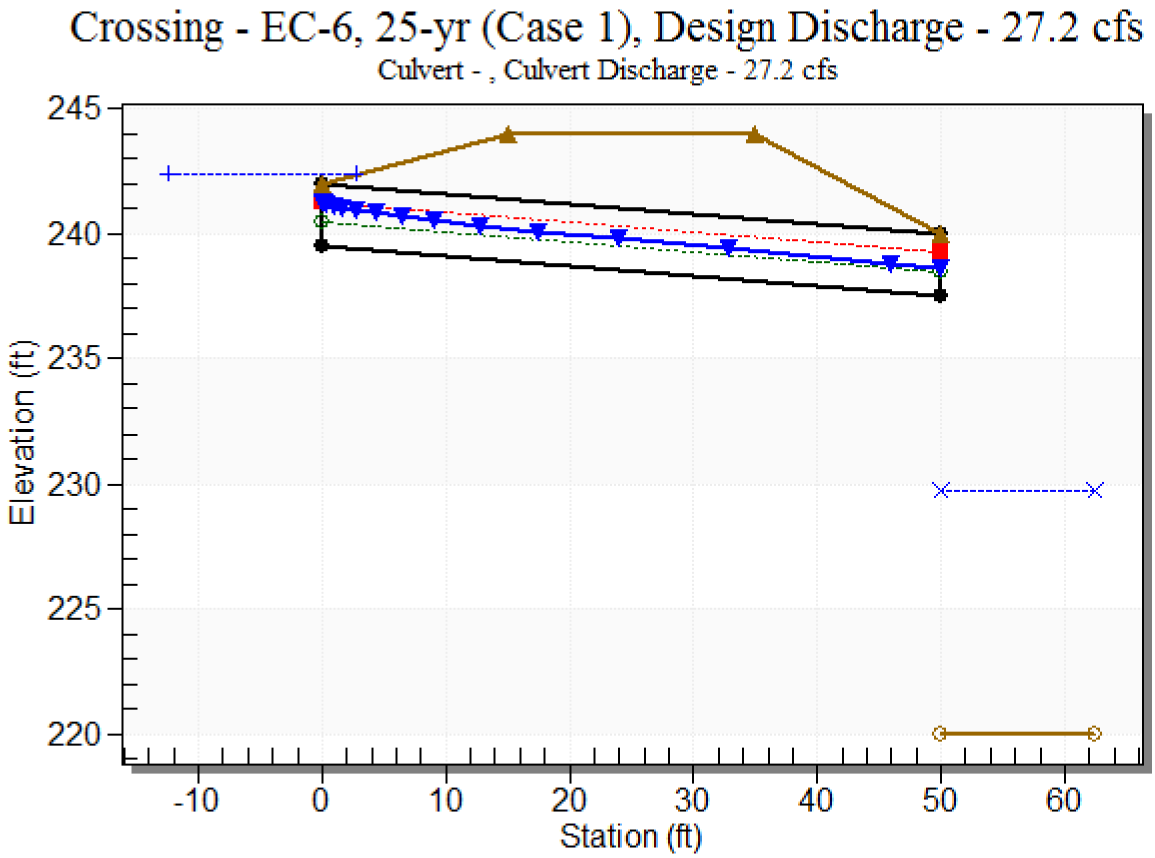
********************************************************************************
                              Straight Culvert
   Inlet Elevation (invert): 239.50 ft,    Outlet Elevation (invert): 237.50 ft
              Culvert Length: 50.04 ft,    Culvert Slope: 0.0400
********************************************************************************
```

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: EC-6, 25-yr (Case 1))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	229.72	9.72
3.62	229.72	9.72
6.25	229.72	9.72
8.87	229.72	9.72
11.49	229.72	9.72
14.12	229.72	9.72
16.74	229.72	9.72
19.36	229.72	9.72
21.98	229.72	9.72
24.61	229.72	9.72
27.23	229.72	9.72

Tailwater Channel Data - EC-6, 25-yr (Case 1)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 229.72 ft

Roadway Data for Crossing: EC-6, 25-yr (Case 1)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 244.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 116.6 cfs

Maximum Flow: 116.6 cfs

Table 4 - Summary of Culvert Flows at Crossing: C-6, 25-yr (case 4)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
237.29	1.00	1.00	0.00	1
238.07	12.56	12.56	0.00	1
238.52	24.12	24.12	0.00	1
238.95	35.68	35.68	0.00	1
239.31	47.24	47.24	0.00	1
239.65	58.80	58.80	0.00	1
239.99	70.36	70.36	0.00	1
240.35	81.92	81.92	0.00	1
240.74	93.48	93.48	0.00	1
241.18	105.04	105.04	0.00	1
241.68	116.60	116.60	0.00	1
244.00	158.96	158.96	0.00	Overtopping

Rating Curve Plot for Crossing: C-6, 25-yr (case 4)

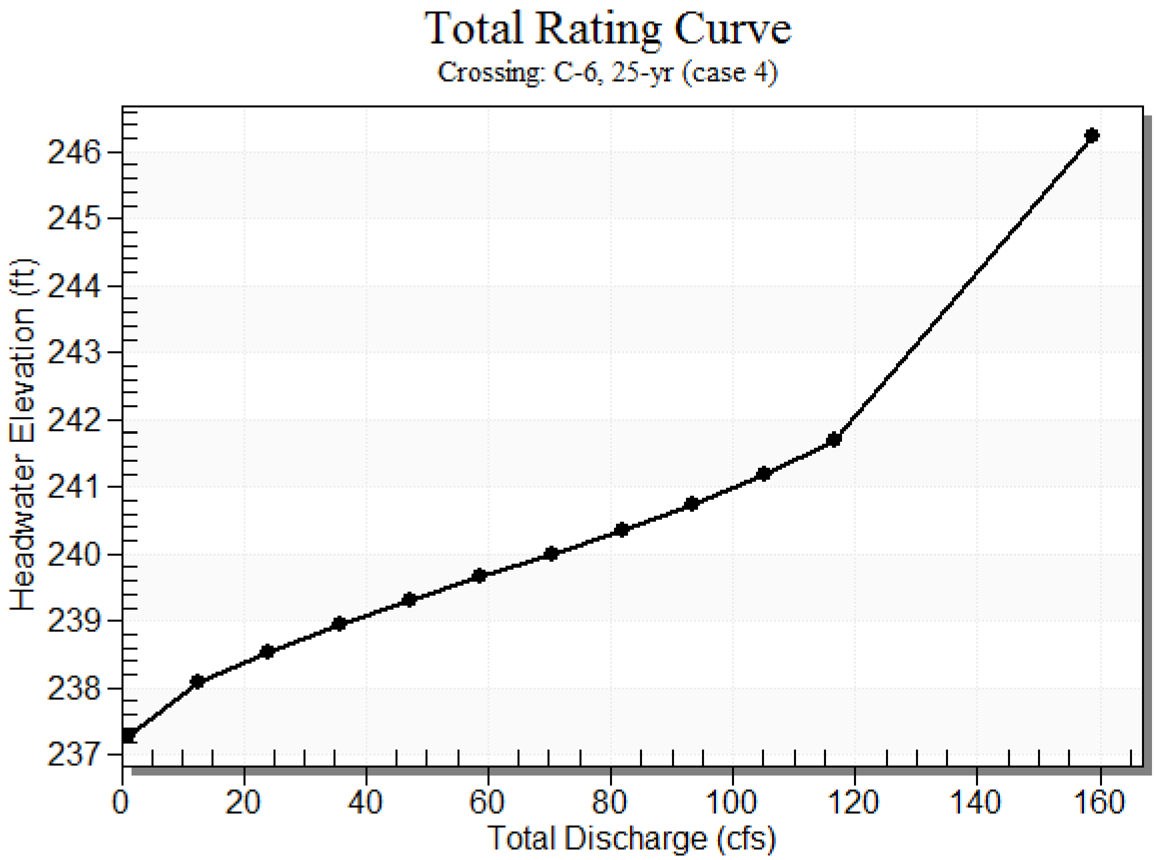


Table 5 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	237.29	0.291	0.0*	1-S2n	0.176	0.214	0.176	11.150	2.955	0.000
12.56	12.56	238.07	1.070	0.307	1-S2n	0.605	0.784	0.630	11.150	5.618	0.000
24.12	24.12	238.52	1.518	0.682	1-S2n	0.841	1.098	0.887	11.150	6.669	0.000
35.68	35.68	238.95	1.945	1.035	1-S2n	1.031	1.352	1.098	11.150	7.354	0.000
47.24	47.24	239.31	2.312	1.386	1-S2n	1.200	1.564	1.285	11.150	7.890	0.000
58.80	58.80	239.65	2.652	1.751	1-S2n	1.357	1.751	1.459	11.150	8.339	0.000
70.36	70.36	239.99	2.990	2.139	1-S2n	1.507	1.924	1.622	11.150	8.736	0.000
81.92	81.92	240.35	3.349	2.552	5-S2n	1.654	2.082	1.778	11.150	9.098	0.000
93.48	93.48	240.74	3.743	2.987	5-S2n	1.801	2.224	1.931	11.150	9.435	0.000
105.04	105.04	241.18	4.185	3.771	5-S2n	1.952	2.353	2.081	11.150	9.754	0.000
116.60	116.60	241.68	4.681	4.199	5-S2n	2.114	2.468	2.235	11.150	10.054	0.000

* Full Flow Headwater elevation is below inlet invert.

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********************************************************************************
Straight Culvert
Inlet Elevation (invert): 237.00 ft,    Outlet Elevation (invert): 236.50 ft
Culvert Length: 50.00 ft,    Culvert Slope: 0.0100
********************************************************************************
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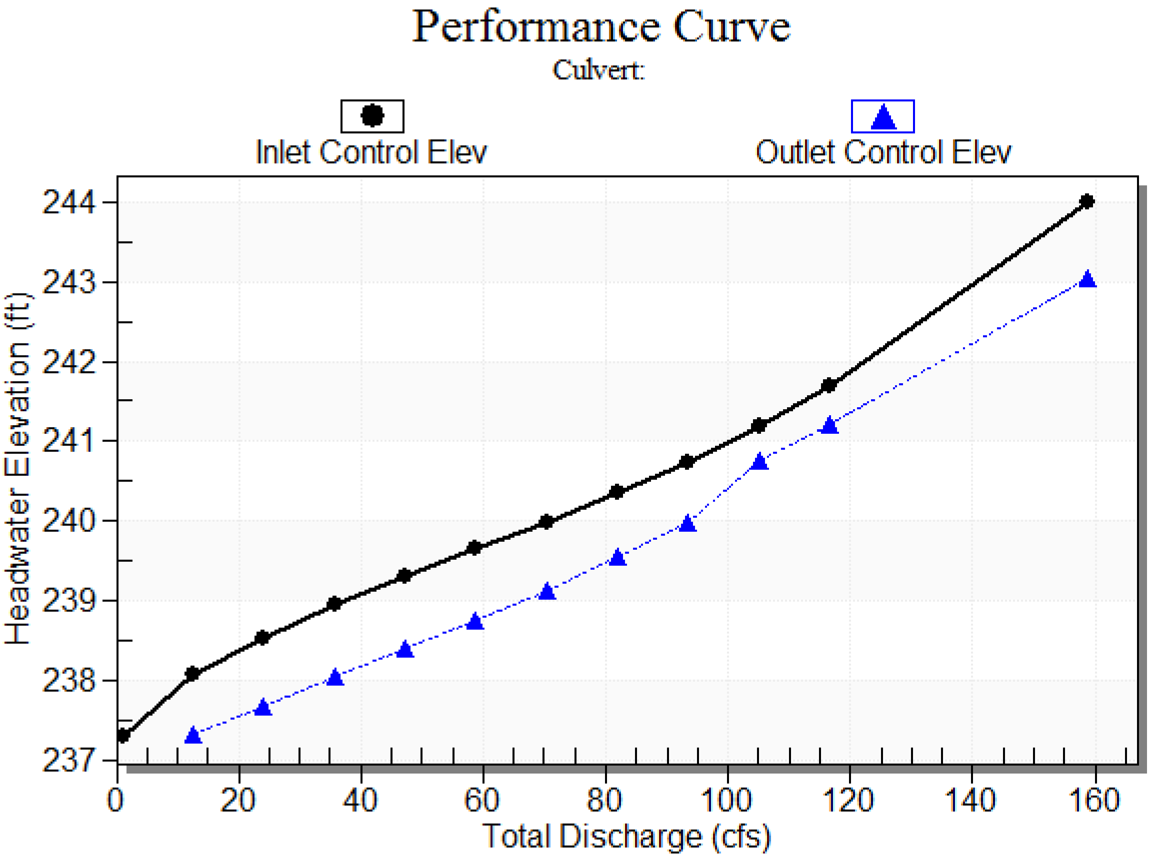
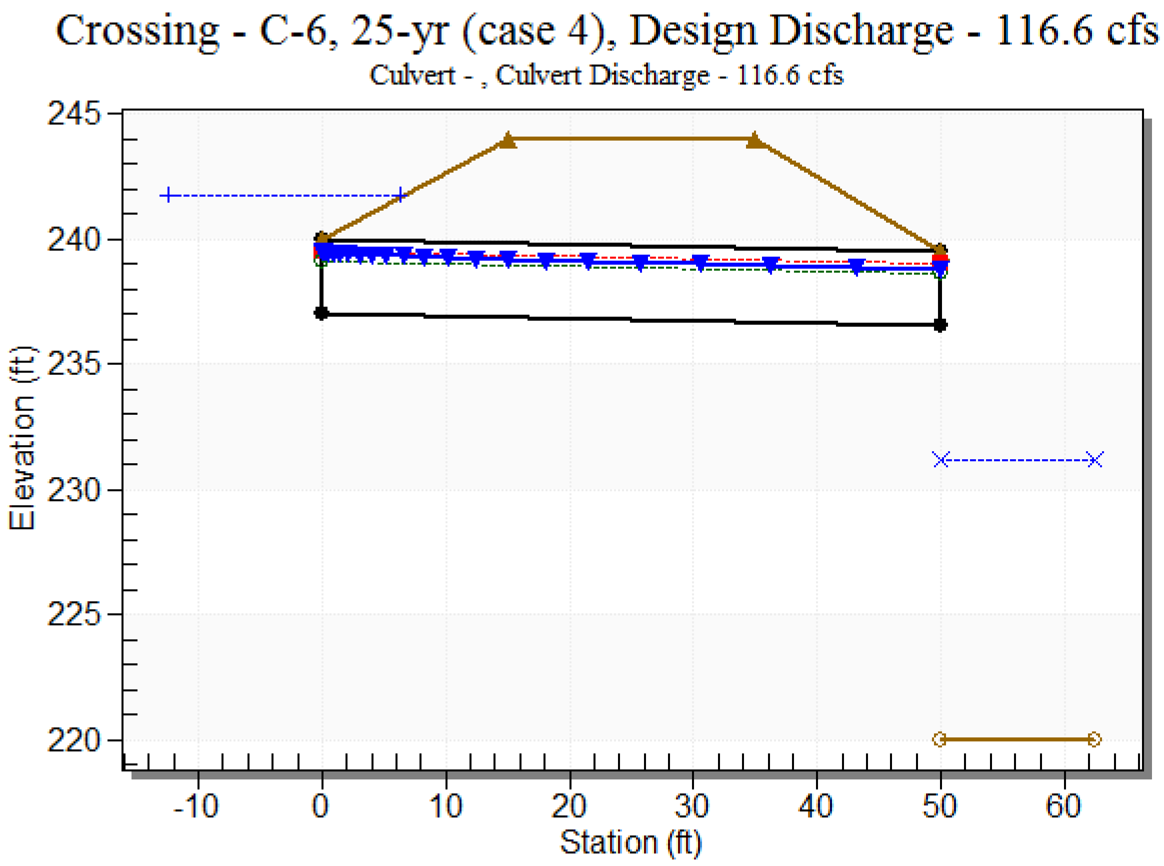
Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 6 - Downstream Channel Rating Curve (Crossing: C-6, 25-yr (case 4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	231.15	11.15
12.56	231.15	11.15
24.12	231.15	11.15
35.68	231.15	11.15
47.24	231.15	11.15
58.80	231.15	11.15
70.36	231.15	11.15
81.92	231.15	11.15
93.48	231.15	11.15
105.04	231.15	11.15
116.60	231.15	11.15

Tailwater Channel Data - C-6, 25-yr (case 4)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 231.15 ft

Roadway Data for Crossing: C-6, 25-yr (case 4)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 244.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 157.18 cfs

Maximum Flow: 157.18 cfs

Table 7 - Summary of Culvert Flows at Crossing: C-6, 100-yr (Case 4)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
237.29	1.00	1.00	0.00	1
