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

October 5, 2021

Jim Bevill
Land and Mines Manager
Carbo Ceramics, Inc.
36 Arch Drive
Eufaula, AL 36027

RE: Draft Permit
Carbo-Sellers Bauxite Pit
NPDES Permit No. AL0082724
Henry County (067)

Dear Mr. Bevill:

Transmitted herein is a draft of the above referenced permit. Please review the enclosed draft permit carefully. If previously permitted, the draft may contain additions/revisions to the language in your current permit. Please submit any comments on the draft permit to the Department within 30 days from the date of receipt of this letter.

Since the Department has made a tentative decision to issue the above referenced permit, ADEM Admin. Code r. 335-6-6-.21 requires a public notice of the draft permit followed by a period of at least 30 days for public comment before the permit can be issued. The United States Environmental Protection Agency will also receive the draft permit for review during the 30-day public comment period.

Any mining, processing, construction, land disturbance, or other regulated activity proposed to be authorized by this draft permit is prohibited prior to the effective date of the formal permit. Any mining or processing activity within the drainage basin associated with each permitted outfall which is conducted prior to Departmental receipt of certification from a professional engineer licensed to practice in the State of Alabama, that the Pollution Abatement/Prevention Plan was implemented according to the design plan, or notification from the Alabama Surface Mining Commission that the sediment control structures have been certified, is prohibited.

Please be aware that Part I.D of your permit requires that you apply for participation in the Department's web-based Electronic Environmental (E2) Reporting System Program for submittal of DMRs upon issuance of this permit unless valid justification as to why you cannot participate is submitted in writing. The E2 Program allows ADEM to electronically validate, acknowledge receipt, and upload data to the state's central wastewater database. This improves the accuracy of reported compliance data and reduces costs to both the regulated community and ADEM. The Permittee Participation Package may be downloaded online at https://e2.adem.alabama.gov/npdes or you may obtain a hard copy by submitting a written request or by emailing e2admin@adem.alabama.gov.

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)

The Alabama Department of Environmental Management encourages you to voluntarily consider pollution prevention practices and alternatives at your facility. Pollution Prevention may assist you in complying with effluent limitations, and possibly reduce or eliminate monitoring requirements.

Should you have any questions concerning this matter, please contact Amber Hicks by email at amber.hicks@adem.alabama.gov or by phone at (334) 271-7975.

Sincerely,

Catherine A. McNeill, Chief
Mining and Natural Resource Section
Stormwater Management Branch
Water Division

CAM/anh File: DPER/45904

Enclosure

cc: Amber Hicks, ADEM
Environmental Protection Agency Region IV
Alabama Department of Conservation and Natural Resources
U.S. Fish and Wildlife Service
Alabama Historical Commission
Advisory Council on Historic Preservation
Alabama Department of Labor

ADEM
Alabama Department of Environmental Management

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM INDIVIDUAL PERMIT

PERMITTEE:	Carbo Cermaics, Inc. 36 Arch Drive Eufaula, Alabama 36027
FACILITY LOCATION:	Carbo-Sellers Bauxite Pit AL Hwy 95 and County Road 204 Abbeville, AL 36310 Henry County T8N, R28E, S22
PERMIT NUMBER:	AL0082724
DSN & RECEIVING STREAM:	001-1 Unnamed Tributary to Abbie Creek 002-1 Unnamed Tributary to Abbie Creek 003-1 Unnamed Tributary to Abbie Creek

In accordance with and subject to the provisions of the Federal Water Pollution Control Act, as amended, 33 U.S.C. §§1251-1378 (the "FWPCA"), the Alabama Water Pollution Control Act, as amended, Code of Alabama 1975, §§ 22-22-1 to 22-22-14 (the "AWPCA"), the Alabama Environmental Management Act, as amended, Code of Alabama 1975, §§22-22A-1 to 22-22A-16, and rules and regulations adopted thereunder, and subject further to the terms and conditions set forth in this permit, the Permittee is hereby authorized to discharge into the above-named receiving waters.

ISSUANCE DATE:

EFFECTIVE DATE:

EXPIRATION DATE:

Draft

Alabama Department of Environmental Management

MINING AND NATURAL RESOURCE SECTION

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

TABLE OF CONTENTS

PART I DISCHARGE LIMITATIONS, CONDITIONS, AND REQUIREMENTS

A. DISCHARGE LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this Permit and lasting through the expiration date of this Permit, the Permittee is authorized to discharge from each point source identified on Page 1 of this Permit and described more fully in the Permittee's application, if the outfalls have been constructed and certified. Discharges shall be limited and monitored by the Permittee as specified below:

Parameter	Discharge Limitations			Monitoring Requirements	
	Daily Minimum	Monthly Average	Daily Maximum	Sample Type	Measurement Frequency[1]
pH 00400	6.0 s.u.	-------	9.0 s.u.	Grab	2/Month
Solids, Total Suspended 00530	-------	20.0 mg/L	30.0 mg/L	Grab	2/Month
Iron, Total (as Fe) 01045	-------	0.5 mg/L	1.0 mg/L	Grab	2/Month
Aluminum, Total (as Al) 01105	-------	1.0 mg/L	2.0 mg/L	Grab	2/Month
Flow, In Conduit or Thru Treatment Plant[2] 50050	-------	Report MGD	Report MGD	Instantaneous	2/Month

B. REQUIREMENTS TO ACTIVATE A PROPOSED MINING OUTFALL

1. Discharge from any point source identified on Page 1 of this Permit which is a proposed outfall is not authorized by this Permit until the outfall has been constructed and certification received by the Department from a professional engineer, registered in the State of Alabama, certifying that such facility has been constructed according to good engineering practices and in accordance with the Pollution Abatement and/or Prevention (PAP) Plan.

2. Certification required by Part I.B.1. shall be submitted on a completed ADEM Form 432. The certification shall include the latitude and longitude of the constructed and certified outfall.

3. Discharge monitoring and Discharge Monitoring Report (DMR) reporting requirements described in Part I.C. of this Permit do not apply to point sources that have not been constructed and certified.

4. Upon submittal of the certification required by Part I.B.1. to the Department, all monitoring and DMR submittal requirements shall apply to the constructed and certified outfall.

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[1] See Part I.C.2. for further measurement frequency requirements.

[2] Flow must be determined at the time of sample collection by direct measurement, calculation, or other method acceptable to the Department.

C. DISCHARGE MONITORING AND RECORD KEEPING REQUIREMENTS

1. Sampling Schedule and Frequency

a. The Permittee shall collect at least one grab sample of the discharge to surface waters from each constructed and certified point source identified on Page 1 of this Permit and described more fully in the Permittee's application twice per month at a rate of at least every other week if a discharge occurs at any time during the two week period, but need not collect more than two samples per calendar month. Each sample collected shall be analyzed for each parameter specified in Part I.A. of this Permit.

b. If the final effluent is pumped in order to discharge (e.g. from incised ponds, old highwall cuts, old pit areas or depressions, etc.), the Permittee shall collect at least one grab sample of the discharge from each point source identified on Page 1 of this Permit and described more fully in the Permittee's application each quarterly (three month) monitoring period if a discharge occurs at any time during the quarterly monitoring period which results from direct pumped drainage. Each sample collected shall be analyzed for each parameter specified in Part I.A. of this Permit.

c. The Permittee may increase the frequency of sampling listed in Parts I.C.1.a and I.C.1.b; however, all sampling results must be reported to the Department and included in any calculated results submitted to the Department in accordance with this Permit.

2. Measurement Frequency

Measurement frequency requirements found in Part I.A. shall mean:

a. A measurement frequency of one day per week shall mean sample collection on any day of discharge which occurs every calendar week.

b. A measurement frequency of two days per month shall mean sample collection on any day of discharge which occurs every other week, but need not exceed two sample days per month.

c. A measurement frequency of one day per month shall mean sample collection on any day of discharge which occurs during each calendar month.

d. A measurement frequency of one day per quarter shall mean sample collection on any day of discharge which occurs during each calendar quarter.

e. A measurement frequency of one day per six months shall mean sample collection on any day of discharge which occurs during the period of January through June and during the period of July through December.

f. A measurement frequency of one day per year shall mean sample collection on any day of discharge which occurs during each calendar year.

3. Monitoring Schedule

The Permittee shall conduct the monitoring required by Part I.A. in accordance with the following schedule:

a. MONITORING REQUIRED MORE FREQUENTLY THAN MONTHLY AND MONTHLY shall be conducted during the first full month following the effective date of coverage under this Permit and every month thereafter. More frequently than monthly and monthly monitoring may be done anytime during the month, unless restricted elsewhere in

this Permit, but the results should be reported on the last Discharge Monitoring Report (DMR) due for the quarter (i.e., with the March, June, September, and December DMRs).

b. QUARTERLY MONITORING shall be conducted at least once during each calendar quarter. Calendar quarters are the periods of January through March, April through June, July through September, and October through December. The Permittee shall conduct the quarterly monitoring during the first complete calendar quarter following the effective date of this Permit and is then required to monitor once during each quarter thereafter. Quarterly monitoring may be done anytime during the quarter, unless restricted elsewhere in this Permit, but the results should be reported on the last DMR due for the quarter (i.e., with the March, June, September, and December DMRs).

c. SEMIANNUAL MONITORING shall be conducted at least once during the period of January through June and at least once during the period of July through December. The Permittee shall conduct the semiannual monitoring during the first complete semiannual calendar period following the effective date of this Permit and is then required to monitor once during each semiannual period thereafter. Semiannual monitoring may be done anytime during the semiannual period, unless restricted elsewhere in this Permit, but it should be reported on the last DMR due for the month of the semiannual period (i.e., with the June and December DMRs).

d. ANNUAL MONITORING shall be conducted at least once during the period of January through December. The Permittee shall conduct the annual monitoring during the first complete calendar annual period following the effective date of this Permit and is then required to monitor once during each annual period thereafter. Annual monitoring may be done anytime during the year, unless restricted elsewhere in this Permit, but it should be reported on the December DMR.

4. Sampling Location

Unless restricted elsewhere in this Permit, samples collected to comply with the monitoring requirements specified in Part I.A. shall be collected at the nearest accessible location just prior to discharge and after final treatment, or at an alternate location approved in writing by the Department.

5. Representative Sampling

Sample collection and measurement actions taken as required herein shall be representative of the volume and nature of the monitored discharge and shall be in accordance with the provisions of this Permit.

6. Test Procedures

For the purpose of reporting and compliance, Permittees shall use one of the following procedures:

a. For parameters with an EPA established Minimum Level (ML), report the measured value if the analytical result is at or above the ML and report "0" for values below the ML. Test procedures for the analysis of pollutants shall conform to 40 CFR Part 136, guidelines published pursuant to Section 304(h) of the FWPCA, 33 U.S.C. Section 1314(h), and ADEM Standard Operating Procedures. If more than one method for analysis of a substance is approved for use, a method having a minimum level lower than the permit limit shall be used. If the minimum level of all methods is higher than the permit limit, the method having the lowest minimum level shall be used and a report of less than the minimum level shall be reported as zero and will constitute compliance, however should EPA approve a method with a lower minimum level during the term of this Permit the Permittee shall use the newly approved method.

b. For pollutant parameters without an established ML, an interim ML may be utilized. The interim ML shall be calculated as 3.18 times the Method Detection Level (MDL) calculated pursuant to 40 CFR Part 136, Appendix B.

Permittees may develop an effluent matrix-specific ML, where an effluent matrix prevents attainment of the established ML. However, a matrix specific ML shall be based upon proper laboratory method and technique. Matrix-specific MLs must be approved by the Department, and may be developed by the Permittee during permit issuance, reissuance, modification, or during compliance schedule.

In either case the measured value should be reported if the analytical result is at or above the ML and "0" reported for values below the ML.

c. For parameters without an EPA established ML, interim ML, or matrix-specific ML, a report of less than the detection limit shall constitute compliance if the detection limit of all analytical methods is higher than the permit limit using the most sensitive EPA approved method. For the purpose of calculating a monthly average, "0" shall be used for values reported less than the detection limit.

The Minimum Level utilized for procedures identified in Parts I.C.6.a. and b. shall be reported on the Permittee's DMR. When an EPA approved test procedure for analysis of a pollutant does not exist, the Director shall approve the procedure to be used.

7. Recording of Results

For each measurement or sample taken pursuant to the requirements of this Permit, the Permittee shall record the following information:

a. The facility name and location, point source number, date, time, and exact place of sampling or measurements;

b. The name(s) of person(s) who obtained the samples or measurements;

c. The dates and times the analyses were performed;

d. The name(s) of the person(s) who performed the analyses;

e. The analytical techniques or methods used including source of method and method number; and

f. The results of all required analyses.

8. Routine Inspection by Permittee

a. The Permittee shall inspect all point sources identified on Page 1 of this Permit and described more fully in the Permittee's application and all treatment or control facilities or systems used by the Permittee to achieve compliance with the terms and conditions of this Permit at least as often as the applicable sampling frequency specified in Part I.C.1 of this Permit.

b. If required by the Director, the Permittee shall maintain a written log for each point source identified on Page 1 of this Permit and described more fully in the Permittee's application in which the Permittee shall record the following information:

(1) The date and time the point source and any associated treatment or control facilities or systems were inspected by the Permittee;

(2) Whether there was a discharge from the point source at the time of inspection by the Permittee;

(3) Whether a sample of the discharge from the point source was collected at the time of inspection by the Permittee;

(4) Whether all associated treatment or control facilities or systems appeared to be in good working order and operating as efficiently as possible, and if not, a description of the problems or deficiencies; and

(5) The name and signature of the person performing the inspection of the point source and associated treatment or control facilities or systems.

9. Records Retention and Production

a. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Permit, and records of all data used to complete the above reports or the application for this Permit, for a period of at least three (3) years from the date of the sample collection, measurement, report, or application. This period may be extended by request of the Director at any time. If litigation or other enforcement action, under the AWPCA, AEMA, and/or the FWPCA, is ongoing which involves any of the above records, the records shall be kept until the litigation is resolved. Upon the written request of the Director, the Permittee shall provide the Director with a copy of any record required to be retained by this paragraph. Copies of these records should not be submitted unless requested.

b. All records required to be kept for a period of three (3) years shall be kept at the permitted facility or an alternate location approved by the Department in writing and shall be available for inspection.

10. Monitoring Equipment and Instrumentation

All equipment and instrumentation used to determine compliance with the requirements of this Permit shall be installed, maintained, and calibrated in accordance with the manufacturer's instructions or, in the absence of manufacturer's instructions, in accordance with accepted practices. The Permittee shall develop and maintain quality assurance procedures to ensure proper operation and maintenance of all equipment and instrumentation. The quality assurance procedures shall include the proper use, maintenance, and installation, when appropriate, of monitoring equipment at the plant site.

D. DISCHARGE REPORTING REQUIREMENTS

1. Requirements for Reporting of Monitoring

a. Monitoring results obtained during the previous three (3) months shall be summarized for each month on a Discharge Monitoring Report (DMR) Form approved by the Department, and submitted to the Department so that it is received by the Director no later than the 28th day of the month following the quarterly reporting period (i.e., on the 28th day of January, April, July, and October of each year).

b. The Department utilizes a web-based electronic environmental (E2) reporting system for submittal of DMRs. **Except as allowed by Part I.D.1.c. or d., the Permittee shall submit all DMRs required by Part I.D.1.a. by utilizing the E2 reporting system.** The E2

reporting system Permittee Participation Package may be downloaded online at https://e2.adem.alabama.gov/npdes.

c. If the electronic environmental (E2) reporting system is down (i.e. electronic submittal of DMR data is unable to be completed due to technical problems originating with the Department's system; this could include entry/submittal issues with an entire set of DMRs or individual parameters), permittees are not relieved of their obligation to submit DMR data to the Department by the required submittal date. However, if the E2 system is down on the 28th day of the month or is down for an extended period of time as determined by the Department when a DMR is required to be submitted, the facility may submit the data in an alternate manner and format acceptable to the Department. Preapproved alternate acceptable methods include faxing, e-mailing, mailing, or hand-delivery of data such that they are received by the required reporting date. Within five calendar days of the E2 system resuming operation, the Permittee shall enter the data into the E2 reporting system unless an alternate timeframe is approved by the Department. An attachment should be included with the E2 DMR submittal verifying the original submittal date (date of the fax, copy of dated e-mail, or hand-delivery stamped date).

d. The permittee may submit a request to the Department for a temporary electronic reporting waiver for DMR submittals. The waiver request should include the permit number; permittee name; facility/site name; facility address; name, address, and contact information for the responsible official or duly authorized representative; a detailed statement regarding the basis for requesting such a waiver; and the duration for which the waiver is requested. Approved electronic reporting waivers are not transferrable. Permittees with an approved electronic reporting waiver for DMRs may submit hard copy DMRs for the period that the approved electronic reporting waiver request is effective. The Permittee shall submit the Department-approved DMR forms to the address listed in Part I.D.1.j.

e. If the Permittee, using approved analytical methods as specified in Part I.C.6., monitors any discharge from a point source identified on Page 1 of this Permit and describe more fully in the Permittee's application more frequently than required by this Permit; the results of such monitoring shall be included in the calculation and reporting of values on the DMR Form, and the increased frequency shall be indicated on the DMR Form.

f. In the event no discharge from a point source identified on Page 1 of this Permit and described more fully in the Permittee's application occurs during a monitoring period, the Permittee shall report "No Discharge" for such period on the appropriate DMR Form.

g. The Permittee shall report "No Discharge During Quarterly Monitoring Period" on the appropriate DMR Form for each point source receiving pumped discharges pursuant to Part I.C.1.b. provided that no discharge has occurred at any time during the entire quarterly (three month) monitoring period.

h. Each DMR Form submitted by the Permittee to the Department in accordance with Part I.D.1. must be legible and bear an original signature or electronic signature. Photo and electronic copies of the signature are not acceptable and shall not satisfy the reporting requirements of this Permit.

i. All reports and forms required to be submitted by this Permit, the AWPCA, and the Department's rules and regulations, shall be signed by a "responsible official" of the Permittee as defined in ADEM Admin. Code r. 335-6-6-.09 or a "duly authorized representative" of such official as defined in ADEM Admin. Code r. 335-6-6-.09 and shall bear the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed

to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

j. All DMRs, reports, and forms required to be submitted by this Permit, the AWPCA and the Department's rules and regulations, shall be addressed to:

Alabama Department of Environmental Management
Water Division, Mining and Natural Resource Section
Post Office Box 301463
Montgomery, Alabama 36130-1463

Certified and Registered Mail shall be addressed to:

Alabama Department of Environmental Management
Water Division, Mining and Natural Resource Section
1400 Coliseum Boulevard
Montgomery, Alabama 36110-2059

k. Unless authorized in writing by the Department, approved reporting forms required by this Permit or the Department are not to be altered, and if copied or reproduced, must be consistent in format and identical in content to the ADEM approved form. Unauthorized alteration, falsification, or use of incorrectly reproduced forms constitutes noncompliance with the requirements of this Permit and may significantly delay processing of any request, result in denial of the request, result in permit termination, revocation, suspension, modification, or denial of a permit renewal application, or result in other enforcement action.

l. If this Permit is a reissuance, then the Permittee shall continue to submit DMRs in accordance with the requirements of their previous permit until such time as DMRs are due as discussed in Part I.D.1.

2. Noncompliance Notification

a. The Permittee must notify the Department if, for any reason, the Permittee's discharge:

(1) Potentially threatens human health or welfare;

(2) Potentially threatens fish or aquatic life;

(3) Causes an in-stream water quality criterion to be exceeded;

(4) Does not comply with an applicable toxic pollutant effluent standard or prohibition established under Section 307(a) of the FWPCA, 33 U.S.C. §1317(a);

(5) Contains a quantity of a hazardous substance which has been determined may be harmful to the public health or welfare under Section 311(b)(4) of the FWPCA, 33 U.S.C. §1321(b)(4); or

(6) Exceeds any discharge limitation for an effluent parameter as a result of an unanticipated bypass or upset.

The Permittee shall orally or electronically report any of the above occurrences, describing the circumstances and potential effects of such discharge to the Director within 24-hours after the Permittee becomes aware of the occurrence of such discharge. In addition to the oral or electronic report, the Permittee shall submit to the Director a written report as provided in Part I.D.2.c., no later than five (5) days after becoming aware of the occurrence of such discharge.

b. If for any reason, the Permittee's discharge does not comply with any limitation of this Permit, the Permittee shall submit a written report to the Director as provided in Part I.D.2.c. This report must be submitted with the next Discharge Monitoring Report required to be submitted by Part I.D.1. of this Permit after becoming aware of the occurrence of such noncompliance.

c. Any written report required to be submitted to the Director in accordance with Parts I.D.2.a. and b. shall be submitted using a Noncompliance Notification Form (ADEM Form 421) available on the Department's website (http://adem.alabama.gov/DeptForms/Form421.pdf) and include the following information:

(1) A description of the discharge and cause of noncompliance;

(2) The period of noncompliance, including exact dates and times, or if not corrected, the anticipated time the noncompliance is expected to continue; and

(3) A description of the steps taken and/or being taken to reduce or eliminate the noncomplying discharge and to prevent its recurrence.

3. Reduction, Suspension, or Termination of Monitoring and/or Reporting

a. The Director may, with respect to any point source identified on Page 1 of this Permit and described more fully in the Permittee's application, authorize the Permittee to reduce, suspend, or terminate the monitoring and/or reporting required by this Permit upon the submission of a written request for such reduction, suspension, or termination by the Permittee provided:

(1) All mining, processing, or disturbance in the drainage basin(s) associated with the discharge has ceased and site access is adequately restricted or controlled to preclude unpermitted and unauthorized mining, processing, transportation, or associated operations/activity;

(2) Permanent, perennial vegetation has been re-established on all areas mined or disturbed for at least one year since mining has ceased in the drainage basin(s) associated with the surface discharge, or all areas have been permanently graded such that all drainage is directed back into the mined pit to preclude all surface discharges;

(3) Unless waived in writing by the Department, the Permittee has been granted, in writing, a 100% Bond Release, if applicable, by the Alabama Department of Industrial Relations and, if applicable, by the Surface Mining Commission for all areas mined or disturbed in the drainage basin(s) associated with the discharge;

(4) Unless waived in writing by the Department, the Permittee has submitted inspection reports prepared and certified by a Professional Engineer (PE)

registered in the State of Alabama or a qualified professional under the PE's direction which certify that the facility has been fully reclaimed or that water quality remediation has been achieved. The first inspection must be conducted approximately one year prior to and the second inspection must be conducted within thirty days of the Permittee's request for termination of monitoring and reporting requirements;

(5) All surface effects of the mining activity such as fuel or chemical tanks, preparation plants or equipment, old tools or equipment, junk or debris, etc., must be removed and disposed of according to applicable state and federal regulations;

(6) The Permittee's request for termination of monitoring and reporting requirements contained in this Permit has been supported by monitoring data covering a period of at least six consecutive months or such longer period as is necessary to assure that the data reflect discharges occurring during varying seasonal climatological conditions;

(7) The Permittee has stated in its request that the samples collected and reported in the monitoring data submitted in support of the Permittee's request for monitoring termination or suspension are representative of the discharge and were collected in accordance with all Permit terms and conditions respecting sampling times (e.g., rainfall events) and methods and were analyzed in accordance with all Permit terms and conditions respecting analytical methods and procedures;

(8) The Permittee has certified that during the entire period covered by the monitoring data submitted, no chemical treatment of the discharge was provided;

(9) The Permittee's request has included the certification required by Part I.D.1.d. of this Permit; and

(10) The Permittee has certified to the Director in writing as part of the request, its compliance with (1) through (9) above.

b. It remains the responsibility of the Permittee to comply with the monitoring and reporting requirements of this Permit until written authorization to reduce, suspend, or terminate such monitoring and/or reporting is received by the Permittee from the Director.

E. OTHER REPORTING AND NOTIFICATION REQUIREMENTS

1. Anticipated Noncompliance

The Permittee shall give the Director written advance notice of any planned changes or other circumstances regarding a facility which may result in noncompliance with permit requirements.

2. Termination of Discharge

The Permittee shall notify the Director, in writing, when all discharges from any point source(s) identified on Page 1 of this Permit and described more fully in the Permittee's application have permanently ceased.

3. Updating Information

a. The Permittee shall inform the Director of any change in the Permittee's mailing address or telephone number or in the Permittee's designation of a facility contact or officer(s) having the authority and responsibility to prevent and abate violations of the AWPCA, the

AEMA, the Department's rules and regulations, and the terms and conditions of this Permit, in writing, no later than ten (10) days after such change. Upon request of the Director, the Permittee shall furnish the Director with an update of any information provided in the permit application.

b. If the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information with a written explanation for the mistake and/or omission.

4. Duty to Provide Information

a. The Permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, suspending, terminating, or revoking and reissuing this Permit, in whole or in part, or to determine compliance with this Permit. The Permittee shall also furnish to the Director upon request, copies of records required to be maintained by this Permit.

b. The Permittee shall furnish to the Director upon request, within a reasonable time, available information (name, phone number, address, and site location) which identifies offsite sources of material or natural resources (mineral, ore, or other material such as iron, coal, coke, dirt, chert, shale, clay, sand, gravel, bauxite, rock, stone, etc.) used in its operation or stored at the facility.

F. SCHEDULE OF COMPLIANCE

The Permittee shall achieve compliance with the discharge limitations specified in Part I.A. of this Permit in accordance with the following schedule:

Compliance must be achieved by the effective date of this Permit.

PART II OTHER REQUIREMENTS, RESPONSIBILITIES, AND DUTIES

A. OPERATIONAL AND MANAGEMENT REQUIREMENTS

1. Facilities Operation and Management

The Permittee shall at all times operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities only when necessary to achieve compliance with the conditions of this Permit.

2. Pollution Abatement and/or Prevention Plan

The Pollution Abatement and/or Prevention (PAP) Plan shall be prepared and certified by a registered Professional Engineer (PE), licensed to practice in the State of Alabama, and shall include at a minimum, the information indicated in ADEM Admin. Code r. 335-6-9-.03 and ADEM Admin. Code ch. 335-6-9 Appendices A and B. The PAP Plan shall become a part of this Permit and all requirements of the PAP Plan shall become requirements of this Permit pursuant to ADEM Admin. Code r. 335-6-9-.05(2).

3. Best Management Practices (BMPs)

a. Unless otherwise authorized in writing by the Director, the Permittee shall provide a means of subsurface withdrawal for any discharge from each point source identified on Page 1 of this Permit and described more fully in the Permittee's application. Notwithstanding the above provision, a means of subsurface withdrawal need not be provided for any discharge caused by a 24-hour precipitation event greater than a 10-year, 24-hour precipitation event.

b. Dilution water shall not be added to achieve compliance with discharge limitations except when the Director has granted prior written authorization for dilution to meet water quality requirements.

c. The Permittee shall minimize the contact of water with overburden, including but not limited to stabilizing disturbed areas through grading, diverting runoff, achieving quick growing stands of temporary vegetation, sealing acid-forming and toxic-forming materials, and maximizing placement of waste materials in back-fill areas.

d. The Permittee shall prepare, submit to the Department for approval, and implement a Best Management Practices (BMPs) Plan for containment of any or all process liquids or solids, in a manner such that these materials do not present a potential for discharge, if so required by the Director. When submitted and approved, the BMP Plan shall become a part of this Permit and all requirements of the BMP Plan shall become requirements of this Permit.

e. Spill Prevention, Control, and Management

The Permittee shall prepare, implement, and maintain a Spill Prevention, Control and Countermeasures (SPCC) Plan acceptable to the Department that is prepared and certified by a Professional Engineer (PE), registered in the State of Alabama, for all onsite petroleum product or other pollutant storage tanks or containers as required by applicable state (ADEM Admin. Code r. 335-6-6-.12(r)) and federal (40 C.F.R. §§112.1-.7) regulations. The Permittee shall implement appropriate structural and/or non-structural spill prevention, control, and/or management sufficient to prevent any spills of pollutants from entering a

ground or surface water of the State or a publicly or privately owned treatment works. Careful consideration should be applied for tanks or containers located near treatment ponds, water bodies, or high traffic areas. In most situations this would require construction of a containment system if the cumulative storage capacity of petroleum products or other pollutants at the facility is greater than 1320 gallons. Any containment system used to implement this requirement shall be constructed of materials compatible with the substance(s) contained and shall prevent the contamination of groundwater. Such containment systems shall be capable of retaining a volume equal to 110 percent of the capacity of the largest tank for which containment is provided. The applicant shall maintain onsite or have readily available flotation booms to contain, and sufficient material to absorb, fuel and chemical spills and leaks. Soil contaminated by chemical spills, oil spills, etc., must be immediately cleaned up or be removed and disposed of in an approved manner.

f. All surface drainage and storm water runoff which originate within or enters the Permittee's premises and which contains any pollutants or other wastes shall be discharged, if at all, from a point source identified on Page 1 of this Permit and described more fully in the Permittee's application.

g. The Permittee shall take all reasonable precautions to prevent any surface drainage or storm water runoff which originates outside the Permittee's premises and which contains any pollutants or other wastes from entering the Permittee's premises. At no time shall the Permittee discharge any such surface drainage or storm water runoff which enters the Permittee's premises if, either alone or in combination with the Permittee's effluent, the discharge would exceed any applicable discharge limitation specified in Part I.A. of this Permit.

4. Biocide Additives

a. The Permittee shall notify the Director in writing not later than sixty (60) days prior to instituting the use of any biocide corrosion inhibitor or chemical additive in any cooling or boiler system(s) regulated by this Permit. Notification is not required for additives that should not reasonably be expected to cause the cooling water or boiler water to exhibit toxicity as determined by analysis of manufacturer's data or testing by the Permittee. Such notification shall include:

(a) Name and general composition of biocide or chemical;

(b) 96-hour median tolerance limit data for organisms representative of the biota of the water(s) which the discharge(s) enter(s);

(c) Quantities to be used;

(d) Frequencies of use;

(e) Proposed discharge concentrations; and

(f) EPA registration number, if applicable.

b. The use of any biocide or chemical additive containing tributyl tin, tributyl tin oxide, zinc, chromium, or related compounds in any cooling or boiler system(s) regulated by the Permit is prohibited except as exempted below. The use of a biocide or additive containing zinc, chromium or related compounds may be used in special circumstances if (1) the permit contains limits for these substances, or (2) the applicant demonstrates during the application process that the use of zinc, chromium or related compounds as a biocide or additive will not pose a reasonable potential to violate the applicable State water quality

standards for these substances. The use of any additive, not identified in this Permit or in the application for this Permit or not exempted from notification under this Permit is prohibited, prior to a determination by the Department that permit modification to control discharge of the additive is not required or prior to issuance of a permit modification controlling discharge of the additive.

5. Facility Identification

The Permittee shall clearly display prior to commencement of any regulated activity and until permit coverage is properly terminated, the name of the Permittee, entire NPDES permit number, facility or site name, and other descriptive information deemed appropriate by the Permittee at an easily accessible location(s) to adequately identify the site, unless approved otherwise in writing by the Department. The Permittee shall repair or replace the sign(s) as necessary upon becoming aware that the identification is missing or is unreadable due to age, vandalism, theft, weather, or other reason.

6. Removed Substances

Solids, sludges, filter backwash, or any other pollutants or other wastes removed in the course of treatment or control of wastewaters shall be disposed of in a manner that complies with all applicable Department rules and regulations.

7. Loss or Failure of Treatment Facilities

Upon the loss or failure of any treatment facility, including but not limited to the loss or failure of the primary source of power of the treatment facility, the Permittee shall, where necessary to maintain compliance with the discharge limitations specified in Part I.A. of this Permit or any other terms or conditions of this Permit, cease, reduce, or otherwise control production and/or discharges until treatment is restored.

8. Duty to Mitigate

The Permittee shall promptly take all reasonable steps to minimize or prevent any violation of this Permit or to mitigate and minimize any adverse impact to waters resulting from noncompliance with any discharge limitation specified in Part I.A. of this Permit, including such accelerated or additional monitoring of the discharge and/or the receiving waterbody as is necessary to determine the nature and impact of the noncomplying discharge.

B. BYPASS AND UPSET

1. Bypass

a. Any bypass is prohibited except as provided in Parts II.B.1.b. and c.

b. A bypass is not prohibited if:

(1) It does not cause any applicable discharge limitation specified in Part I.A. of this Permit to be exceeded;

(2) The discharge resulting from such bypass enters the same receiving water as the discharge from the permitted outfall;

(3) It is necessary for essential maintenance of a treatment or control facility or system to assure efficient operation of such facility or system; and

(4) The Permittee monitors the discharge resulting from such bypass at a frequency, at least daily, sufficient to prove compliance with the discharge limitations specified in Part I.A. of this Permit.

c. A bypass is not prohibited and need not meet the discharge limitations specified in Part I.A. of this Permit if:

(1) It is unavoidable to prevent loss of life, personal injury, or severe property damage;

(2) There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the Permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The Permittee submits a written request for authorization to bypass to the Director at least ten (10) days, if possible, prior to the anticipated bypass or within 24 hours of an unanticipated bypass, the Permittee is granted such authorization, and Permittee complies with any conditions imposed by the Director to minimize any adverse impact to waters resulting from the bypass.

d. The Permittee has the burden of establishing that each of the conditions of Parts II.B.1.b. or c. have been met to qualify for an exception to the general prohibition against bypassing contained in Part II.B.1.a. and an exemption, where applicable, from the discharge limitations specified in Part I.A. of this Permit.