238.24	16.62	16.62	0.00	1
238.83	32.24	32.24	0.00	1
239.33	47.85	47.85	0.00	1
239.79	63.47	63.47	0.00	1
240.26	79.09	79.09	0.00	1
240.79	94.71	94.71	0.00	1
241.40	110.33	110.33	0.00	1
242.12	125.94	125.94	0.00	1
242.95	141.56	141.56	0.00	1
243.89	157.18	157.18	0.00	1
244.00	158.96	158.96	0.00	Overtopping

Rating Curve Plot for Crossing: C-6, 100-yr (Case 4)

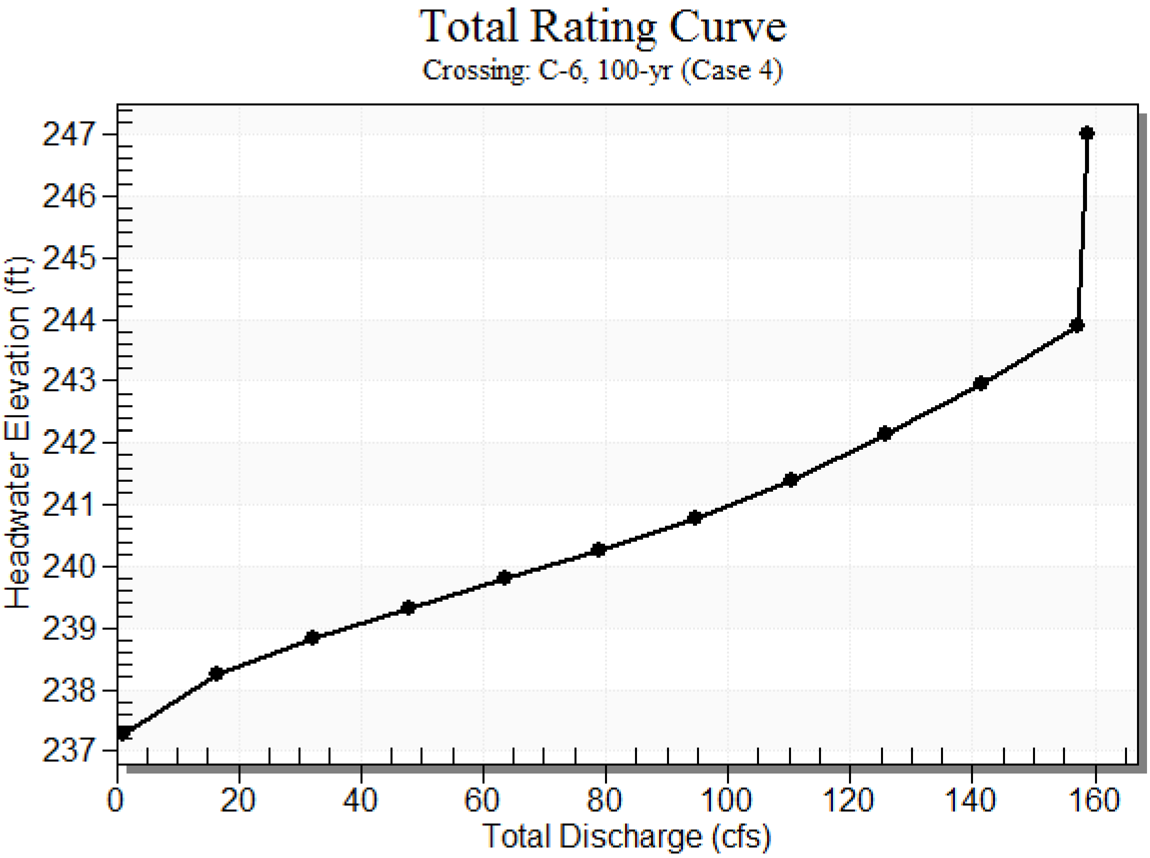


Table 8 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	237.29	0.291	0.0*	1-S2n	0.176	0.214	0.176	12.820	2.955	0.000
16.62	16.62	238.24	1.241	0.445	1-S2n	0.696	0.905	0.727	12.820	6.063	0.000
32.24	32.24	238.83	1.826	0.930	1-S2n	0.977	1.280	1.038	12.820	7.172	0.000
47.85	47.85	239.33	2.331	1.405	1-S2n	1.208	1.574	1.295	12.820	7.916	0.000
63.47	63.47	239.79	2.787	1.907	1-S2n	1.418	1.825	1.526	12.820	8.504	0.000
79.09	79.09	240.26	3.258	2.449	5-S2n	1.618	2.045	1.741	12.820	9.010	0.000
94.71	94.71	240.79	3.788	3.034	5-S2n	1.817	2.238	1.947	12.820	9.469	0.000
110.33	110.33	241.40	4.405	3.962	5-S2n	2.024	2.407	2.151	12.820	9.894	0.000
125.94	125.94	242.12	5.124	4.567	5-S2n	2.258	2.551	2.365	12.820	10.279	0.000
141.56	141.56	242.95	5.952	5.313	7-M2c	3.000	2.668	2.668	12.820	10.658	0.000
157.18	157.18	243.89	6.887	5.933	7-M2c	3.000	2.757	2.757	12.820	11.560	0.000

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 237.00 ft,   Outlet Elevation (invert): 236.50 ft

Culvert Length: 50.00 ft,   Culvert Slope: 0.0100

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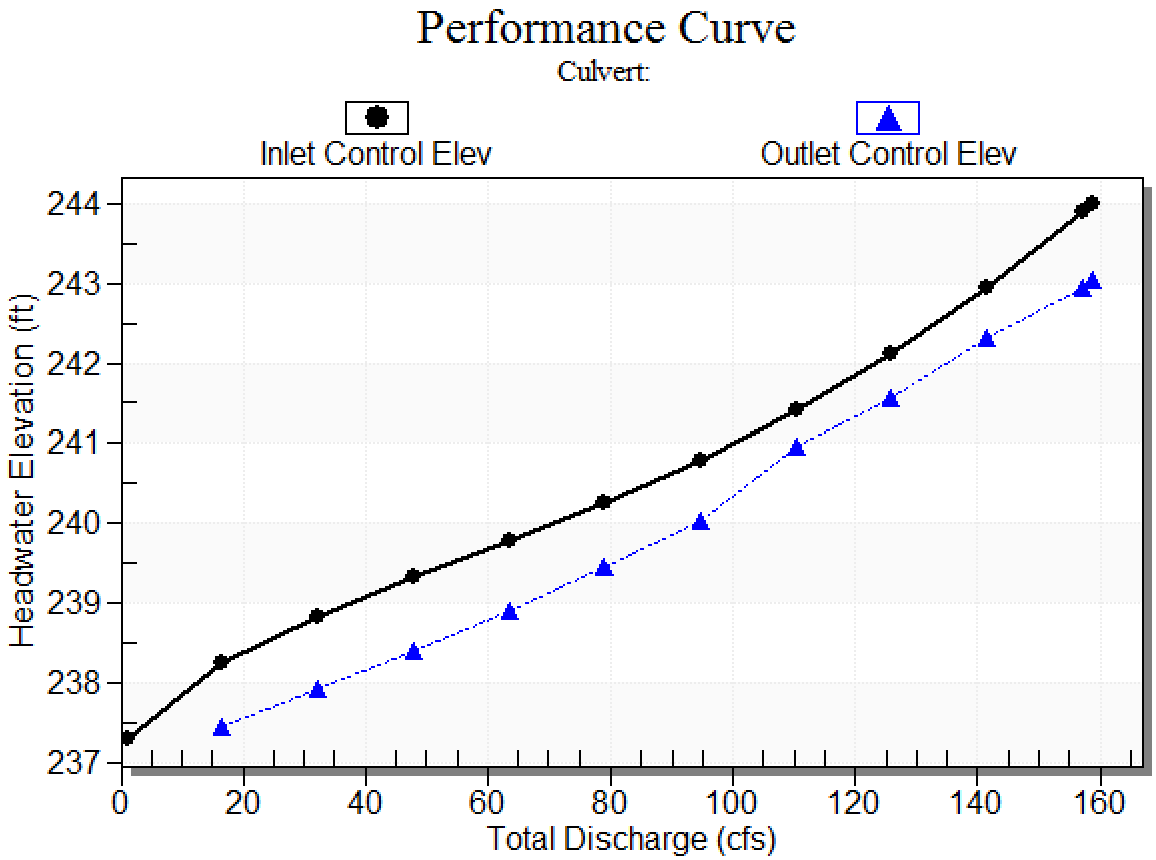
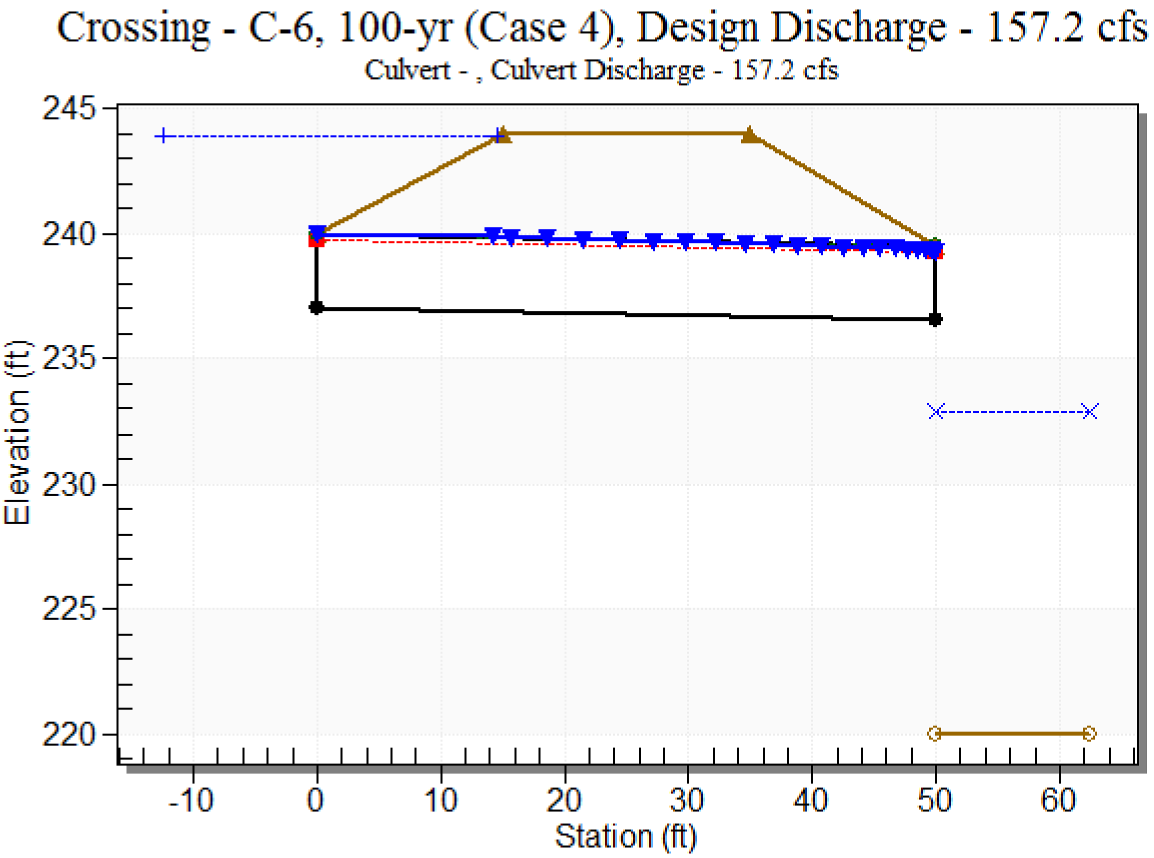
Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 9 - Downstream Channel Rating Curve (Crossing: C-6, 100-yr (Case 4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	232.82	12.82
16.62	232.82	12.82
32.24	232.82	12.82
47.85	232.82	12.82
63.47	232.82	12.82
79.09	232.82	12.82
94.71	232.82	12.82
110.33	232.82	12.82
125.94	232.82	12.82
141.56	232.82	12.82
157.18	232.82	12.82

Tailwater Channel Data - C-6, 100-yr (Case 4)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 232.82 ft

Roadway Data for Crossing: C-6, 100-yr (Case 4)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 244.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 157.2 cfs

Maximum Flow: 157.2 cfs

Table 10 - Summary of Culvert Flows at Crossing: C-7 25-yr (Case 3)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
242.26	1.00	1.00	0.00	1
243.09	16.62	16.62	0.00	1
243.55	32.24	32.24	0.00	1
243.96	47.86	47.86	0.00	1
244.37	63.48	63.48	0.00	1
244.74	79.10	79.10	0.00	1
245.10	94.72	94.72	0.00	1
245.47	110.34	110.34	0.00	1
245.87	125.96	125.96	0.00	1
246.31	141.58	141.58	0.00	1
246.79	157.20	157.20	0.00	1
248.00	190.27	190.27	0.00	Overtopping

Rating Curve Plot for Crossing: C-7 25-yr (Case 3)

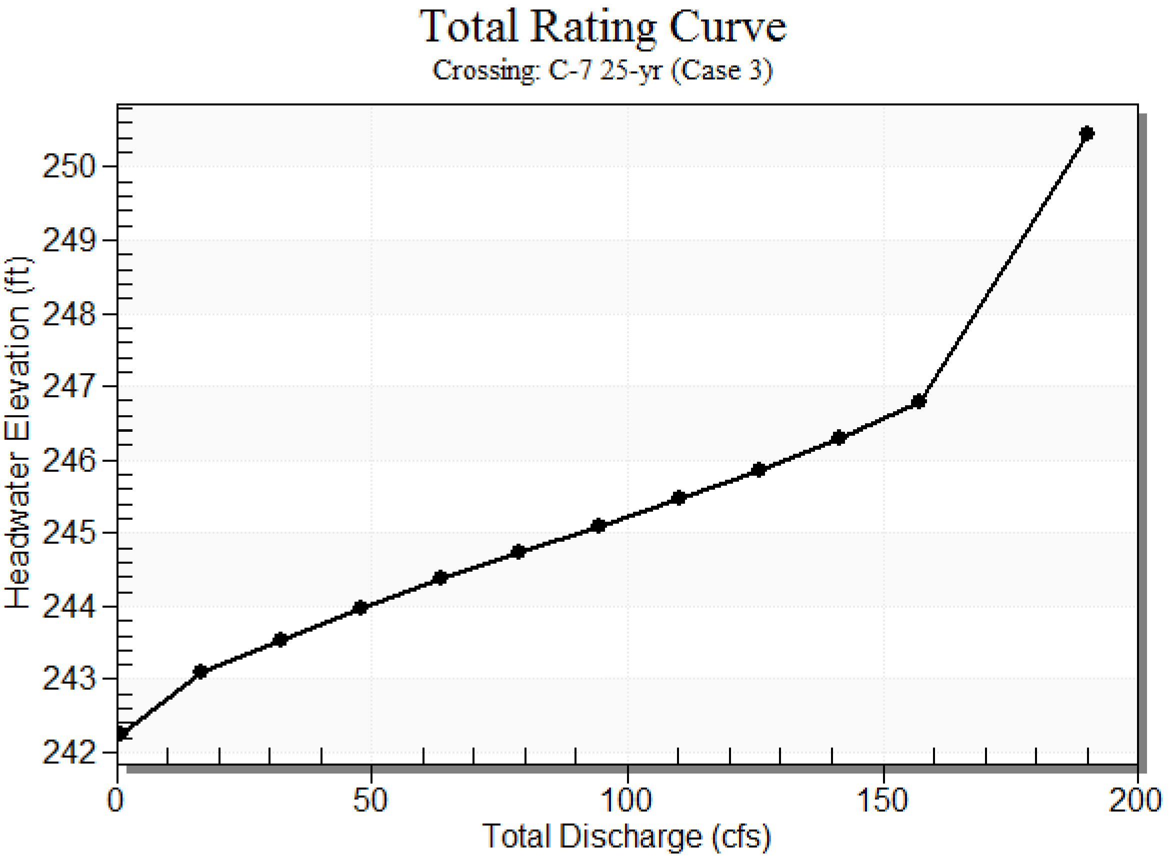


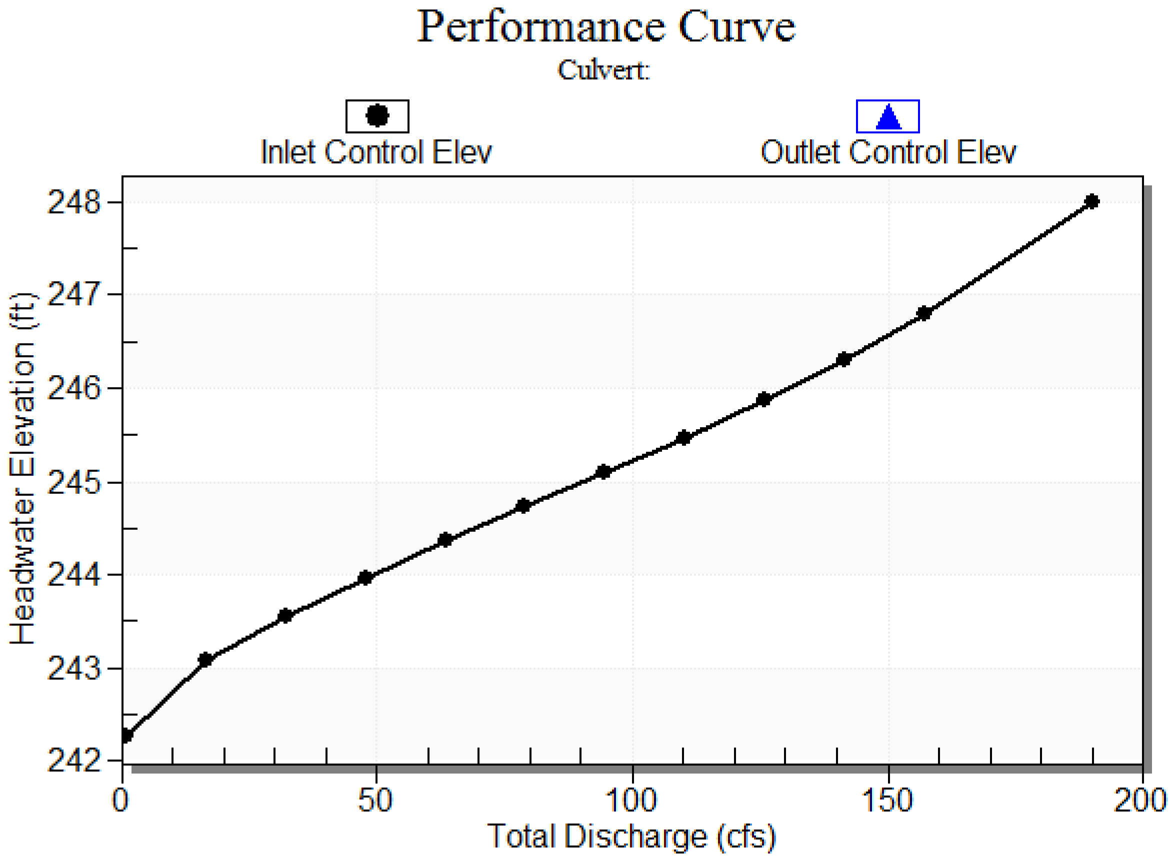
Table 11 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	242.26	0.261	0.0*	1-JS1t	0.095	0.204	1.510	6.510	0.122	0.000
16.62	16.62	243.09	1.089	0.0*	1-S2n	0.366	0.866	0.374	6.510	14.531	0.000
32.24	32.24	243.55	1.546	0.0*	1-S2n	0.503	1.221	0.503	6.510	18.218	0.000
47.86	47.86	243.96	1.961	0.0*	1-S2n	0.611	1.501	0.611	6.510	20.444	0.000
63.48	63.48	244.37	2.370	0.0*	1-S2n	0.702	1.743	0.748	6.510	20.337	0.000
79.10	79.10	244.74	2.742	0.0*	1-S2n	0.784	1.952	0.849	6.510	21.207	0.000
94.72	94.72	245.10	3.102	0.0*	1-S2n	0.858	2.145	0.939	6.510	22.021	0.000
110.34	110.34	245.47	3.472	0.0*	1-S2n	0.927	2.319	1.022	6.510	22.791	0.000
125.96	125.96	245.87	3.869	0.0*	5-S2n	0.993	2.485	1.108	6.510	23.257	0.000
141.58	141.58	246.31	4.305	0.0*	5-S2n	1.054	2.633	1.184	6.510	23.852	0.000
157.20	157.20	246.79	4.790	0.0*	5-S2n	1.113	2.768	1.263	6.510	24.265	0.000

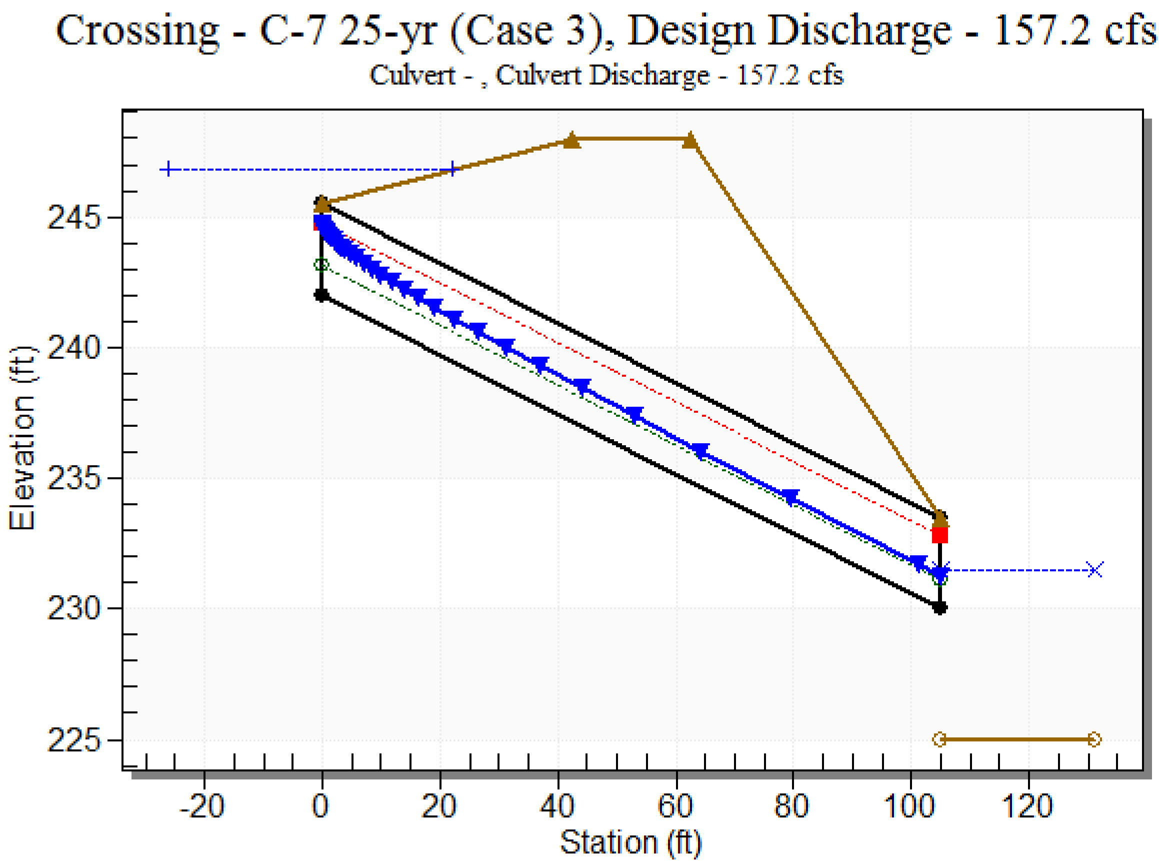
* Full Flow Headwater elevation is below inlet invert.

```
*******************************************************************************
                              Straight Culvert
       Inlet Elevation (invert): 242.00 ft,    Outlet Elevation (invert): 230.00 ft
                 Culvert Length: 105.68 ft,    Culvert Slope: 0.1143
*******************************************************************************
```

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 12 - Downstream Channel Rating Curve (Crossing: C-7 25-yr (Case 3))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	231.51	6.51
16.62	231.51	6.51
32.24	231.51	6.51
47.86	231.51	6.51
63.48	231.51	6.51
79.10	231.51	6.51
94.72	231.51	6.51
110.34	231.51	6.51
125.96	231.51	6.51
141.58	231.51	6.51
157.20	231.51	6.51

Tailwater Channel Data - C-7 25-yr (Case 3)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 231.51 ft

Roadway Data for Crossing: C-7 25-yr (Case 3)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 248.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 179.7 cfs

Maximum Flow: 179.7 cfs

Table 13 - Summary of Culvert Flows at Crossing: C-7 100-yr (Case 4)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
242.26	1.00	1.00	0.00	1
243.17	18.87	18.87	0.00	1
243.66	36.74	36.74	0.00	1
244.14	54.61	54.61	0.00	1
244.59	72.48	72.48	0.00	1
245.00	90.35	90.35	0.00	1
245.42	108.22	108.22	0.00	1
245.87	126.09	126.09	0.00	1
246.38	143.96	143.96	0.00	1
246.94	161.83	161.83	0.00	1
247.58	179.70	179.70	0.00	1
248.00	190.28	190.28	0.00	Overtopping

Rating Curve Plot for Crossing: C-7 100-yr (Case 4)

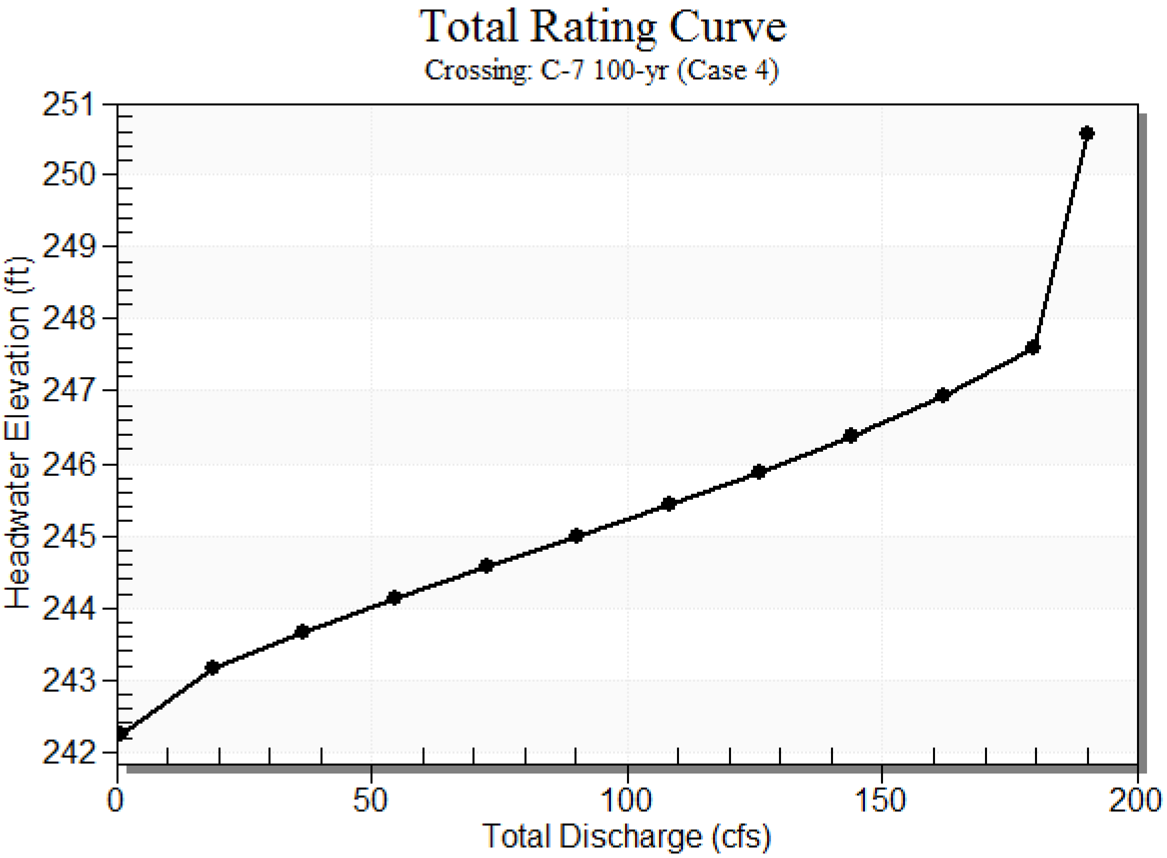


Table 14 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	242.26	0.261	0.0*	1-JS1t	0.095	0.204	2.820	7.820	0.059	0.000
18.87	18.87	243.17	1.165	0.0*	1-S2n	0.388	0.926	0.388	7.820	15.734	0.000
36.74	36.74	243.66	1.658	0.0*	1-S2n	0.538	1.305	0.556	7.820	18.045	0.000
54.61	54.61	244.14	2.144	0.0*	1-S2n	0.652	1.611	0.701	7.820	19.154	0.000
72.48	72.48	244.59	2.587	0.0*	1-S2n	0.750	1.864	0.810	7.820	20.714	0.000
90.35	90.35	245.00	3.001	0.0*	1-S2n	0.838	2.094	0.915	7.820	21.755	0.000
108.22	108.22	245.42	3.420	0.0*	1-S2n	0.918	2.297	1.013	7.820	22.604	0.000
126.09	126.09	245.87	3.872	0.0*	5-S2n	0.993	2.486	1.108	7.820	23.264	0.000
143.96	143.96	246.38	4.376	0.0*	5-S2n	1.064	2.654	1.198	7.820	23.881	0.000
161.83	161.83	246.94	4.944	0.0*	5-S2n	1.130	2.806	1.287	7.820	24.361	0.000
179.70	179.70	247.58	5.585	0.0*	5-S2n	1.195	2.939	1.371	7.820	24.828	0.000

* Full Flow Headwater elevation is below inlet invert.

****

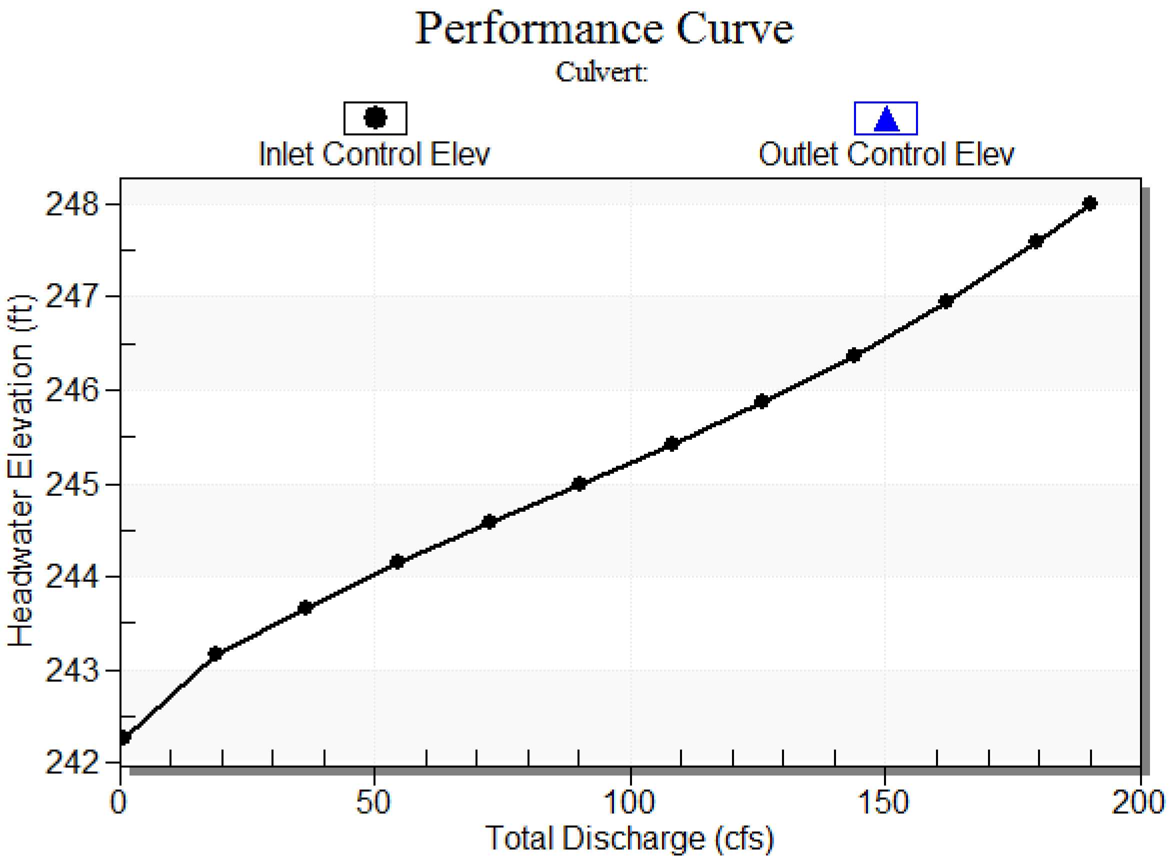
Straight Culvert

Inlet Elevation (invert): 242.00 ft,   Outlet Elevation (invert): 230.00 ft

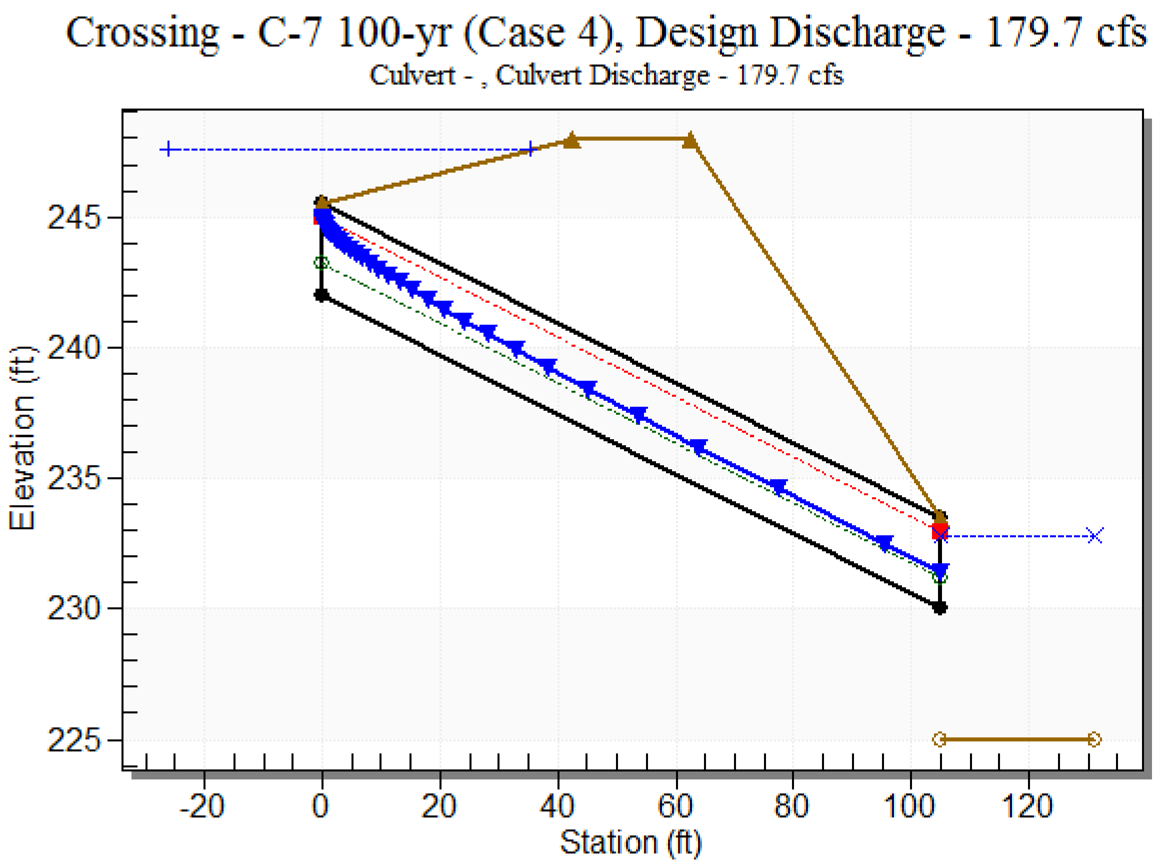
Culvert Length: 105.68 ft,   Culvert Slope: 0.1143

****

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 15 - Downstream Channel Rating Curve (Crossing: C-7 100-yr (Case 4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	232.82	7.82
18.87	232.82	7.82
36.74	232.82	7.82
54.61	232.82	7.82
72.48	232.82	7.82
90.35	232.82	7.82
108.22	232.82	7.82
126.09	232.82	7.82
143.96	232.82	7.82
161.83	232.82	7.82
179.70	232.82	7.82

Tailwater Channel Data - C-7 100-yr (Case 4)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 232.82 ft

Roadway Data for Crossing: C-7 100-yr (Case 4)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 248.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 89.3 cfs

Maximum Flow: 89.3 cfs

Table 16 - Summary of Culvert Flows at Crossing: C-8 25-yr (Case 3)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
277.38	1.00	1.00	0.00	1
278.22	9.83	9.83	0.00	1
278.72	18.66	18.66	0.00	1
279.22	27.49	27.49	0.00	1
279.65	36.32	36.32	0.00	1
280.06	45.15	45.15	0.00	1
280.48	53.98	53.98	0.00	1