2. Upset

a. Except as provided in Parts II.B.2.b. and c., a discharge which results from an upset need not meet the applicable discharge limitations specified in Part I.A. of this Permit if:

(1) No later than 24-hours after becoming aware of the occurrence of the upset, the Permittee orally reports the occurrence and circumstances of the upset to the Director; and

(2) No later than five (5) days after becoming aware of the occurrence of the upset, the Permittee furnishes the Director with evidence, including properly signed, contemporaneous operating logs, design drawings, construction certification, maintenance records, weir flow measurements, dated photographs, rain gauge measurements, or other relevant evidence, demonstrating that:

(i) An upset occurred;

(ii) The Permittee can identify the specific cause(s) of the upset;

(iii) The Permittee's treatment facility was being properly operated at the time of the upset; and

(iv) The Permittee promptly took all reasonable steps to minimize any adverse impact to waters resulting from the upset.

b. Notwithstanding the provisions of Part II.B.2.a., a discharge which is an overflow from a treatment facility or system, or an excess discharge from a point source associated with a treatment facility or system and which results from a 24-hour precipitation event larger

than a 10-year, 24-hour precipitation event is not exempted from the discharge limitations specified in Part I.A. of this Permit unless:

(1) The treatment facility or system is designed, constructed, and maintained to contain the maximum volume of wastewater which would be generated by the facility during a 24-hour period without an increase in volume from precipitation and the maximum volume of wastewater resulting from a 10-year, 24-hour precipitation event or to treat the maximum flow associated with these volumes.

In computing the maximum volume of wastewater which would result from a 10-year, 24-hour precipitation event, the volume which would result from all areas contributing runoff to the individual treatment facility must be included (i.e., all runoff that is not diverted from the mining area and runoff which is not diverted from the preparation plant area); and

(2) The Permittee takes all reasonable steps to maintain treatment of the wastewater and minimize the amount of overflow or excess discharge.

c. The Permittee has the burden of establishing that each of the conditions of Parts II.B.2.a. and b. have been met to qualify for an exemption from the discharge limitations specified in Part I.A. of this Permit.

C. PERMIT CONDITIONS AND RESTRICTIONS

1. Prohibition against Discharge from Facilities Not Certified

a. Notwithstanding any other provisions of this Permit, if the permitted facility has not obtained or is not required to obtain a permit from the Alabama Surface Mining Commission, any discharge(s) from any point or nonpoint source(s) from the permitted facility which was not certified to the Department on a form approved by the Department by a professional engineer, registered in the State of Alabama, as being designed, constructed, and in accordance with plans and specifications reviewed by the Department is prohibited; or

b. Notwithstanding any other provisions of this Permit, if the permitted facility has obtained or is required to obtain a permit from the Alabama Surface Mining Commission, any discharge(s) from any point or nonpoint source(s) from the permitted facility which is associated with a treatment facility which was not constructed and certified to the Alabama Surface Mining Commission pursuant to applicable provisions of said Commission's regulations, is prohibited until the Permittee submits to the Alabama Surface Mining Commission, certification by a professional engineer, registered in the State of Alabama, certifying that such facility has been constructed in accordance with plans and specifications approved by the Alabama Surface Mining Commission. This requirement shall not apply to pumped discharges from the underground works of underground coal mines where no surface structure is required by the Alabama Surface Mining Commission, provided the Department is notified in writing of the completion or installation of such facilities, and the pumped discharges will meet permit effluent limits without treatment.

2. Permit Modification, Suspension, Termination, and Revocation

a. This Permit may be modified, suspended, terminated, or revoked and reissued, in whole or in part, during its term for cause, including but not limited to, the following:

(1) The violation of any term or condition of this Permit;

(2) The obtaining of this Permit by misrepresentation or the failure to disclose fully all relevant facts;

(3) The submission of materially false or inaccurate statements or information in the permit application or reports required by the Permit;

(4) The need for a change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge;

(5) The existence of any typographical or clerical errors or of any errors in the calculation of discharge limitations;

(6) The existence of material and substantial alterations or additions to the facility or activity generating wastewater which occurred after permit issuance which justify the application of permit conditions that are different or absent in the existing permit;

(7) The threat of the Permittee's discharge on human health or welfare; or

(8) Any other cause allowed by ADEM Admin. Code ch. 335-6-6.

b. The filing of a request by the Permittee for modification, suspension, termination, or revocation and reissuance of this Permit, in whole or in part, does not stay any Permit term or condition of this Permit.

3. Automatic Expiration of Permits for New or Increased Discharges

a. Except as provided by ADEM Admin. Code r. 335-6-6-.02(g) and 335-6-6-.05, if this Permit was issued for a new discharger or new source, it shall expire eighteen months after the issuance date if construction has not begun during that eighteen month period.

b. Except as provided by ADEM Admin. Code r. 335-6-6-.02(g) and 335-6-6-.05, if any portion of this Permit was issued or modified to authorize the discharge of increased quantities of pollutants to accommodate the modification of an existing facility, that portion of this Permit shall expire eighteen months after this Permit's issuance if construction of the modification has not begun within eighteen month period.

c. Construction has begun when the owner or operator has:

(1) Begun, or caused to begin as part of a continuous on-site construction program:

(i) Any placement, assembly, or installation of facilities or equipment; or

(ii) Significant site preparation work including clearing, excavation, or removal of existing buildings, structures, or facilities which is necessary for the placement, assembly, or installation of new source facilities or equipment; or

(2) Entered into a binding contractual obligation for the purpose of placement, assembly, or installation of facilities or equipment which are intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under the paragraph. The entering into a lease with the State of

Alabama for exploration and production of hydrocarbons shall also be considered beginning construction.

d. The automatic expiration of this Permit for new or increased discharges if construction has not begun within the eighteen month period after the issuance of this Permit may be tolled by administrative or judicial stay.

4. Transfer of Permit

This Permit may not be transferred or the name of the Permittee changed without notice to the Director and subsequent modification or revocation and reissuance of this Permit to identify the new Permittee and to incorporate any other changes as may be required under the FWPCA or AWPCA. In the case of a change in name, ownership, or control of the Permittee's premises only, a request for permit modification in a format acceptable to the Director is required at least 30 days prior to the change. In the case of a change in name, ownership, or control of the Permittee's premises accompanied by a change or proposed change in effluent characteristics, a complete permit application is required to be submitted to the Director at least 180 days prior to the change. Whenever the Director is notified of a change in name, ownership, or control, he may decide not to modify the existing Permit and require the submission of a new permit application.

5. Groundwater

Unless authorized on page 1 of this Permit, this Permit does not authorize any discharge to groundwater. Should a threat of groundwater contamination occur, the Director may require groundwater monitoring to properly assess the degree of the problem, and the Director may require that the Permittee undertake measures to abate any such discharge and/or contamination.

6. Property and Other Rights

This Permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to persons or property or invasion of other private rights, trespass, or any infringement of Federal, State, or local laws or regulations, nor does it authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any waters of the State or of the United States.

D. RESPONSIBILITIES

1. Duty to Comply

a. The Permittee must comply with all terms and conditions of this Permit. Any permit noncompliance constitutes a violation of the AWPCA, AEMA, and the FWPCA and is grounds for enforcement action, for permit termination, revocation and reissuance, suspension, modification, or denial of a permit renewal application.

b. The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the FWPCA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this Permit has not yet been modified to incorporate the effluent standard, prohibition or requirement.

c. For any violation(s) of this Permit, the Permittee is subject to a civil penalty as authorized by the AWPCA, the AEMA, the FWPCA, and Code of Alabama 1975, §§22-22A-1 et. seq., as amended, and/or a criminal penalty as authorized by Code of Alabama 1975, §22-22-1 et. seq., as amended.

d. The necessity to halt or reduce production or other activities in order to maintain compliance with the conditions of this Permit shall not be a defense for a Permittee in an enforcement action.

e. Nothing in this Permit shall be construed to preclude or negate the Permittee's responsibility or liability to apply for, obtain, or comply with other ADEM, federal, state, or local government permits, certifications, licenses, or other approvals.

f. The discharge of a pollutant from a source not specifically identified in the permit application for this Permit and not specifically included in the description of an outfall in this Permit is not authorized and shall constitute noncompliance with this Permit.

g. The Permittee shall take all reasonable steps, including cessation of production or other activities, to minimize or prevent any violation of this Permit or to minimize or prevent any adverse impact of any permit violation.

2. Change in Discharge

a. The Permittee shall apply for a permit modification at least 180 days in advance of any facility expansion, production increase, process change, or other action that could result in the discharge of additional pollutants, increase the quantity of a discharged pollutant, or that could result in an additional discharge point. This requirement also applies to pollutants that are not subject to discharge limitations in this Permit. No new or increased discharge may begin until the Director has authorized it by issuance of a permit modification or a reissued permit.

b. The Permittee shall notify the Director as soon as it knows or has reason to believe that it has begun or expects to begin to discharge any pollutant listed as a toxic pollutant pursuant to Section 307(a) of the FWPCA, 33 U.S.C. §1317(a), any substance designated as a hazardous substance pursuant to Section 311(b)(2) of the FWPCA, 33 U.S.C. §1321(b)(2), any waste listed as a hazardous waste pursuant to Code of Alabama 1975, §22-30-10, or any other pollutants or other wastes which is not subject to any discharge limitations specified in Part I.A. of this Permit and was not reported in the Permittee's application, was reported in the Permittee's application in concentrations or mass rates lower than that which the Permittee expects to begin to be discharged, or has reason to believe has begun to be discharged.

3. Compliance with Toxic or Other Pollutant Effluent Standard or Prohibition

If any applicable effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Sections 301(b)(2)(C),(D),(E) and (F) of the FWPCA, 33 U.S.C. §1311(b)(2)(C),(D),(E), and (F); 304(b)(2) of the FWPCA, 33 U.S.C. §1314(b)(2); or 307(a) of the FWPCA, 33 U.S.C. §1317(a), for a toxic or other pollutant discharged by the Permittee, and such standard or prohibition is more stringent than any discharge limitation on the pollutant specified in Part I.A. of this Permit or controls a pollutant not limited in Part I.A. of this Permit, this Permit shall be modified to conform to the toxic or other pollutant effluent standard or prohibition and the Permittee shall be notified of such modification. If this Permit has not been modified to conform to the toxic or other pollutant effluent standard or prohibition before the effective date of such standard or prohibition, the authorization to discharge in this Permit shall be void to the extent that any discharge limitation on such pollutant in Part I.A. of this Permit exceeds or is inconsistent with the established toxic or other pollutant effluent standard or prohibition.

4. Compliance with Water Quality Standards and Other Provisions

a. On the basis of the Permittee's application, plans, or other available information, the Department has determined that compliance with the terms and conditions of this Permit

will assure compliance with applicable water quality standards. However, this Permit does not relieve the Permittee from compliance with applicable State water quality standards established in ADEM Admin. Code ch. 335-6-10, and does not preclude the Department from taking action as appropriate to address the potential for contravention of applicable State water quality standards which could result from discharges of pollutants from the permitted facility.

b. Compliance with Permit terms and conditions notwithstanding, if the Permittee's discharge(s) from point source(s) identified on Page 1 of this Permit cause(s) or contribute(s) to a condition in contravention of State water quality standards, the Department may require abatement action to be taken by the Permittee, modify the Permit pursuant to the Department's rules and regulations, or both.

c. If the Department determines, on the basis of a notice provided pursuant to Part II.C.2. of this Permit or any investigation, inspection, or sampling, that a modification of this Permit is necessary to assure maintenance of water quality standards or compliance with other provisions of the AWPCA or FWPCA, the Department may require such modification and, in cases of emergency, the Director may prohibit the noticed act until the Permit has been modified.

5. Compliance with Statutes and Rules

a. This Permit has been issued under ADEM Admin. Code div. 335-6. All provisions of this division, that are applicable to this Permit, are hereby made a part of this Permit. A copy of this division may be obtained for a small charge from the Office of General Counsel, Alabama Department of Environmental Management, 1400 Coliseum Blvd., Montgomery, AL 36110-2059.

b. This Permit does not authorize the noncompliance with or violation of any Laws of the State of Alabama or the United States of America or any regulations or rules implementing such laws. FWPCA, 33 U.S.C. Section 1319, and Code of Alabama 1975, Section 22-22-14.

6. Right of Entry and Inspection

The Permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law to:

a. Enter upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the Permit;

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

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

d. Sample or monitor at reasonable times, for the purposes of assuring Permit compliance or as otherwise authorized by the AWPCA, any substances or parameters at any location.

7. Duty to Reapply or Notify of Intent to Cease Discharge

a. If the Permittee intends to continue to discharge beyond the expiration date of this Permit, the Permittee shall file with the Department a complete permit application for reissuance of this Permit at least 180 days prior to its expiration.

b. If the Permittee does not desire to continue the discharge(s) allowed by this Permit, the Permittee shall notify the Department at least 180 days prior to expiration of this Permit of the Permittee's intention not to request reissuance of this Permit. This notification must include the information required in Part I.D.4.a. and be signed by an individual meeting the signatory requirements for a permit application as set forth in ADEM Admin. Code r. 335-6-6-.09.

c. Failure of the Permittee to submit to the Department a complete application for reissuance of this Permit at least 180 days prior to the expiration date of this Permit will void the automatic continuation of this Permit provided by ADEM Admin. Code r. 335-6-6-.06; and should this Permit not be reissued for any reason, any discharge after the expiration of this Permit will be an unpermitted discharge.

PART III ADDITIONAL REQUIREMENTS, CONDITIONS, AND LIMITATIONS

A. CIVIL AND CRIMINAL LIABILITY

1. Tampering

Any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained or performed under this Permit shall, upon conviction, be subject to penalties and/or imprisonment as provided by the AWPCA and/or the AEMA.

2. False Statements

Any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this Permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished as provided by applicable State and Federal law.

3. Permit Enforcement

This NPDES Permit is a Permit for the purpose of the AWPCA, the AEMA, and the FWPCA, and as such all terms, conditions, or limitations of this Permit are enforceable under State and Federal law.

4. Relief From Liability

Except as provided in Part II.B.1. (Bypass) and Part II.B.2. (Upset), nothing in this Permit shall be construed to relieve the Permittee of civil or criminal liability under the AWPCA, AEMA, or FWPCA for noncompliance with any term or condition of this Permit.

B. OIL AND HAZARDOUS SUBSTANCE LIABILITY

Nothing in this Permit shall be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, or penalties to which the Permittee is or may be subject to under Section 311 of the FWPCA, 33 U.S.C. §1321.

C. AVAILABILITY OF REPORTS

Except for data determined to be confidential under Code of Alabama 1975, §22-22-9(c), all reports prepared in accordance with the terms of this Permit shall be available for public inspection at the offices of the Department. Effluent data shall not be considered confidential. Knowingly making any false statement in any such report may result in the imposition of criminal penalties as provided for in Section 309 of the FWPCA, 33 U.S.C. §1319, and Code of Alabama 1975, §22-22-14.

D. DEFINITIONS

1. Alabama Environmental Management Act (AEMA) - means Code of Alabama 1975, §§22-22A-1 et. seq., as amended.

2. Alabama Water Pollution Control Act (AWPCA) - means Code of Alabama 1975, §§22-22-1 et. seq., as amended.

3. Average monthly discharge limitation - means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar

month divided by the number of "daily discharges" measured during that month (zero discharge days shall not be included in the number of "daily discharges" measured and a less than detectable test result shall be treated as a concentration of zero if the most sensitive EPA approved method was used).

4. Arithmetic Mean - means the summation of the individual values of any set of values divided by the number of individual values.

5. Bauxitic clay - means a refractory clay containing bauxite which is mined for use as a refractory material and is not usable as an aluminum ore.

6. Bauxitic clay mine - means an area, on or beneath land, used or disturbed in activity related to the extraction, removal, or recovery of bauxitic clay from natural or artificial deposits, including active mining, reclamation, and mineral storage areas.

7. BOD - means the five-day measure of the pollutant parameter biochemical oxygen demand

8. Bypass - means the intentional diversion of waste streams from any portion of a treatment facility.

9. CBOD - means the five-day measure of the pollutant parameter carbonaceous biochemical oxygen demand.

10. Controlled Surface Mine Drainage – means any surface mine drainage that is pumped or siphoned from the active mining area.

11. Daily discharge - means the discharge of a pollutant measured during any consecutive 24-hour period in accordance with the sample type and analytical methodology specified by the discharge permit.

12. Daily maximum - means the highest value of any individual sample result obtained during a day.

13. Daily minimum - means the lowest value of any individual sample result obtained during a day.

14. Day - means any consecutive 24-hour period.

15. Department - means the Alabama Department of Environmental Management.

16. Director - means the Director of the Department or his authorized representative or designee.

17. Discharge - means "[t]he addition, introduction, leaking, spilling or emitting of any sewage, industrial waste, pollutant or other waste into waters of the state." Code of Alabama 1975, §22-22-1(b)(8).

18. Discharge monitoring report (DMR) - means the form approved by the Director to accomplish monitoring report requirements of an NPDES Permit.

19. DO - means dissolved oxygen.

20. Dry process bauxitic clay and kaolin processing plants and associated areas - means facilities engaged in crushing, screening, drying, or stockpiling of bauxitic clay or kaolin including the processing facility, plant roads, stockpiles, and any other areas associated with the facility. Facilities which use any form of wet processing or chemical treatment are excluded under this definition.

21. E. coli – means the pollutant parameter Escherichia coli.

22. 8HC - means 8-hour composite sample, including any of the following:

a. The mixing of at least 5 equal volume samples collected at constant time intervals of not more than 2 hours over a period of not less than 8 hours between the hours of 6:00 a.m. and 6:00 p.m. If the sampling period exceeds 8 hours, sampling may be conducted beyond the 6:00 a.m. to 6:00 p.m. period.

b. A sample continuously collected at a constant rate over period of not less than 8 hours between the hours of 6:00 a.m. and 6:00 p.m. If the sampling period exceeds 8 hours, sampling may be conducted beyond the 6:00 a.m. to 6:00 p.m. period.

23. EPA - means the United States Environmental Protection Agency.

24. Federal Water Pollution Control Act (FWPCA) - means 33 U.S.C. §§1251 et. seq., as amended.

25. Flow – means the total volume of discharge in a 24-hour period.

26. Geometric Mean - means the Nth root of the product of the individual values of any set of values where N is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For purposes of calculating the geometric mean, values of zero (0) shall be considered one (1).

27. Grab Sample - means a single influent or effluent portion which is not a composite sample. The sample(s) shall be collected at the period(s) most representative of the discharge.

28. Indirect Discharger - means a nondomestic discharger who discharges pollutants to a publicly owned treatment works or a privately owned treatment facility operated by another person.

29. Industrial User - means those industries identified in the Standard Industrial Classification manual, Bureau of the Budget 1967, as amended and supplemented, under the category "Division D – Manufacturing" and such other classes of significant waste producers as, by regulation, the Director deems appropriate.

30. Kaolin - means a refractory clay containing kaolinite.

31. Kaolin mine - means an area, on or beneath land, used or disturbed in activity related to the extraction, removal, or recovery of kaolin from natural or artificial deposits, including active mining, reclamation, and mineral storage areas.

32. mg/L - means milligrams per liter of discharge.

33. MGD - means million gallons per day.

34. Monthly Average - means, other than for E. coli bacteria, the arithmetic mean of all the composite or grab samples taken for the daily discharges collected in one month period. The monthly average for E. coli bacteria is the geometric mean of daily discharge samples collected in a one month period. The monthly average for flow is the arithmetic mean of all flow measurements taken in a one month period. (Zero discharges shall not be included in the calculation of monthly averages.)

35. New Discharger - means a person owning or operating any building, structure, facility or installation:

a. From which there is or may be a discharge of pollutants;

b. From which the discharge of pollutants did not commence prior to August 13, 1979, and which is not a new source; and

c. Which has never received a final effective NPDES Permit for dischargers at that site.

36. New Source - means:

a. A new source as defined for coal mines by 40 CFR Part 434.11 (1994); and

b. Any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced:

(1) After promulgation of standards of performance under Section 306 of FWPCA which are applicable to such source; or

(2) After proposal of standards of performance in accordance with Section 306 of the FWPCA which are applicable to such source, but only if the standards are promulgated in accordance with Section 206 within 120 days of their proposal.

37. NH3-N - means the pollutant parameter ammonia, measured as nitrogen.

38. 1-year, 24-hour precipitation event - means the maximum 24-hour precipitation event with a probable recurrence interval of once in one year as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed therefrom.

39. Permit application - means forms and additional information that are required by ADEM Admin. Code r. 335-6-6-.08 and applicable permit fees.

40. Point Source - means "any discernible, confined and discrete conveyance, including but not limited to any pipe, channel, ditch, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged." Section 502(14) of the FWPCA, 33 U.S.C. §1362(14).

41. Pollutant - includes for purposes of this Permit, but is not limited to, those pollutants specified in Code of Alabama 1975, §22-22-1(b)(3) and those effluent characteristics, excluding flow, specified in Part I.A. of this Permit.

42. Pollutant of Concern - means those pollutants for which a water body is listed as impaired or which contribute to the listed impairment.

43. Pollution Abatement and/or Prevention Plan (PAP Plan) – mining operations plan developed to minimize impacts on water quality to avoid a contravention of the applicable water quality standards as defined in ADEM Admin. Code r. 335-6-9-.03

44. Preparation, Dry - means a dry preparation facility within which the mineral/material is cleaned, separated, or otherwise processed without use of water or chemical additives before it is shipped to the customer or otherwise utilized. A dry preparation plant includes all ancillary operations and structures necessary to clean, separate, or otherwise process the mineral/material, such as storage areas and loading facilities. Dry preparation also includes minor water spray(s) used solely for dust suppression on equipment and roads to minimize dust emissions.

45. Preparation, Wet - means a wet preparation facility within which the mineral/material is cleaned, separated, or otherwise processed using water or chemical additives before it is shipped to the customer or otherwise utilized. A wet preparation plant includes all ancillary operations and structures necessary to clean, separate, or otherwise process the mineral/material, such as storage areas and loading facilities. Wet preparation also includes mineral extraction/processing by dredging, slurry pumping, etc.

46. Privately Owned Treatment Works - means any devices or system which is used to treat wastes from any facility whose operator is not the operator of the treatment works, and which is not a "POTW".

47. Publicly Owned Treatment Works (POTW) - means a wastewater collection and treatment facility owned by the State, municipality, regional entity composed of two or more municipalities, or another entity created by the State or local authority for the purpose of collecting and treating municipal wastewater.

48. Receiving Stream - means the "waters" receiving a "discharge" from a "point source".

49. Severe property damage - means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

50. 10-year, 24-hour precipitation event - means that amount of precipitation which occurs during the maximum 24-hour precipitation event with a probable recurrence interval of once in ten years as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed therefrom.

51. TKN - means the pollutant parameter Total Kjeldahl Nitrogen.

52. TON - means the pollutant parameter Total Organic Nitrogen.

53. TRC - means Total Residual Chlorine.

54. TSS – means the pollutant parameter Total Suspended Solids

55. Treatment facility and treatment system - means all structures which contain, convey, and as necessary, chemically or physically treat mine and/or associated preparation plant drainage, which remove pollutants limited by this Permit from such drainage or wastewater. This includes all pipes, channels, ponds, tanks, and all other equipment serving such structures.

56. 24HC - means 24-hour composite sample, including any of the following:

    a. The mixing of at least 12 equal volume samples collected at constant time intervals of not more than 2 hours over a period of 24 hours;

    b. A sample collected over a consecutive 24-hour period using an automatic sampler composite to one sample. As a minimum, samples shall be collected hourly and each shall be no more than one twenty-fourth (1/24) of the total sample volume collected; or

    c. A sample collected over a consecutive 24-hour period using an automatic composite sampler composited proportional to flow.

57. 24-hour precipitation event - means that amount of precipitation which occurs within any 24-hour period.

58. 2-year, 24-hour precipitation event - means the maximum 24-hour precipitation event with a probable recurrence interval of once in two years as defined by the National Weather Service and Technical Paper No. 40, "Rainfall Frequency Atlas of the U.S.," May 1961, or equivalent regional or rainfall probability information developed therefrom.

59. Upset - means an exceptional incident in which there is an unintentional and temporary noncompliance with technology-based permit discharge limitations because of factors beyond the control of the Permittee. An upset does not include noncompliance to the extent caused by

operational error, improperly designed treatment facilities, inadequate facilities, lack of preventive maintenance, or careless or improper operation.

60. Waters - means "[a]ll waters of any river, stream, watercourse, pond, lake, coastal, ground or surface water, wholly or partially within the State, natural or artificial. This does not include waters which are entirely confined and retained completely upon the property of a single individual, partnership, or corporation unless such waters are used in interstate commerce." Code of Alabama 1975, §22-22-1(b)(2). "Waters" include all "navigable waters" as defined in §502(7) of the FWPCA, 33 U.S.C. §1362(7), which are within the State of Alabama.

61. Week - means the period beginning at twelve midnight Saturday and ending at twelve midnight the following Saturday.

62. Weekly (7-day and calendar week) Average – is the arithmetic mean of all samples collected during a consecutive 7-day period or calendar week, whichever is applicable. The calendar week is defined as beginning on Sunday and ending on Saturday. Weekly averages shall be calculated for all calendar weeks with Saturdays in the month. If a calendar week overlaps two months (i.e., the Sunday is in one month and the Saturday in the following month), the weekly average calculated for the calendar week shall be included in the data for the month that contains the Saturday.

E. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit or the application of any 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.

F. PROHIBITIONS AND ACTIVIES NOT AUTHORIZED

1. Discharges from disposal or landfill activities as described in ADEM Admin. Code div. 335-13 are not authorized by this Permit unless specifically approved by the Department.

2. Relocation, diversion, or other alteration of a water of the State is not authorized by this Permit unless specifically approved by the Department.

3. Lime or cement manufacturing or production and discharge of process waters from such manufacturing or production is not authorized by this Permit unless specifically approved by the Department.

4. Concrete or asphalt manufacturing or production and discharge of process waters from such manufacturing or production is not authorized by this Permit unless specifically approved by the Department.

5. The discharge of wastewater, generated by any process, facility, or by any other means not under the operational control of the Permittee or not identified in the application for this Permit or not identified specifically in the description of an outfall in this Permit is not authorized by this Permit.

G. DISCHARGES TO IMPAIRED WATERS

1. This Permit does not authorize new sources or new discharges of pollutants of concern to impaired waters unless consistent with an EPA-approved or EPA-established Total Maximum Daily Load (TMDL) and applicable State law. Impaired waters are those that do not meet applicable water quality standards and are identified on the State of Alabama's §303(d) list or on an EPA-approved or EPA-established TMDL. Pollutants of concern are those pollutants for which the receiving water is listed as impaired or contribute to the listed impairment.

2. Facilities that discharge into a receiving stream which is listed on the State of Alabama's §303(d) list of impaired waters, and with discharges that contain the pollutant(s) for which the waters are impaired, must within six (6) months of the Final §303(d) list approval, document in its BMP plan how the BMPs will control the discharge of the pollutant(s) of concern, and must ensure that there will be no increase of the pollutants of concern. A monitoring plan to assess the effectiveness of the BMPs in achieving the allocations must also be included in the BMP plan.

3. If the facility discharges to impaired waters as described above, it must determine whether a TMDL has been developed and approved or established by EPA for the listed waters. If a TMDL is approved or established during this Permit cycle by EPA for any waters into which the facility discharges, the facility must review the applicable TMDL to see if it includes requirements for control of any water discharged by the Permittee. Within six (6) months of the date of TMDL approval or establishment, the facility must notify the Department on how it will modify its BMP plan to include best management practices specifically targeted to achieve the allocations prescribed by the TMDL, if necessary. Any revised BMP plans must be submitted to the Department for review. The facility must include in the BMP plan a monitoring component to assess the effectiveness of the BMPs in achieving the allocations.

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
WATER DIVISION

NPDES INDIVIDUAL PERMIT RATIONALE

Company Name:	Carbo Cermaics
Facility Name:	Carbo-Sellers Bauxite Pit
County:	Barbour County
Permit Number:	AL0082724
Prepared by:	Amber Hicks
Date:	October 5, 2021
Receiving Waters:	Unnamed Tributary to Abbie Creek
Permit Coverage:	Dry Process Bauxitic Clay Mine, Dry Preparation, Transportation and Storage, and Associated Areas
SIC Code:	1459 and 1455

The Department has made a tentative determination that the available information is adequate to support issuance of this permit.

This proposed permit covers a bauxitic clay mining pit and associated dry preparation areas.

This proposed permit authorizes treated discharges into a stream segment, other State waters, or local watershed that currently has a water quality classification of Fish and Wildlife (F&W) (ADEM Admin. Code r. 335-6-10-.09). If the requirements of the proposed permit are fully implemented, the facility will not discharge pollutants at levels that will cause or contribute to a violation of the F&W classification.

Full compliance with the proposed permit terms and conditions is expected to be protective of instream water quality and ensure consistency with applicable instream State water quality standards for the receiving stream.

The bauxitic clay mining discharge limitations for Total Suspended Solids, Total Iron as Fe, and Total Aluminum as Al are based on best professional judgement with consideration given to bauxite ore limitations established in 40 CFR Part 440.20.

The instream water quality standards for pH in streams classified as Fish and Wildlife are 6.0 – 8.5 s.u. per ADEM Admin. Code r. 335-6-10-.09. However, a daily maximum pH limit of 9.0 s.u. is occasionally allowed by the Department for precipitation driven discharges. During precipitation events, if the background stream flow is expected to be great enough to allow for adequate dilution of the discharge to maintain an in-stream pH of less than or equal to 8.5 s.u., as it is in this case, a daily maximum of 9.0 s.u. is permitted. Therefore, this Permit imposed the pH limitations of 6.0 s.u. (daily minimum) and 9.0 s.u. (daily maximum). Regardless, the discharge shall not cause the in-stream pH to deviate more than 1.0 s.u. from the normal or natural pH, nor be less than 6.0 s.u. nor greater than 8.5 s.u.

The applicant has requested, in accordance with 40 CFR Part 122.21 and their NPDES permit application, a waiver from testing for the Part A, B, and C pollutants listed in the EPA Form 2C and 2D that are not addressed in their application. They have also certified that due to the processes involved in their mining activity these pollutants are believed to be not present in the waste stream.

The Pollution Abatement/Prevention (PAP) plan for this facility has been prepared by a professional engineer (PE) registered in the State of Alabama and is designed to ensure reduction of pollutants in the waste stream to a level that, if operated properly, the discharge will not contribute to or cause a violation of applicable State water quality standards. The proposed permit terms and conditions are predicated on the basis of ensuring a reduction of pollutants in the discharge to a level that reduces the potential of contributing to or causing a violation of applicable State water quality standards.

In accordance with ADEM Admin. Code R. 335-6-3-.07 the design professional engineer, as evidenced by their seal and/or signature on the application, has accepted full responsibility for the effectiveness of the waste treatment facility to treat the permittee's effluent to meet NPDES permit limitations and requirements, and to fully comply with Alabama's water quality standards, when such treatment facilities are properly operated.

If there is a reasonable potential that a pollutant present in the treated discharges from a facility could cause or contribute to a contravention of applicable State water quality standards above numeric or narrative criteria, 40 CFR Part 122 requires the Department to establish effluent limits using calculated water quality criterion, establish effluent limits on a case-by-case basis using criteria established by EPA, or establish effluent limits based on an indicator parameter. Based on available information, potential pollutants discharged from this facility, if discharged within the concentrations allowed by this permit, would not have a reasonable potential to cause or contribute to a contravention of applicable State water quality standards.

Pursuant to ADEM Admin. Code R. 335-6-6-.12(r) this permit requires the permittee to design and implement a Spill Prevention Control and Countermeasures (SPCC) plan for all stored chemicals, fuels and/or stored pollutants that have the potential to discharge to a water of the State. This plan must meet the minimum engineering requirements as defined in 40 CFR Part 112 and must provide for secondary containment adequate to control a potential spill.

If the requirements of the proposed permit are fully implemented, there is reasonable assurance that the pollutants will not be present in the discharge at levels of concern and/or the facility will not discharge pollutants at levels that will cause or contribute to a violation of applicable State water quality standards in the receiving water.

The applicant is not proposing discharges of pollutants to a water of the State with an approved Total Maximum Daily Load (TMDL).

The applicant is proposing discharges into an Unnamed Tributary to Abbie Creek, a segment or other State Water that is not included on Alabama's current CWA §303(d) list. However, Abbie Creek is on the §303(d) list for pathogens. If the requirements of the proposed permit and pollution abatement plan are fully implemented, there is reasonable assurance that the facility will not discharge pollutants at levels that will cause or contribute to any further impairment of Abbie Creek.

The applicant is proposing continuation of existing discharges of pollutant(s) to an ADEM identified Tier I water. If the requirements of the proposed permit and pollution abatement plan are fully implemented, there is reasonable assurance that the facility will not discharge pollutants at levels that will cause or contribute to a violation of applicable State water quality standards in the Tier I water.