280.92	62.81	62.81	0.00	1
281.42	71.64	71.64	0.00	1
281.98	80.47	80.47	0.00	1
282.61	89.30	89.30	0.00	1
284.00	105.99	105.99	0.00	Overtopping

Rating Curve Plot for Crossing: C-8 25-yr (Case 3)

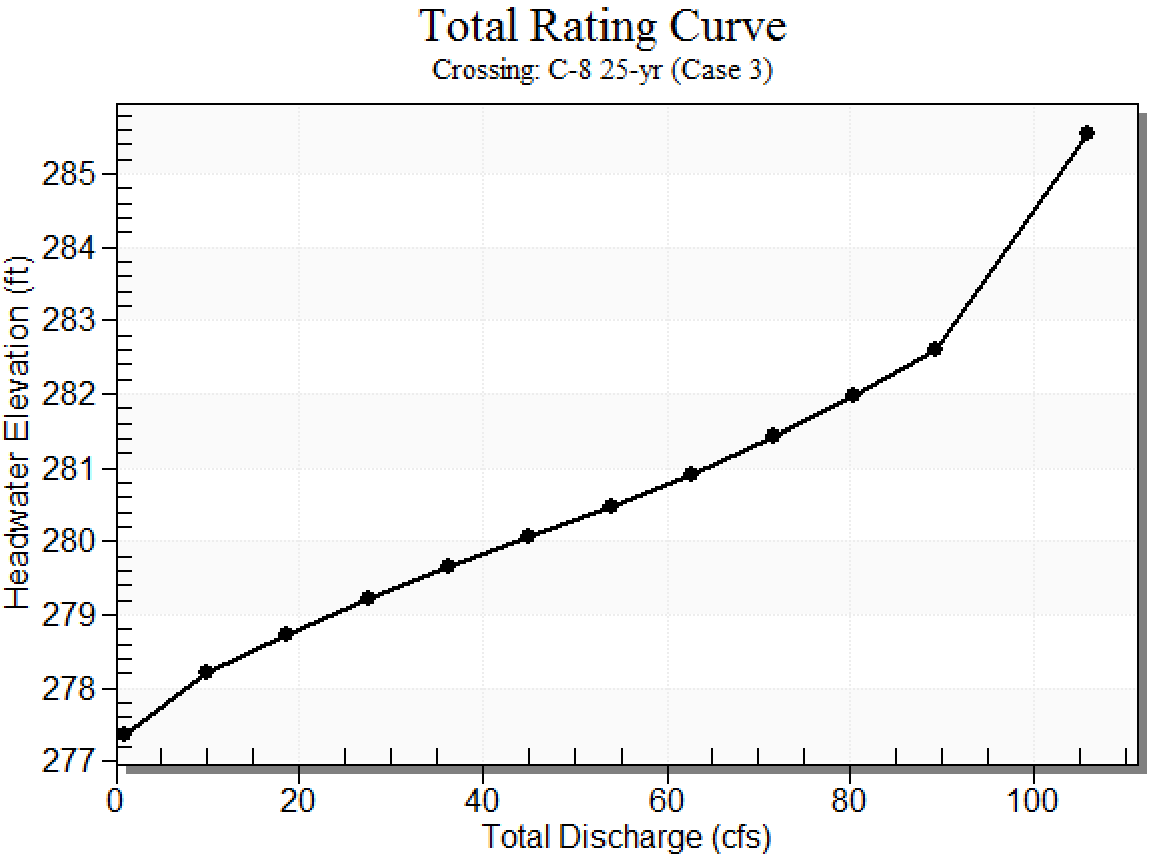


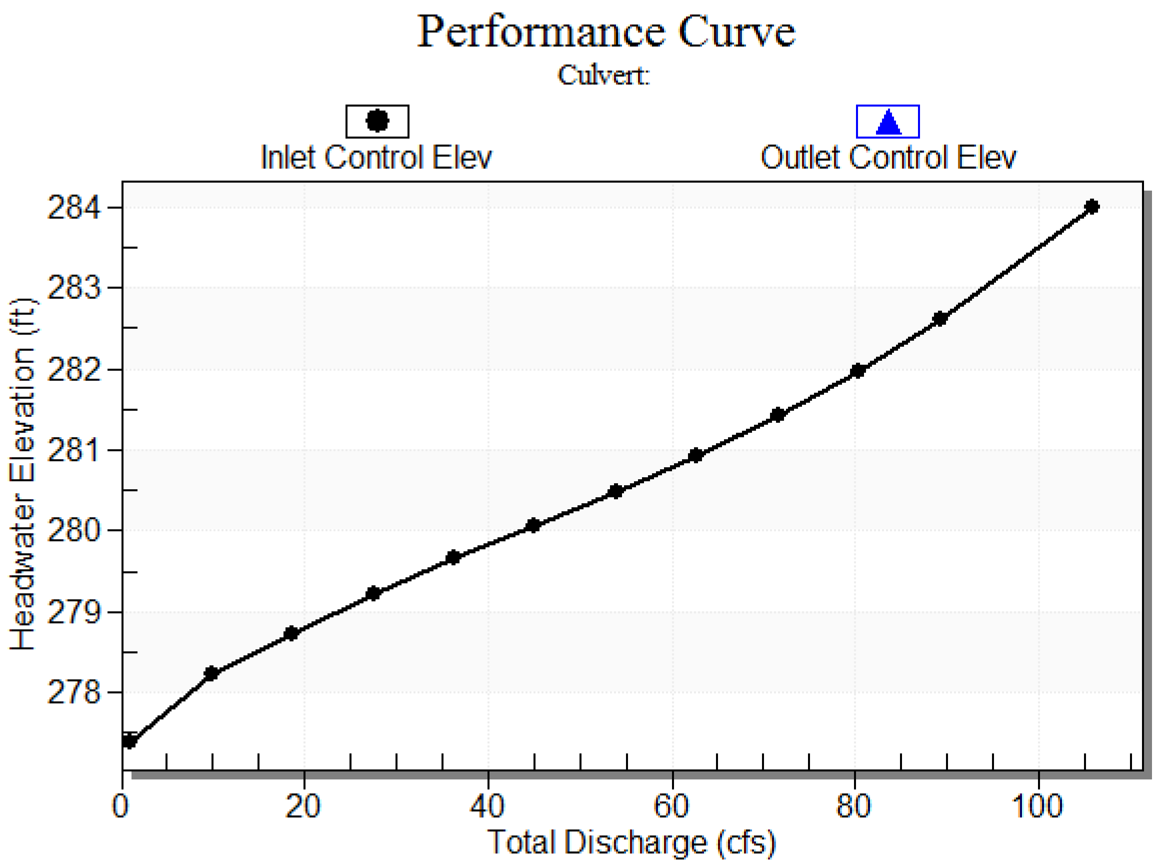
Table 17 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	277.38	0.380	0.0*	1-S2n	0.140	0.293	0.140	5.040	7.170	0.000
9.83	9.83	278.22	1.224	0.0*	1-S2n	0.434	0.945	0.434	5.040	13.751	0.000
18.66	18.66	278.72	1.719	0.0*	1-S2n	0.593	1.316	0.593	5.040	16.638	0.000
27.49	27.49	279.22	2.217	0.0*	1-S2n	0.719	1.617	0.766	5.040	17.049	0.000
36.32	36.32	279.65	2.654	0.0*	1-S2n	0.826	1.866	0.889	5.040	18.214	0.000
45.15	45.15	280.06	3.063	0.0*	1-S2n	0.922	2.093	0.999	5.040	19.236	0.000
53.98	53.98	280.48	3.477	0.0*	1-S2n	1.010	2.294	1.109	5.040	19.908	0.000
62.81	62.81	280.92	3.923	0.0*	5-S2n	1.093	2.481	1.213	5.040	20.497	0.000
71.64	71.64	281.42	4.418	0.0*	5-S2n	1.172	2.648	1.310	5.040	21.048	0.000
80.47	80.47	281.98	4.977	0.0*	5-S2n	1.246	2.799	1.404	5.040	21.540	0.000
89.30	89.30	282.61	5.606	0.0*	5-S2n	1.318	2.932	1.498	5.040	21.948	0.000

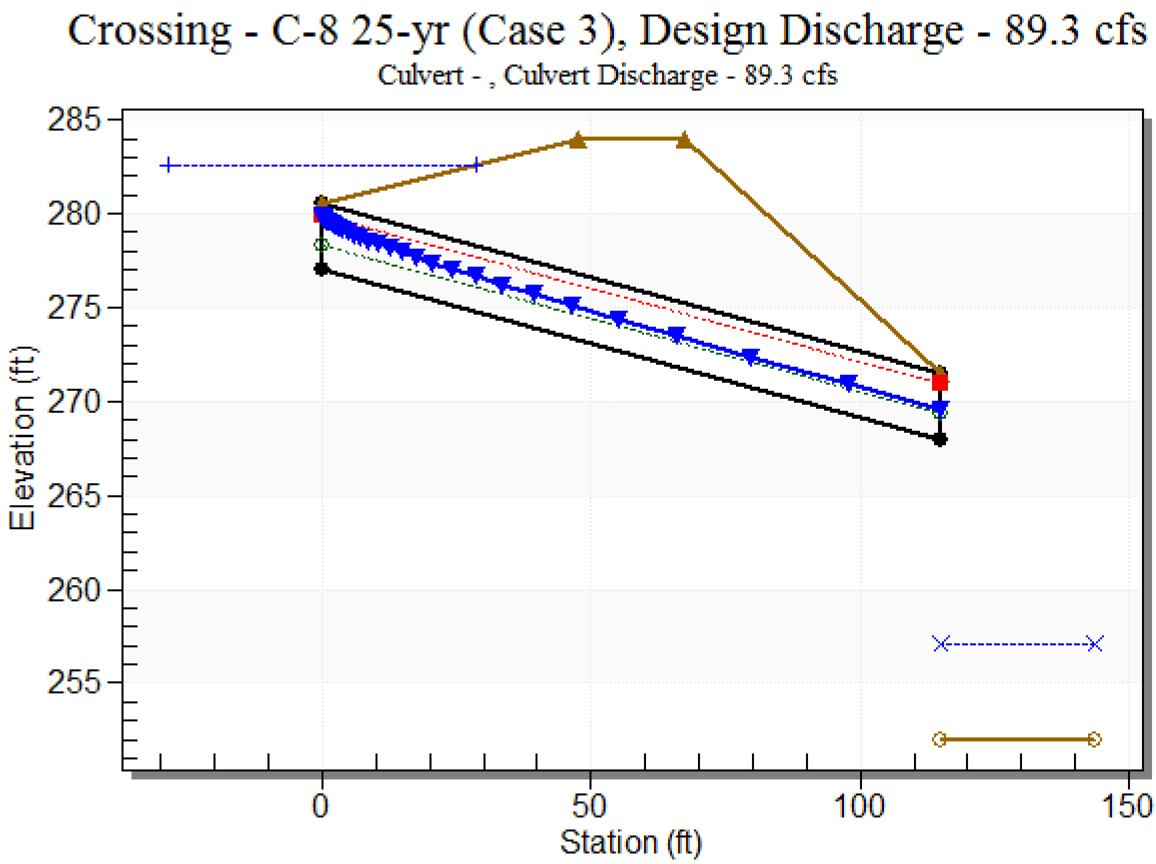
* Full Flow Headwater elevation is below inlet invert.

```
********************************************************************************
Straight Culvert
Inlet Elevation (invert): 277.00 ft,    Outlet Elevation (invert): 268.00 ft
Culvert Length: 115.35 ft,    Culvert Slope: 0.0783
********************************************************************************
```

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 18 - Downstream Channel Rating Curve (Crossing: C-8 25-yr (Case 3))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	257.04	5.04
9.83	257.04	5.04
18.66	257.04	5.04
27.49	257.04	5.04
36.32	257.04	5.04
45.15	257.04	5.04
53.98	257.04	5.04
62.81	257.04	5.04
71.64	257.04	5.04
80.47	257.04	5.04
89.30	257.04	5.04

Tailwater Channel Data - C-8 25-yr (Case 3)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 257.04 ft

Roadway Data for Crossing: C-8 25-yr (Case 3)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 284.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 102 cfs

Maximum Flow: 102 cfs

Table 19 - Summary of Culvert Flows at Crossing: C-8 100-yr (Case 4)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
277.38	1.00	1.00	0.00	1
278.30	11.10	11.10	0.00	1
278.87	21.20	21.20	0.00	1
279.41	31.30	31.30	0.00	1
279.89	41.40	41.40	0.00	1
280.36	51.50	51.50	0.00	1
280.86	61.60	61.60	0.00	1
281.42	71.70	71.70	0.00	1
282.07	81.80	81.80	0.00	1
282.81	91.90	91.90	0.00	1
283.64	102.00	102.00	0.00	1
284.00	106.00	106.00	0.00	Overtopping

Rating Curve Plot for Crossing: C-8 100-yr (Case 4)

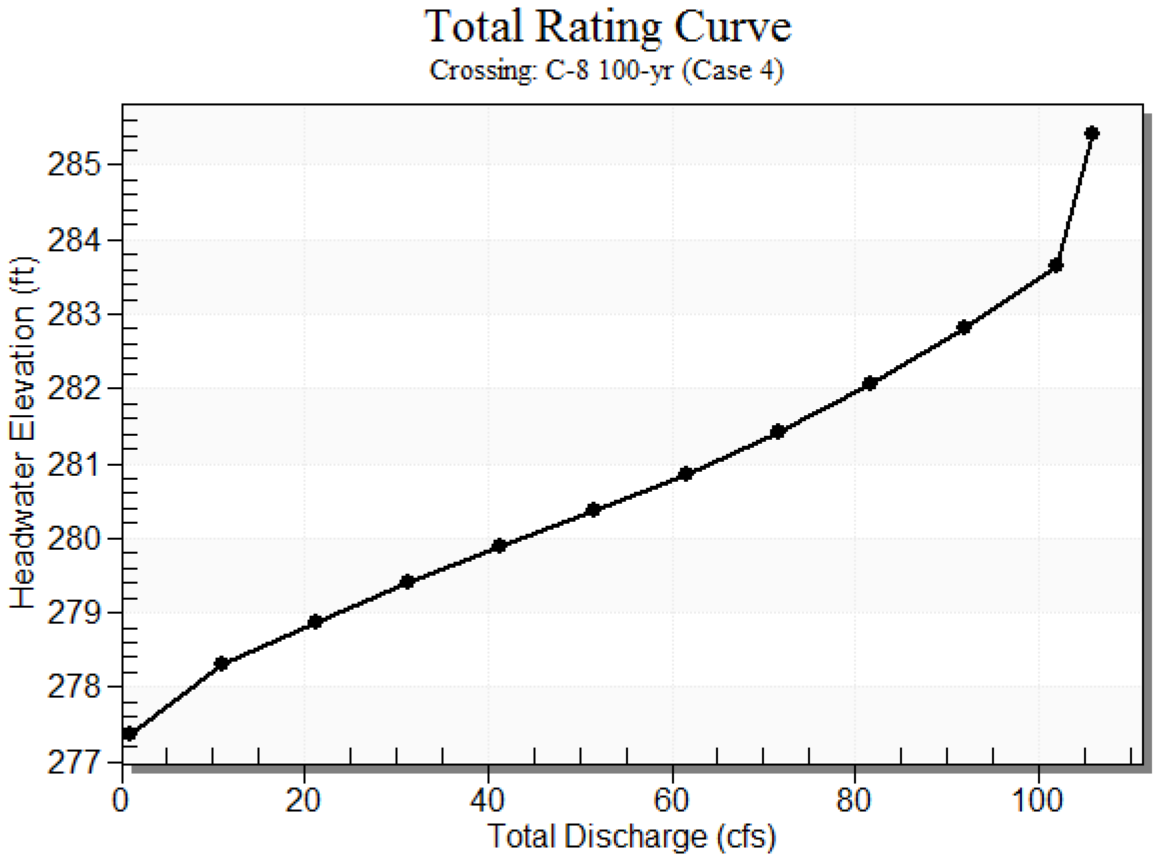


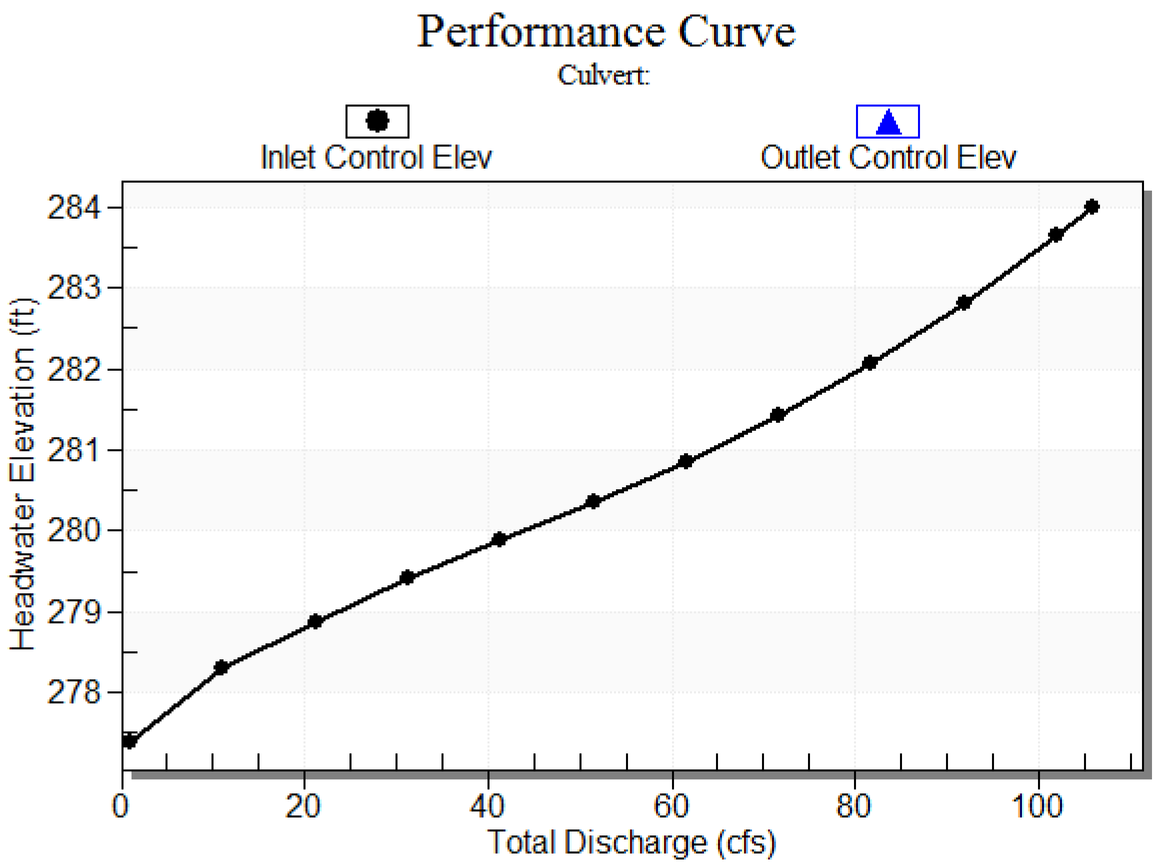
Table 20 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	277.38	0.380	0.0*	1-S2n	0.140	0.293	0.140	5.490	7.170	0.000
11.10	11.10	278.30	1.304	0.0*	1-S2n	0.461	1.007	0.495	5.490	12.979	0.000
21.20	21.20	278.87	1.867	0.0*	1-S2n	0.632	1.409	0.632	5.490	17.253	0.000
31.30	31.30	279.41	2.411	0.0*	1-S2n	0.766	1.730	0.822	5.490	17.517	0.000
41.40	41.40	279.89	2.890	0.0*	1-S2n	0.882	1.999	0.949	5.490	18.925	0.000
51.50	51.50	280.36	3.359	0.0*	1-S2n	0.987	2.239	1.080	5.490	19.684	0.000
61.60	61.60	280.86	3.859	0.0*	5-S2n	1.083	2.457	1.198	5.490	20.434	0.000
71.70	71.70	281.42	4.422	0.0*	5-S2n	1.172	2.649	1.310	5.490	21.053	0.000
81.80	81.80	282.07	5.067	0.0*	5-S2n	1.258	2.820	1.418	5.490	21.616	0.000
91.90	91.90	282.81	5.805	0.0*	5-S2n	1.339	2.967	1.524	5.490	22.091	0.000
102.00	102.00	283.64	6.642	0.0*	5-S2n	1.418	3.090	1.627	5.490	22.522	0.000

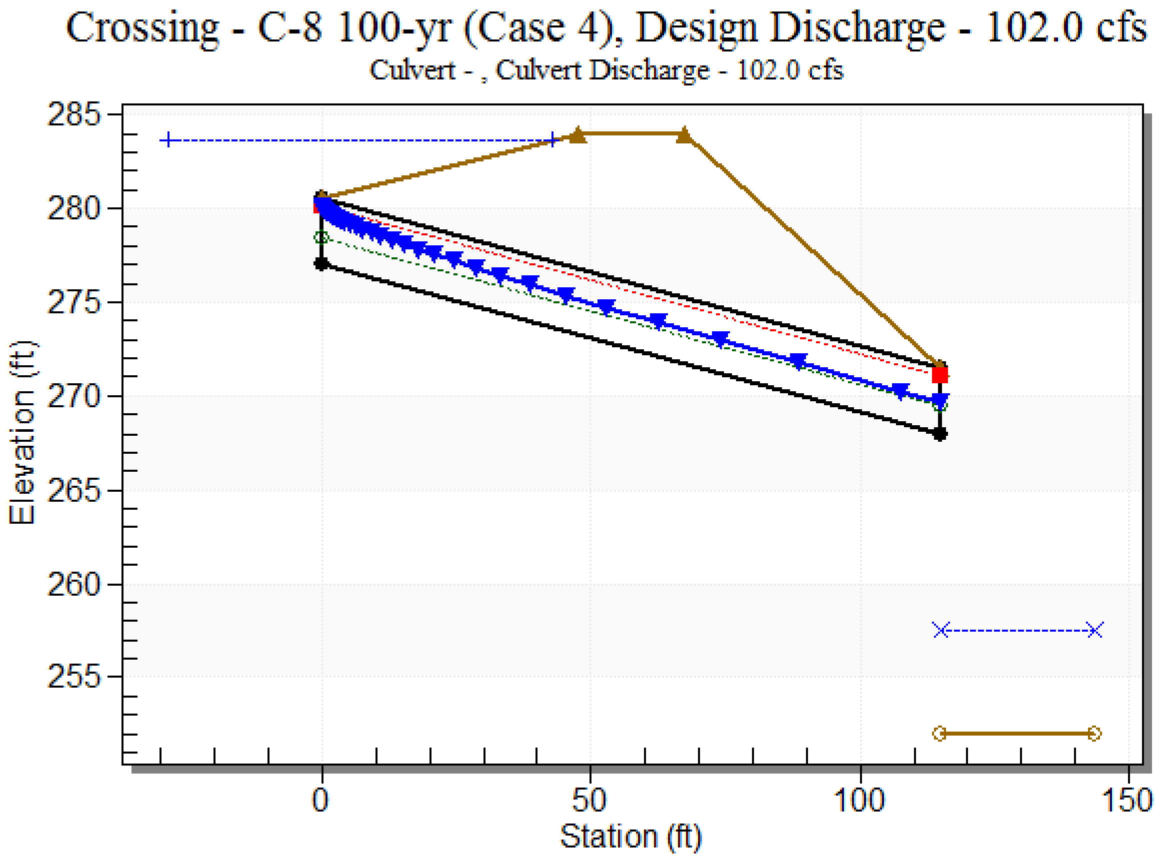
* Full Flow Headwater elevation is below inlet invert.

```
********************************************************************************
Straight Culvert
Inlet Elevation (invert): 277.00 ft,    Outlet Elevation (invert): 268.00 ft
Culvert Length: 115.35 ft,    Culvert Slope: 0.0783
********************************************************************************
```

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 21 - Downstream Channel Rating Curve (Crossing: C-8 100-yr (Case 4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	257.49	5.49
11.10	257.49	5.49
21.20	257.49	5.49
31.30	257.49	5.49
41.40	257.49	5.49
51.50	257.49	5.49
61.60	257.49	5.49
71.70	257.49	5.49
81.80	257.49	5.49
91.90	257.49	5.49
102.00	257.49	5.49

Tailwater Channel Data - C-8 100-yr (Case 4)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 257.49 ft

Roadway Data for Crossing: C-8 100-yr (Case 4)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 284.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 197.45 cfs

Maximum Flow: 197.45 cfs

Table 22 - Summary of Culvert Flows at Crossing: C-9 25-yr (Case 2)

Headwater Elevation (ft)	Total Discharge (cfs)	48 Discharge (cfs)	30 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
220.22	1.00	0.97	0.51	0.00	6
220.27	20.65	15.32	5.49	0.00	8
220.39	40.29	29.68	10.66	0.00	6
220.60	59.94	44.14	15.82	0.00	5
220.89	79.58	58.67	20.97	0.00	4
221.26	99.22	73.15	26.10	0.00	4
221.71	118.87	87.69	31.22	0.00	4
222.24	138.51	102.16	36.33	0.00	4
222.72	158.16	117.77	40.41	0.00	7
223.54	177.81	131.19	46.63	0.00	3
224.48	197.45	144.68	52.77	0.00	3
226.90	240.67	174.56	66.12	0.00	Overtopping

Rating Curve Plot for Crossing: C-9 25-yr (Case 2)

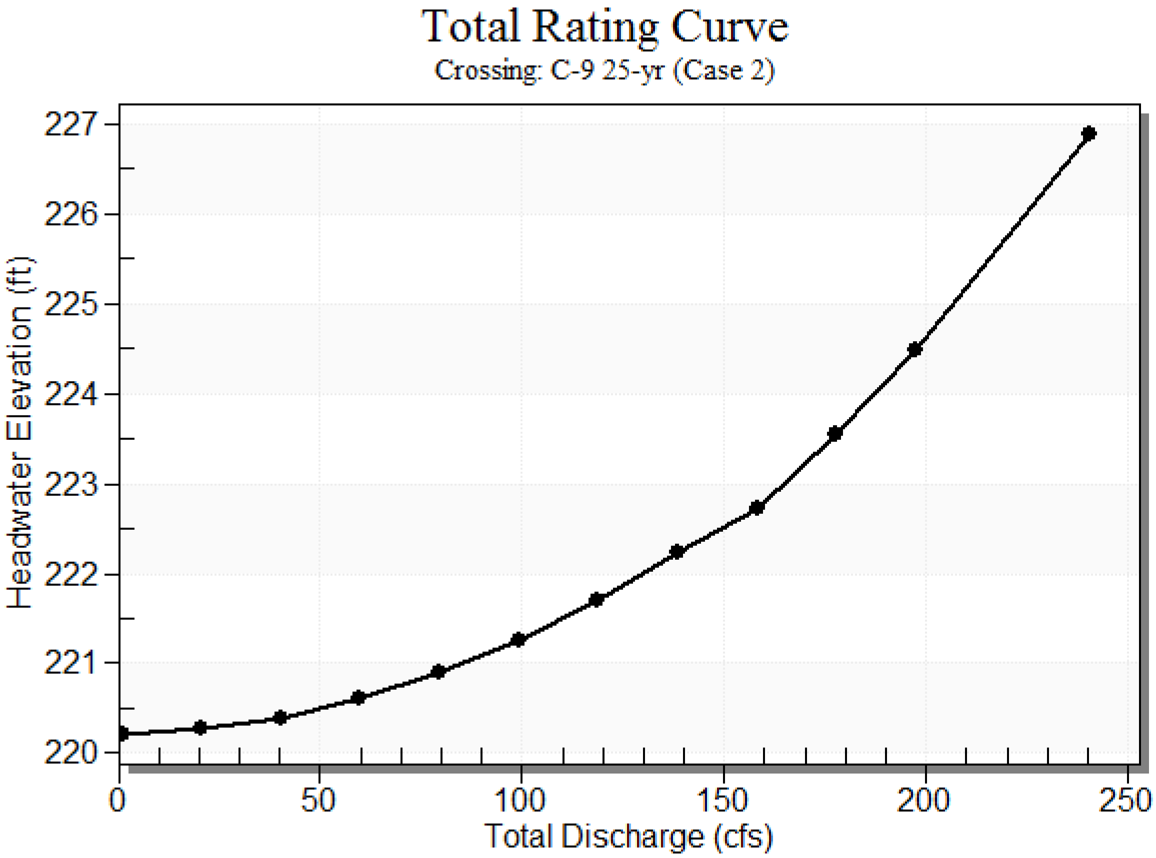
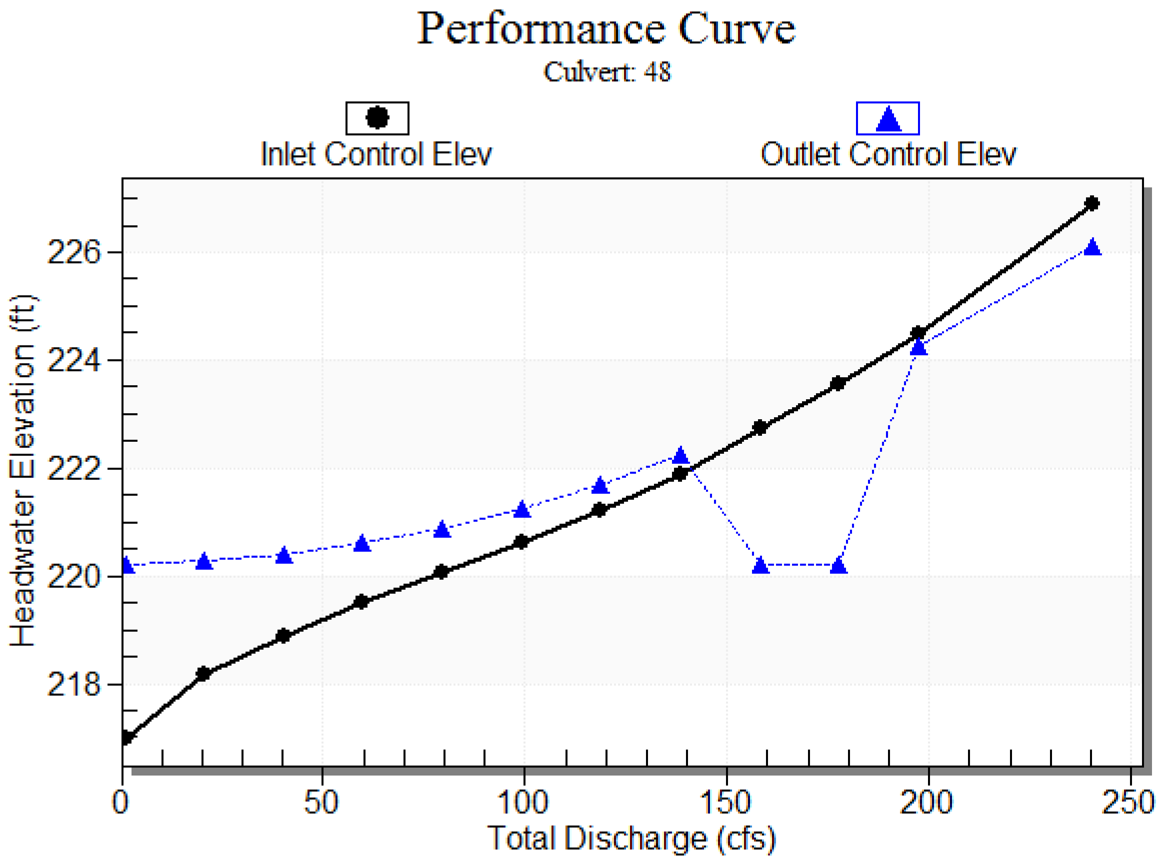


Table 23 - Culvert Summary Table: 48

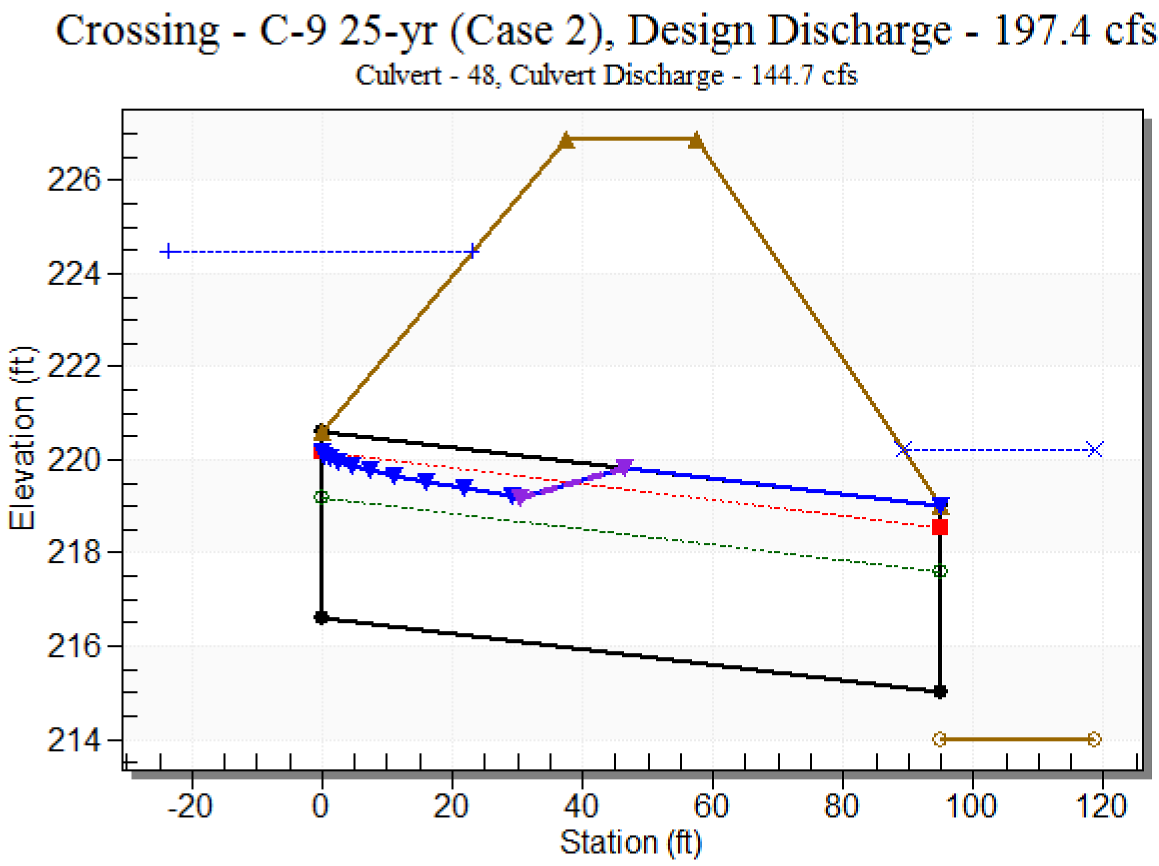
Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	0.97	220.22	0.375	3.620	1-S1f	0.201	0.278	4.000	6.220	0.077	0.000
20.65	15.32	220.27	1.554	3.666	1-S1f	0.753	1.144	4.000	6.220	1.219	0.000
40.29	29.68	220.39	2.260	3.793	1-S1f	1.050	1.613	4.000	6.220	2.362	0.000
59.94	44.14	220.60	2.897	4.003	1-S1f	1.289	1.987	4.000	6.220	3.513	0.000
79.58	58.67	220.89	3.458	4.293	1-S1f	1.500	2.302	4.000	6.220	4.669	0.000
99.22	73.15	221.26	4.009	4.660	1-S1f	1.694	2.582	4.000	6.220	5.821	0.000
118.87	87.69	221.71	4.606	5.110	1-S1f	1.878	2.835	4.000	6.220	6.978	0.000
138.51	102.16	222.24	5.277	5.637	4-FFf	2.056	3.058	4.000	6.220	8.130	0.000
158.16	117.77	222.72	6.116	3.620	5-JS1f	2.245	3.268	4.000	6.220	9.372	0.000
177.81	131.19	223.54	6.943	3.620	5-JS1f	2.408	3.422	4.000	6.220	10.439	0.000
197.45	144.68	224.48	7.877	7.666	5-JS1f	2.576	3.552	4.000	6.220	11.513	0.000

```
********************************************************************************
Straight Culvert
Inlet Elevation (invert): 216.60 ft,    Outlet Elevation (invert): 215.00 ft
Culvert Length: 95.01 ft,    Culvert Slope: 0.0168
********************************************************************************
```

Culvert Performance Curve Plot: 48



Water Surface Profile Plot for Culvert: 48



Culvert Data Summary - 48

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

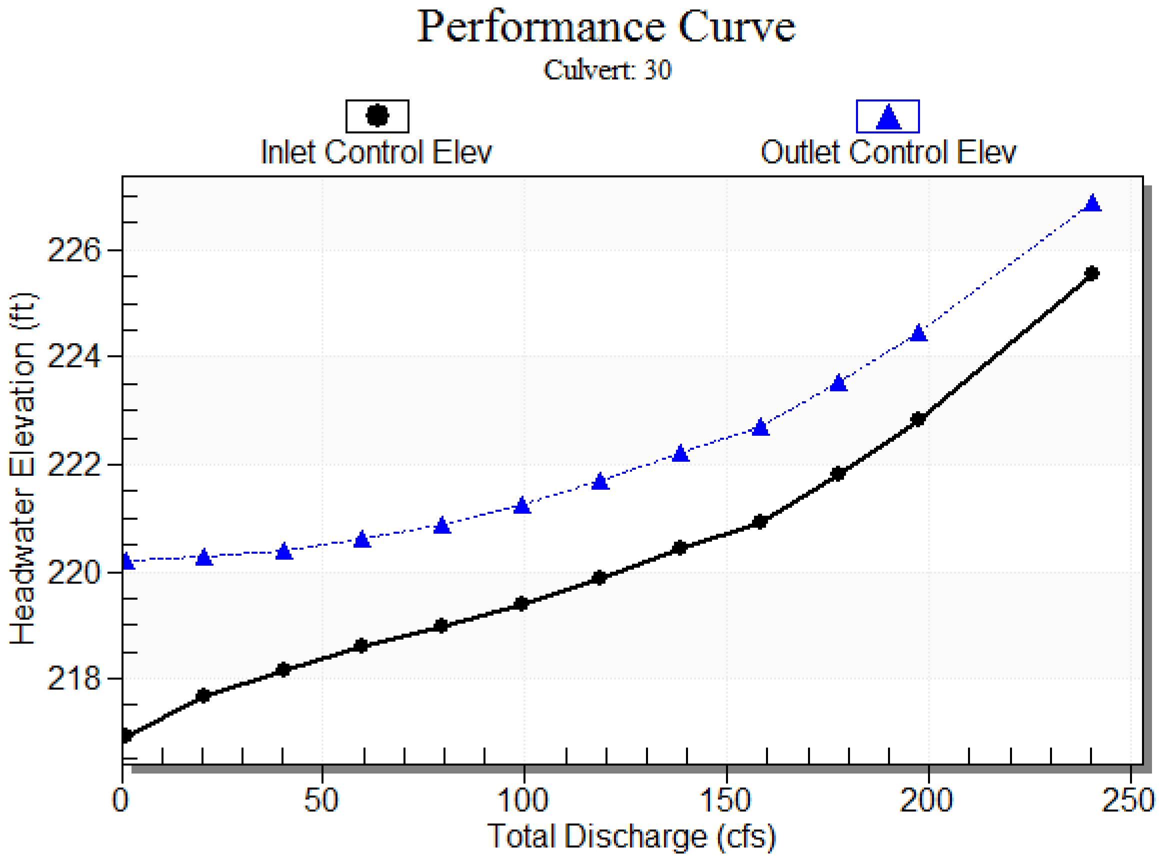
Inlet Depression: None

Table 24 - Culvert Summary Table: 30

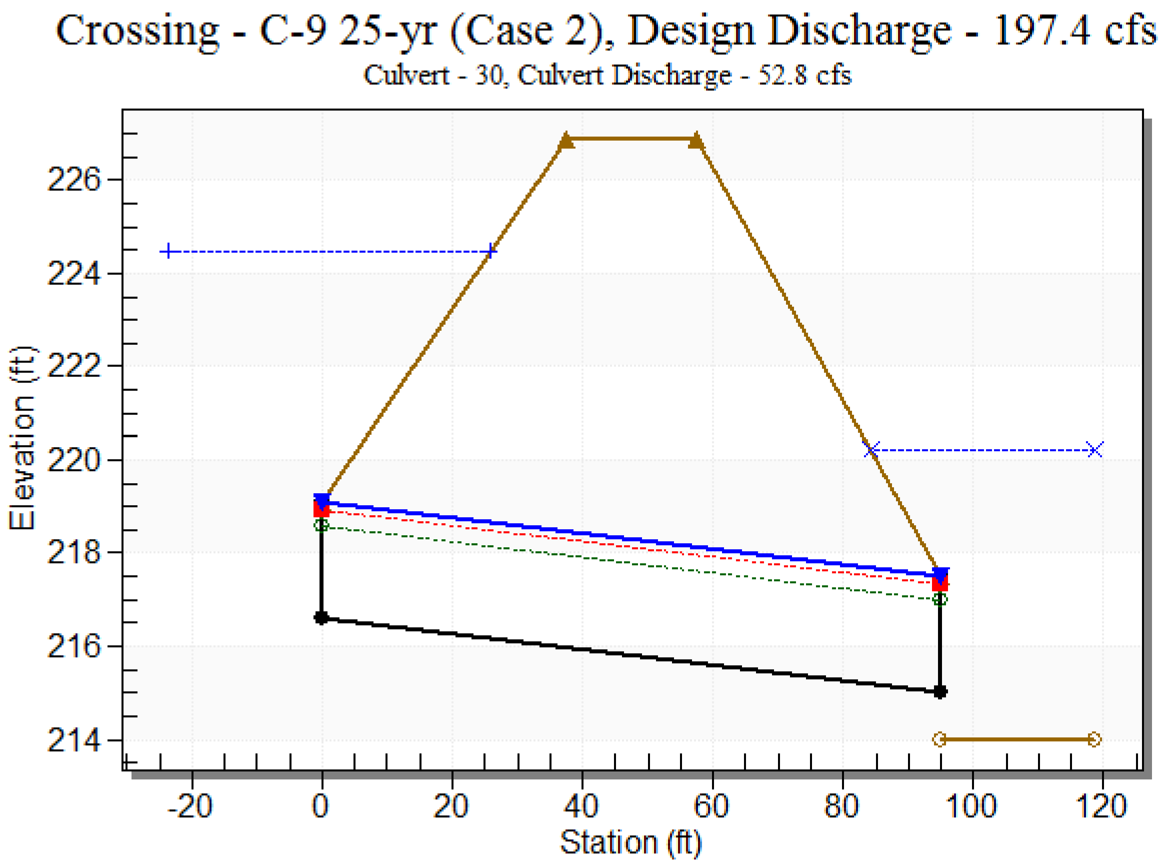
Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	0.51	220.22	0.314	3.620	4-FFf	0.166	0.226	2.500	6.220	0.105	0.000
20.65	5.49	220.27	1.051	3.666	4-FFf	0.527	0.771	2.500	6.220	1.119	0.000
40.29	10.66	220.39	1.554	3.793	4-FFf	0.738	1.091	2.500	6.220	2.171	0.000
59.94	15.82	220.60	1.985	4.002	4-FFf	0.909	1.340	2.500	6.220	3.223	0.000
79.58	20.97	220.89	2.380	4.292	4-FFf	1.061	1.553	2.500	6.220	4.273	0.000
99.22	26.10	221.26	2.794	4.661	4-FFf	1.203	1.736	2.500	6.220	5.317	0.000
118.87	31.22	221.71	3.265	5.109	4-FFf	1.339	1.901	2.500	6.220	6.360	0.000
138.51	36.33	222.24	3.818	5.637	4-FFf	1.475	2.041	2.500	6.220	7.401	0.000
158.16	40.41	222.72	4.326	6.115	4-FFf	1.585	2.137	2.500	6.220	8.233	0.000
177.81	46.63	223.54	5.219	6.943	4-FFf	1.764	2.252	2.500	6.220	9.500	0.000
197.45	52.77	224.48	6.236	7.876	4-FFf	1.974	2.334	2.500	6.220	10.751	0.000

```
********************************************************************************
                              Straight Culvert