The proposed permit action authorizes new or increased discharges of pollutant(s) to receiving waters determined by the Department to be waters where the quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water (Tier II). Pursuant to ADEM Admin. Code r. 335-6-10 (Antidegradation Policy and Implementation of the Antidegradation Policy), the applicant has submitted and the Department has reviewed/considered information regarding (1) demonstration of necessity/importance, (2) alternatives analysis, and (3) if required, calculation(s) of total annualized costs for technically feasible treatment alternatives regarding the proposed new or increased discharges to Tier II waters. The Department has determined, based on the applicant's demonstration, that the proposed new or increased discharges to the Tier II waters are necessary for important economic or social development in the area in which the waters are located.

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
WATER DIVISION

ANTIDEGRADATION RATIONALE

Company Name: Carbo Ceramics, Inc.

Facility Name: Carbo-Sellers Bauxite Pit

County: Henry

Permit Number: AL0082724

Prepared by: Amber Hicks

Date: October 5, 2021

Receiving Waters: Unnamed Tributary to Abbie Creek

Stream Category: Tier II as defined by ADEM Admin. Code 335-6-10-.12

Discharge Description: Dry Process Bauxitic Clay Mine, Dry Preparation, Transportation and Storage, and Associated Areas

The following preliminary determination was prepared in accordance with ADEM Admin. Code 335-6-10-.12(7)(c):

The Department has reviewed the information submitted by applicant in accordance with ADEM Admin. Code 335-6-10-.12(9). The applicant has demonstrated that there are no technically or economically viable treatment options in its alternatives analysis that would completely eliminate a direct discharge.

The permit applicant has indicated that the following economic and social benefits will result from this project:

1. The Permittee will not hire workers for this facility. Contractors will be transferred from a current site to this site to work.

2. The Permittee states that the employment of local contractors who mine and haul the minerals will be maintained.

3. The Permittee will allow for the closure of a known environmental and possible health hazard by supplying materials for the closure.

The Department has determined that the discharge proposed by the permit applicant is necessary for important economic and social development in the area of the outfall location in the receiving water.

Reviewed By: Catherine McNeill

Date: 10-5-21

S: 148031
P: 201089.1
F: 58062.2

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT (ADEM)
NPDES INDIVIDUAL PERMIT APPLICATION (MINING OPERATIONS)

Instructions: This form should be used to submit an application for an NPDES individual permit to authorize discharges from surface & underground mineral, ore, or mineral product mining, quarrying, excavation, borrowing, hydraulic mining, storage, processing, preparation, recovery, handling, loading, storing, or disposing activities, and associated areas including pre-mining site development, construction, excavation, clearing, disturbance, and reclamation. Please complete all questions. Respond with "N/A" as appropriate. Incomplete or incorrect answers or missing signatures will delay processing. Attach additional comments or information as needed. If space is insufficient, continue on an attached sheet(s) as necessary. Commencement of activities applied for as detailed in this application are not authorized until permit coverage has been issued by the Department. Please type or print legibly in blue or black ink.

R#21-53294 $5,280.00
R# 21-53446 $ 540.00

Purpose of this Application

- ☐ Initial Permit Application for New Facility
- ☐ Initial Permit Application for Existing Facility (*e.g.*, facility previously permitted less than 5 acres)
- ☐ Modification of Existing Permit
- ☒ Reissuance of Existing Permit
- ☐ Reissuance & Modification Existing Permit
- ☐ Reissuance & Transfer of Existing Permit
- ☐ Revocation and Reissuance of Existing Permit
- ☐ Other _____

I. GENERAL INFORMATION

RECEIVED
JUN 17 2021
STORM WATER MANAGEMENT BRANCH

NPDES Permit Number (Not applicable if initial permit application):	County(s) in which Facility is Located:
AL 0082724	HENRY

Company/Permittee and Facility Information

Company/Permittee Name			Facility Name		
CARBO CERAMICS, INC.			CARBO-SELLERS BAUXITE PIT		
Mailing Address of Company/Permittee:			Physical Address of Operation (as near as possible to main entrance):		
36 ARCH DRIVE			AL HWY 95 @ COUNTY ROAD 204		
City	State	Zip Code	City	State	Zip
EUFAULA	AL	36027	ABBEVILLE	AL	36310
Permittee Phone Number	Permittee Fax Number:		Latitude and Longitude of Main Entrance:		
(334) 687-7005	(334) 687-6136		LAT: 31.652050 LON: -85.218271		

Responsible Official (RO) Information

RO Name (as described on Page 12 of this application):			RO Official Title:		
JIM BEVILL			LANDS & MINES MANAGER		
Mailing Address:			Physical Address:		
36 ARCH DRIVE			36 ARCH DRIVE		
City	State	Zip Code	City	State	Zip Code
EUFAULA	AL	36027	EUFAULA	AL	36027
Phone Number:	Fax Number:		Email Address:		
(334) 687-7005	(334) 687-6136		James.Bevill@carboceramics.com		

Facility Contact Information

Facility Contact Name:			Facility Contact Title:	
JIM BEVILL			LANDS & MINES MANAGER	
Physical Address:			Phone Number:	Fax Number:
36 ARCH DRIVE			(334) 687-7005	(334) 687-6136
City	State	Zip Code	Email Address:	
EUFAULA	AL	36027	James.Bevill@carboceramics.com	

II. MEMBER INFORMATION

A. Identify the name, title/position, and unless waived in writing by the Department, the resident address of every officer (a PO Box is not acceptable), general partner, LLP partner, LLC member, investor, director, or person performing a function similar to a director, of the applicant, and each person who is the record or beneficial owner of 10 percent or more of any class of voting stock of the applicant, or any other responsible official(s) of the applicant with legal or decision making responsibility or authority for the facility:

Name	Title/Position	Physical Address of Residence
SHANNON NELSON	VP OF OPERATIONS	5050 WESTWAY PARK BLVD, SUITE 150, HOUSTON, TX 77041

B. Other than the "Company/Permittee" listed in Part I, identify the name of each corporation, partnership, association, and single proprietorship for which any individual identified in Part II.A. is or was an officer, general partner, LLP partner, LLC member, investor, director, or individual performing a function similar to a director, or principal (10% or more) stockholder, that had an Alabama NPDES permit at any time during the five year (60 month) period immediately preceding the date on which this form is signed:

Name of Corporation, Partnership, Association, or Single Proprietorship	Name of Individual from Part II.A	Title/Position in Corporation, Partnership, Association, or Single Proprietorship
NONE		

III. LEGAL STRUCTURE OF APPLICANT

A. Indicate the legal structure of the "Company/Permittee" listed in Part I:

☒ Corporation ☐ Association ☐ Individual ☐ Single Proprietorship ☐ Partnership ☐ LLP ☐ LLC

☐ Government Agency _____ ☐ Other _____

B. If not an individual, single proprietorship, or government agency, is the "Company/Permittee" listed in Part I. properly registered and in good standing with the Alabama Secretary of State's office. **(If the answer is "No," attach a letter of explanation.)** ☒ Yes ☐ No

C. Parent Corporation and Subsidiary Corporations of Applicant, if any:

NONE

D. Landowner(s):

CARBO CERAMICS, INC. - 36 ARCH DRIVE, EUFAULA, AL 36027

E. Sub-contractor(s)/Operator(s), if known:

NONE KNOWN

IV. COMPLIANCE HISTORY

A. Has the applicant ever had any of the following:

Yes	No		
☐	☒	(1)	An Alabama NPDES, SID, or UIC permit suspended or terminated?
☐	☒	(2)	An Alabama or federal environmental permit suspended/terminated?
☐	☒	(3)	An Alabama State Oil & Gas Board permit or other approval suspended or terminated?
☐	☒	(4)	An Alabama or federal performance/environmental bond, or similar security deposited in lieu of a bond, or portion thereof, forfeited?

(If the response to any item of Part IV.A. is "Yes," attach a letter of explanation.)

B. Identify every Warning Letter, Notice of Violation (NOV), Administrative Action, or litigation issued to the applicant, parent corporation, subsidiary, general partner, LLP partner, or LLC Member and filed by ADEM or EPA during the three year (36 month) period preceding the date on which this form is signed. Indicate the date of issuance, briefly describe alleged violations, list actions (if any) to abate alleged violations, and indicate date of final resolution:

NOTICE OF VIOLATION - 2/23/21 - AL0082724 - FAILURE TO RENEW
NOTICE OF VIOLATION - 2/23/21 - AL0082716 - FAILURE TO RENEW
NOTICE OF VIOLATION - 2/23/21 - AL0082783 - FAILURE TO RENEW

V. OTHER PERMITS/AUTHORIZATIONS

A. List any other NPDES, State Oil & Gas Board (OGB) Class II Injection well permits, or other environmental permits (including permit numbers), authorizations, or certifications that have been applied for or issued within the State by ADEM, EPA, Alabama Surface Mining Commission (ASMC), Alabama Department of Labor (ADOL), or other agency, to the applicant, parent corporation, subsidiary, or LLC member for this operation whether presently effective, expired, suspended, revoked or terminated:

ADIR PERMIT 15092

B. List any other NPDES or other ADEM permits (including permit numbers), authorizations, or certifications that have been applied for or issued within the State by ADEM, EPA, OGB, ASMC, or ADOL to the applicant, parent corporation, subsidiary, or LLC member for other facilities whether presently effective, expired, suspended, revoked, or terminated:

AL0082643 ALG230028 AL0082104 AL0082171 AL0082546 AL0082724 AL0082783 AL0083411 AL0082716

VI. PROPOSED SCHEDULE

Anticipated Activity Commencement Date: 6/1/2016 Anticipated Activity Completion Date: 6/1/2025

VII. ACTIVITY DESCRIPTION & INFORMATION

A. Proposed Total Area of the Permitted Site: 493 acres Proposed Total Disturbed Area of the Permitted Site: 35 acres

B. Township(s), Range(s), Section(s): T-8-N, R-28-E, SEC. 22

C. Detailed Directions to Site:

From intersection of US Hwy 431 and Ala. Hwy 95, go South on Ala. Hwy 95 11.8 miles. The entrance is on the left.

D. Is/will this operation:

Yes	No	
☒	☐	(1) an existing facility which currently results in discharges to State waters?
☐	☒	(2) a proposed facility which will result in a discharge to State waters?
☐	☒	(3) be located within any 100-year flood plain?
☐	☒	(4) discharge to Municipal Separate Storm Sewer?
☐	☒	(5) discharge to waters of or be located in the Coastal Zone?
☐	☒	(6) need/have ADEM UIC permit coverage?
☐	☒	(7) be located on Indian/historically significant lands?
☐	☒	(8) need/have ADEM SID permit coverage?
☐	☒	(9) need/have ASMC permit coverage?
☒	☐	(10) need/have ADOL permit coverage?
☐	☒	(11) generate, treat, store, or dispose of hazardous or toxic waste? (If "Yes," attach a detailed explanation.)
☐	☒	(12) be located in or discharge to a Public Water Supply (PWS) watershed or be located within ½ mile of any PWS well?

VIII. MATERIAL TO BE REMOVED, PROCESSED, OR TRANSLOADED

List relative percentages of the mineral(s) or mineral product(s) that are proposed to be and/or are currently mined, quarried, recovered, prepared, processed, handled, transloaded, or disposed at the facility. **If more than one mineral is to be mined, list the relative percentages of each mineral by tonnage for the life of the mine.**

	Dirt &/or Chert		Sand &/or Gravel		Coal product, coke		Talc		Crushed rock (other)
	Bentonite		Industrial Sand		Shale &/or Common Clay		Marble		Sandstone
	Coal		Kaolin		Coal fines/refuse recovery		Chalk		Slag, Red Rock
	Fire clay		Iron ore		Dimension stone		Granite		Phosphate rock
100	Bauxitic Clay		Bauxite Ore		Limestone, crushed limestone and dolomite				
	Gold, other trace minerals:				Other:				
	Other:				Other:				
	Other:				Other:				

IX. PROPOSED ACTIVITY TO BE CONDUCTED

A. Type(s) of activity presently conducted at applicant's existing facility or proposed to be conducted at facility (check all that apply):

☒ Surface mining	☐ Underground mining	☒ Quarrying	☐ Auger mining	☐ Hydraulic mining
☐ Within-bank mining	☐ Solution mining	☒ Mineral storing	☐ Lime production	☐ Cement production
☐ Synthetic fuel production	☐ Alternative fuels operation	☐ Mineral dry processing (crushing & screening)		☐ Mineral wet preparation
☐ Other beneficiation & manufacturing operations		☒ Mineral loading		☐ Chemical processing or leaching
☒ Grading, clearing, grubbing, *etc.*		☐ Pre-construction ponded water removal		☒ Excavation
☒ Pre-mining logging or land clearing		☐ Waterbody relocation or other alteration		☐ Creek/stream crossings
☒ Construction related temporary borrow pits/areas		☐ Mineral transportation: ☐ rail ☐ barge ☐ truck		
☐ Preparation plant waste recovery		☐ Hydraulic mining, dredging, instream or between stream-bank mining		
☐ Onsite construction debris or equipment storage/disposal		☐ Onsite mining debris or equipment storage/disposal		
☐ Reclamation of disturbed areas		☐ Chemicals used in process or wastewater treatment (coagulant, biocide, etc.)		
☐ Adjacent/associated asphalt/concrete plant(s)		☐ Low volume sewage treatment package plant		
☐ Other (Please describe):				

B. Primary SIC Code: 1400 NAICS Code: _____ Description: MINING & QUAR. OF NONMETALLIC MIN.

Secondary SIC Code: _____ NAICS Code: _____ Description: _____

C. Narrative Description of the Activity:
PROPOSED PIT IS MINED FOR BAUXITE CLAY

X. FUEL – CHEMICAL HANDLING, STORAGE & SPILL PREVENTION CONTROL & COUNTERMEASURES (SPCC) PLAN

A. Will fuels, chemicals, compounds, or liquid waste be used or stored onsite? ☐ Yes ☒ No

B. If "Yes," identify the fuel, chemicals, compounds, or liquid waste and indicate the volume of each:

Volume (*gallons*)	Contents	Volume (*gallons*)	Contents	Volume (*gallons*)	Contents

C. If "Yes", a detailed SPCC Plan with acceptable format and content, including diagrams, must be attached to application in accordance with ADEM Admin. Code R. 335-6-6-.12(r). Unless waived in writing by the Department on a programmatic, categorical, or individual compound/chemical basis, Material Safety Data Sheets (MSDS) for chemicals/compounds used or proposed to be used at the facility must be included in the SPCC Plan submittal.

XI. POLLUTION ABATEMENT & PREVENTION (PAP) PLAN

A. For non-coal mining facilities, a PAP Plan in accordance with ADEM Admin. Code r. 335-6-9-.03 has been completed and is attached as part of this application. ☒ Yes ☐ No

B. For coal mining facilities, a detailed PAP Plan has been submitted to ASMC according to submittal procedures for ASMC regulated facilities. ☐ Yes ☐ No

(1) If "Yes" to Part XI.B., provide the date that the PAP Plan was submitted to ASMC: _____

(2) If "No" to Part XI.B., provide the anticipated date that the PAP Plan will be submitted to ASMC: _____

XII. ASMC REGULATED ENTITIES

A. Is this coal mining operation regulated by ASMC? ☐ Yes ☒ No

B. If "Yes," provide copies as part of this application of any pre-mining hydrologic sampling reports and Hydrologic Monitoring Reports which have been submitted to ASMC within the 36 months prior to submittal of this application.

XIII. TOPOGRAPHIC MAP SUBMITTAL

Attach to this application a 7.5 minute series U.S.G.S. topographic map(s) or equivalent map(s) no larger than, or folded to a size of 8.5 by 11 inches (several pages may be necessary), of the area extending to at least one mile beyond property boundaries. The topographic or equivalent map(s) must include a caption indicating the name of the topographic map, name of the applicant, facility name, county, and township, range, & section(s) where the facility are located. Unless approved in advance by the Department, the topographic or equivalent map(s), at a minimum, must show:

(a) An accurate outline of the area to be covered by the permit

(b) An outline of the facility

(c) All existing and proposed disturbed areas

(d) Location of intake and discharge areas

(e) Proposed and existing discharge points

(f) Perennial, intermittent, and ephemeral streams

(g) Lakes, springs, water wells, wetlands

(h) All known facility dirt/improved access/haul roads

(i) All surrounding unimproved/improved roads

(j) High-tension power lines and railroad tracks

(l) Contour lines, township-range-section lines

(m) Drainage patterns, swales, washes

(n) All drainage conveyance/treatment structures (ditches, berms, etc.)

(o) Any other pertinent or significant feature

XIV. DETAILED FACILITY MAP SUBMITTAL

Attach to this application a 1:500 scale or better, detailed auto-CAD map(s) or equivalent map(s) no larger than, or folded to a size of 8.5 by 11 inches (several pages may be necessary), of the facility. The facility map(s) must include a caption indicating the name of the facility, name of the applicant, facility name, county, and township, range, & section(s) where the facility is located. Unless approved in advance by the Department, the facility or equivalent map(s), at a minimum, must show:

(a) Information listed in Item XIII (a) – (o) above

(b) If noncoal, detailed, planned mining progression

(c) If noncoal, location of topsoil storage areas

(d) Location of ASMC bonded increments (if applicable)

(e) Location of mining or pond cleanout waste storage/disposal areas

(f) Other information relevant to facility or operation

(g) Location of facility sign showing Permittee name, facility name, and NPDES Number

XV. RECEIVING WATERS

List the requested permit action for each outfall (issue, reissue, add, delete, move, *etc.*); outfall designation including denoting "E" for existing and "P" for proposed outfalls; name of receiving water(s); latitude and longitude (to seconds) of location(s) of each discharge point; distance of receiving water from the discharge point; number of disturbed acres; the number of drainage acres which will drain through each outfall; and if the outfall discharges to an ADEM listed CWA Section 303(d) waterbody segment or is included in a TMDL at the time of application submittal.

Action	Outfall E/P	Receiving Water	Latitude	Longitude	Distance to Rec. Water (ft)	Disturbed Area (acres)	Drainage Area (acres)	ADEM WUC	303(d) Segment (Y/N)	TMDL Segment* (Y/N)
Reissue	E	UT to Abbie Creek	31d39'14"N	- 85d13'13" W	300	13	13	F&W	N	N
Reissue	E	UT to Abbie Creek	31d38'46"N	- 85d12'56" W	150	13	13	F&W	N	N
Reissue	E	UT to Abbie Creek	31d39'20"N	- 85d12'24" W	450	5	5	F&W	N	N
				-						
				-						
				-						
				-						
				-						

*If a TMDL Compliance Schedule is requested, the following should be attached as supporting documentation: (1) Justification for the requested Compliance Schedule (*e.g.*, time for design and installation of control equipment); (2) Monitoring results for the pollutant(s) of concern which have not previously been submitted to the Department including sample collection dates, analytical results in mass and concentration, methods utilized, and RL and MDL; (3) Requested interim limitations, if applicable; (4) Date of final compliance with the TMDL limitations; and (5) Any other additional information available to support the requested compliance schedule.

XVI. DISCHARGE CHARACTERIZATION

A. EPA Form 2C, EPA Form 2D, and/or ADEM Form 567 Submittal

☒ Yes, pursuant to 40 CFR 122.21, the applicant requests a waiver for completion of EPA Form 2C, EPA Form 2D, and ADEM Form 567 and certifies that the operating facility will discharge treated stormwater only; that chemical/compound additives are not used (unless waived in writing by the Department on a programmatic, categorical, or individual compound/chemical basis); that there are no process, manufacturing, or other industrial operations or wastewaters, including but not limited to lime or cement production and synfuel operations; and that coal and coal products are not mined nor stored onsite.

☐ No, the applicant does not request a waiver and a complete EPA Form 2C, EPA Form 2D, and/or ADEM Form 567 is attached.

B. The applicant is required to supply the following information separately for every proposed or existing outfall. (Attach extra sheets if necessary.) List expected average daily discharge flow rate in cfs and gpd; frequency of discharge in hours per day and days per month; average summer and winter temperature of discharge(s) in degrees centigrade; average pH in standard units; and average daily discharges in pounds per day of BOD_5, Total Suspended Solids, Total Iron, Total Manganese, and Total Aluminum (if bauxite or bauxitic clay or if otherwise believed present):

Outfall E/P	Information Source - # of Samples	Flow (cfs)	Flow (gpd)	Frequency (hours/day)	Frequency (days/month)	Sum/Win Temp, (°C)	pH (s.u.)	BOD_5 (lbs/day)	TSS (lbs/day)	Tot Fe (lbs/day)	Tot Mn (lbs/day)	Tot Al (lbs/day)
001E	1	4.51	1.05	Precip. Driven	Precip. Driven	26	8	5	50	0	0	0.5
002E	1	4.93	1.00	Precip. Driven	Precip. Driven	26	8	5	50	0	0	0.5
003E	1	7.38	0.16	Precip. Driven	Precip. Driven	26	8	5	50	0	0	0.5

C. The applicant is required to supply the following information separately for every proposed or existing outfall. (Attach extra sheets if necessary.) Identify and list expected average daily discharge of any other pollutant(s) listed in EPA Form 2C Tables A, B, C, D, and E that are not referenced in Part XVI.B. or otherwise submitted elsewhere, that you know is present or have reason to believe could be present in the discharge(s) at levels of concern:

Outfall E/P	Reason Believed Present	Information Source - # of Samples								
			lbs/day	mg/L	lbs/day	mg/L	lbs/day	mg/L	lbs/day	mg/L
N/A										

XVII. DISCHARGE STRUCTURE DESCRIPTION & POLLUTANT SOURCE

The applicant is required to supply outfall number(s) as it appears on the map(s) required by this application [if this application is for a modification to an existing permit do not change the numbering sequence of the permitted outfalls], describe each, (*e.g.*, pipe, spillway, channel, tunnel, conduit, well, discrete fissure, or container), and identify the origin of pollutants. The response must be precise for each outfall. If the discharge of pollutants from any outfall is the result of commingling of waste streams from different origins, each origin must be completely described.

Outfall	Discharge structure Description	Description of Origin of pollutants	Surface Discharge	Groundwater Discharge	Wet Prep -Other Production Plant	Pumped or Controlled Discharge	Low Volume STP
001E	Plastic Pipe	6 & 9	X	X	N/A	N/A	N/A
002E	Plastic Pipe	6 & 9	X	X	N/A	N/A	N/A
003E	Concrete Pipe	6 & 9	X	X	N/A	N/A	N/A

Origin of Pollutants – typical examples: **(1)** Discharge of drainage from the underground workings of an underground coal mine, **(2)** Discharge of drainage from a coal surface mine, **(3)** Discharge of drainage from a coal preparation plant and associated areas, **(4)** Discharge of process wastewater from a gravel-washing plant, **(5)** Discharge of wastewater from an existing source coal preparation plant, **(6)** Discharge of drainage from a sand and gravel pit, **(7)** Pumped discharge from a limestone quarry, **(8)** Controlled surface mine drainage (pumped or siphoned), **(9)** Discharge of drainage from mine reclamation, **(10) Other** (please describe):

XVIII. COOLING WATER

A. Does your facility use cooling water? ☐ Yes ☒ No

B. If "Yes," identify the source of the cooling water: N/A

XIX. VARIANCE REQUEST

A. Do you intend to request or renew one or more of the CWA technology variances authorized at 40 CFR 122.21(m)? ☐ Yes ☒ No

B. If "Yes," select all that apply:

☐ Fundamentally different factors (CWA Section 301(n))

☐ Water quality related effluent limitations (CWA Section 302(b)(2))

☐ Non-conventional pollutants (CWA Section 301(c) and (g))

☐ Thermal discharges (CWA Section 316(a))

XX. PROPOSED NEW OR INCREASED DISCHARGES

A. Pursuant to ADEM Admin. Code ch. 335-6-10-.12(9), responses to the following questions must be provided by the applicant requesting NPDES permit coverage for new or expanded discharges of pollutant(s) to Tier 2 waters (except discharges eligible for coverage under general permits). As part of the permit application review process, the Department is required to consider, based on the applicant's demonstration, whether the proposed new or increased discharge to Tier 2 waters is necessary for important economic or social development in the area in which the waters are located.

☐ Yes. New/increased discharges of pollutant(s) or discharge locations to Tier 2 waters are proposed.

☒ No. New/increased discharges of pollutants(s) or discharge locations to Tier 2 waters are not proposed.

B. If "Yes," complete Items 1 through 6 of this Part (XIII.B.), ADEM Form 311-Alternative Analysis, and either ADEM Form 312 or ADEM Form 313-Calculation of Total Annualized Project Costs (Public-Section or Private-Sector, whichever is applicable). ADEM Form 312 or ADEM Form 313, whichever is applicable, should be completed for each technically feasible alternative evaluated on ADEM Form 311. ADEM Forms can be found on the Department's website at www.adem.alabama.gov/DeptForms. **Attach additional sheets/documentation and supporting information as needed.**

(1) What environmental or public health problem will the discharge be correcting?

(2) How much will the discharger be increasing employment (at its existing facility or as a result of locating a new facility)?

(3) How much reduction in employment will the discharger be avoiding?

(4) How much additional state or local taxes will the discharger be paying?

(5) What public service to the community will the discharger be providing?

(6) What economic or social benefit will the discharger be providing to the community?

XXI. POLLUTION ABATEMENT & PREVENTION (PAP) PLAN SUMMARY (must be completed for all outfalls)

Yes	No	N/A	Outfall(s): 001E, 002E, 003E
☒	☐	☐	1. Runoff from all areas of disturbance is controlled
☒	☐	☐	2. Drainage from pit area, stockpiles, and spoil areas directed to a sedimentation pond
☒	☐	☐	3. Sedimentation basin at least 0.25 acre/feet for every acre of disturbed drainage
☒	☐	☐	4. Sedimentation basin cleaned out when sediment accumulation is 60% of design capacity
☒	☐	☐	5. Trees, boulders, and other obstructions removed from pond during initial construction
☒	☐	☐	6. Width of top of dam greater than 12'
☒	☐	☐	7. Side slopes of dam no steeper than 3:1
☒	☐	☐	8. Cutoff trench at least 8' wide
☒	☐	☐	9. Side slopes of cutoff trench no less than 1:1
☒	☐	☐	10. Cutoff trench located along the centerline of the dam
☒	☐	☐	11. Cutoff trench extends at least 2' into bedrock or impervious soil
☒	☐	☐	12. Cutoff trench filled with impervious material
☒	☐	☐	13. Embankments and cutoff trench 95% compaction standard proctor ASTM
☒	☐	☐	14. Embankment free of roots, tree debris, stones >6" diameter, etc.
☒	☐	☐	15. Embankment constructed in lifts no greater than 12"
☒	☐	☐	16. Spillpipe sized to carry peak flow from a one year storm event
☒	☐	☐	17. Spillpipe will not chemically react with effluent
☒	☐	☐	18. Subsurface withdrawal
☒	☐	☐	19. Anti-seep collars extend radially at least 2' from each joint in spillpipe
☒	☐	☐	20. Splashpad at the end of the spillpipe
☒	☐	☐	21. Emergency Spillway sized for peak flow from 25-yr 24-hr event if discharge not into PWS classified stream
☐	☐	☒	22. Emergency spillway sized for peak flow from 50-yr 24-hr event if discharge is into PWS classified stream
☒	☐	☐	23. Emergency overflow at least 20' long
☒	☐	☐	24. Side slopes of emergency spillway no steeper than 2:1
☒	☐	☐	25. Emergency spillway lined with riprap or concrete
☒	☐	☐	26. Minimum of 1.5' of freeboard between normal overflow and emergency overflow
☒	☐	☐	27. Minimum of 1.5' of freeboard between max. design flow of emergency spillway and top of dam
☒	☐	☐	28. All emergency overflows are sized to handle entire drainage area for ponds in series
☒	☐	☐	29. Dam stabilized with permanent vegetation
☒	☐	☐	30. Sustained grade of haul road <10%
☒	☐	☐	31. Maximum grade of haul road <15% for no more than 300'
☒	☐	☐	32. Outer slopes of haul road no steeper than 2:1
☒	☐	☐	33. Outer slopes of haul road vegetated or otherwise stabilized
☐	☐	☒	34. Detail drawings supplied for all stream crossings
☒	☐	☐	35. Short-Term Stabilization/Grading And Temporary Vegetative Cover Plans
☒	☐	☐	36. Long-Term Stabilization/Grading And Permanent Reclamation or Water Quality Remediation Plans

IDENTIFY AND PROVIDE DETAILED EXPLANATION FOR ANY "N" OR "N/A" RESPONSE(s):

Surface runoff does not discharge into a PWS.
There are no new stream crossings proposed for this project.

XXII. POLLUTION ABATEMENT & PREVENTION (PAP) PLAN REVIEW CHECKLIST

Yes	No	N/A	
			General Information:
☒	☐	☐	PE Seal with License #
☒	☐	☐	Name and Address of Operator
☒	☐	☐	Legal Description of Facility
☒	☐	☐	Name of Company
☒	☐	☐	Number of Employees
☒	☐	☐	Products to be Mined
☒	☐	☐	Hours of Operation
☒	☐	☐	Water Supply and Disposition
			Maps:
☒	☐	☐	Topographic Map including Information from Part XIII (a) – (o) of this Application
☒	☐	☐	1" – 500' or Equivalent Facility Map including Information from Part XIV of this Application
			Detailed Design Diagrams:
☒	☐	☐	Plan Views
☒	☐	☐	Cross-section Views
☒	☐	☐	Method of Diverting Runoff to Treatment Basins
☒	☐	☐	Line Drawing of Water Flow through Facility with Water Balance or Pictorial Description of Water Flow
			Narrative of Operations:
☒	☐	☐	Raw Materials Defined
☒	☐	☐	Processes Defined
☒	☐	☐	Products Defined
			Schematic Diagram:
☒	☐	☐	Points of Waste Origin
☒	☐	☐	Collection System
☒	☐	☐	Disposal System
			Post Treatment Quantity and Quality of Effluent:
☒	☐	☐	Flow
☒	☐	☐	Suspended Solids
☒	☐	☐	Iron Concentration
☒	☐	☐	pH
			Description of Waste Treatment Facility:
☐	☐	☒	Pre-Treatment Measures
☐	☐	☒	Recovery System
☒	☐	☐	Expected Life of Treatment Basin
☒	☐	☐	Measures for Ensuring Access to All Treatment Structures and Related Appurtenances including Outfall Locations
☒	☐	☐	Schedule of Cleaning and/or Abandonment
			Other:
☒	☐	☐	Precipitation/Volume Calculations/Diagram Attached
☒	☐	☐	BMP Plan for Haul Roads
☒	☐	☐	Measures for Minimizing Impacts to Adjacent Stream (*e.g.*, Buffer Strips, Berms)
☒	☐	☐	Measures for Ensuring Appropriate Setbacks are Maintained at All Times
☒	☐	☐	Methods for Minimizing Nonpoint Source Discharges
☒	☐	☐	If Chemical Treatment Used, Methods for Ensuring Appropriate Dosage
☒	☐	☐	Facility Closure Plans
☐	☐	☒	PE Rationale(s) For Alternate Standards, Designs or Plans

IDENTIFY AND PROVIDE DETAILED EXPLANATION FOR ANY "N" OR "N/A" RESPONSE(s):

No proposed pre-treatment process.
No proposed recovery system.
No alternatives applied.

XXIII. INFORMATION

Contact the Department prior to submittal with any questions or to request acceptable alternate content/format.
Be advised that you are not authorized to commence regulated activity until this application can be processed, publicly noticed, and approval to proceed is received in writing from the Department.

EPA Form(s) 1 and 2F need not be submitted unless specifically required by the Department. EPA Form(s) 2C and/or 2D are required to be submitted unless the applicant is eligible for a waiver and the Department grants a waiver, or unless the relevant information required by EPA Form(s) 2C and/or 2D are submitted to the Department in an alternative format acceptable to the Department.

Planned/proposed mining sites that are greater than 5 acres, that mine/process coal or metallic mineral/ore, or that have wet or chemical processing, must apply for and obtain coverage under an Individual or General NPDES Permit prior to commencement of any land disturbance. Such Individual NPDES Permit coverage may be requested via this ADEM Form 315.

The applicant is advised to contact:

(1) The Alabama Surface Mining Commission (ASMC) if coal, coal fines, coal refuse, or other coal related materials are mined, transloaded, processed, *etc.*;
(2) The Alabama Department of Labor (ADOL) if conducting non-coal mining operations;
(3) The Alabama Historical Commission for requirements related to any potential historic or culturally significant sites;
(4) The Alabama Department of Conservation and Natural Resources (ADCNR) for requirements related to potential presence of threatened/endangered species; and
(5) The US Army Corps of Engineers, Mobile or Nashville Districts, if this project could cause fill to be placed in federal waters or could interfere with navigation.