     Inlet Elevation (invert): 216.60 ft,    Outlet Elevation (invert): 215.00 ft
               Culvert Length: 95.01 ft,    Culvert Slope: 0.0168
********************************************************************************
```

Culvert Performance Curve Plot: 30



Water Surface Profile Plot for Culvert: 30



Culvert Data Summary - 30

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 25 - Downstream Channel Rating Curve (Crossing: C-9 25-yr (Case 2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	220.22	6.22
20.65	220.22	6.22
40.29	220.22	6.22
59.94	220.22	6.22
79.58	220.22	6.22
99.22	220.22	6.22
118.87	220.22	6.22
138.51	220.22	6.22
158.16	220.22	6.22
177.81	220.22	6.22
197.45	220.22	6.22

Tailwater Channel Data - C-9 25-yr (Case 2)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 220.22 ft

Roadway Data for Crossing: C-9 25-yr (Case 2)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 226.90 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 231.14 cfs

Maximum Flow: 231.14 cfs

Table 26 - Summary of Culvert Flows at Crossing: C-9 100-yr (Case 4)

Headwater Elevation (ft)	Total Discharge (cfs)	48 Discharge (cfs)	30 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
220.39	1.00	0.98	0.53	0.00	6
220.45	24.01	17.78	6.41	0.00	8
220.62	47.03	34.62	12.45	0.00	6
220.91	70.04	51.55	18.51	0.00	5
221.30	93.06	68.55	24.57	0.00	4
221.80	116.07	85.45	30.62	0.00	5
222.32	139.08	110.76	35.85	0.00	14
222.91	162.10	121.15	40.96	0.00	7
223.91	185.11	136.72	48.39	0.00	2
225.06	208.13	152.42	55.70	0.00	4
226.35	231.14	168.22	62.92	0.00	6
226.90	240.33	174.55	65.78	0.00	Overtopping

Rating Curve Plot for Crossing: C-9 100-yr (Case 4)

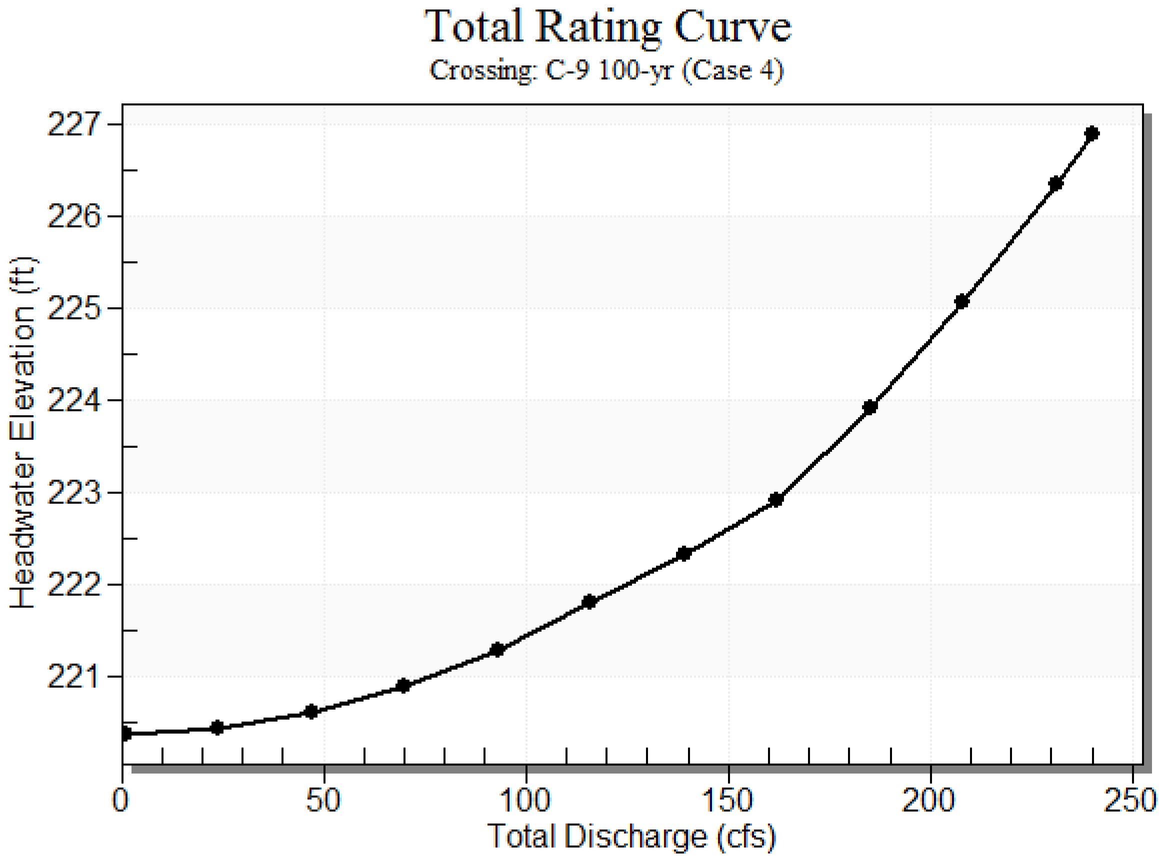


Table 27 - Culvert Summary Table: 48

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	0.98	220.39	0.376	3.790	1-S1f	0.202	0.278	4.000	6.390	0.078	0.000
24.01	17.78	220.45	1.682	3.852	1-S1f	0.812	1.233	4.000	6.390	1.415	0.000
47.03	34.62	220.62	2.491	4.023	1-S1f	1.136	1.749	4.000	6.390	2.755	0.000
70.04	51.55	220.91	3.188	4.306	1-S1f	1.399	2.151	4.000	6.390	4.103	0.000
93.06	68.55	221.30	3.832	4.698	4-FFf	1.634	2.497	4.000	6.390	5.455	0.000
116.07	85.45	221.80	4.509	5.201	4-FFf	1.850	2.799	4.000	6.390	6.800	0.000
139.08	110.76	222.32	5.724	3.790	5-S2n	2.160	3.177	2.421	6.390	13.507	0.000
162.10	121.15	222.91	6.315	3.790	5-JS1f	2.286	3.309	4.000	6.390	9.641	0.000
185.11	136.72	223.91	7.313	3.790	5-JS1f	2.476	3.479	4.000	6.390	10.880	0.000
208.13	152.42	225.06	8.459	8.280	5-JS1f	2.676	3.614	4.000	6.390	12.129	0.000
231.14	168.22	226.35	9.746	9.259	5-JS1f	2.893	3.718	4.000	6.390	13.386	0.000

****

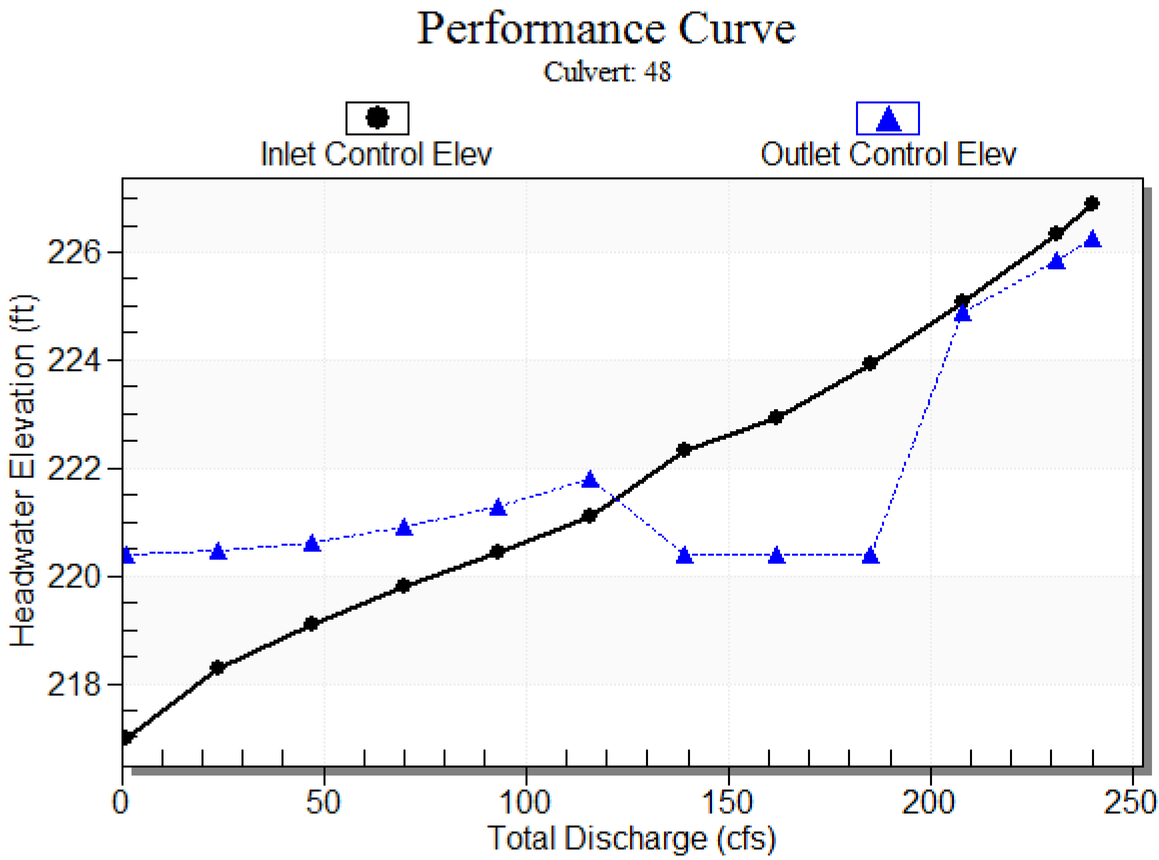
Straight Culvert

Inlet Elevation (invert): 216.60 ft,   Outlet Elevation (invert): 215.00 ft

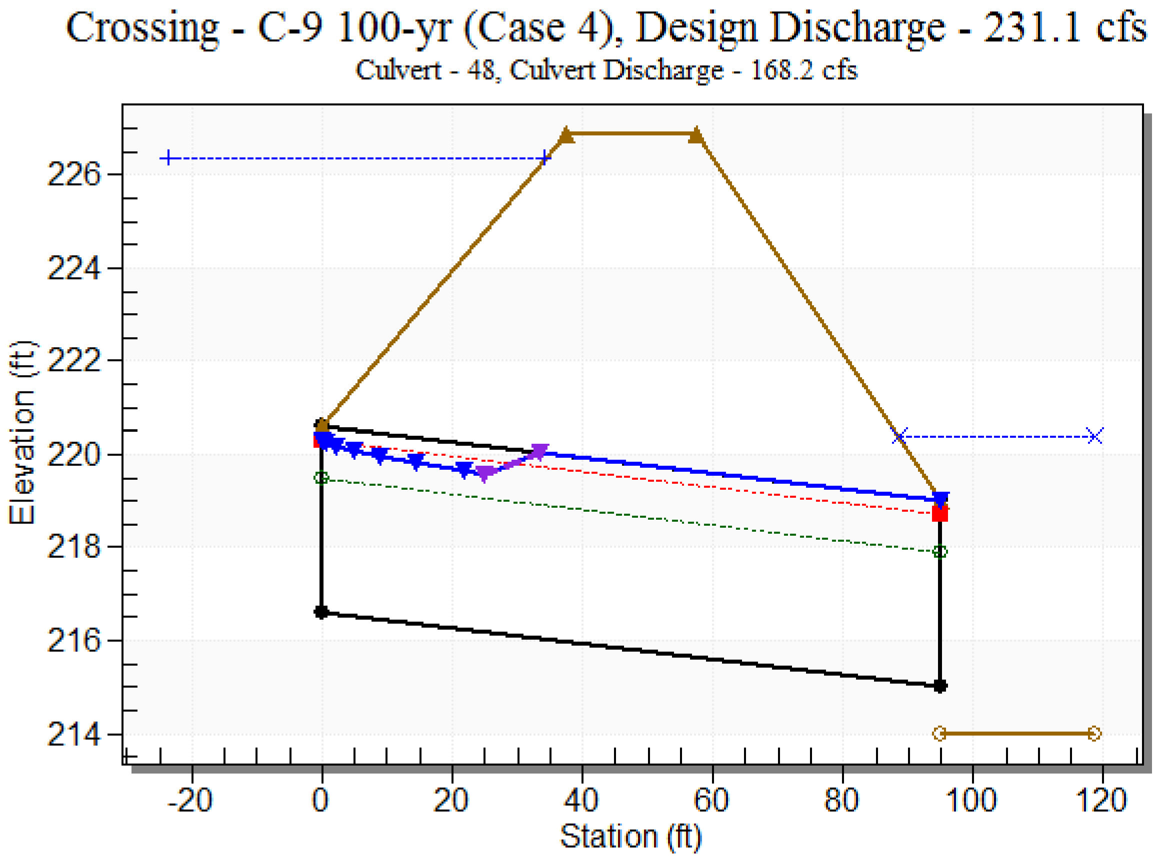
Culvert Length: 95.01 ft,   Culvert Slope: 0.0168

****

Culvert Performance Curve Plot: 48



Water Surface Profile Plot for Culvert: 48



Culvert Data Summary - 48

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 28 - Culvert Summary Table: 30

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	0.53	220.39	0.319	3.790	4-FFf	0.167	0.230	2.500	6.390	0.108	0.000
24.01	6.41	220.45	1.141	3.852	4-FFf	0.564	0.836	2.500	6.390	1.306	0.000
47.03	12.45	220.62	1.711	4.023	4-FFf	0.791	1.185	2.500	6.390	2.536	0.000
70.04	18.51	220.91	2.191	4.305	4-FFf	0.978	1.454	2.500	6.390	3.772	0.000
93.06	24.57	221.30	2.664	4.698	4-FFf	1.147	1.684	2.500	6.390	5.004	0.000
116.07	30.62	221.80	3.206	5.201	4-FFf	1.306	1.884	2.500	6.390	6.239	0.000
139.08	35.85	222.32	3.761	5.723	4-FFf	1.442	2.029	2.500	6.390	7.303	0.000
162.10	40.96	222.91	4.398	6.314	4-FFf	1.576	2.148	2.500	6.390	8.344	0.000
185.11	48.39	223.91	5.496	7.313	4-FFf	1.787	2.279	2.500	6.390	9.858	0.000
208.13	55.70	225.06	6.765	8.458	4-FFf	2.500	2.364	2.500	6.390	11.348	0.000
231.14	62.92	226.35	8.226	9.746	4-FFf	2.500	2.256	2.500	6.390	12.817	0.000

****

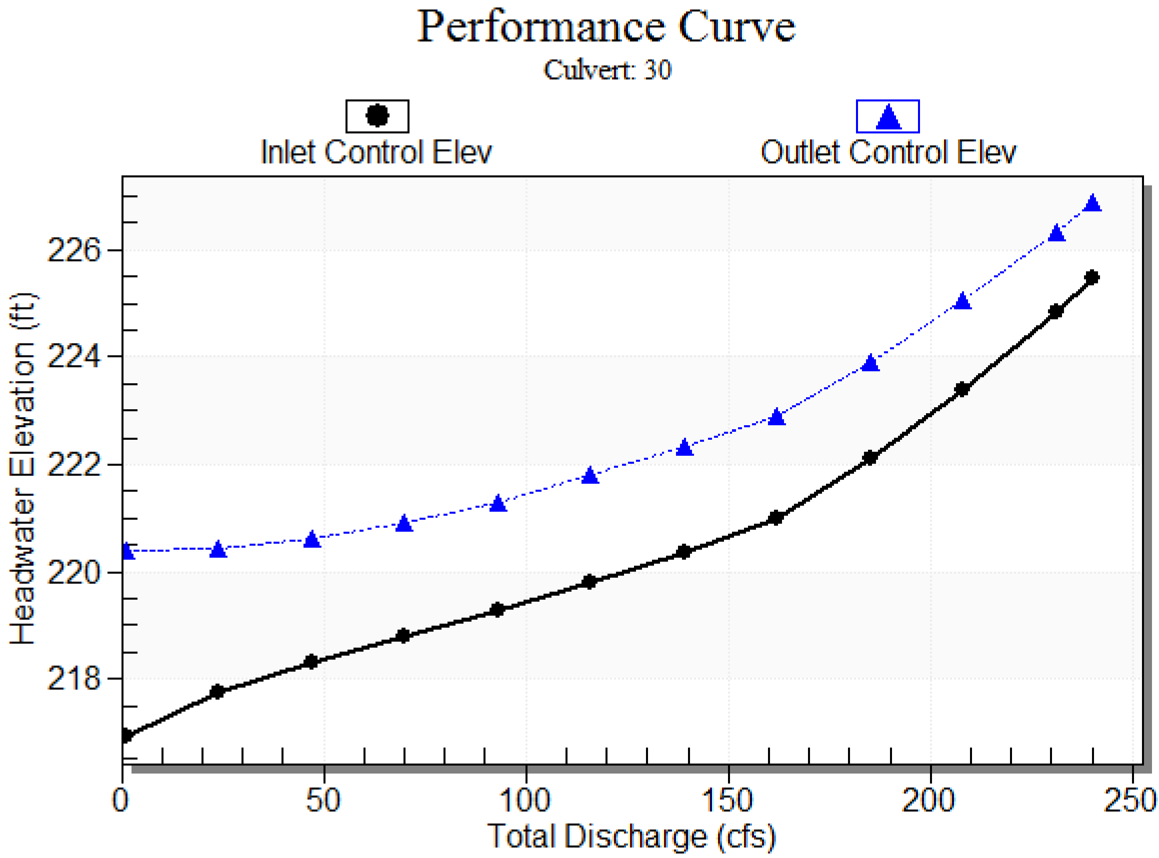
Straight Culvert

Inlet Elevation (invert): 216.60 ft,   Outlet Elevation (invert): 215.00 ft

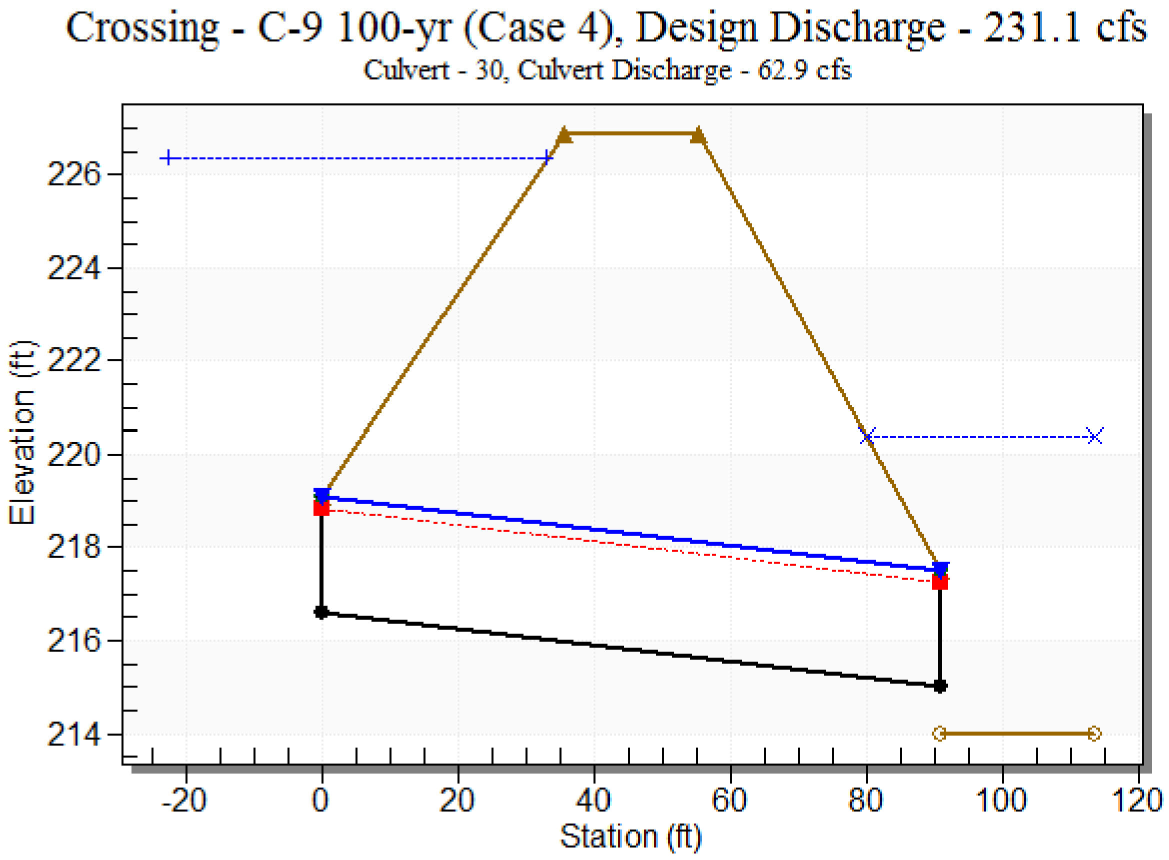
Culvert Length: 91.01 ft,   Culvert Slope: 0.0176

****

Culvert Performance Curve Plot: 30



Water Surface Profile Plot for Culvert: 30



Culvert Data Summary - 30

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 29 - Downstream Channel Rating Curve (Crossing: C-9 100-yr (Case 4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	220.39	6.39
24.01	220.39	6.39
47.03	220.39	6.39
70.04	220.39	6.39
93.06	220.39	6.39
116.07	220.39	6.39
139.08	220.39	6.39
162.10	220.39	6.39
185.11	220.39	6.39
208.13	220.39	6.39
231.14	220.39	6.39

Tailwater Channel Data - C-9 100-yr (Case 4)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 220.39 ft

Roadway Data for Crossing: C-9 100-yr (Case 4)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 226.90 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 66.6 cfs

Maximum Flow: 66.6 cfs

Table 30 - Summary of Culvert Flows at Crossing: EC-10 25-yr (Case 1)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
220.43	1.00	1.00	0.00	1
221.22	7.56	7.56	0.00	1
221.82	14.12	14.12	0.00	1
222.33	20.68	20.68	0.00	1
222.86	27.24	27.24	0.00	1
223.51	33.80	33.80	0.00	1
224.29	40.36	40.36	0.00	1
225.24	46.92	46.92	0.00	1
226.33	53.48	53.48	0.00	1
227.57	60.04	60.04	0.00	1
229.03	66.60	66.60	0.00	1
230.00	70.63	70.63	0.00	Overtopping

Rating Curve Plot for Crossing: EC-10 25-yr (Case 1)

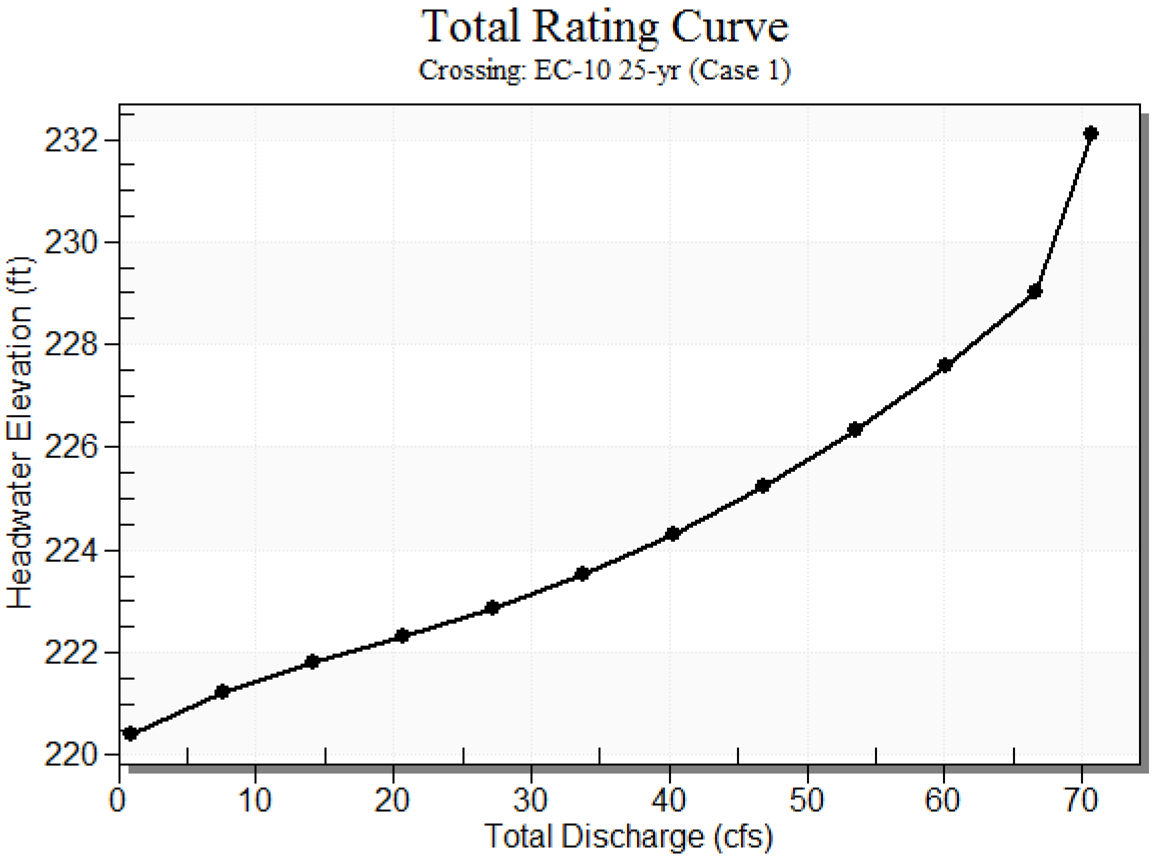


Table 31 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	220.43	0.426	0.0*	1-S2n	0.189	0.321	0.196	5.750	5.395	0.000
7.56	7.56	221.22	1.225	0.0*	1-S2n	0.501	0.909	0.536	5.750	9.465	0.000
14.12	14.12	221.82	1.822	0.0*	1-S2n	0.686	1.265	0.761	5.750	10.784	0.000
20.68	20.68	222.33	2.329	0.085	1-S2n	0.837	1.542	0.948	5.750	11.698	0.000
27.24	27.24	222.86	2.865	0.719	5-S2n	0.971	1.777	1.120	5.750	12.365	0.000
33.80	33.80	223.51	3.505	1.686	5-S2n	1.094	1.975	1.277	5.750	12.966	0.000
40.36	40.36	224.29	4.291	2.384	5-S2n	1.212	2.136	1.428	5.750	13.495	0.000
46.92	46.92	225.24	5.235	3.170	5-S2n	1.327	2.256	1.570	5.750	14.027	0.000
53.48	53.48	226.33	6.333	4.048	5-S2n	1.441	2.342	1.704	5.750	14.575	0.000
60.04	60.04	227.57	7.573	4.999	5-S2n	1.556	2.353	1.832	5.750	15.150	0.000
66.60	66.60	229.03	9.031	6.093	5-S2n	1.676	2.434	1.957	5.750	15.751	0.000

* Full Flow Headwater elevation is below inlet invert.

****

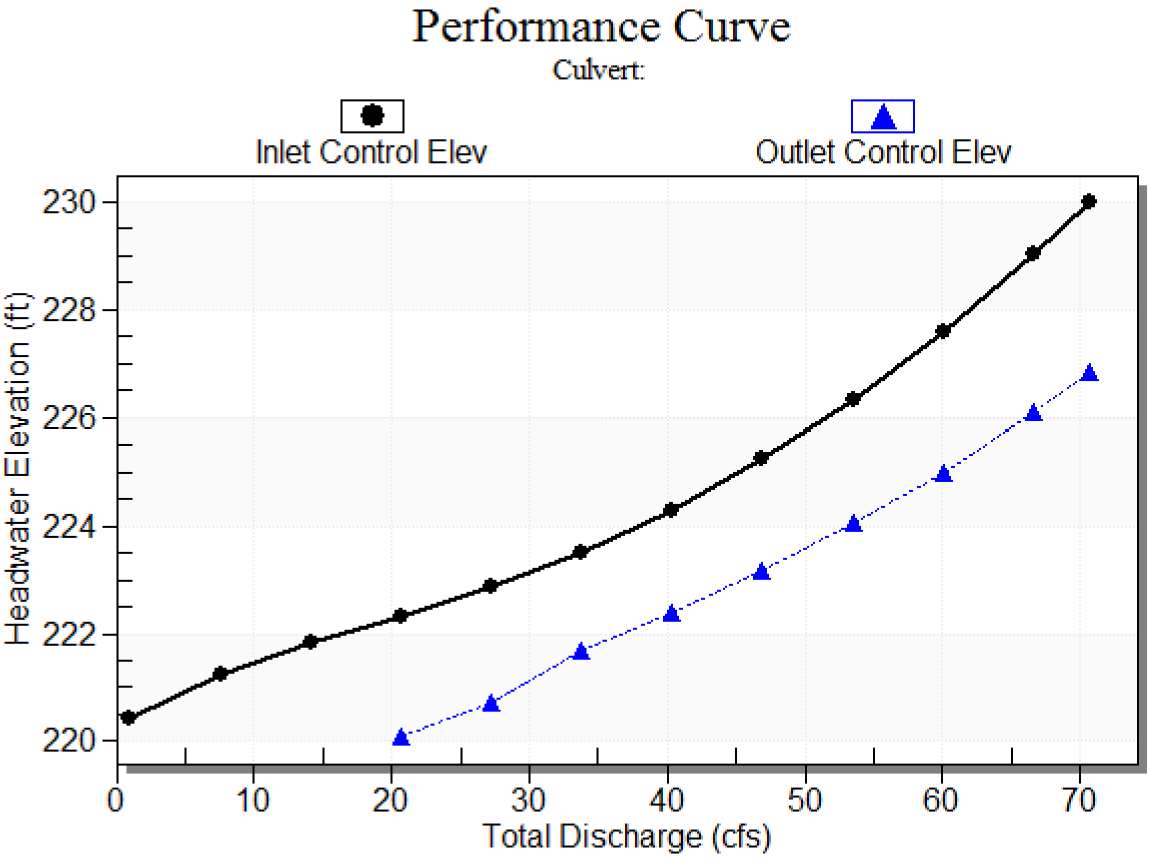
Straight Culvert

Inlet Elevation (invert): 220.00 ft, Outlet Elevation (invert): 218.00 ft

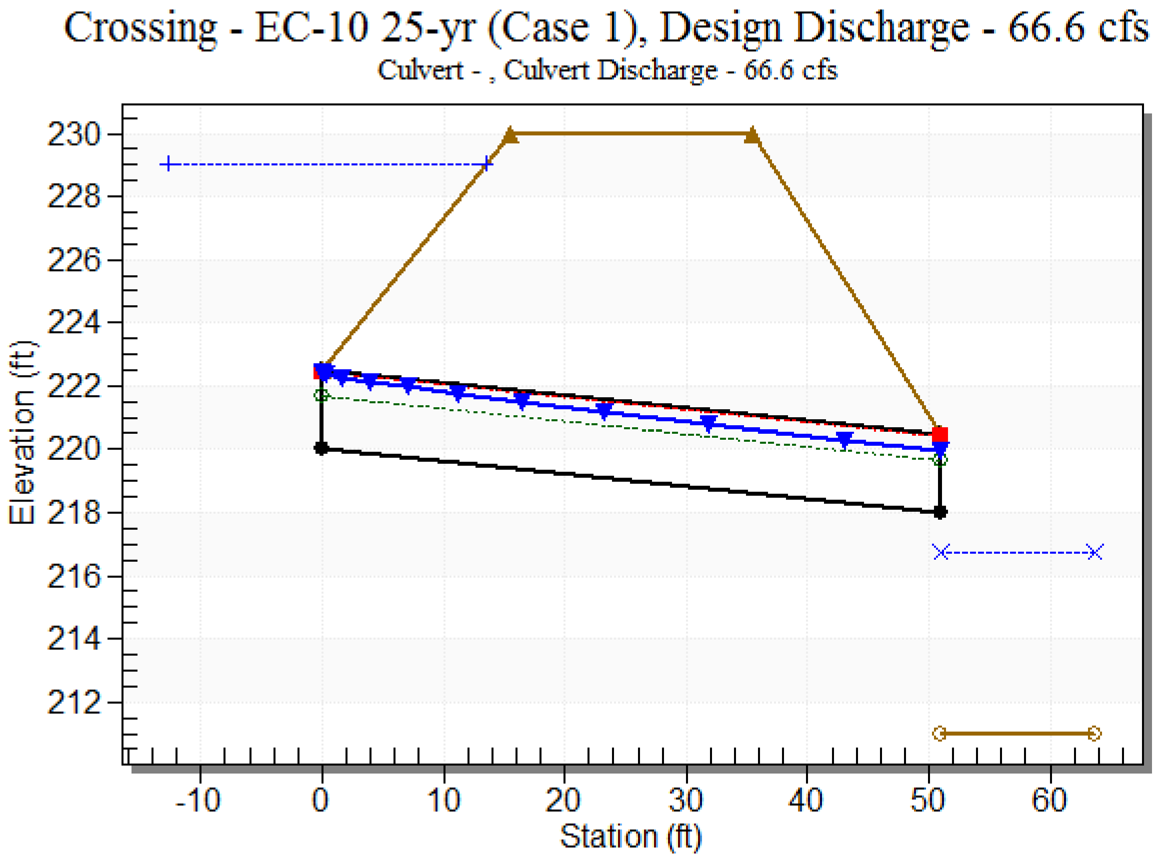
Culvert Length: 51.04 ft, Culvert Slope: 0.0392

****

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 32 - Downstream Channel Rating Curve (Crossing: EC-10 25-yr (Case 1))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	216.75	5.75
7.56	216.75	5.75
14.12	216.75	5.75
20.68	216.75	5.75
27.24	216.75	5.75
33.80	216.75	5.75
40.36	216.75	5.75
46.92	216.75	5.75
53.48	216.75	5.75
60.04	216.75	5.75
66.60	216.75	5.75

Tailwater Channel Data - EC-10 25-yr (Case 1)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 216.75 ft

Roadway Data for Crossing: EC-10 25-yr (Case 1)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 230.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 59.2 cfs

Maximum Flow: 59.2 cfs

Table 33 - Summary of Culvert Flows at Crossing: C-10 25-yr (Case 2)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
224.40	1.00	1.00	0.00	1
225.08	6.82	6.82	0.00	1
225.49	12.64	12.64	0.00	1
225.91	18.46	18.46	0.00	1
226.28	24.28	24.28	0.00	1
226.62	30.10	30.10	0.00	1
226.96	35.92	35.92	0.00	1
227.32	41.74	41.74	0.00	1
227.73	47.56	47.56	0.00	1
228.18	53.38	53.38	0.00	1
228.69	59.20	59.20	0.00	1
230.00	71.86	71.86	0.00	Overtopping

Rating Curve Plot for Crossing: C-10 25-yr (Case 2)

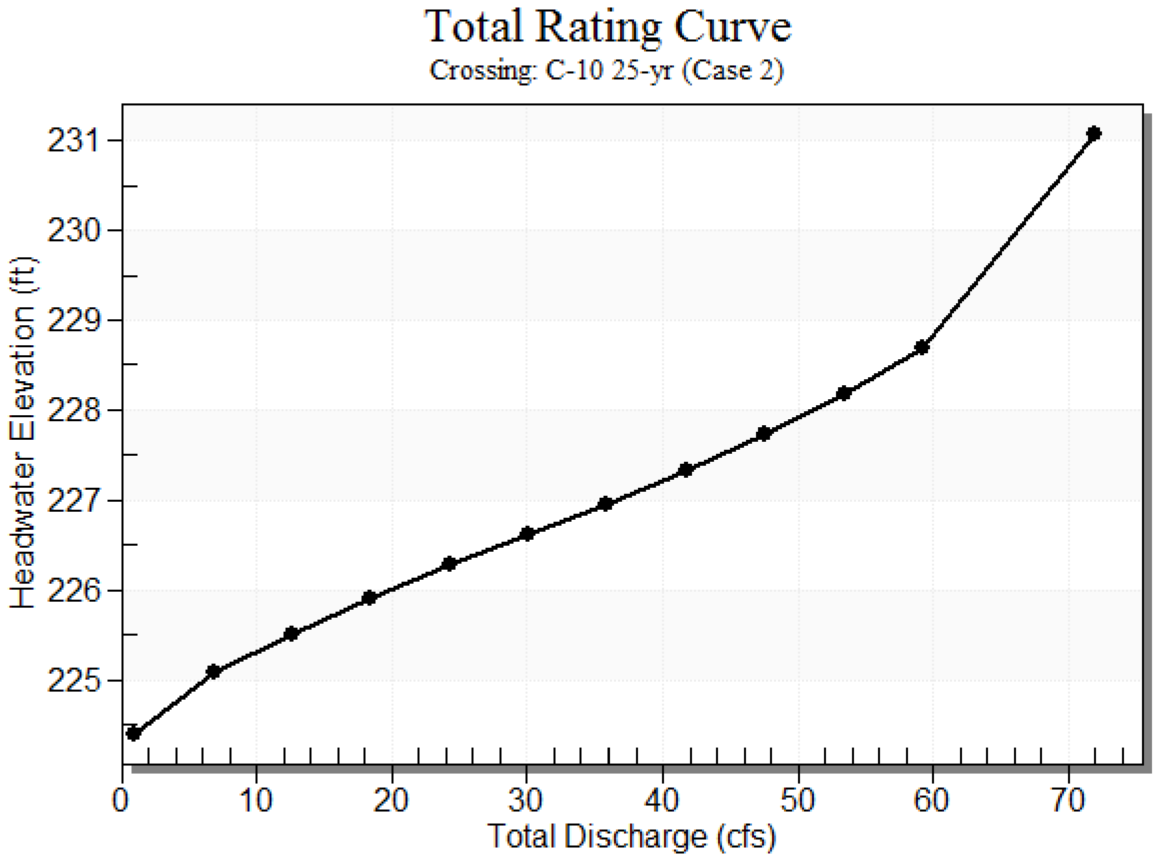


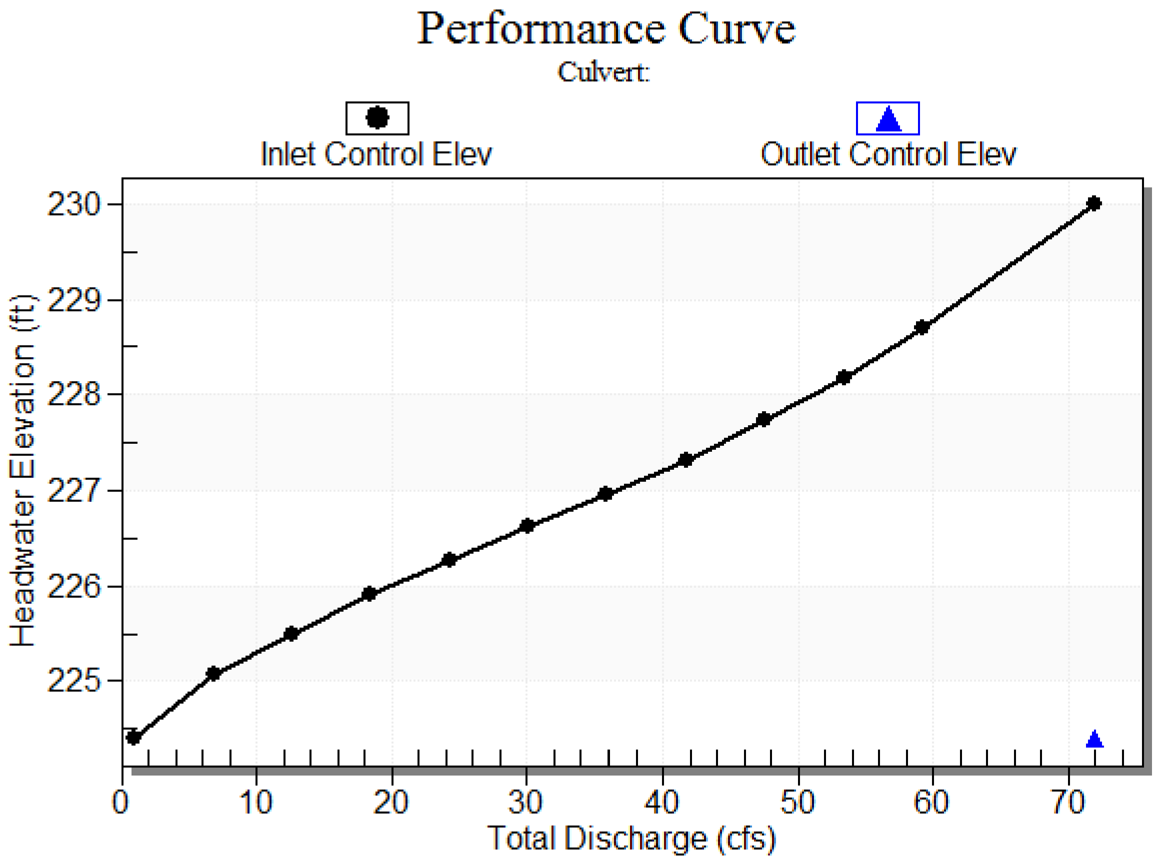
Table 34 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	224.40	0.399	0.0*	1-S2n	0.162	0.303	0.162	5.660	6.579	0.000
6.82	6.82	225.08	1.075	0.0*	1-S2n	0.405	0.819	0.417	5.660	11.115	0.000
12.64	12.64	225.49	1.493	0.0*	1-S2n	0.549	1.126	0.549	5.660	13.761	0.000
18.46	18.46	225.91	1.912	0.0*	1-S2n	0.662	1.376	0.708	5.660	13.975	0.000
24.28	24.28	226.28	2.277	0.0*	1-S2n	0.760	1.586	0.818	5.660	15.024	0.000
30.10	30.10	226.62	2.617	0.0*	1-S2n	0.849	1.772	0.918	5.660	15.842	0.000
35.92	35.92	226.96	2.960	0.0*	1-S2n	0.930	1.944	1.016	5.660	16.447	0.000