The Department must be in receipt of a completed version of this form, including any supporting documentation, and the appropriate processing fee [including Greenfield Fee and Biomonitoring & Toxicity Limits fee(s), if applicable], prior to development of a draft NPDES permit. The completed form, supporting documentation, and the appropriate fees must be submitted to:

Water Division
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463
Phone: (334) 271-7823
Fax: (334) 279-3051
h2omail@adem.alabama.gov
adem.alabama.gov

XXIV. PROFESSIONAL ENGINEER (PE) CERTIFICATION

A detailed, comprehensive Pollution Abatement & Prevention (PAP) Plan must be prepared, signed, and certified by a professional engineer (PE), registered in the State of Alabama, and the PE must certify as follows:

"I certify on behalf of the applicant, that I have completed an evaluation of discharge alternatives (Item XVIII) for any proposed new or increased discharges of pollutant(s) to Tier 2 waters and reached the conclusions indicated. I certify under penalty of law that technical information and data contained in this application, and a comprehensive PAP Plan including any attached SPCC plan, maps, engineering designs, etc. acceptable to ADEM, for the prevention and minimization of all sources of pollution in stormwater and authorized related process wastewater runoff has been prepared under my supervision for this facility utilizing effective, good engineering and pollution control practices and in accordance with the provisions of ADEM Admin. Code Division 335-6 , including Chapter 335-6-9 and Appendices A & B. If the PAP Plan is properly implemented and maintained by the Permittee, discharges of pollutants can reasonably be expected to be effectively minimized to the maximum extent practicable and according to permit discharge limitations and other permit requirements. The applicant has been advised that appropriate pollution abatement/prevention facilities and structural & nonstructural management practices or Department approved equivalent management practices as detailed in the PAP Plan must be fully implemented and regularly maintained as needed at the facility in accordance with good sediment, erosion, and other pollution control practices, permit requirements, and other ADEM requirements to ensure protection of groundwater and surface water quality."

Name (type or print):	Christopher M. Rogers	PE Registration #	30447
Title:	Engineering Manager	Phone Number	(334) 297-2423
Address:	706 12th Street, Phenix City, AL 36867		
Signature:		Date Signed	4/22/21

XXV. RESPONSIBLE OFFICIAL SIGNATURE*

This application must be signed and initialed by a Responsible Official of the applicant pursuant to ADEM Admin. Code Rule 335-6-6-.09 who has overall responsibility for the operation of the facility.

"I certify under penalty of law that this document, including technical information and data, the PAP Plan, including any SPCC plan, maps, engineering designs, and all other attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the PE and other person or persons under my supervision who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine or imprisonment for knowing violations. SN *(initial here)*

"A comprehensive PAP Plan to prevent and minimize discharges of pollution to the maximum extent practicable has been prepared at my direction by a PE for this facility utilizing effective, good engineering and pollution control practices and in accordance with the provisions of ADEM Admin. Code Division 335-6, including Chapter 335-6-9 and Appendices A & B, and information contained in this application, including any attachments. I understand that regular inspections must be performed by, or under the direct supervision of, a PE and all appropriate pollution abatement/prevention facilities and structural & nonstructural management practices or Department approved equivalent management practices identified by the PE must be fully implemented prior to and concurrent with commencement of regulated activities and regularly maintained as needed at the facility in accordance with good sediment, erosion, and other pollution control practices and ADEM requirements. I understand that the PAP Plan must be fully implemented and regularly maintained so that discharges of pollutants can reasonably be expected to be effectively minimized to the maximum extent practicable and according to permit discharge limitations and other requirements to ensure protection of groundwater and surface water quality. I understand that failure to fully implement and regularly maintain required management practices for the protection of groundwater and surface water quality may subject the Permittee to appropriate enforcement action. SN *(initial here)*

"I certify that this form has not been altered, and if copied or reproduced, is consistent in format and identical in content to the ADEM approved form. SN *(initial here)*

"I further certify that the discharges described in this application have been tested or evaluated for the presence of non-stormwater discharges and any non-mining associated beneficiation/process pollutants and wastewaters have been fully identified." SN *(initial here)*

"I acknowledge my understanding that if coal, coal fines, coal refuse, or other coal related materials are mined, transloaded, processed, etc., that I may be required to obtain a permit from the ASMC. SN *(initial here)*

"I acknowledge my understanding that if non-coal, non-limestone materials are mined, transloaded, processed, etc., that I may be required to obtain a permit from the ADOL. SN *(initial here)*

"I acknowledge my understanding that if the proposed activities will be conducted in or potentially impact waters of the state or waters of the US (including wetlands), that I may be required to obtain a permit from the USACE." SN *(initial here)*

Name (type or print): Shannon Nelson Official Title: VP Manufacturing

Signature: Shannon Nelson Date Signed 6-8-21

*335-6-6-.09 Signatories to Permit Applications and Reports.

(1) The application for an NPDES permit shall be signed by a responsible official, as indicated below:

(a) In the case of a corporation, by a principal executive officer of at least the level of vice president, or a manager assigned or delegated in accordance with corporate procedures, with such delegation submitted in writing if required by the Department, who is responsible for manufacturing, production, or operating facilities and is authorized to make management decisions which govern the operation of the regulated facility;

(b) In the case of a partnership, by a general partner;

(c) In the case of a sole proprietorship, by the proprietor; or

(d) In the case of a municipal, state, federal, or other public entity by either a principal executive officer, or ranking elected official.

POLLUTION ABATEMENT/PREVENTION (PAP) PLAN

FOR

CARBO-SELLERS BAUXITE PIT

OF

CARBO CERAMICS, INC.

September 10, 2014
Updated: April 22, 2021

BARRETT-SIMPSON, INC.
706 12TH STREET
Phenix City, AL 36867
(334) 297-2423

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APPENDIX G – RAINFALL DATA

I. INTRODUCTION:

This Pollution Abatement/Prevention (PAP) plan is a required part of an application for a NPDES Permit. The Carbo-Sellers Bauxite Pit, will be located in Section 22, T-8-N, R-28-E, Henry County, Alabama. This application is being prepared in accordance with the rules and regulations of the Alabama Department of Environmental Management (ADEM). A thorough field review of the proposed site has been conducted prior to the compilation and submittal of this plan. The existing conditions and geology of the proposed site has been evaluated to determine the potential for bauxite mining, to calculate runoff coefficients, and determine the sediment control measures required.

The PAP plan is presented in two parts, which includes a narrative description of the operation and treatment requirements, drainage maps, design plans, and discharge calculations. The narrative description is intended to address the format as outlined by the ADEM Admin. Code R. 335-6-9, as well as present the basis for the designs as further detailed in the PAP Plan. Drawings as presented in the PAP Plan were derived from rules and regulations of the ADEM Admin. Code R. 335-6-9, Appendix "A" and Appendix "B", as well as from other generally accepted design data sources primarily from the U.S. Department of Agriculture's Natural Resource Conservation Service.

II. OPERATOR

The operator of this pit is CARBO Ceramics, Inc. Their business address is:

36 Arch Drive
Eufaula, AL 36027

The proposed pit will lie within a property owned by Carbo Ceramics.

III. GENERAL INFORMATION

This facility will operate five days a week from 9:00 a.m. to 5:00 p.m., and will employ approximately three people. The product to be mined is bauxite clay. There will be no mining or processing of coal.

IV. TOPOGRAPHIC MAP

A site drainage map indicating topography, areas of excavation, proposed mineral stockpile areas, proposed topsoil stockpile areas, drainage diversionary structures, treatment ponds, and discharge points is provided as part of this plan.

V. METHOD OF DIVERTING SURFACE WATER RUNOFF

The site drainage map shows topography and all diversionary structures. The treatment pond is located using natural topography to minimize the construction of diversionary structures. Drainage from all spoil, stockpile areas, excavation areas, loading areas, equipment storage areas, and any other areas of disturbance related to the mining site will be directed to a permitted treatment structure prior to discharging. Any minor areas of disturbance that drainage cannot feasibly be routed to a treatment pond will be graded and will be vegetated with annual and perennial grasses and will have effective Best Management Practices (BMP's) for the control of non-point source pollution fully implemented and maintained at all times.

VI. RAW MATERIALS, PROCESSES AND PRODUCTS

The material that will be mined is bauxite clay. There will be no washing or screening of any of the raw materials at this site.

VII. SCHEMATIC DIAGRAM

A schematic diagram showing each process that creates wastewater, the wastewater collection system has been provided as part of this PAP plan.

VIII. POST TREATMENT QUANTITY AND QUALITY OF EFFLUENT

Runoff calculations have been provided as part of this plan to determine flow and to size the discharge structures. The treatment ponds have been designed to allow adequate settling times for the expected particles sizes to reduce suspended solids concentrations to meet effluent limits. The treatment ponds are designed to provide adequate oxidation for the removal of iron and other metals to a concentration within the permit requirements. The pH of the effluent will be between 6.0 su and 8.5 su or as allowed by the permit.

IX. WASTE TREATMENT FACILITIES

The primary method of treatment for the removal of expected pollutants will be settling. The proposed sediment ponds have adequate capacity to detain all surface runoff for a 24-hour 25-year storm event. The sediment ponds will allow sedimentation to ensure that silt does not leave the site. All aspects of the proposed sediment pond shall be in accordance with the requirements of the PAP Plan checklist.

The sediment ponds at a minimum will provide 0.25 acre-feet of storage for every acre of disturbed land draining to the pond. All trees, brush, boulders, and other objects that would impair compaction will be removed from the pond prior to construction. The

minimum width at the top of the dam will be at least 12 feet. The side slopes of the dam will be no steeper than 3:1. At least 80% coverage of annual and perennial grasses will be established on the embankments of the dam. A cutoff trench will be constructed along the center of the dam and will extend at least 2 feet into the bedrock. The cutoff trench will be at least 8 feet wide, the side slopes will no less than 1:1, and it will be filled with impervious material compacted to 95% compaction standard proctor ASTM. The dam will also be compacted 95% compaction standard proctor ASTM. The embankments will be constructed in lifts less than 12 inches.

The spill-pipe is sized to carry peak flow from the 25-year, 24 hour storm event, and are constructed of material that will not chemically react with the effluent. Anti-seep collars will extend radially at least 2 feet from each joint in the spill-pipes. A splash pad constructed of riprap will be installed at the discharge pipe to prevent erosion from the discharge.

The dam will be equipped with an emergency spillway sized for the peak flow from 100-year, 24-hour storm event. The emergency overflow will be at least 20 feet long, lined with riprap, and the side slopes will be no steeper than 2:1. There will be at least 1.5 feet of freeboard between the normal overflow and the emergency overflow, and there will be at least 1.5 feet of freeboard between the maximum design flow of the emergency spillway and the top of the dam.

The treatment pond shall be maintained until mining has ceased, the site has been completely reclaimed, and the operator has received written permission from ADEM to remove the treatment ponds. Accumulated sediments/sludge in the treatment ponds will be removed when the ponds have lost 60% of their liquid storage capacity due to sedimentation.

X. SEDIMENT CONTROL FOR HAUL ROADS

The access and haul roads will have a sustained grade of no greater than 10%, with a maximum grade no greater 15% for 300 feet. The outer slope will be no steeper than 2:1 and will maintain 80% coverage of annual and perennial grasses. Effective BMP's will be installed and maintained at all times. The roads will be crowned and properly ditched. Also, water bars and wing ditches will be installed where appropriate. Typical designs for these structures are included as part of this plan. There will be no stream crossing at this facility. If it becomes necessary to construct a stream crossing the certified design plans will be submitted to ADEM for their review.

XI. LOCATION OF ALL STREAMS ADJACENT TO MINING AREA

The topographic map submitted as part of this plan shows all water bodies. The mining operation will provide a 50-foot minimum buffer zone around streams. If a buffer zone cannot be maintained ADEM will be contacted regarding construction of a designed berm to protect the stream. There will be no new stream crossings for this permit.

XII. NON-POINT SOURCE POLLUTION

By virtue of the fact that all disturbed areas are graded such that the drainage will carry sediment to the ponds, non-point sources of pollution are not expected for this project.

XIII. PUBLIC WATER SUPPLY IMPOUNDMENT

This facility will not discharge to a stream segment classified as a Public Water Supply.

XIV. SPILL PREVENTION CONTROL & COUNTERMEASURES PLAN

Fuel will not be stored on-site; therefore, a SPCC plan has not been developed.

XV. RUNOFF CALCULATIONS

Runoff calculations where calculated for the sediment basin on the site. All numbers are based on a 25-year, 24-hour storm event and calculated using the Modified Rational Method. All variables and conclusions can be seen in the table below:

Pond #	*Area, ac*	*Length, ft*	*Slope, %*	*Tc, min*	*Flow, cfs*	*Req'd Storage, cu. ft.*
003P	*4.0*	*450*	*6*	*8*	*20.61*	*21,663*

Pond #1
Required Stormwater Storage: 21,663 cubic feet
Available Stormwater Storage: 45,344 cubic feet

Two additional sediment ponds exist on the property and shall be utilized for outfalls 001E and 002E. Adequate capacity has been provided as detailed within the Design Data portion at the end of this report.

XVI. RECLAMATION PROCEDURE

As mining is completed in an area, the area shall be dressed to eliminate any piles of dirt, or low areas which will hold water, with terraces to keep erosion to a minimum, and grassed. A sump shall be maintained at the low end of all reclamation work until a satisfactory stand of grass is obtained.

During construction and reclamation, erosion control measures such as hay bales, riprap, cleared trees, and other acceptable methods will be utilized as needed to minimize erosion.

XVII. BMP TYPICALS (attached)

Pipe and Spillway Detail
Typical section for Constructed Dam
Swale Detail
Outlet Protection Detail
Flow Schematic

XVIII. CHEMICALS/COMPOUNDS AND POTENTIAL TOXICITY SOURCES

No chemicals/compounds shall be used on this project which would contaminate any of the existing creeks.

XIX. EPA FORM 2D and/or EPA FORM 2C

EPA Form 2C & 2D were not completed because only stormwater runoff will be discharged from the proposed facility.

XX. COPY OF ASMC REQUIRED WATER QUALITY RELATED DATA AND INFORMATION

No information pertaining to the ASMC is attached or included because this project is only for non-coal mining operations. ASMC regulates coal mining operations.

CERTIFICATION

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

Prepared by:

Christopher M. Rogers, PE #30447
Barrett-Simpson, Inc.

Date

XXI. DESIGN DATA

001E

DISTURBED AREA = 13.0 AC. X 1/4 AC. FT/AC. =
THEREFORE: 3.25 AC. FT. POND REQ'D (141,570 CUBIC FEET)

DRAINAGE AREA – 13.0 AC.
THIS IS AN EXISTING SEDIMENT POND WITH AN EXISTING OUTFALL PIPE AND EMERGENCY SPILLWAY.

POND VOLUME REQUIRED: 3.25 AC. FT.
POND VOLUME PROVIDED: 9.00 AC. FT.

002E

DISTURBED AREA = 13.0 AC. X 1/4 AC. FT/AC. =
THEREFORE: 3.25 AC. FT. POND REQ'D (141,570 CUBIC FEET)

DRAINAGE AREA – 13.0 AC.

THIS IS AN EXISTING SEDIMENT POND WITH AN EXISTING OUTFALL PIPE AND EMERGENCY SPILLWAY.

POND VOLUME REQUIRED: 3.25 AC. FT.
POND VOLUME PROVIDED: 7.47 AC. FT.

003P

DISTURBED AREA = 4.0 AC. X 1/4 AC. FT/AC. =
THEREFORE: 1.00 AC. FT. POND REQ'D (43,560 CUBIC FEET)

DRAINAGE AREA – 4.0 AC.
THEREFORE, REQ'D: 1 - 18" PIPE
1 - 10' x 1.5' SPILLWAY

POND VOLUME REQUIRED: 1.00 AC. FT.
POND VOLUME PROVIDED: 1.04 AC. FT.

APPENDIX A

CONSTRUCTION DETAILS

BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors
706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4287, FAX 334-687-8829)

PROJECT: Sellers – Bauxite Pit
SHEET TITLE: Berm & Diversion Detail
LOCATION: Henry County, AL
TOPOGRAPHIC MAP: Ft. Gaines, Ala.
SCALE: None
DATE: September 10, 2014

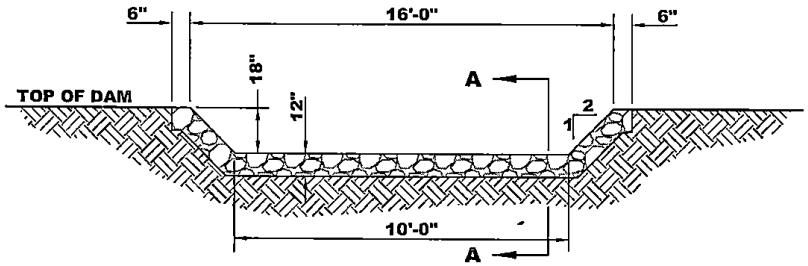
Note:
All slopes for the proposed berm and diversion ditches shall be seeded and mulched.

Interior and exterior slopes of sediment pond shall be seeded and mulched.

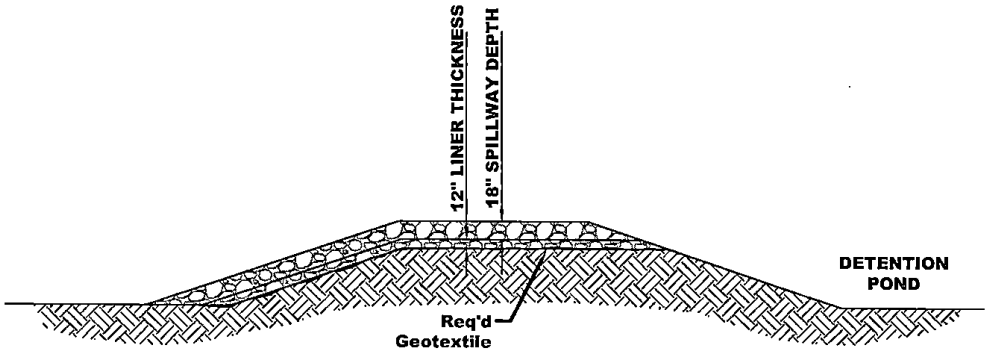
PROFILE VIEW - SECTION "A-A"

NOTES:

1. **Spillway bottom slope shall not exceed 3%.**
2. **All rip-rap shall be Class I.**
3. **Spillway Detail is applicable to Pond 1 & Pond 2.**
4. **Rip-rap shall extend to the bottom of the pond dam.**



PLAN VIEW



SECTION A-A

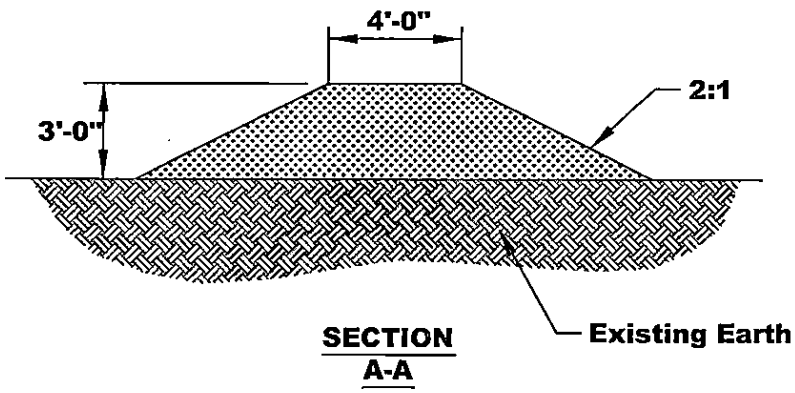
EMERGENCY SPILLWAY DETAIL

NOT TO SCALE

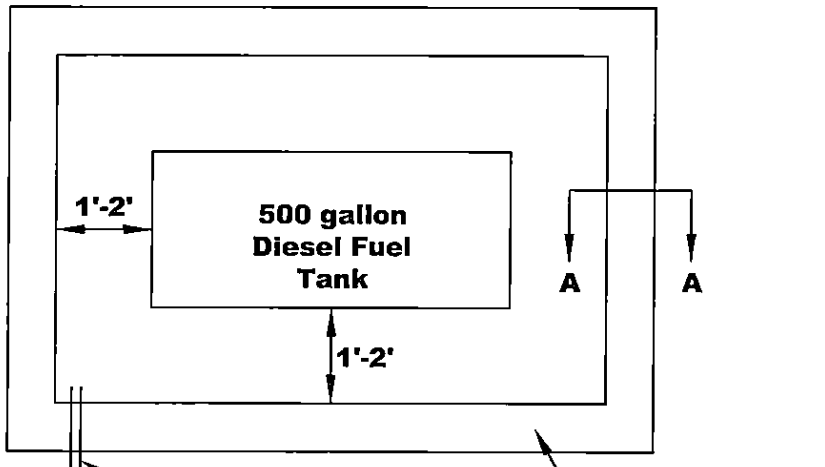
BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors

706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4357)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-3829)

PROJECT: Sellers – Bauxite Pit
SHEET TITLE: Emergency Spillway Detail
LOCATION: Henry County, AL
TOPOGRAPHIC MAP: Ft. Gaines, Ala.
SCALE: None
DATE: September 10, 2014



SECTION A-A



PLAN VIEW

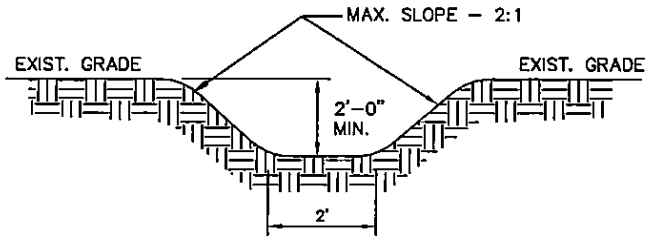
CONTAINMENT BASIN FOR 500–GAL DIESEL FUEL TANK

NOT TO SCALE

BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors

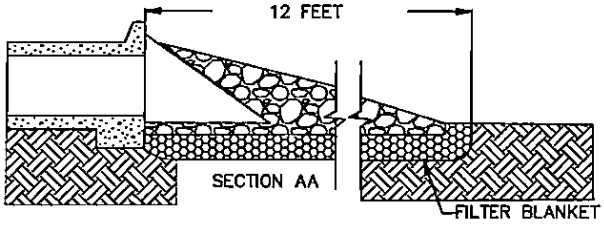
706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

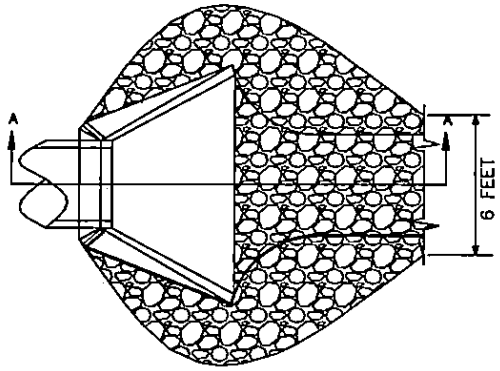
PROJECT:	Sellers – Bauxite Pit
SHEET TITLE:	Fuel Containment Diagram
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	None
DATE:	September 10, 2014

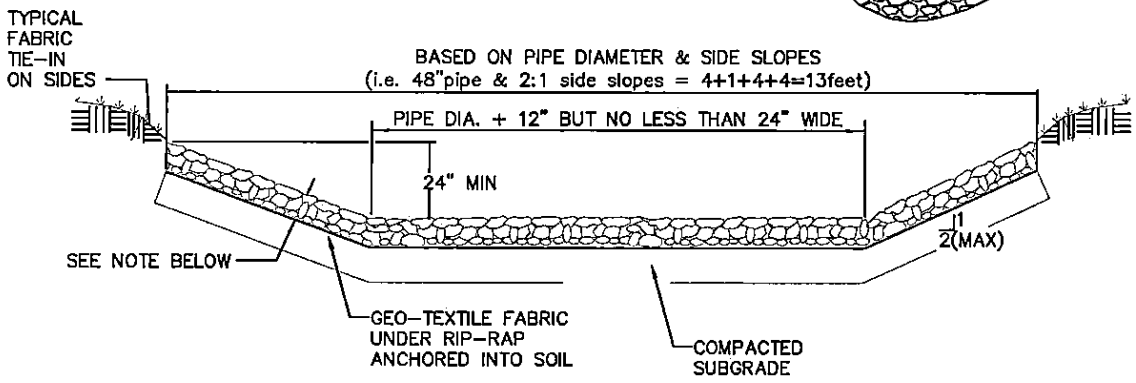


GRASSED SWALE & DIVERSION CHANNEL DETAIL

NOT TO SCALE







NOTES:

1. STONE SIZE SHALL BE AN AVERAGE SIZE OF 9". APRON THICKNESS SHALL BE A MINIMUM OF 15 INCHES.

INSTALLATION INSTRUCTIONS

1. Excavate trench area by depth required for outlet.
2. Get excavation work inspected and approved engineer.
3. Install geo-textile fabric and tie into soil as required using trenches and/or staples.
4. Get fabric installation approved by engineer.
5. Install riprap in size and quantities as indicated on Sheet EC-4.

OUTLET PROTECTION DETAIL

NOT TO SCALE

BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors

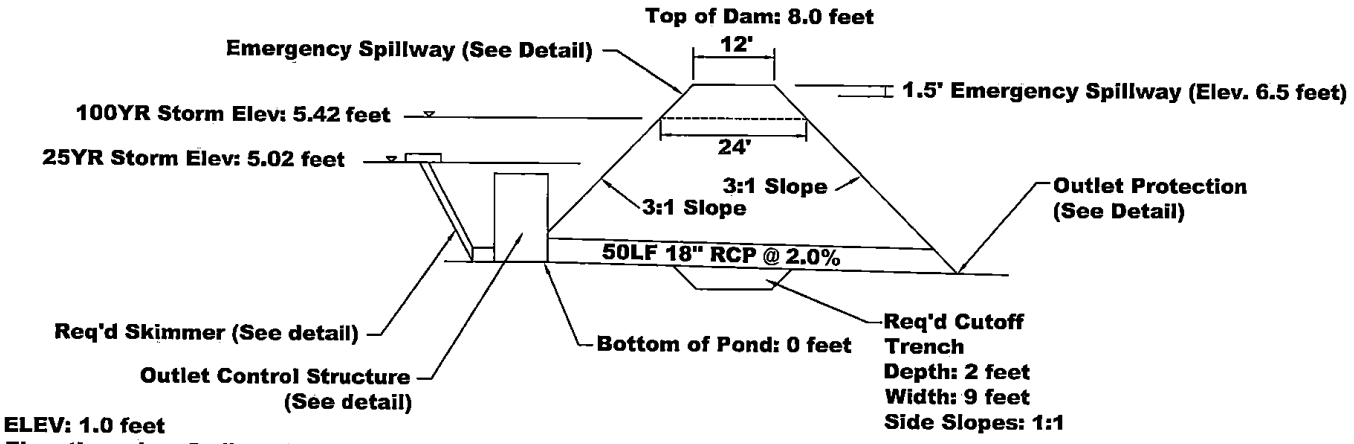
706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

APPLICANT:	Eufaula Pulpwood Company, Inc.
FACILITY NAME:	Sellers – Bauxite Pit
Section/Township/Range:	Sec. 22, T–8–N, R–28–E
SHEET TITLE:	Misc. Erosion Control Details
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	N/A
DATE:	September 10, 2014

BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors
706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

NOTES:

1. **Dam shall be constructed of a well compacted clay material.**
2. **Bottom slope of pond shall not exceed 10%.**
3. **Pond dam & cutoff trench shall be compacted to 95% Standard Proctor ASTM.**
4. **Embankment shall be free of roots, tree debris, stones >6", etc.**
5. **Embankment shall be constructed in lifts no greater than 12".**
6. **All portions of sediment pond and dam shall be seeded and mulched so that permanent vegetation is obtained.**
7. **Clean sediment out at elevation shown during construction.**
8. **An anti-seep collar that be installed to extend at least 24" from the side of the drain pipe.**



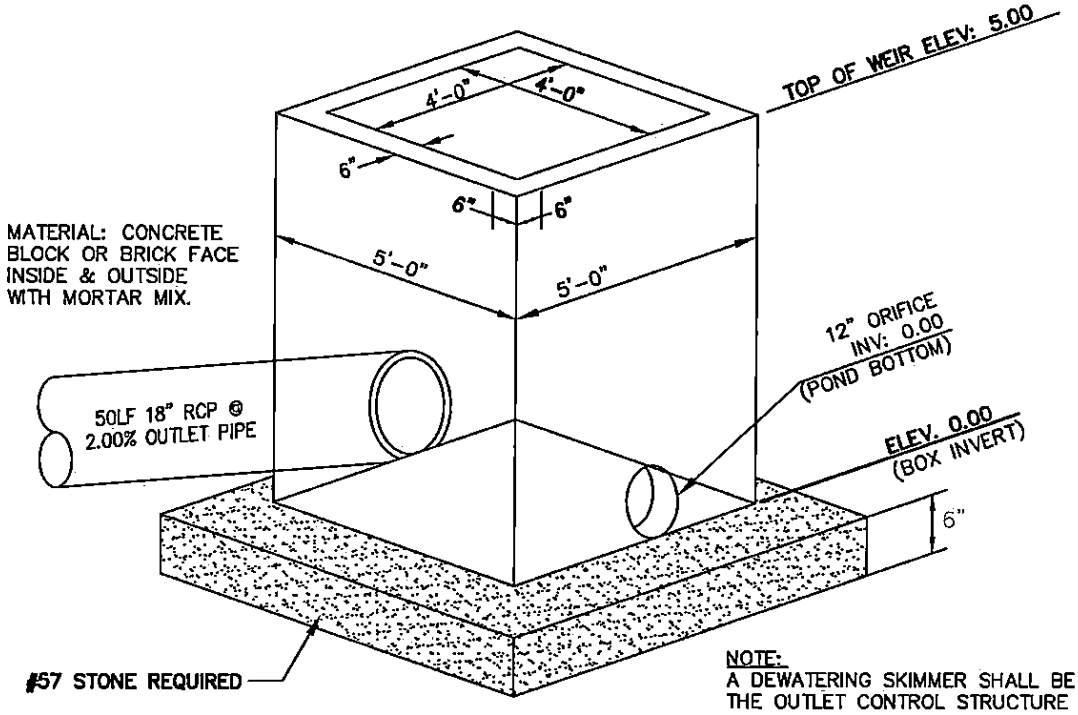
POND 1 DETAIL

NOT TO SCALE

NOTE:
THE POND SHALL BE 50'x50' AT THE BOTTOM AND 8.0 FEET DEEP TO OBTAIN THE VOLUME SHOWN.

THIS DETAIL PERTAINS TO THE SEDIMENT POND FOR THE MATERIAL STORAGE

PROJECT: Sellers – Bauxite Pit
SHEET TITLE: Pond – Dam Detail
LOCATION: Henry County, AL
TOPOGRAPHIC MAP: Ft. Gaines, Ala.
SCALE: None
DATE: September 10, 2014



NOTE:
A DEWATERING SKIMMER SHALL BE INSTALLED ON THE OUTLET CONTROL STRUCTURE AS DETAILED IN THE "TEMPORARY SEDIMENT BASIN" DETAILS CONTAINED WITHIN THE PAP PLAN.

SEDIMENT POND OUTLET CONTROL STRUCTURE DETAIL

NOT TO SCALE

THIS DETAIL PERTAINS TO THE SEDIMENT POND FOR THE MATERIAL STORAGE

BARRETT-SIMPSON, INC.

Civil *Engineers and Land Surveyors*

706 12th STREET, PHENIX CITY, AL 36868
(PH 334-297-2423, FAX 334-297-2449)

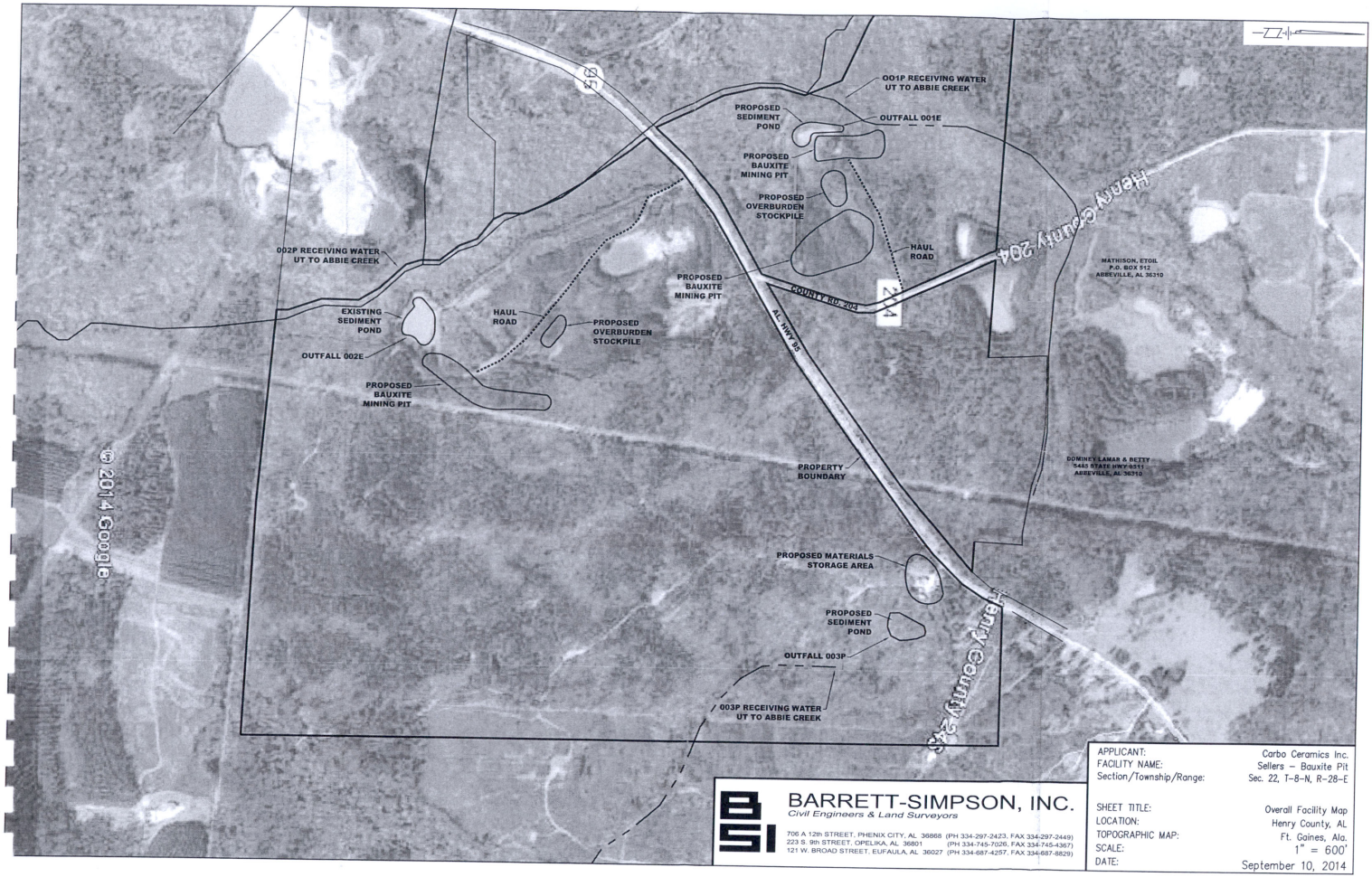
223 S. 9th STREET, OPELIKA, AL 36801
(PH 334-745-7026, FAX 334-745-4367)

121 W. BROAD STREET, EUFAULA, AL 36027
(PH 334-687-4257, FAX 334-687-8829)

APPLICANT:	Eufaula Pulpwood Company, Inc.
FACILITY NAME:	Sellers – Bauxite Pit
Section/Township/Range:	Sec. 22, T-8-N, R-28-E
SHEET TITLE:	Sediment Pond – OCS Detail
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	N/A
DATE:	September 10, 2014

APPENDIX B

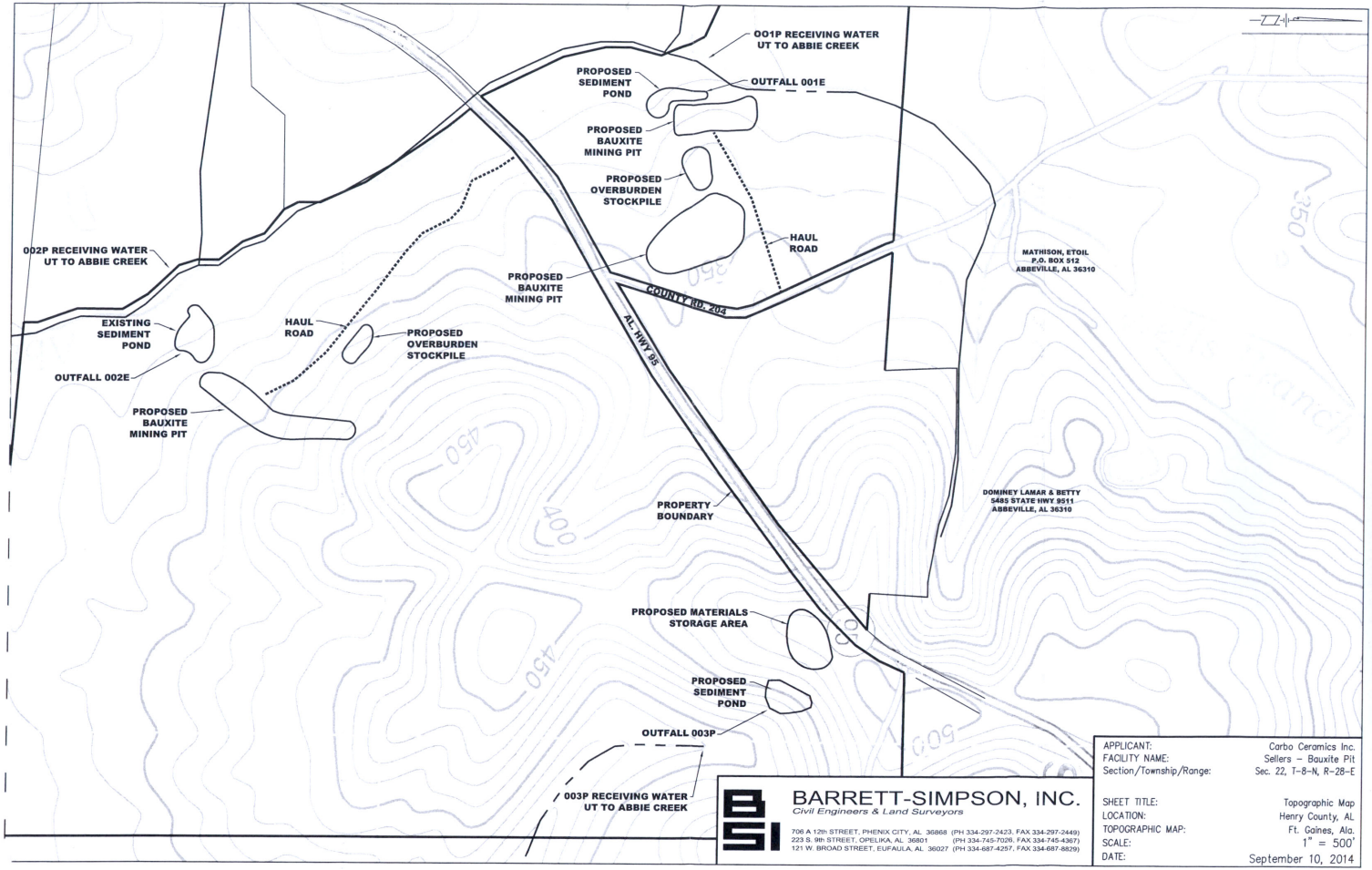
SITE LAYOUT & SURFACE WATER FLOW DIAGRAM



BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors

706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

APPLICANT:	Carbo Ceramics Inc.
FACILITY NAME:	Sellers – Bauxite Pit
Section/Township/Range:	Sec. 22, T-8-N, R-28-E
SHEET TITLE:	Overall Facility Map
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	1" = 600'
DATE:	September 10, 2014

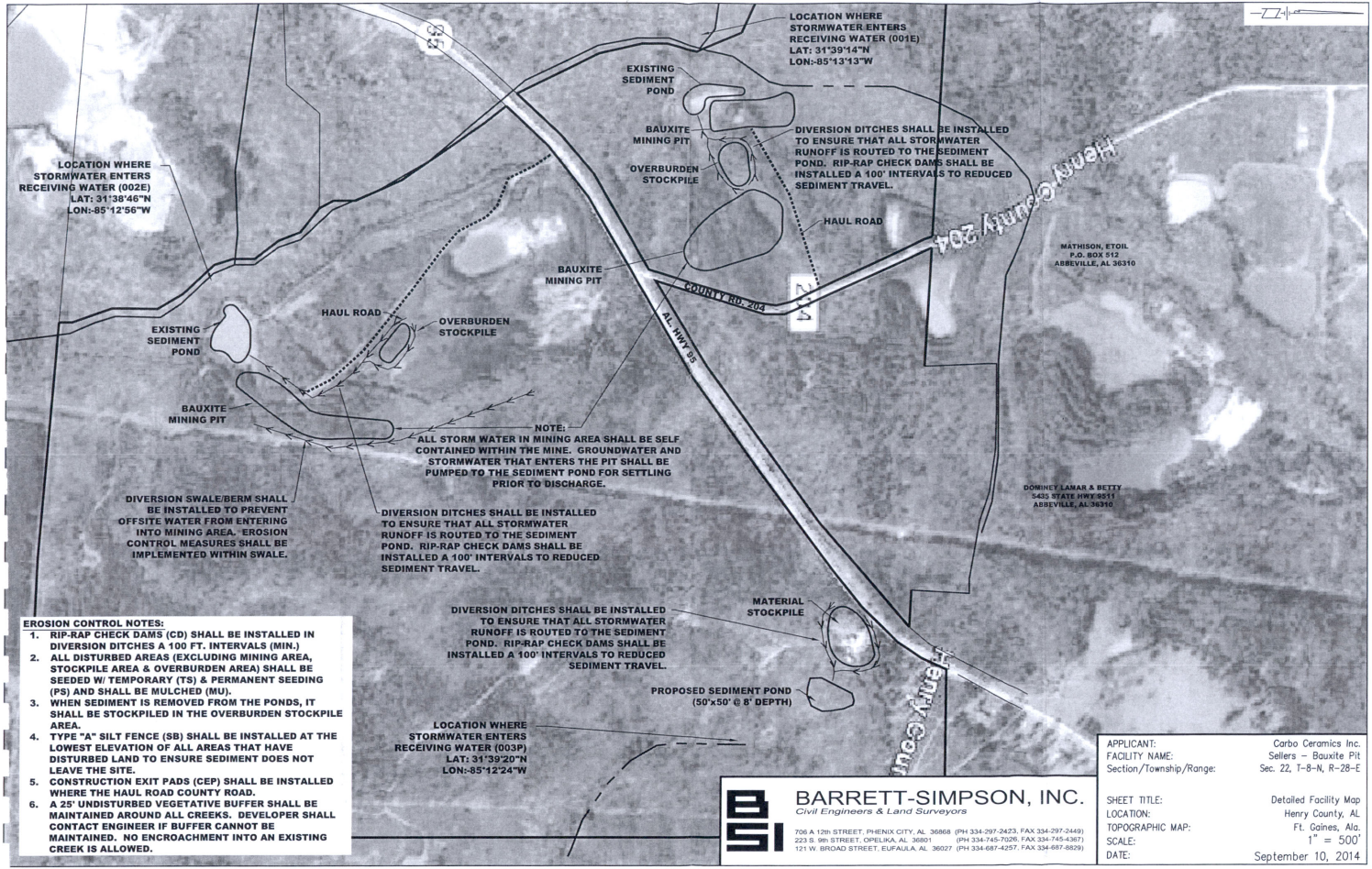


BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors
706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

APPLICANT:	Carbo Ceramics Inc.
FACILITY NAME:	Sellers – Bauxite Pit
Section/Township/Range:	Sec. 22, T-8-N, R-28-E
SHEET TITLE:	Topographic Map
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	1" = 500'
DATE:	September 10, 2014

APPENDIX C

DETAILED FACILITY MAP



EROSION CONTROL NOTES:

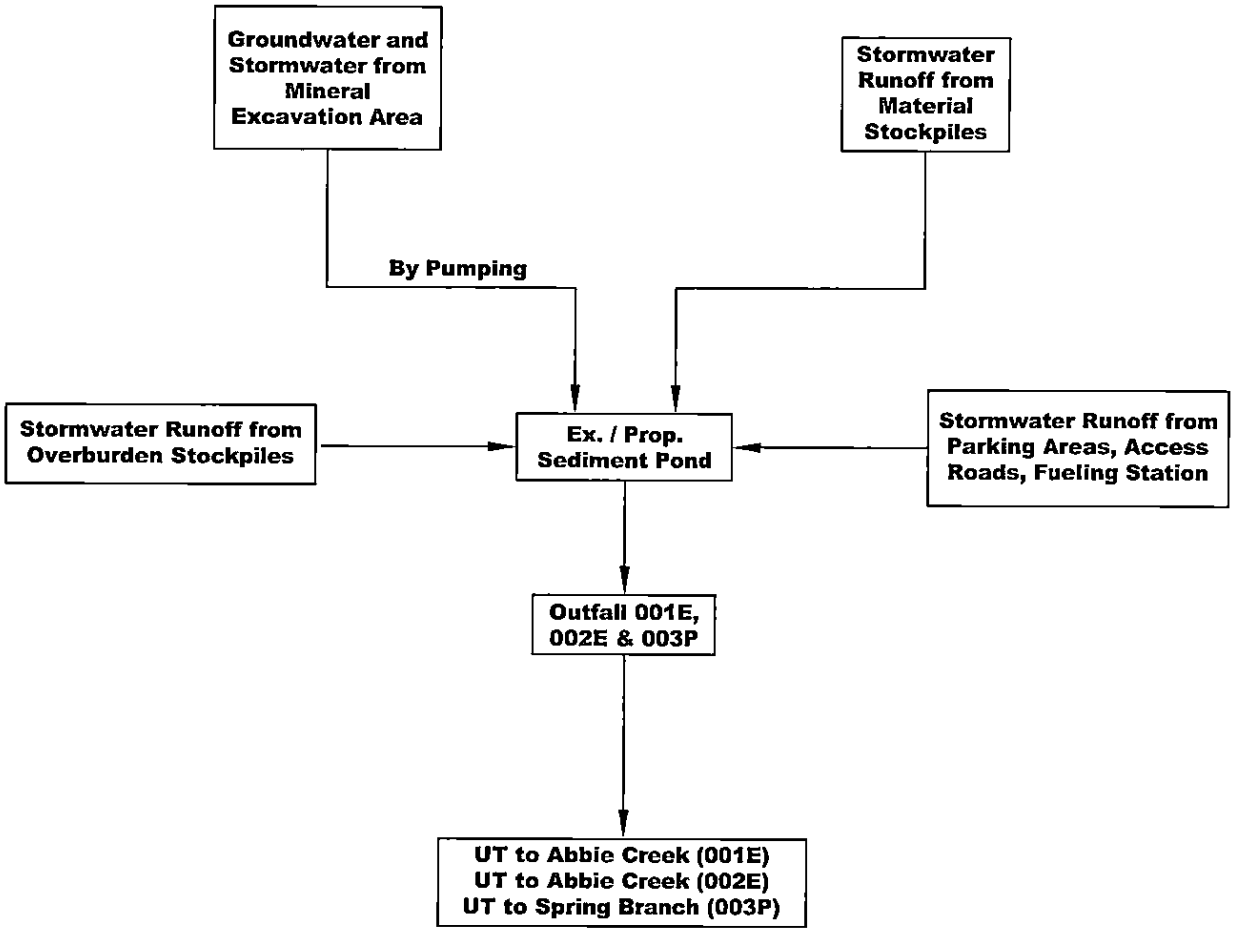
1. RIP-RAP CHECK DAMS (CD) SHALL BE INSTALLED IN DIVERSION DITCHES A 100 FT. INTERVALS (MIN.)
2. ALL DISTURBED AREAS (EXCLUDING MINING AREA, STOCKPILE AREA & OVERBURDEN AREA) SHALL BE SEEDED W/ TEMPORARY (TS) & PERMANENT SEEDING (PS) AND SHALL BE MULCHED (MU).
3. WHEN SEDIMENT IS REMOVED FROM THE PONDS, IT SHALL BE STOCKPILED IN THE OVERBURDEN STOCKPILE AREA.
4. TYPE "A" SILT FENCE (SB) SHALL BE INSTALLED AT THE LOWEST ELEVATION OF ALL AREAS THAT HAVE DISTURBED LAND TO ENSURE SEDIMENT DOES NOT LEAVE THE SITE.
5. CONSTRUCTION EXIT PADS (CEP) SHALL BE INSTALLED WHERE THE HAUL ROAD COUNTY ROAD.
6. A 25' UNDISTURBED VEGETATIVE BUFFER SHALL BE MAINTAINED AROUND ALL CREEKS. DEVELOPER SHALL CONTACT ENGINEER IF BUFFER CANNOT BE MAINTAINED. NO ENCROACHMENT INTO AN EXISTING CREEK IS ALLOWED.

BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors
706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

APPLICANT:	Carbo Ceramics Inc.
FACILITY NAME:	Sellers – Bauxite Pit
Section/Township/Range:	Sec. 22, T-8-N, R-28-E
SHEET TITLE:	Detailed Facility Map
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	1" = 500'
DATE:	September 10, 2014

APPENDIX D

SCHEMATIC FLOW DIAGRAM



BARRETT-SIMPSON, INC.
Civil Engineers & Land Surveyors

706 A 12th STREET, PHENIX CITY, AL 36868 (PH 334-297-2423, FAX 334-297-2449)
223 S. 9th STREET, OPELIKA, AL 36801 (PH 334-745-7026, FAX 334-745-4367)
121 W. BROAD STREET, EUFAULA, AL 36027 (PH 334-687-4257, FAX 334-687-8829)

PROJECT:	Sellers – Bauxite Pit
SHEET TITLE:	Schematic Diagram
LOCATION:	Henry County, AL
TOPOGRAPHIC MAP:	Ft. Gaines, Ala.
SCALE:	None
DATE:	September 10, 2014

APPENDIX E

RUNOFF HYDROGRAPHS

Hydraflow Table of Contents

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 09 / 11 / 2014

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Rational	------	------	13.62	------	16.35	18.33	21.28	23.50	25.80	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	------	------	5.173	------	7.179	8.591	10.33	12.13	13.38	001P Sellers Bauxite Pit - POST
3	Reservoir	2	------	2.650	------	3.466	3.962	4.506	5.016	5.344	001P Routed Flow
5	Rational	------	------	13.62	------	16.35	18.33	21.28	23.50	25.80	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	------	------	5.599	------	7.719	9.209	11.06	12.95	14.28	002P Sellers Bauxite Pit - POST
7	Reservoir	6	------	3.001	------	3.851	4.364	4.938	5.469	5.814	002P Routed Flow
9	Rational	------	------	7.105	------	8.313	9.214	10.58	11.61	12.68	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	------	------	10.80	------	13.01	14.61	16.97	18.76	20.61	003P Sellers Bauxite Pit - POST
11	Reservoir	10	------	5.628	------	6.255	6.638	7.386	12.74	16.91	003P Routed Flow

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

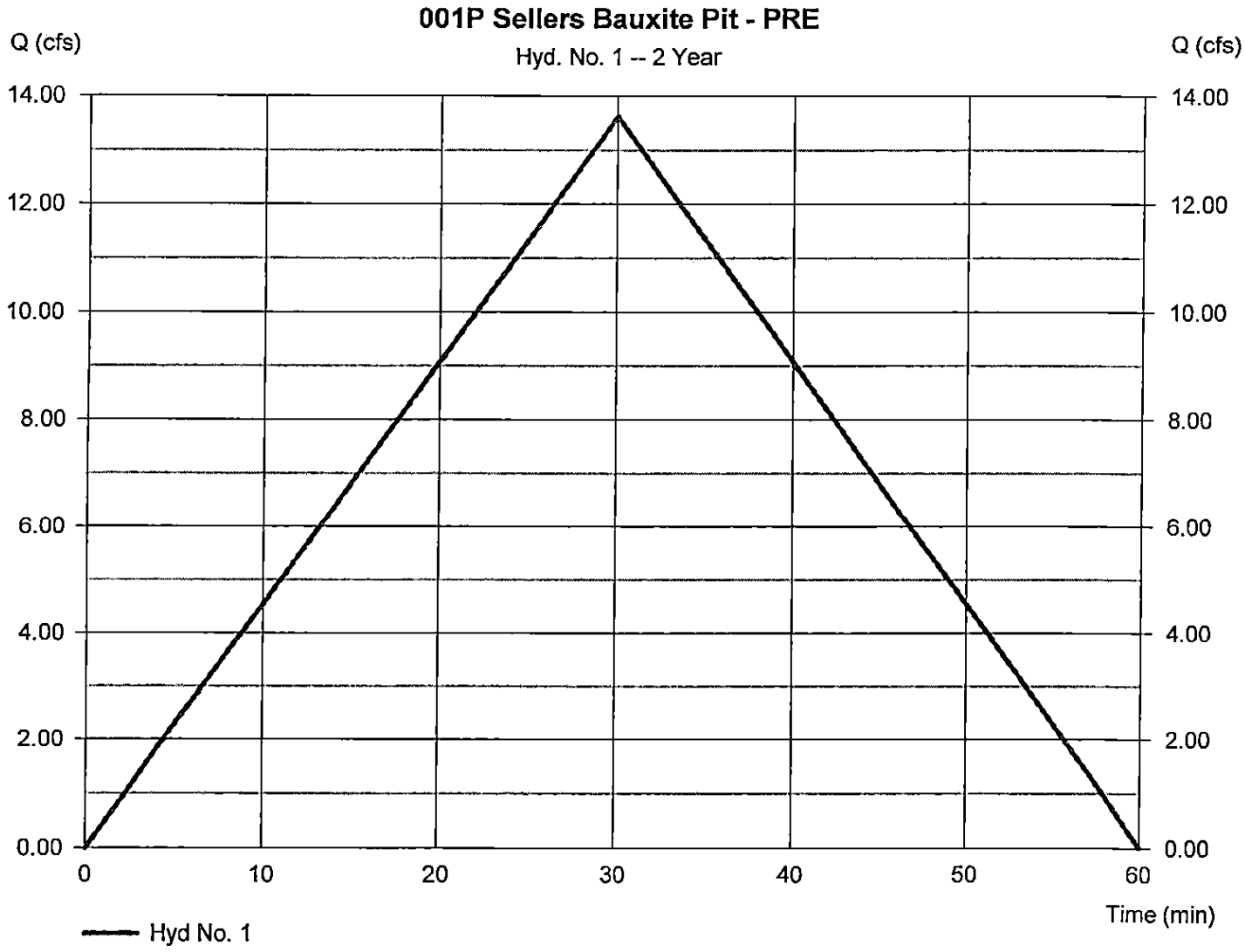
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	13.62	1	30	24,522	------	------	------	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	5.173	1	14	95,603	------	------	------	001P Sellers Bauxite Pit - POST
3	Reservoir	2.650	1	315	88,540	2	320.99	71,070	001P Routed Flow
5	Rational	13.62	1	30	24,522	------	------	------	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	5.599	1	14	94,065	------	------	------	002P Sellers Bauxite Pit - POST
7	Reservoir	3.001	1	286	89,253	6	321.13	67,016	002P Routed Flow
9	Rational	7.105	1	17	7,247	------	------	------	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	10.80	1	8	20,741	------	------	------	003P Sellers Bauxite Pit - POST
11	Reservoir	5.628	1	36	20,729	10	453.41	12,543	003P Routed Flow

Hydrograph Report

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 13.62 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 24,522 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 2.994 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1



FAA Formula Tc Worksheet

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Description

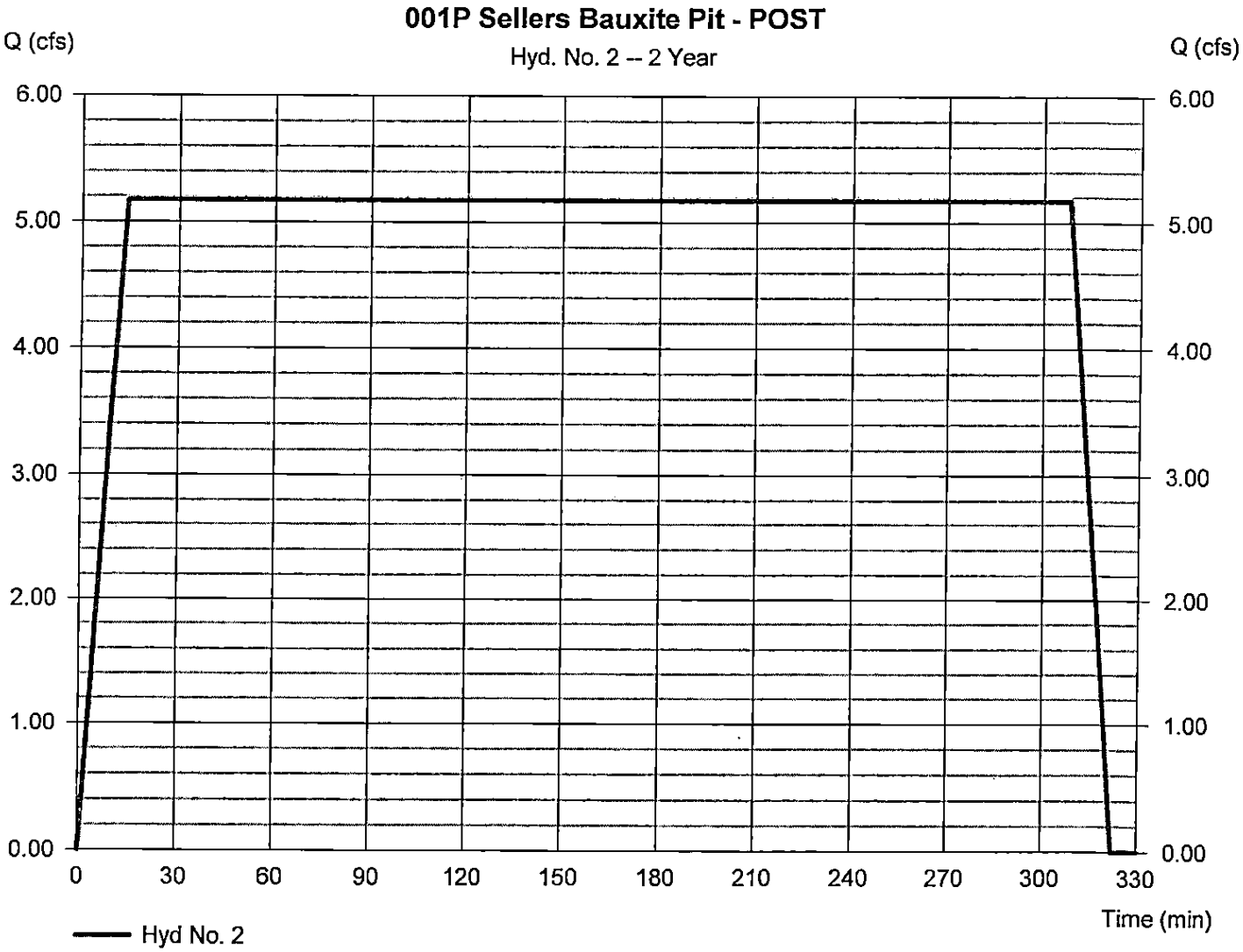
Flow length (ft)	= 1000.00
Watercourse slope (%)	= 3.00
Runoff coefficient (C)	= 0.35
Time of Conc. (min)	**= 30**

Hydrograph Report

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 5.173 cfs
Storm frequency	= 2 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 95,603 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 0.531 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 22.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



FAA Formula Tc Worksheet

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Description

Flow length (ft)	= 1000.00
Watercourse slope (%)	= 3.00
Runoff coefficient (C)	= 0.75
Time of Conc. (min)	**= 14**

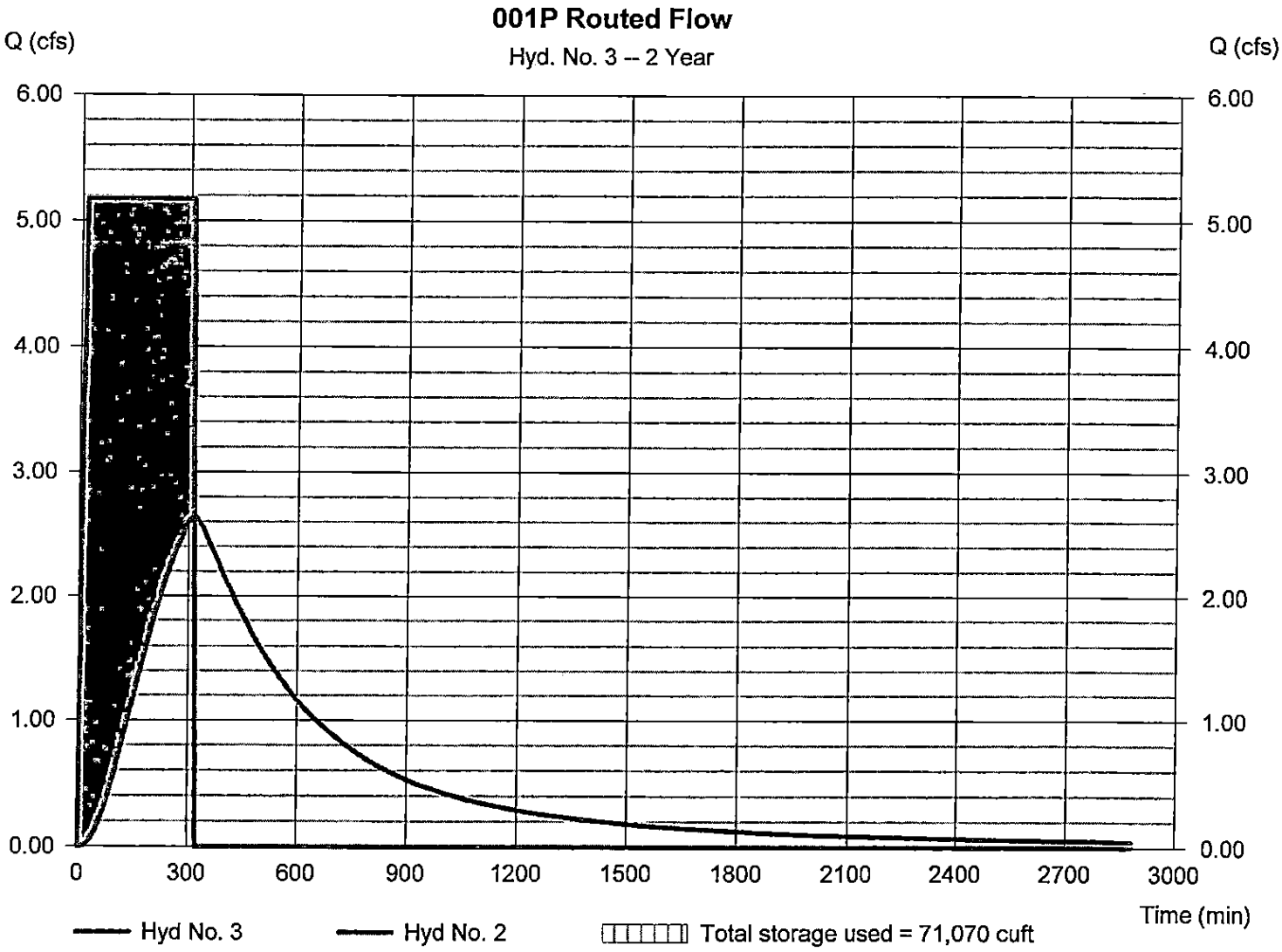
Hydrograph Report

Hyd. No. 3

001P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 2.650 cfs
Storm frequency	= 2 yrs	Time to peak	= 315 min
Time interval	= 1 min	Hyd. volume	= 88,540 cuft
Inflow hyd. No.	= 2 - 001P Sellers Bauxite Pit - MOST	Max. Elevation	= 320.99 ft
Reservoir name	= 001P Sediment Pond	Max. Storage	= 71,070 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - 001P Sediment Pond

Pond Data

Trapezoid -Bottom L x W = 265.0 x 265.0 ft, Side slope = 3.00:1, Bottom elev. = 320.00 ft, Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	320.00	70,225	0	0
0.50	320.50	71,824	35,512	35,512
1.00	321.00	73,441	36,316	71,827
1.50	321.50	75,076	37,129	108,956
2.00	322.00	76,729	37,951	146,906
2.50	322.50	78,400	38,782	185,688
3.00	323.00	80,089	39,622	225,309
3.50	323.50	81,796	40,471	265,780
4.00	324.00	83,521	41,329	307,108
4.50	324.50	85,264	42,196	349,304
5.00	325.00	87,025	43,072	392,375

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 320.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

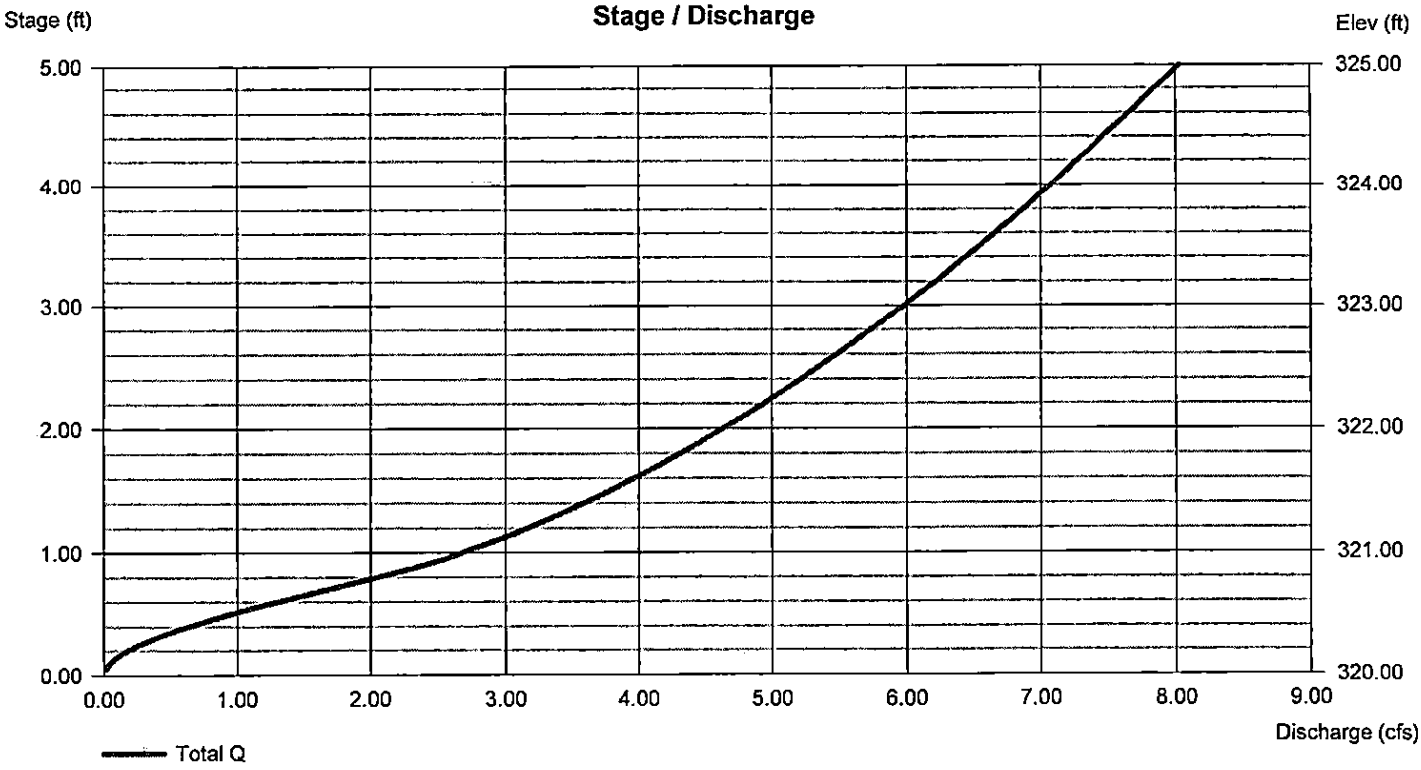
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

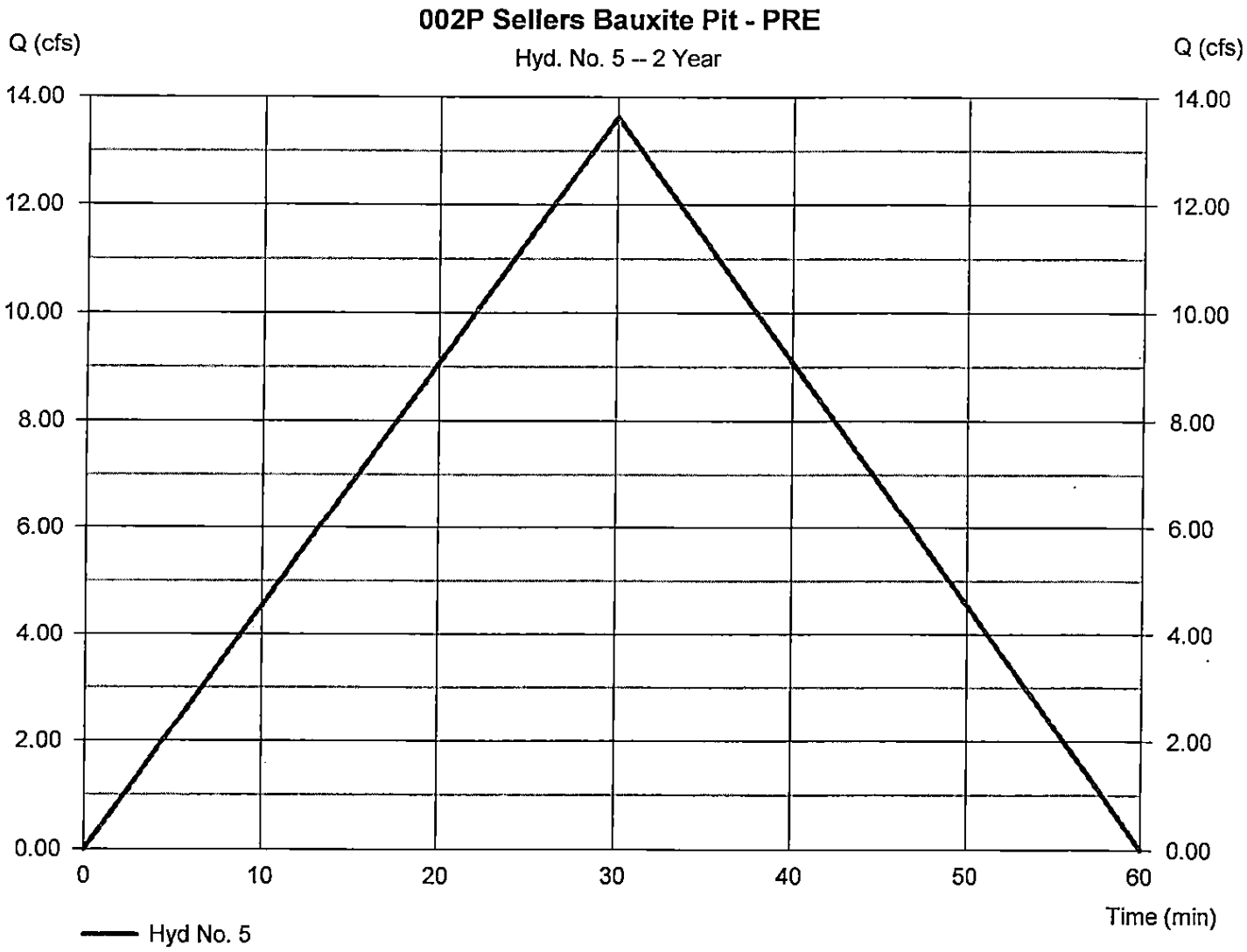


Hydrograph Report

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 13.62 cfs
Storm frequency	= 2 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 24,522 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 2.994 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1



FAA Formula Tc Worksheet

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Description

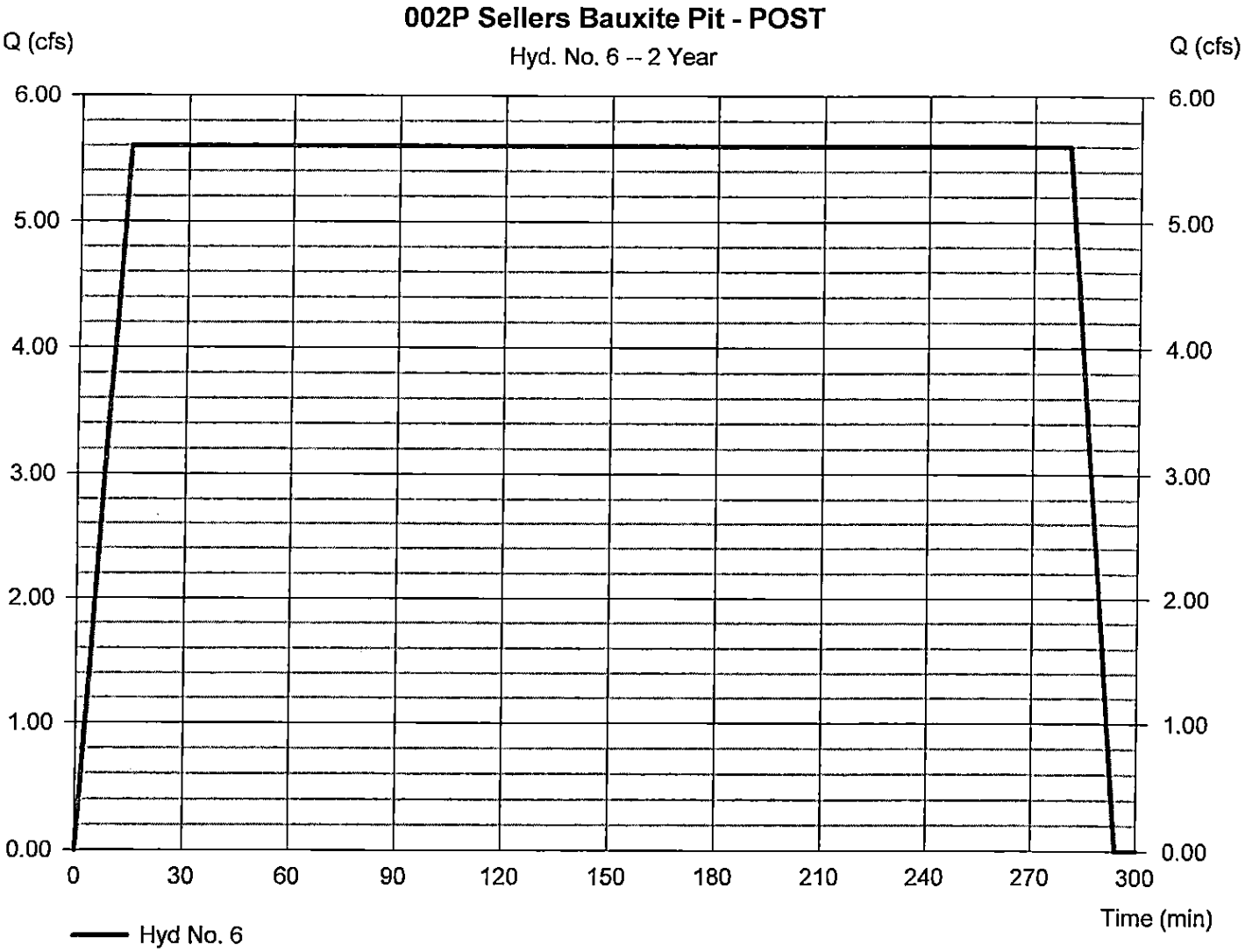
Flow length (ft)	= 1150.00
Watercourse slope (%)	= 3.50
Runoff coefficient (C)	= 0.35
Time of Conc. (min)	**= 30**

Hydrograph Report

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 5.599 cfs
Storm frequency	= 2 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 94,065 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 0.574 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 20.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



FAA Formula Tc Worksheet

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Description

Flow length (ft)	= 1150.00
Watercourse slope (%)	= 3.50
Runoff coefficient (C)	= 0.75
Time of Conc. (min)	**= 14**

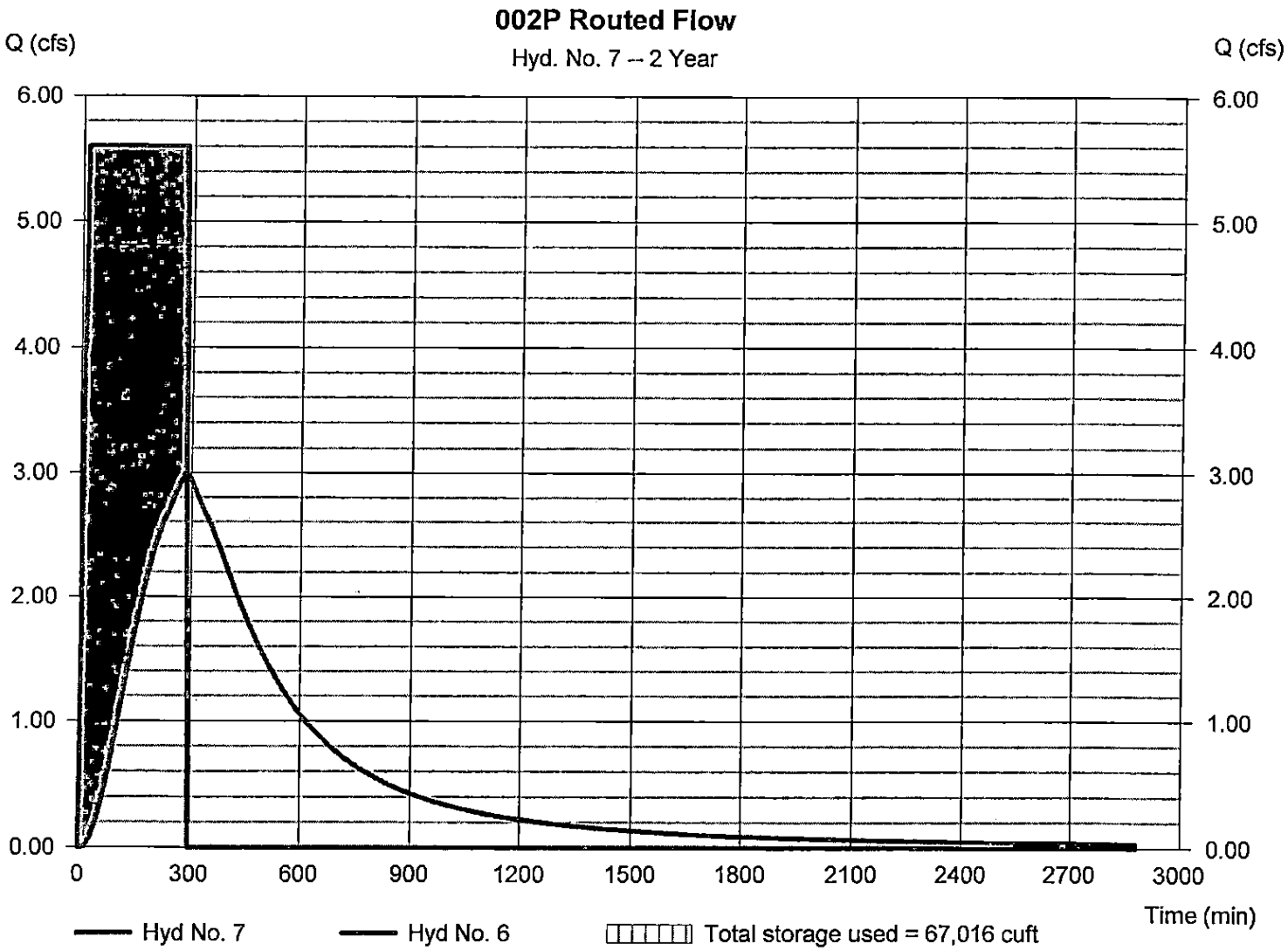
Hydrograph Report

Hyd. No. 7

002P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 3.001 cfs
Storm frequency	= 2 yrs	Time to peak	= 286 min
Time interval	= 1 min	Hyd. volume	= 89,253 cuft
Inflow hyd. No.	= 6 - 002P Sellers Bauxite Pit - MOST	Max. Elevation	= 321.13 ft
Reservoir name	= 002P Sediment Pond	Max. Storage	= 67,016 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - 002P Sediment Pond

Pond Data

Trapezoid -Bottom L x W = 240.0 x 240.0 ft, Side slope = 3.00:1, Bottom elev. = 320.00 ft, Depth = 5.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	320.00	57,600	0	0
0.50	320.50	59,049	29,162	29,162
1.00	321.00	60,516	29,891	59,052
1.50	321.50	62,001	30,629	89,681
2.00	322.00	63,504	31,376	121,056
2.50	322.50	65,025	32,132	153,188
3.00	323.00	66,564	32,897	186,084
3.50	323.50	68,121	33,671	219,755
4.00	324.00	69,696	34,454	254,208
4.50	324.50	71,289	35,246	289,454
5.00	325.00	72,900	36,047	325,500

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	0.00	0.00	0.00
Span (in)	= 12.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 320.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

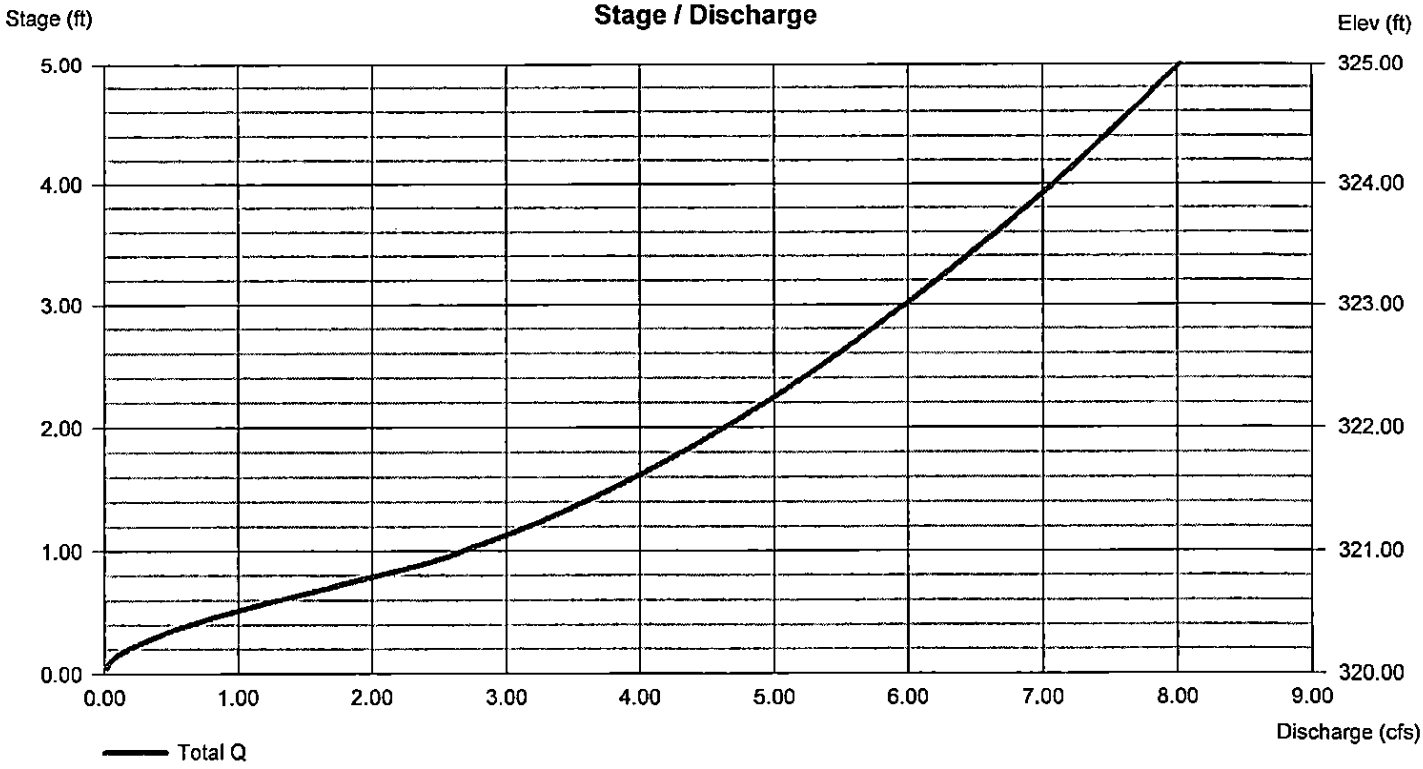
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



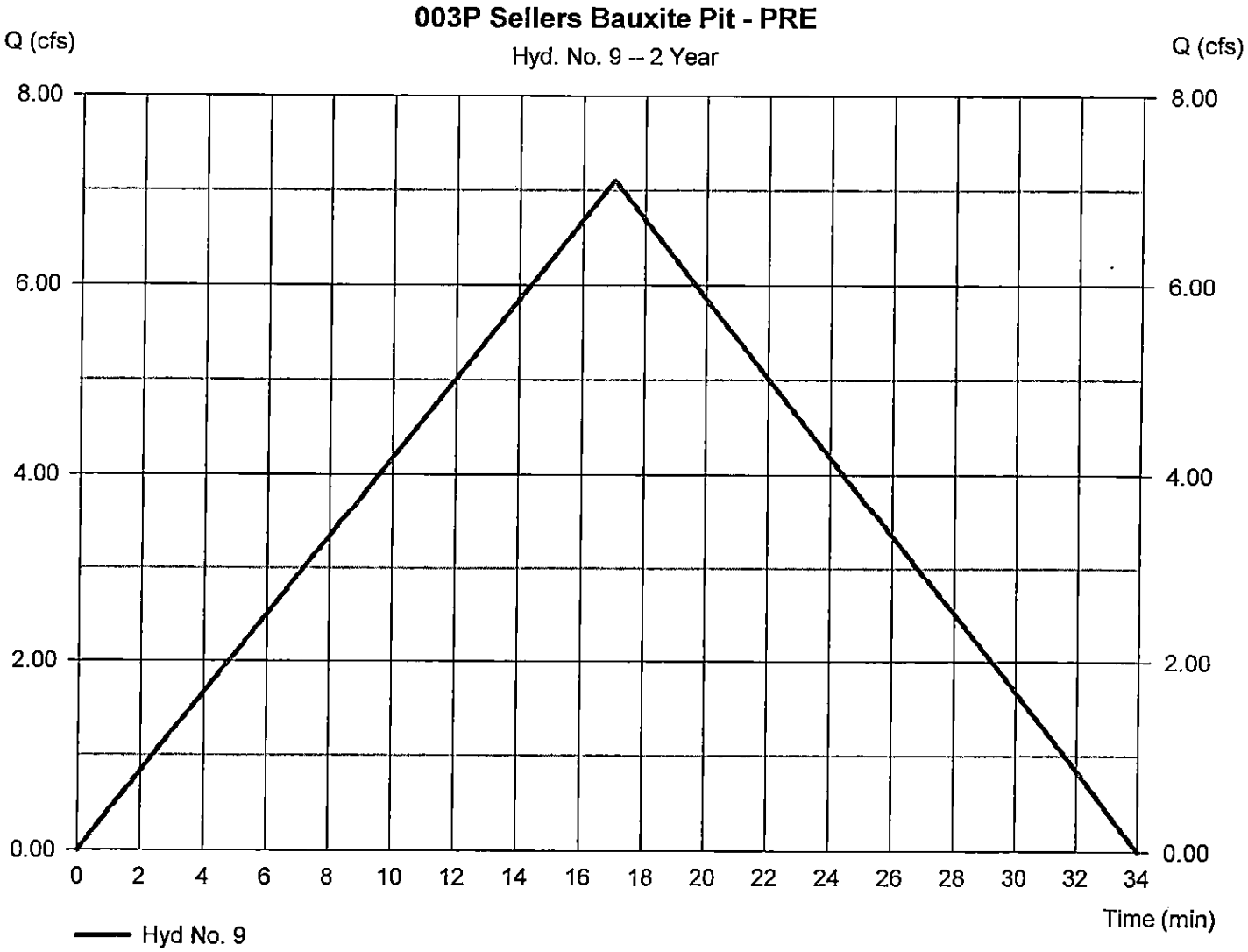
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 09 / 11 / 2014

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 7.105 cfs
Storm frequency	= 2 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 7,247 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.35
Intensity	= 4.060 in/hr	Tc by FAA	= 17.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1



FAA Formula Tc Worksheet

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Description

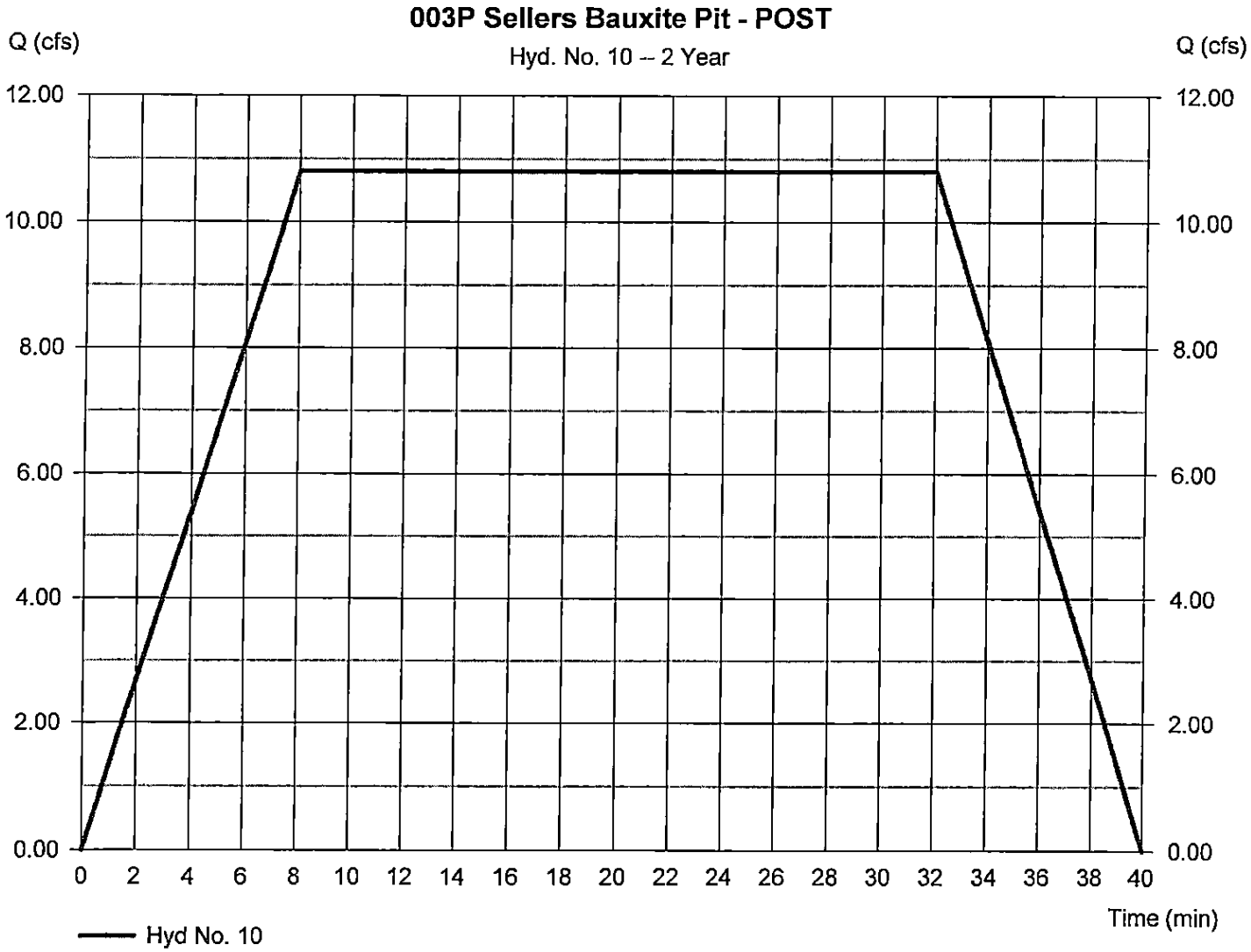
Flow length (ft)	= 500.00
Watercourse slope (%)	= 6.00
Runoff coefficient (C)	= 0.35
Time of Conc. (min)	**= 17**

Hydrograph Report

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 10.80 cfs
Storm frequency	= 2 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 20,741 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.75
Intensity	= 2.881 in/hr	Tc by FAA	= 8.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 4.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



FAA Formula Tc Worksheet

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Description

Flow length (ft)	= 500.00
Watercourse slope (%)	= 6.00
Runoff coefficient (C)	= 0.75

Time of Conc. (min) **= 8**

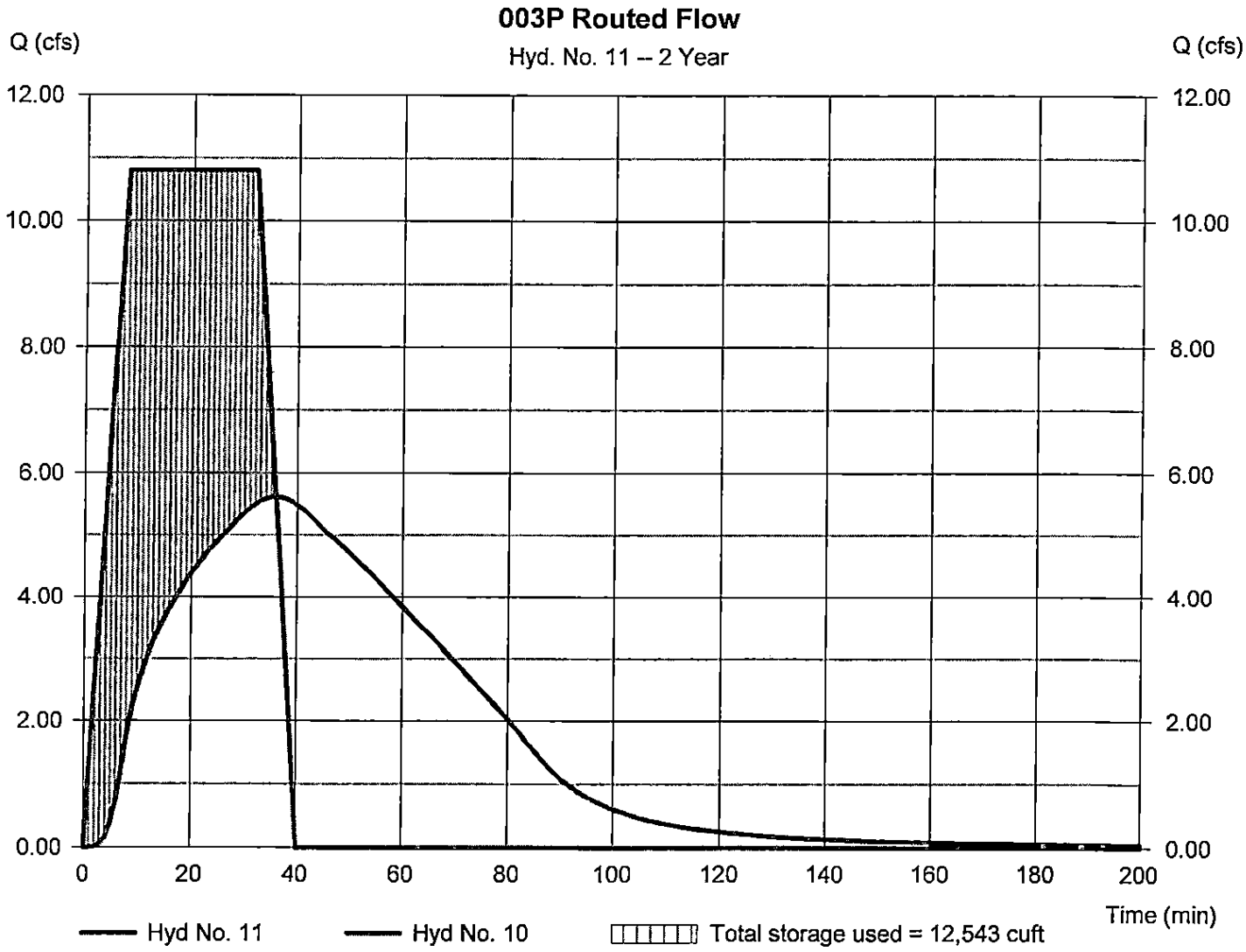
Hydrograph Report

Hyd. No. 11

003P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 5.628 cfs
Storm frequency	= 2 yrs	Time to peak	= 36 min
Time interval	= 1 min	Hyd. volume	= 20,729 cuft
Inflow hyd. No.	= 10 - 003P Sellers Bauxite Pit MBOS	Max. Elevation	= 453.41 ft
Reservoir name	= 003P Sediment Pond	Max. Storage	= 12,543 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 09 / 11 / 2014

Pond No. 3 - 003P Sediment Pond

Pond Data

Trapezoid -Bottom L x W = 50.0 x 50.0 ft, Side slope = 3.00:1, Bottom elev. = 450.00 ft, Depth = 8.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	450.00	2,500	0	0
0.80	450.80	3,003	2,198	2,198
1.60	451.60	3,552	2,619	4,817
2.40	452.40	4,147	3,077	7,894
3.20	453.20	4,789	3,571	11,465
4.00	454.00	5,476	4,103	15,568
4.80	454.80	6,209	4,671	20,239
5.60	455.60	6,989	5,276	25,515
6.40	456.40	7,815	5,918	31,434
7.20	457.20	8,686	6,597	38,031
8.00	458.00	9,604	7,313	45,344

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	12.00	0.00	0.00
Span (in)	= 18.00	12.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 450.00	450.01	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 2.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

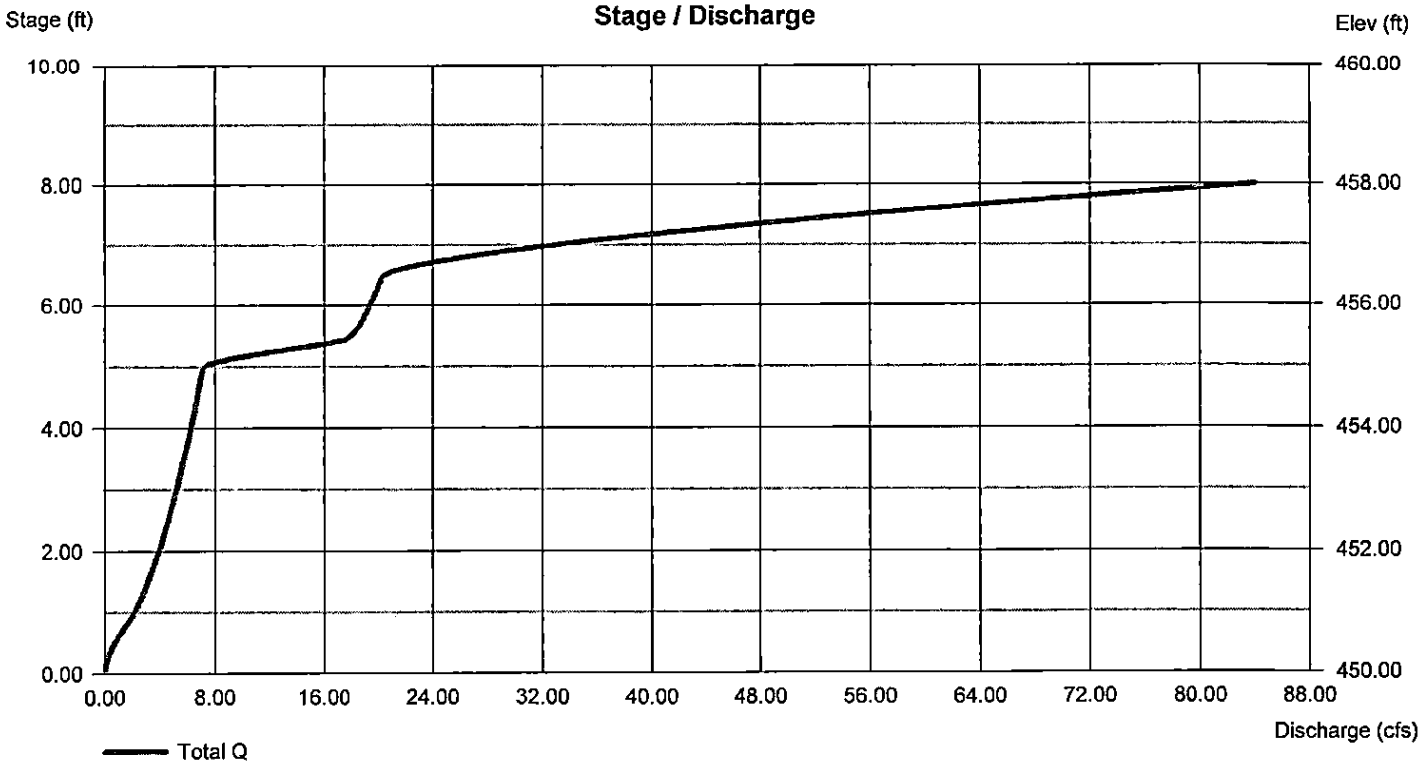
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	10.00	0.00	0.00
Crest El. (ft)	= 455.00	456.50	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= 1	Ciplti	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

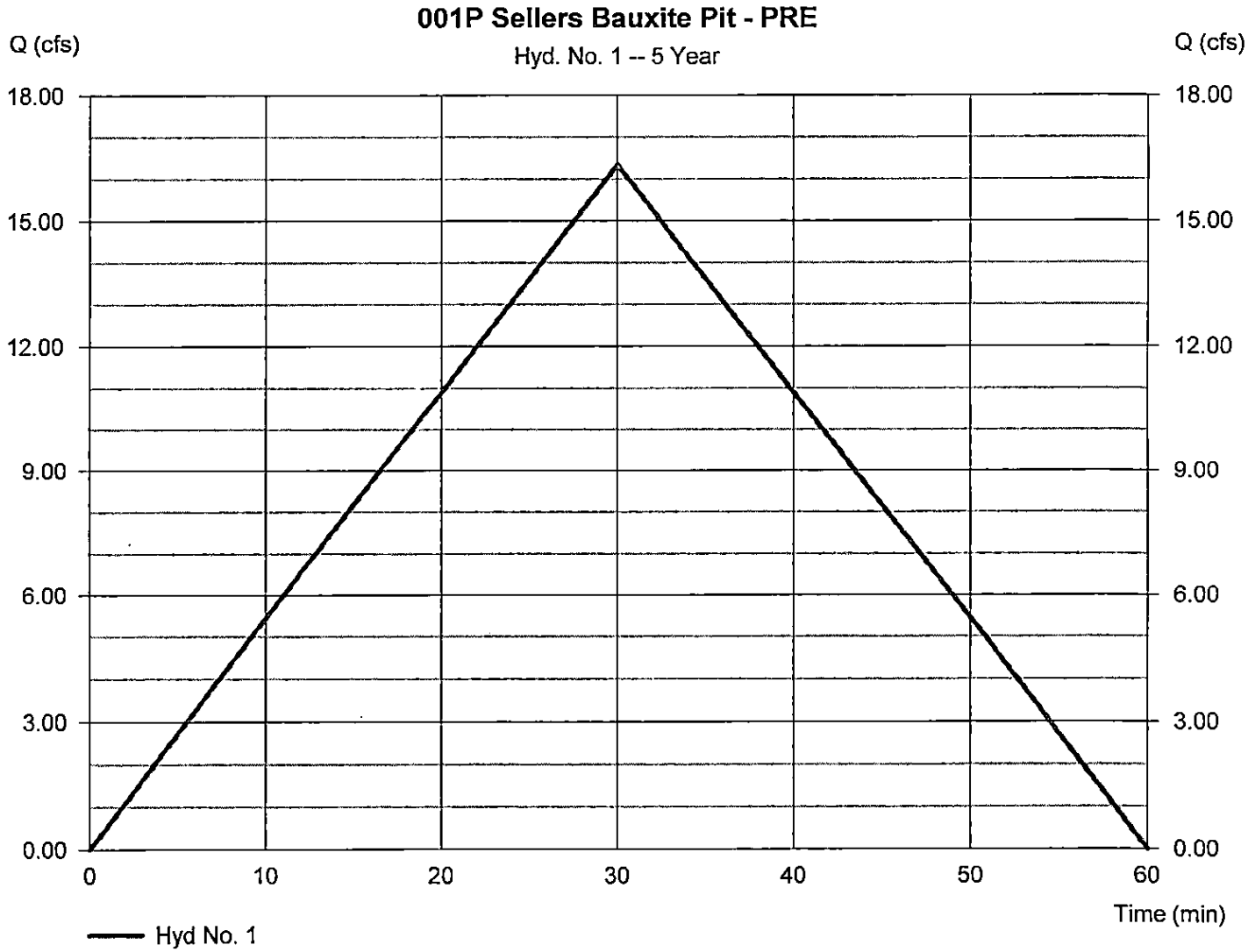
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	16.35	1	30	29,434	------	------	------	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	7.179	1	14	132,669	------	------	------	001P Sellers Bauxite Pit - POST
3	Reservoir	3.466	1	315	125,210	2	321.34	97,122	001P Routed Flow
5	Rational	16.35	1	30	29,434	------	------	------	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	7.719	1	14	129,672	------	------	------	002P Sellers Bauxite Pit - POST
7	Reservoir	3.851	1	287	124,612	6	321.54	92,021	002P Routed Flow
9	Rational	8.313	1	17	8,479	------	------	------	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	13.01	1	8	24,976	------	------	------	003P Sellers Bauxite Pit - POST
11	Reservoir	6.255	1	36	24,964	10	454.03	15,713	003P Routed Flow

Hydrograph Report

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 16.35 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 29,434 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 3.594 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

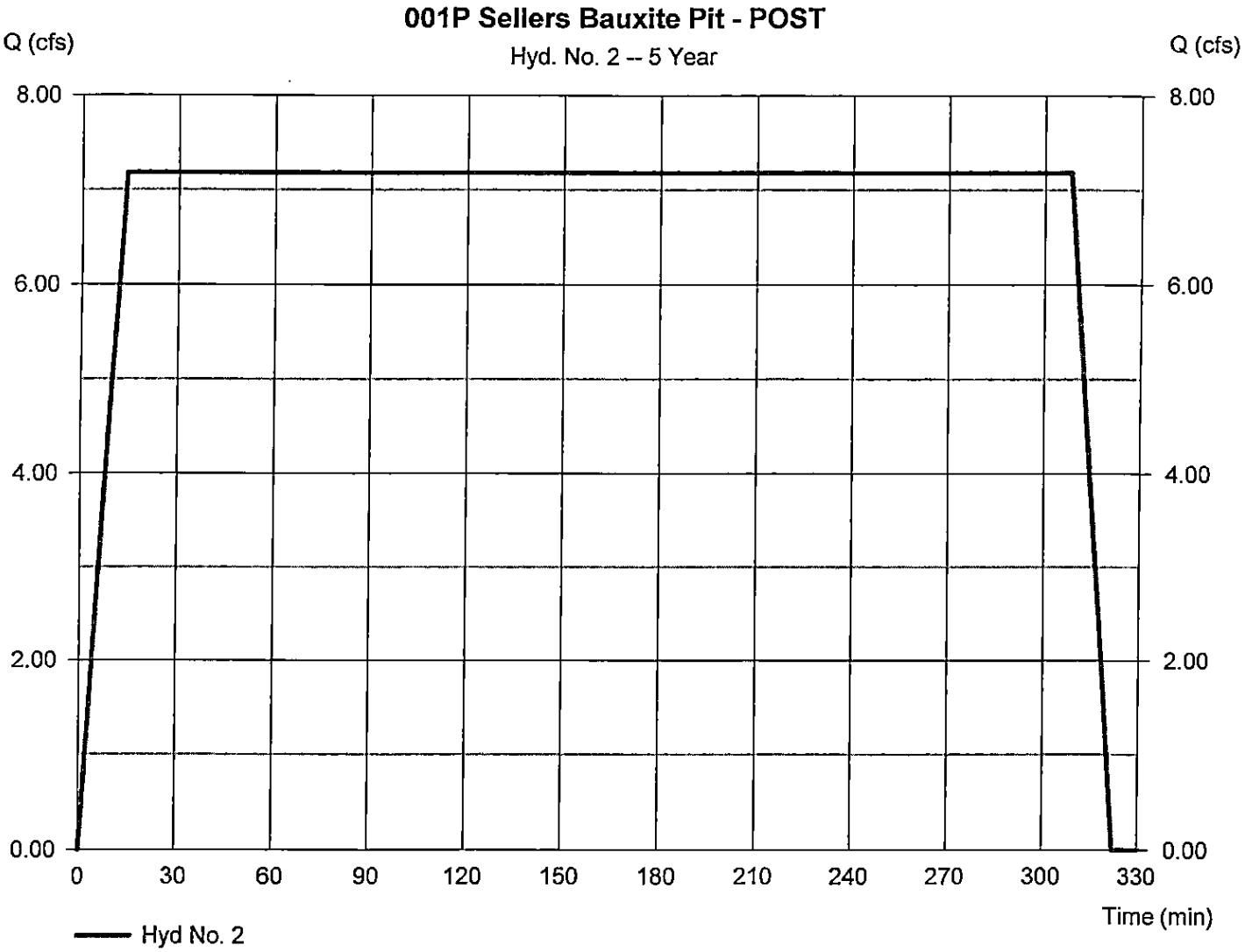


Hydrograph Report

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 7.179 cfs
Storm frequency	= 5 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 132,669 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 0.736 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 22.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



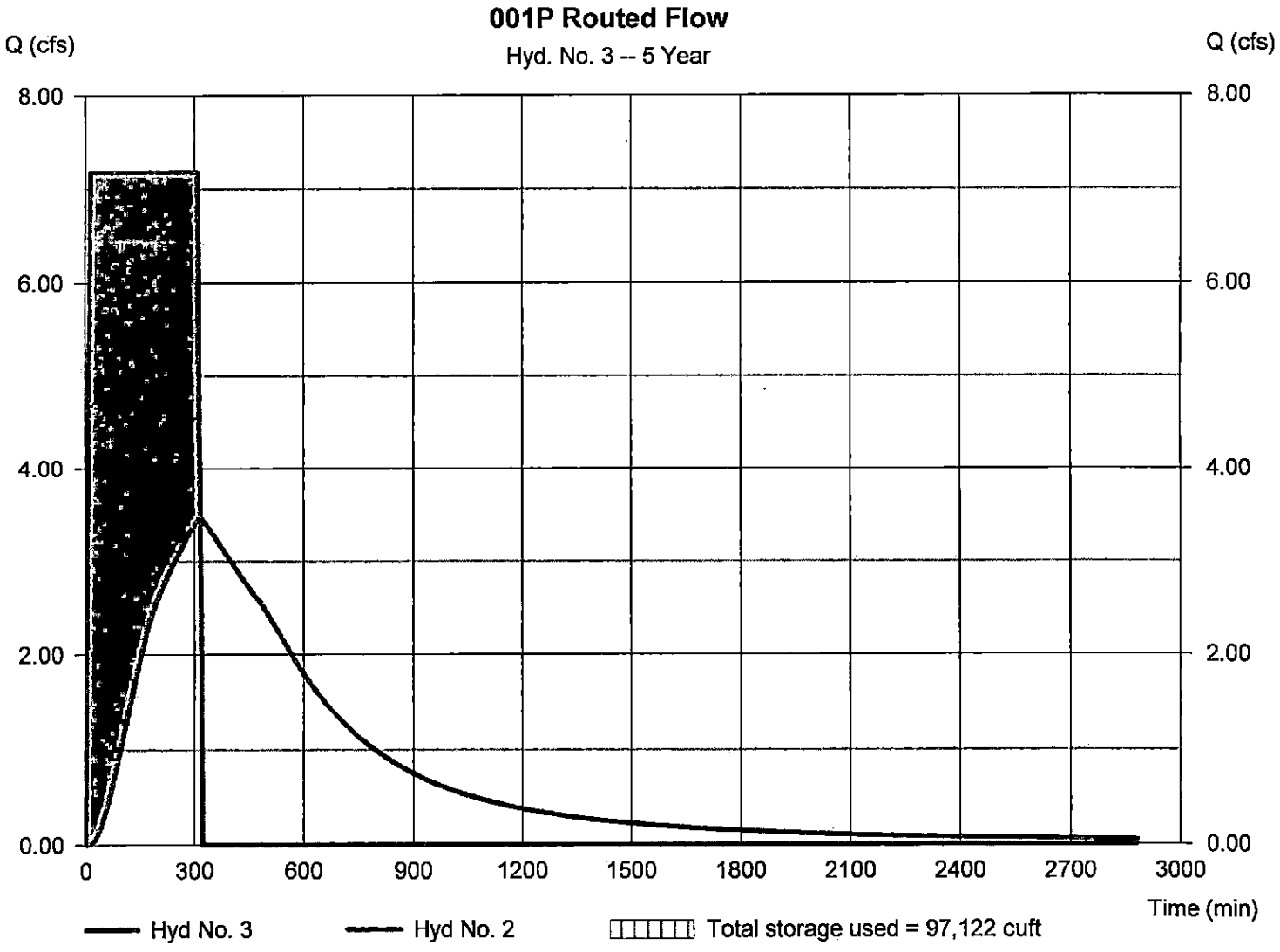
Hydrograph Report

Hyd. No. 3

001P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 3.466 cfs
Storm frequency	= 5 yrs	Time to peak	= 315 min
Time interval	= 1 min	Hyd. volume	= 125,210 cuft
Inflow hyd. No.	= 2 - 001P Sellers Bauxite Pit - POST	Max. Elevation	= 321.34 ft
Reservoir name	= 001P Sediment Pond	Max. Storage	= 97,122 cuft

Storage Indication method used.

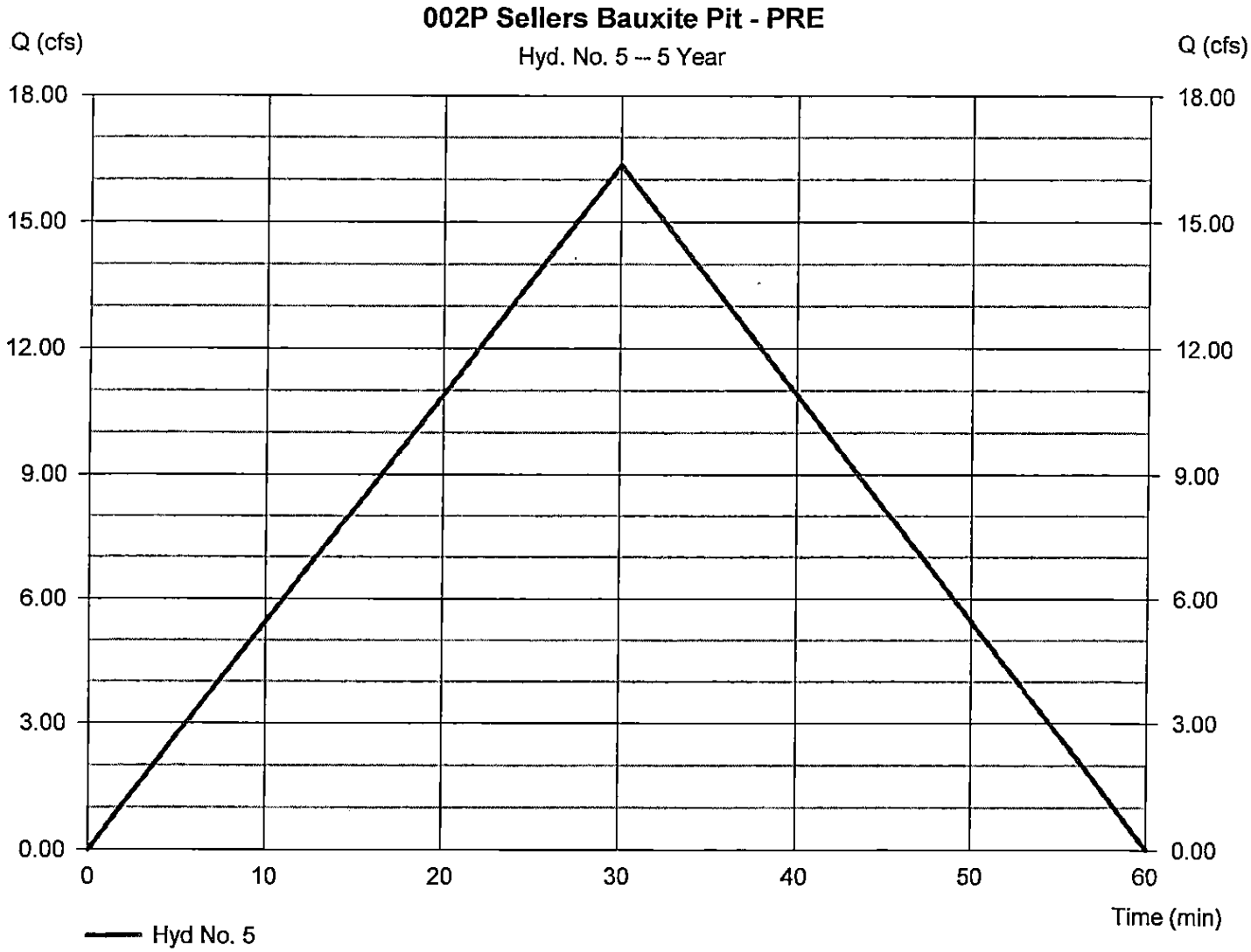


Hydrograph Report

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 16.35 cfs
Storm frequency	= 5 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 29,434 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 3.594 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

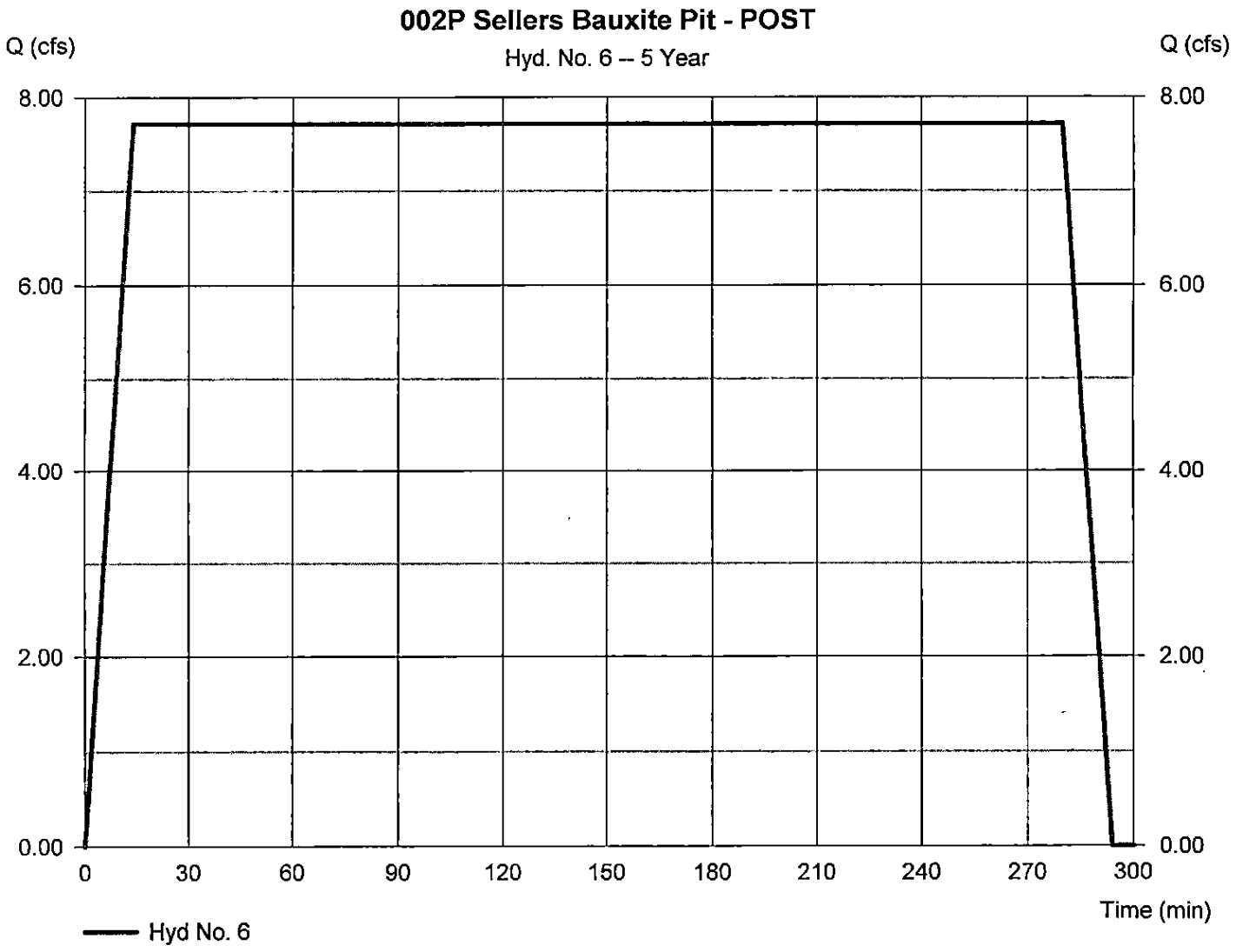


Hydrograph Report

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 7.719 cfs
Storm frequency	= 5 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 129,672 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 0.792 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 20.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



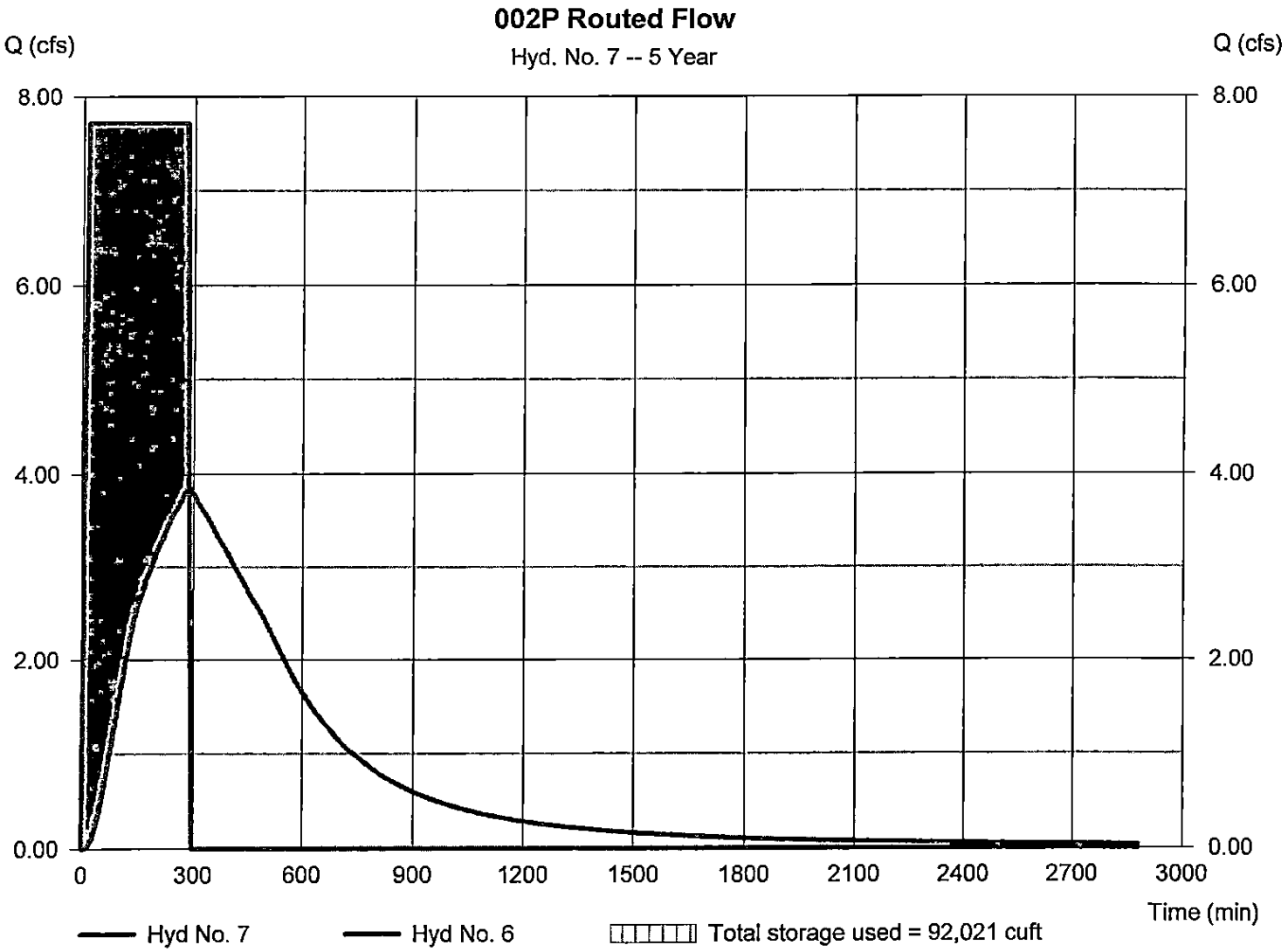
Hydrograph Report

Hyd. No. 7

002P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 3.851 cfs
Storm frequency	= 5 yrs	Time to peak	= 287 min
Time interval	= 1 min	Hyd. volume	= 124,612 cuft
Inflow hyd. No.	= 6 - 002P Sellers Bauxite Pit - POST	Max. Elevation	= 321.54 ft
Reservoir name	= 002P Sediment Pond	Max. Storage	= 92,021 cuft

Storage Indication method used.

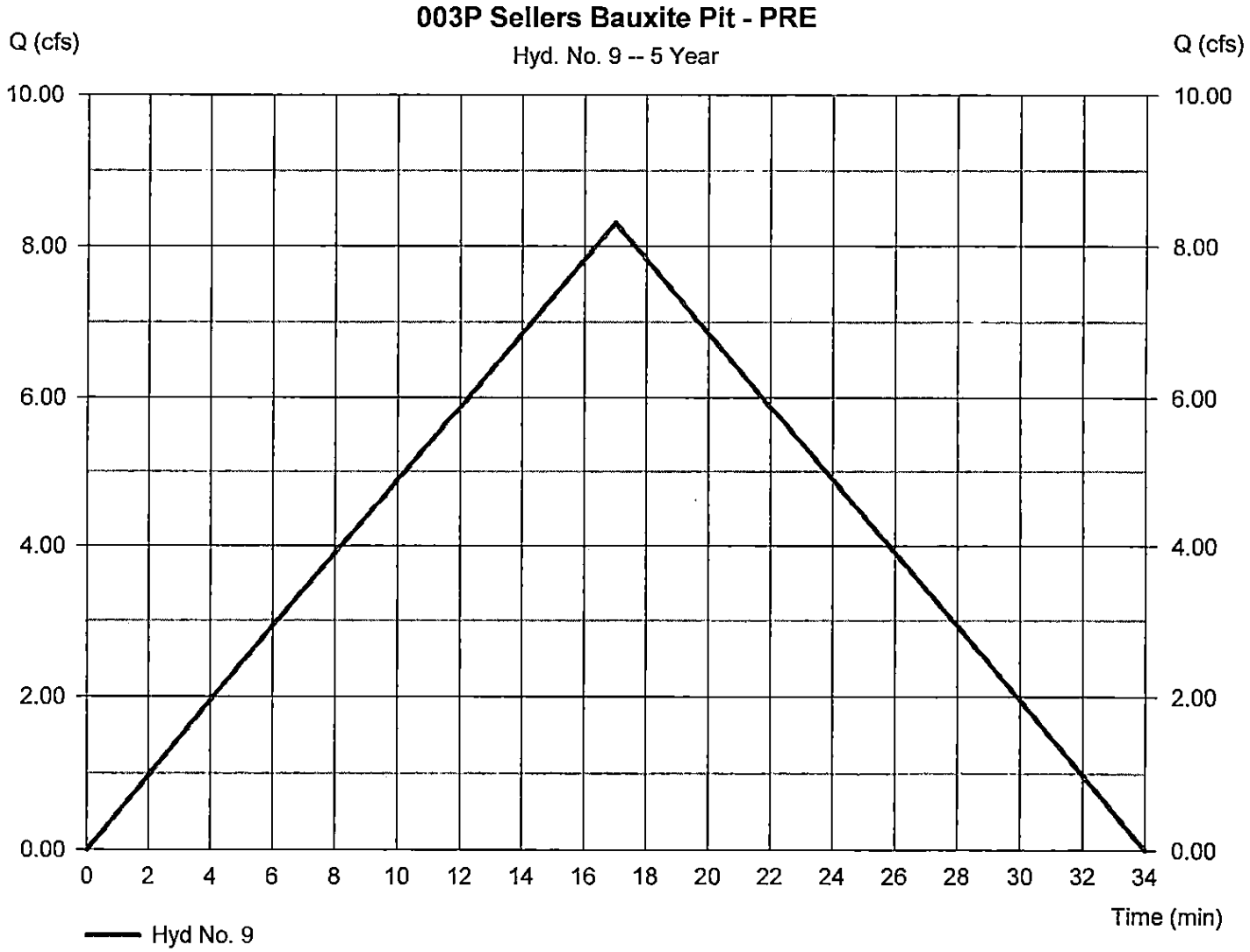


Hydrograph Report

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 8.313 cfs
Storm frequency	= 5 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 8,479 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.35
Intensity	= 4.750 in/hr	Tc by FAA	= 17.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

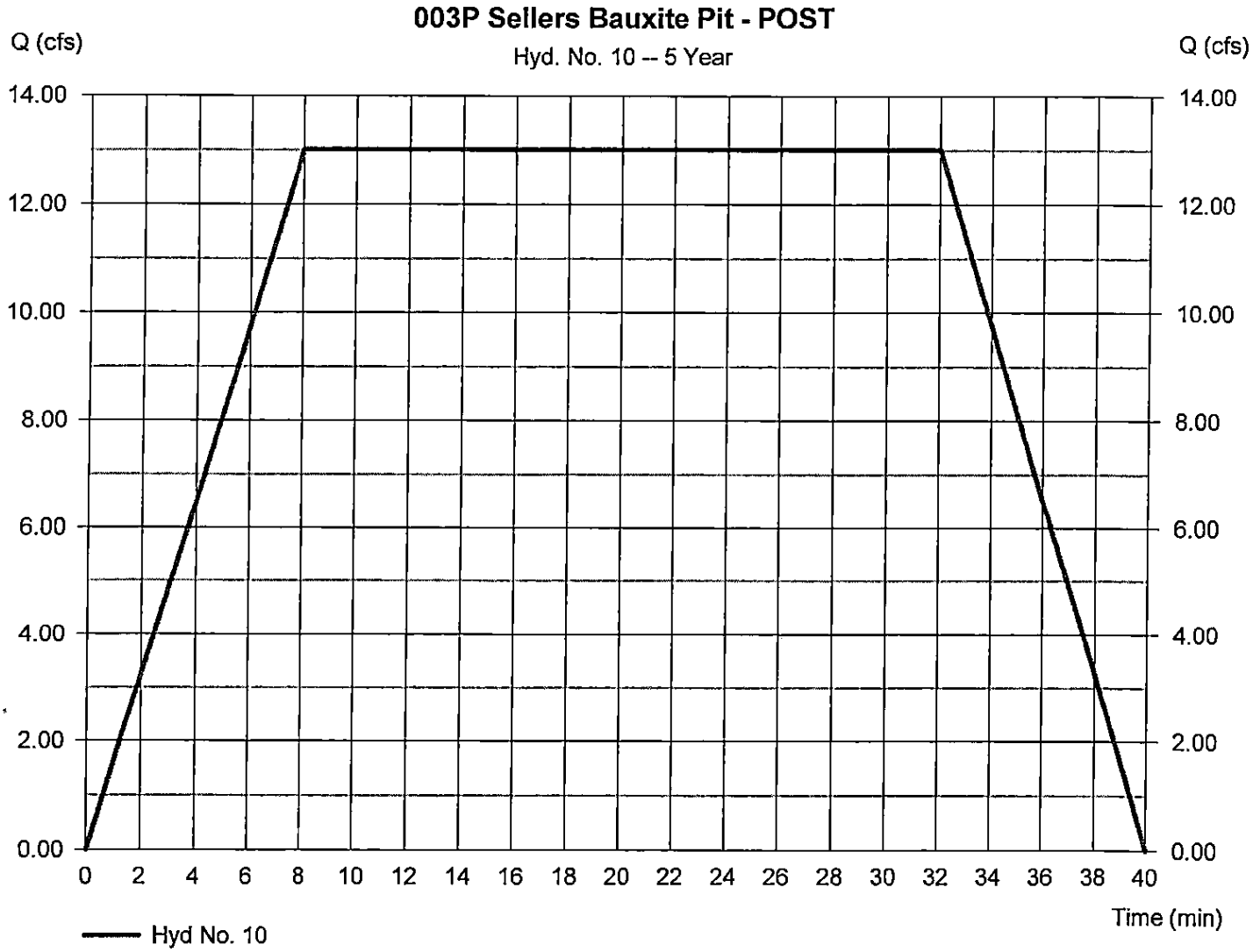


Hydrograph Report

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 13.01 cfs
Storm frequency	= 5 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 24,976 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.75
Intensity	= 3.469 in/hr	Tc by FAA	= 8.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 4.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



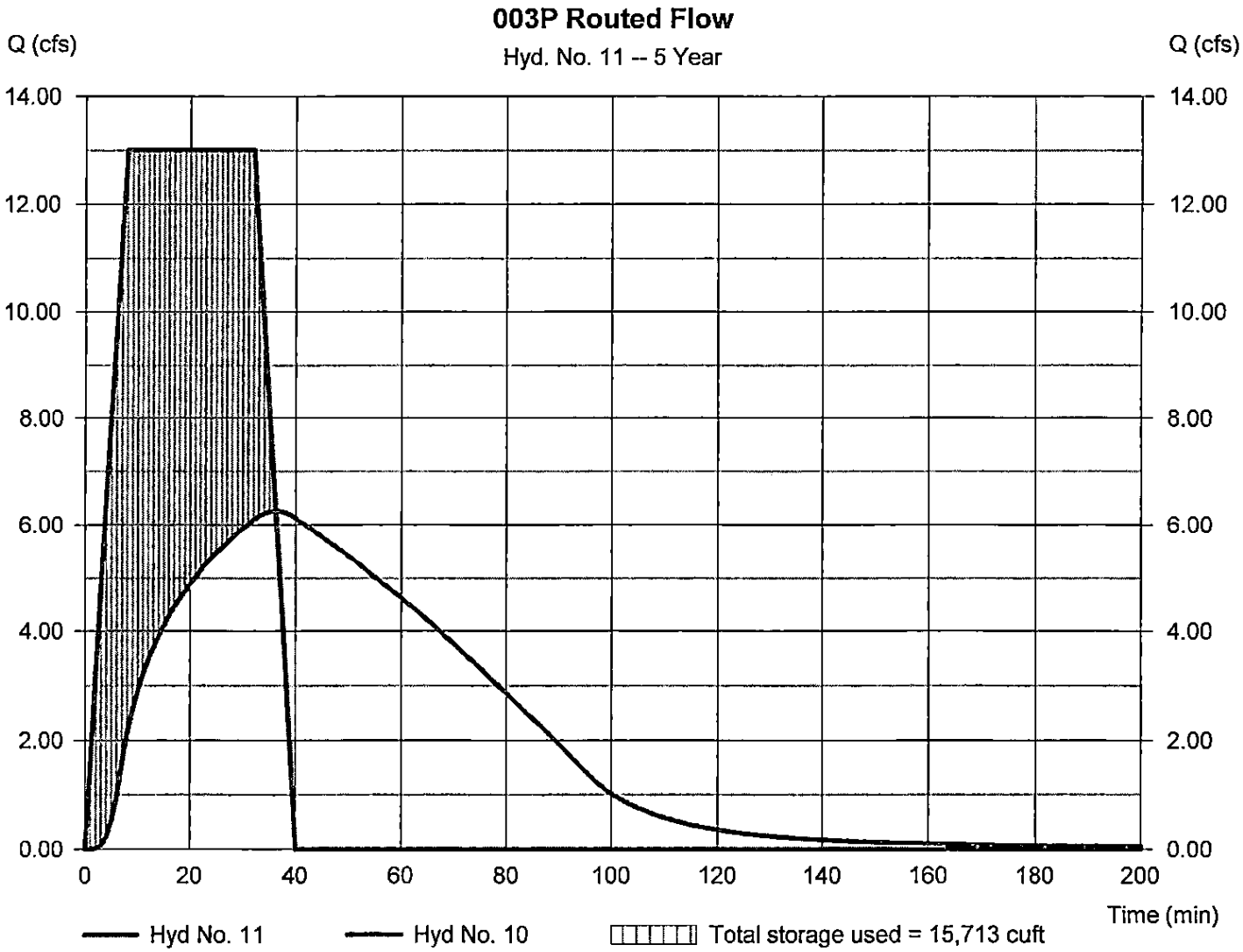
Hydrograph Report

Hyd. No. 11

003P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 6.255 cfs
Storm frequency	= 5 yrs	Time to peak	= 36 min
Time interval	= 1 min	Hyd. volume	= 24,964 cuft
Inflow hyd. No.	= 10 - 003P Sellers Bauxite Pit MBOS	Max. Elevation	= 454.03 ft
Reservoir name	= 003P Sediment Pond	Max. Storage	= 15,713 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

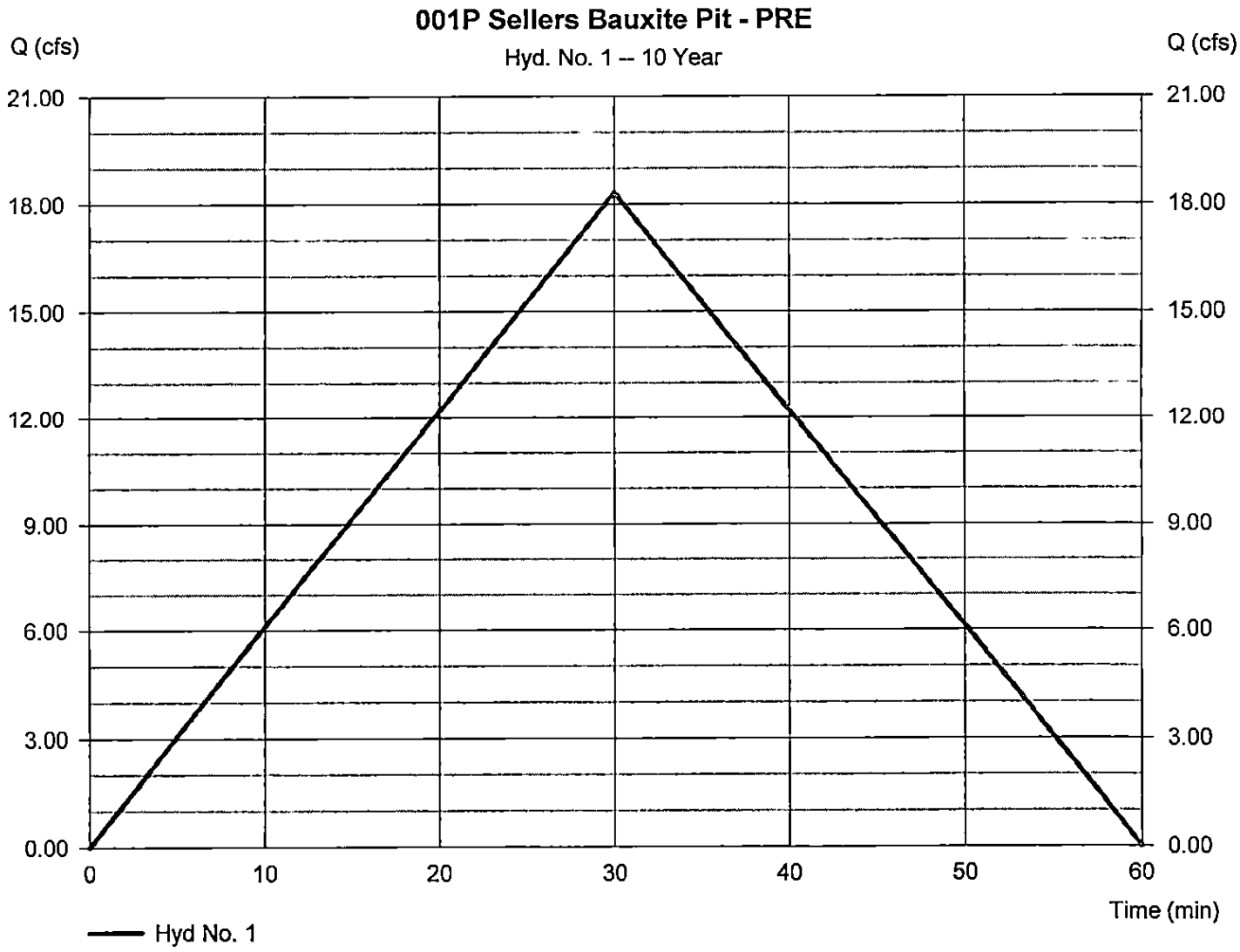
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	18.33	1	30	33,001	-----	-----	-----	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	8.591	1	14	158,754	-----	-----	-----	001P Sellers Bauxite Pit - POST
3	Reservoir	3.962	1	316	151,026	2	321.60	116,371	001P Routed Flow
5	Rational	18.33	1	30	33,001	-----	-----	-----	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	9.209	1	14	154,706	-----	-----	-----	002P Sellers Bauxite Pit - POST
7	Reservoir	4.364	1	287	149,483	6	321.83	110,519	002P Routed Flow
9	Rational	9.214	1	17	9,398	-----	-----	-----	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	14.61	1	8	28,044	-----	-----	-----	003P Sellers Bauxite Pit - POST
11	Reservoir	6.638	1	36	28,032	10	454.43	18,084	003P Routed Flow

Hydrograph Report

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 18.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 33,001 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 4.029 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

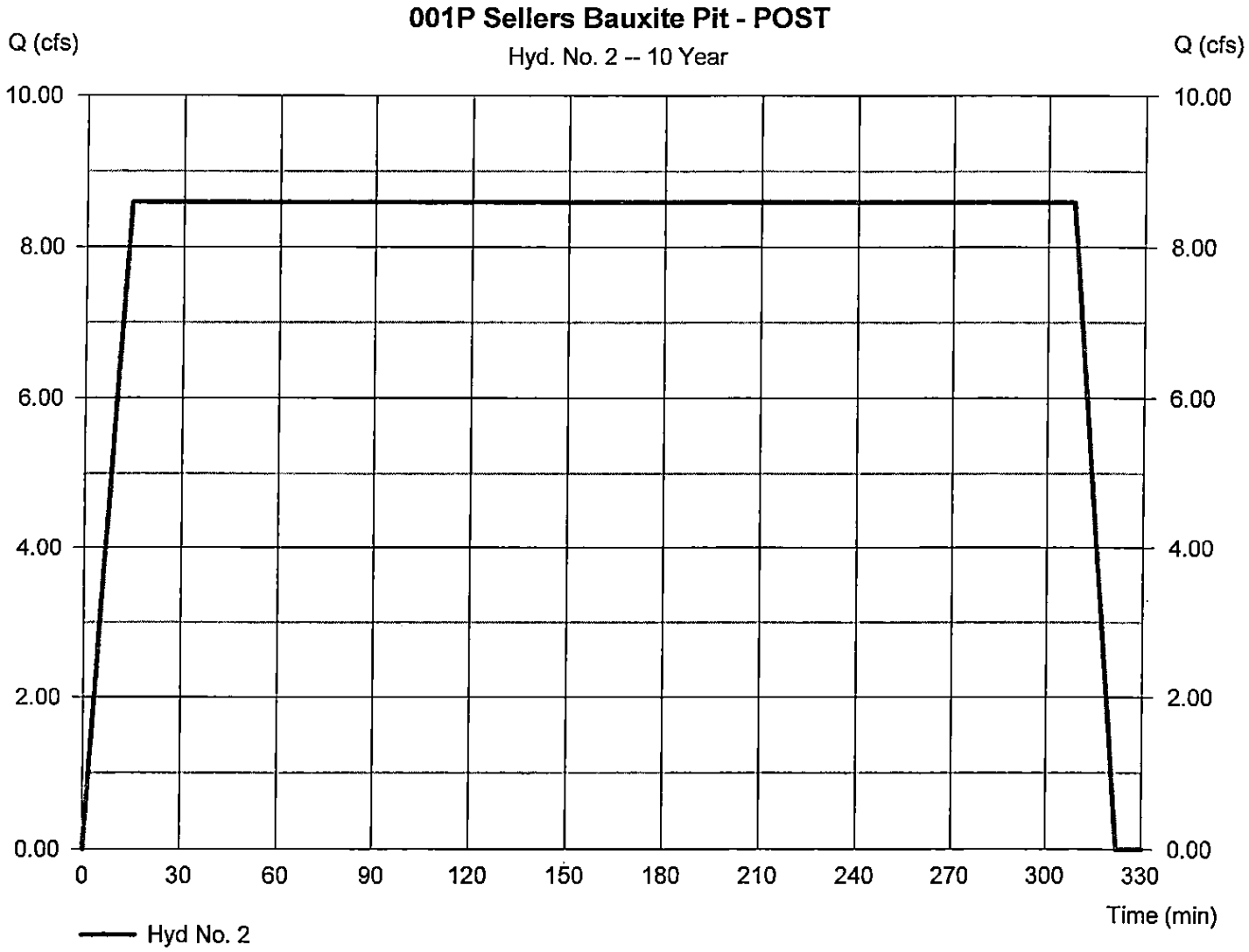


Hydrograph Report

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 8.591 cfs
Storm frequency	= 10 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 158,754 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 0.881 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 22.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



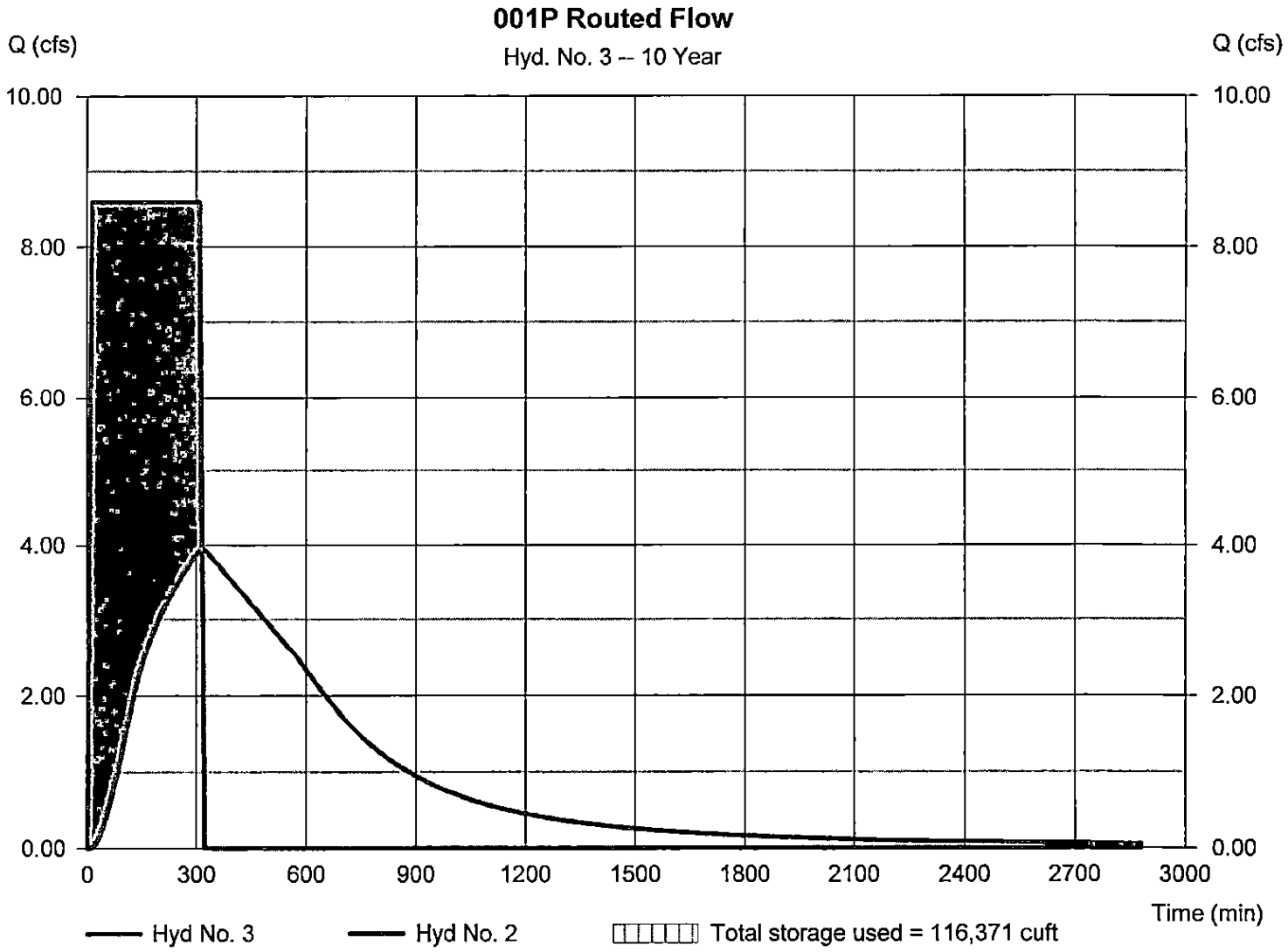
Hydrograph Report

Hyd. No. 3

001P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 3.962 cfs
Storm frequency	= 10 yrs	Time to peak	= 316 min
Time interval	= 1 min	Hyd. volume	= 151,026 cuft
Inflow hyd. No.	= 2 - 001P Sellers Bauxite Pit - MOST	Max. Elevation	= 321.60 ft
Reservoir name	= 001P Sediment Pond	Max. Storage	= 116,371 cuft

Storage Indication method used.

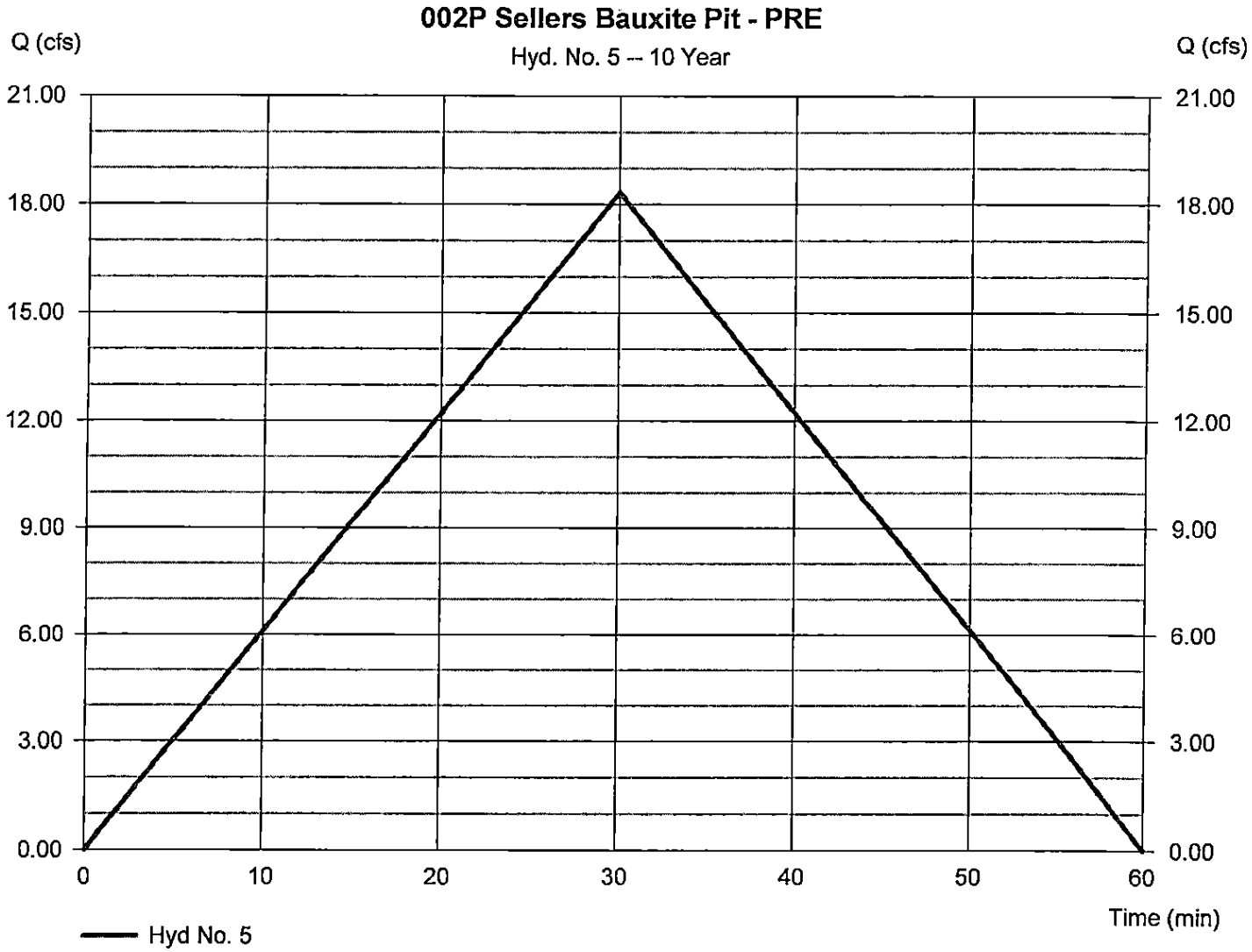


Hydrograph Report

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 18.33 cfs
Storm frequency	= 10 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 33,001 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 4.029 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

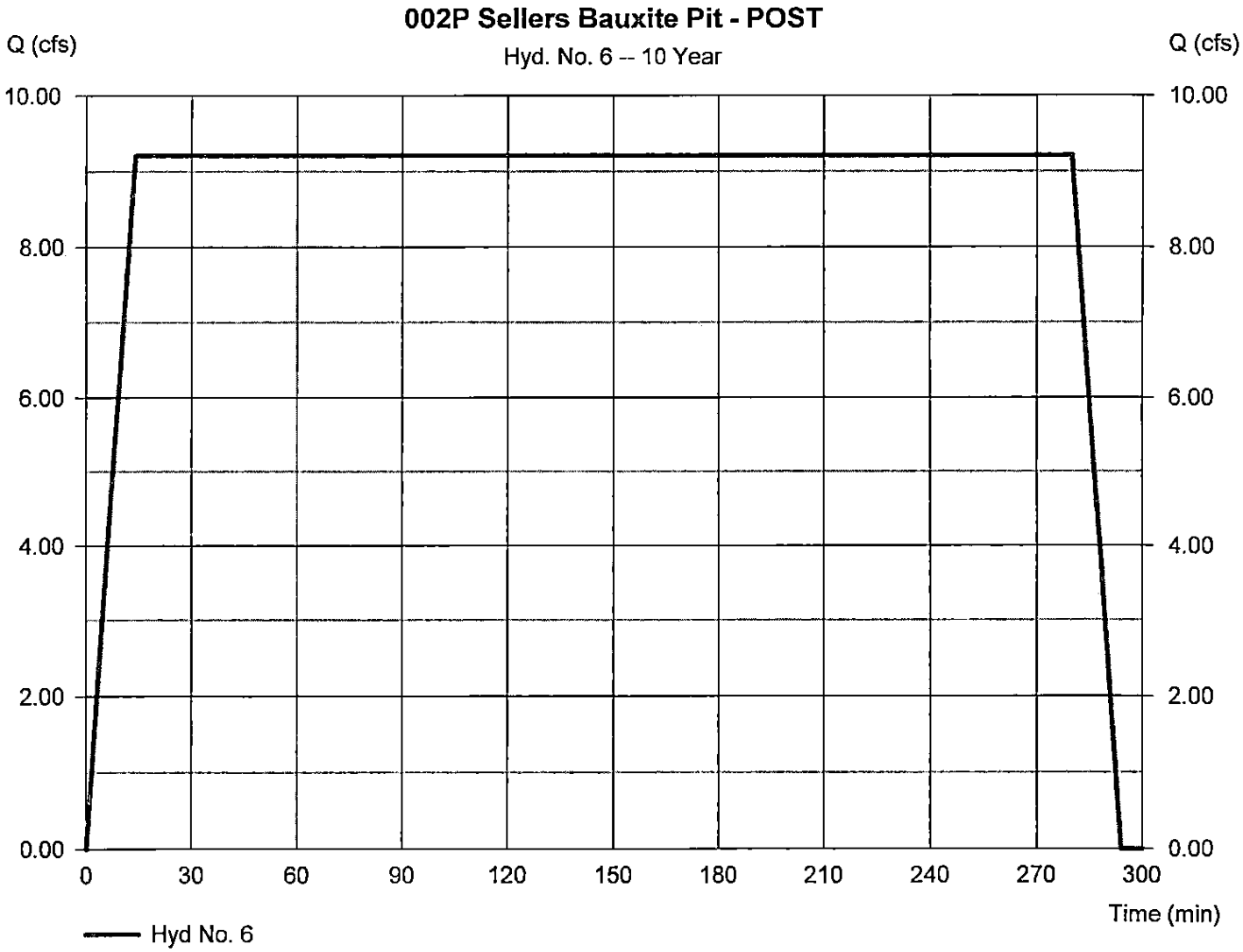


Hydrograph Report

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 9.209 cfs
Storm frequency	= 10 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 154,706 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 0.944 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 20.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



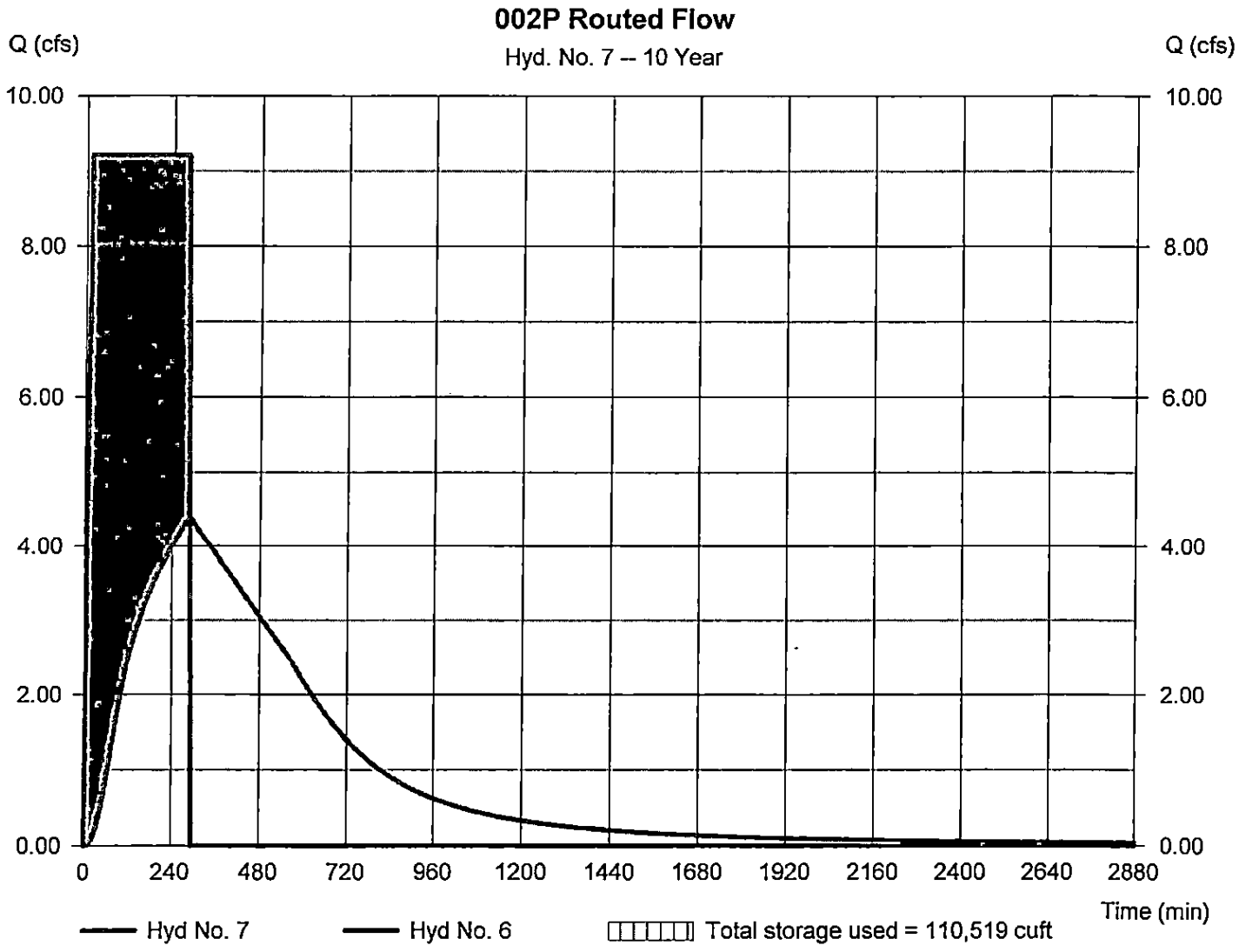
Hydrograph Report

Hyd. No. 7

002P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 4.364 cfs
Storm frequency	= 10 yrs	Time to peak	= 287 min
Time interval	= 1 min	Hyd. volume	= 149,483 cuft
Inflow hyd. No.	= 6 - 002P Sellers Bauxite Pit - POST	Max. Elevation	= 321.83 ft
Reservoir name	= 002P Sediment Pond	Max. Storage	= 110,519 cuft

Storage Indication method used.

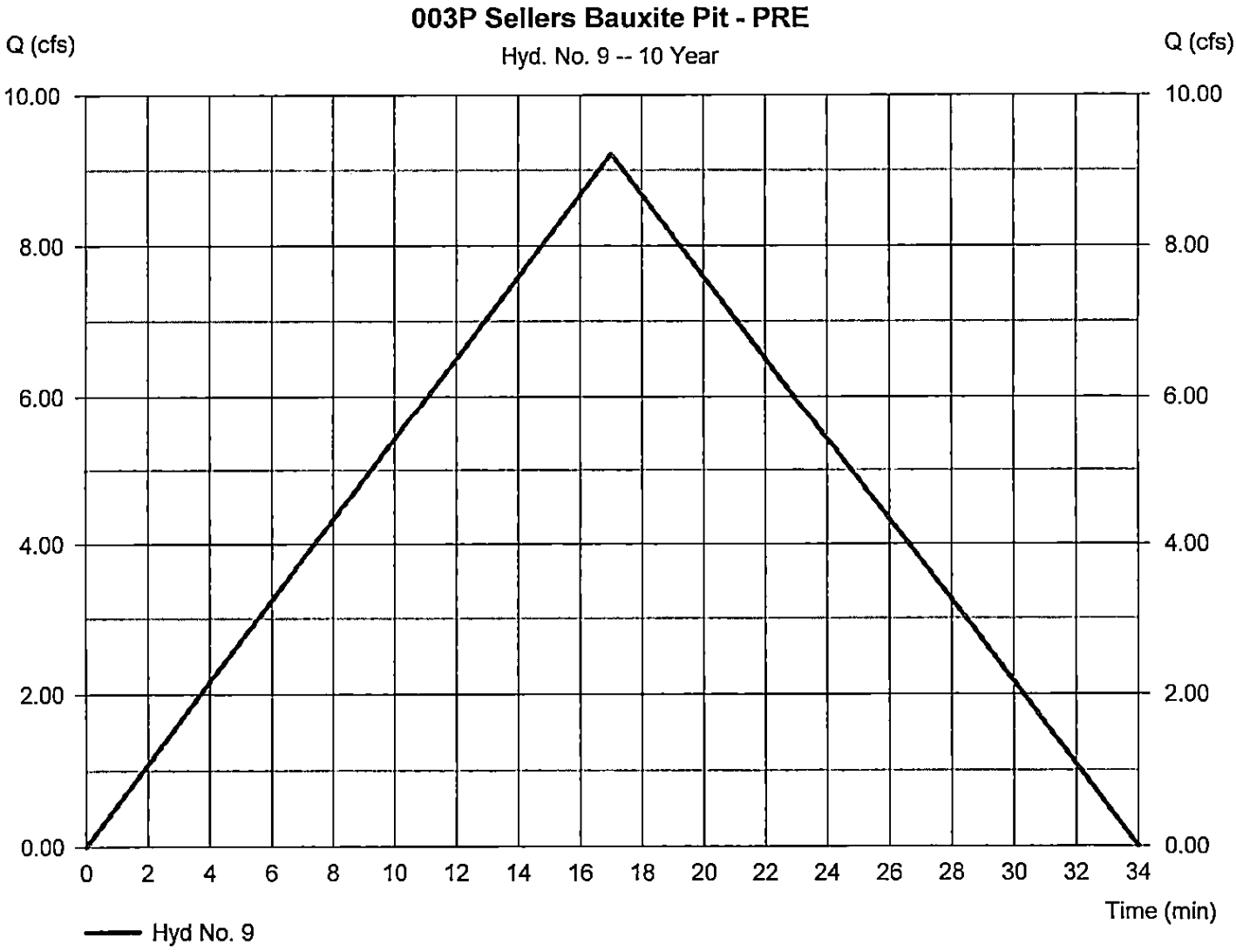


Hydrograph Report

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 9.214 cfs
Storm frequency	= 10 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 9,398 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.35
Intensity	= 5.265 in/hr	Tc by FAA	= 17.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