41.74	41.74	227.32	3.325	0.0*	5-S2n	1.006	2.102	1.105	5.660	17.051	0.000
47.56	47.56	227.73	3.728	0.0*	5-S2n	1.079	2.243	1.195	5.660	17.511	0.000
53.38	53.38	228.18	4.180	0.0*	5-S2n	1.148	2.371	1.283	5.660	17.873	0.000
59.20	59.20	228.69	4.688	0.0*	5-S2n	1.215	2.485	1.368	5.660	18.233	0.000

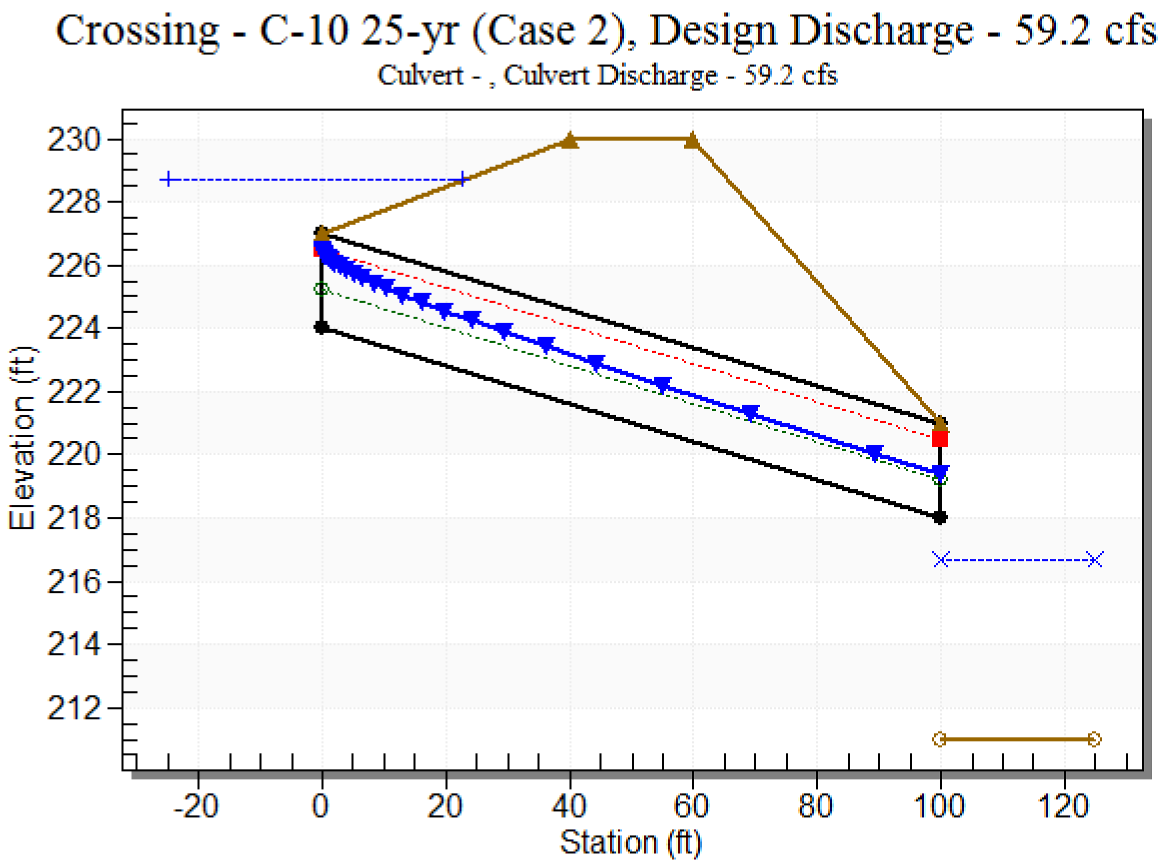
* Full Flow Headwater elevation is below inlet invert.

```
*******************************************************************************
                              Straight Culvert
    Inlet Elevation (invert): 224.00 ft,    Outlet Elevation (invert): 218.00 ft
              Culvert Length: 100.18 ft,    Culvert Slope: 0.0600
*******************************************************************************
```

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 35 - Downstream Channel Rating Curve (Crossing: C-10 25-yr (Case 2))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	216.66	5.66
6.82	216.66	5.66
12.64	216.66	5.66
18.46	216.66	5.66
24.28	216.66	5.66
30.10	216.66	5.66
35.92	216.66	5.66
41.74	216.66	5.66
47.56	216.66	5.66
53.38	216.66	5.66
59.20	216.66	5.66

Tailwater Channel Data - C-10 25-yr (Case 2)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 216.66 ft

Roadway Data for Crossing: C-10 25-yr (Case 2)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 230.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1 cfs

Design Flow: 67.6 cfs

Maximum Flow: 67.6 cfs

Table 36 - Summary of Culvert Flows at Crossing: C-10 100-yr (Case 4)

Headwater Elevation (ft)	Total Discharge (cfs)	Discharge (cfs)	Roadway Discharge (cfs)	Iterations
224.40	1.00	1.00	0.00	1
225.14	7.66	7.66	0.00	1
225.62	14.32	14.32	0.00	1
226.07	20.98	20.98	0.00	1
226.47	27.64	27.64	0.00	1
226.86	34.30	34.30	0.00	1
227.27	40.96	40.96	0.00	1
227.73	47.62	47.62	0.00	1
228.25	54.28	54.28	0.00	1
228.85	60.94	60.94	0.00	1
229.53	67.60	67.60	0.00	1
230.00	71.86	71.86	0.00	Overtopping

Rating Curve Plot for Crossing: C-10 100-yr (Case 4)

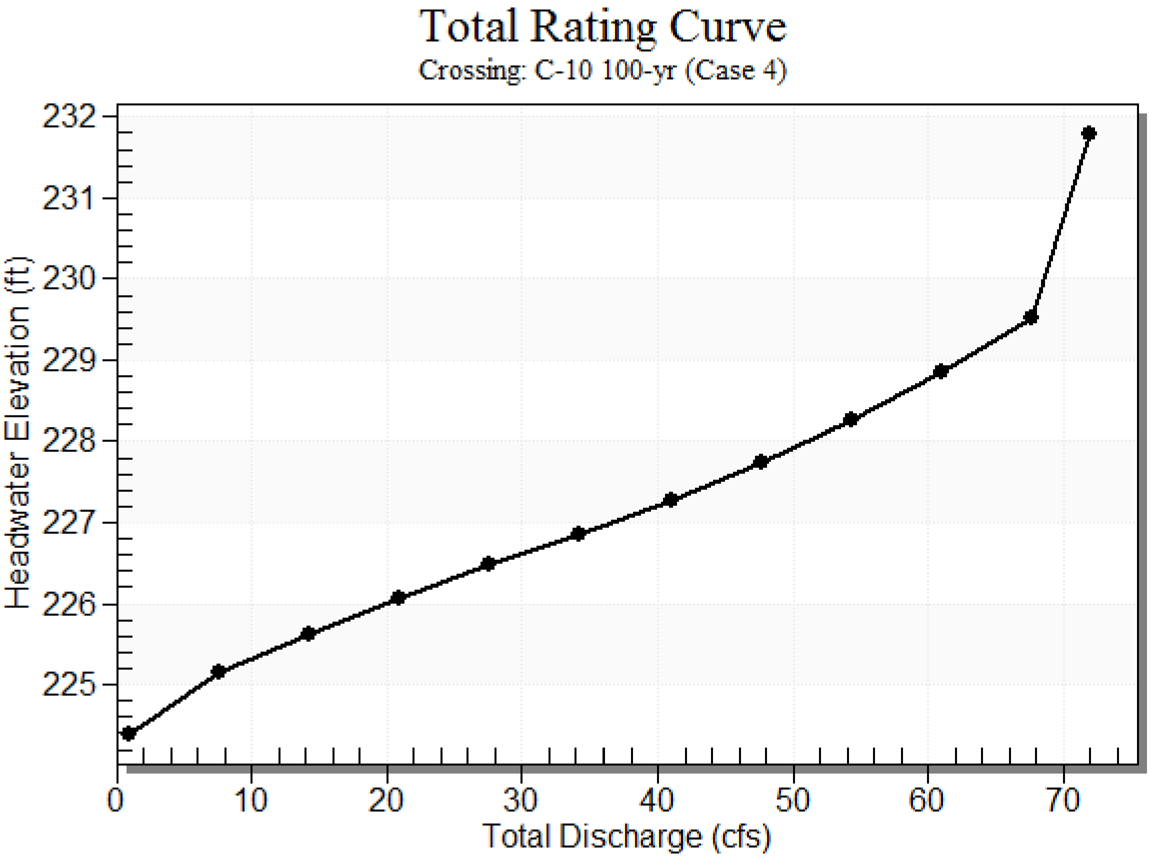


Table 37 - Culvert Summary Table:

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1.00	1.00	224.40	0.399	0.0*	1-S2n	0.162	0.303	0.162	5.770	6.579	0.000
7.66	7.66	225.14	1.142	0.0*	1-S2n	0.429	0.867	0.429	5.770	12.019	0.000
14.32	14.32	225.62	1.620	0.0*	1-S2n	0.583	1.200	0.613	5.770	13.292	0.000
20.98	20.98	226.07	2.075	0.0*	1-S2n	0.706	1.472	0.758	5.770	14.421	0.000
27.64	27.64	226.47	2.474	0.0*	1-S2n	0.812	1.697	0.878	5.770	15.489	0.000
34.30	34.30	226.86	2.863	0.0*	1-S2n	0.908	1.899	0.990	5.770	16.276	0.000
40.96	40.96	227.27	3.274	0.0*	5-S2n	0.996	2.082	1.095	5.770	16.938	0.000
47.62	47.62	227.73	3.732	0.0*	5-S2n	1.080	2.245	1.195	5.770	17.518	0.000
54.28	54.28	228.25	4.255	0.0*	5-S2n	1.159	2.390	1.295	5.770	17.952	0.000
60.94	60.94	228.85	4.851	0.0*	5-S2n	1.235	2.516	1.393	5.770	18.341	0.000
67.60	67.60	229.53	5.526	0.0*	5-S2n	1.309	2.624	1.484	5.770	18.757	0.000

* Full Flow Headwater elevation is below inlet invert.

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*******************************************************************************
                              Straight Culvert
   Inlet Elevation (invert): 224.00 ft,    Outlet Elevation (invert): 218.00 ft
              Culvert Length: 100.18 ft,    Culvert Slope: 0.0600
*******************************************************************************
```
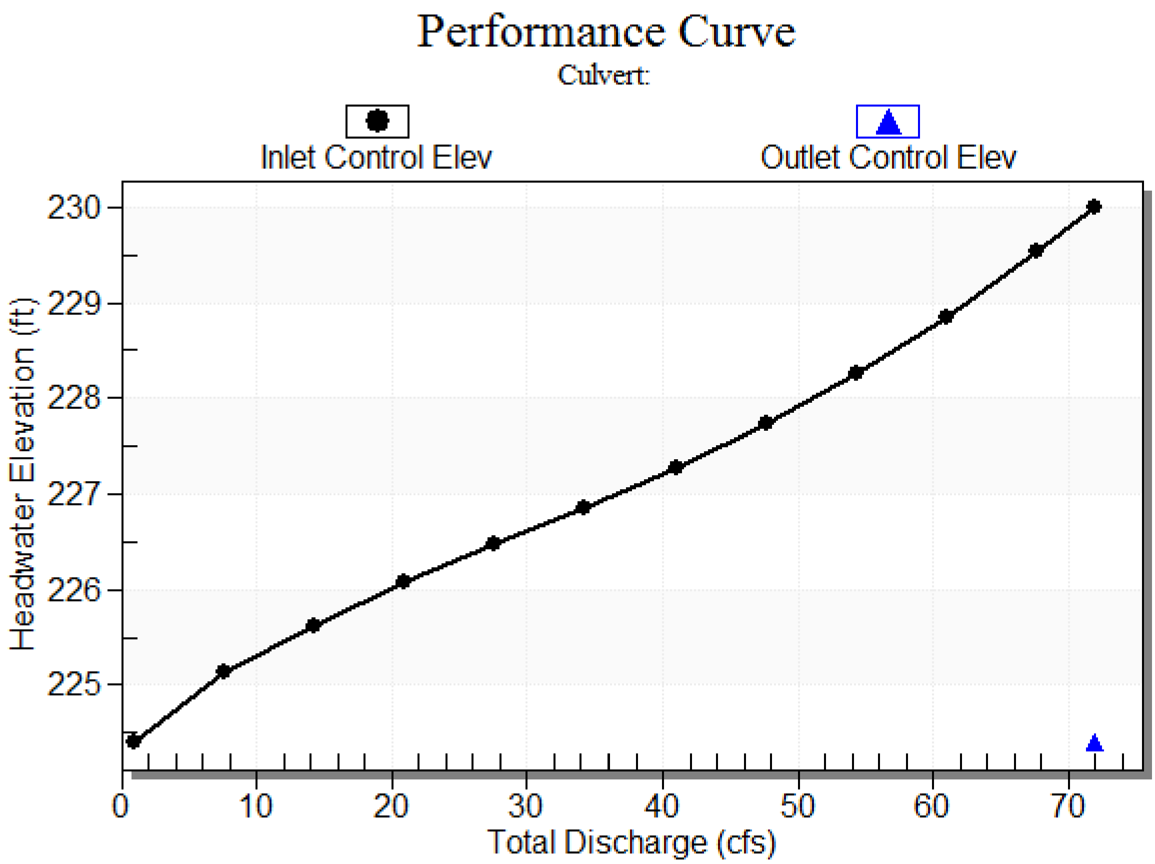
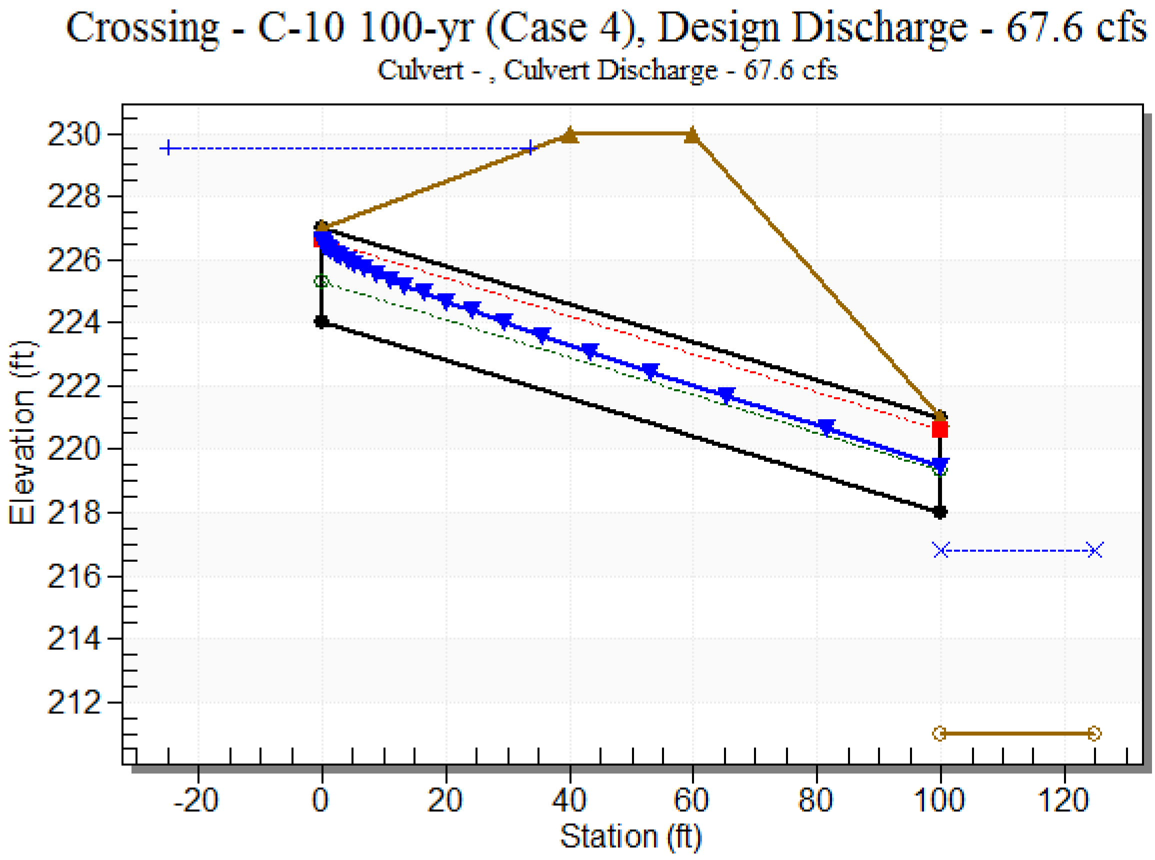

Culvert Performance Curve Plot:



Water Surface Profile Plot for Culvert:



Culvert Data Summary -

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Table 38 - Downstream Channel Rating Curve (Crossing: C-10 100-yr (Case 4))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
1.00	216.77	5.77
7.66	216.77	5.77
14.32	216.77	5.77
20.98	216.77	5.77
27.64	216.77	5.77
34.30	216.77	5.77
40.96	216.77	5.77
47.62	216.77	5.77
54.28	216.77	5.77
60.94	216.77	5.77
67.60	216.77	5.77

Tailwater Channel Data - C-10 100-yr (Case 4)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 216.77 ft

Roadway Data for Crossing: C-10 100-yr (Case 4)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 230.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft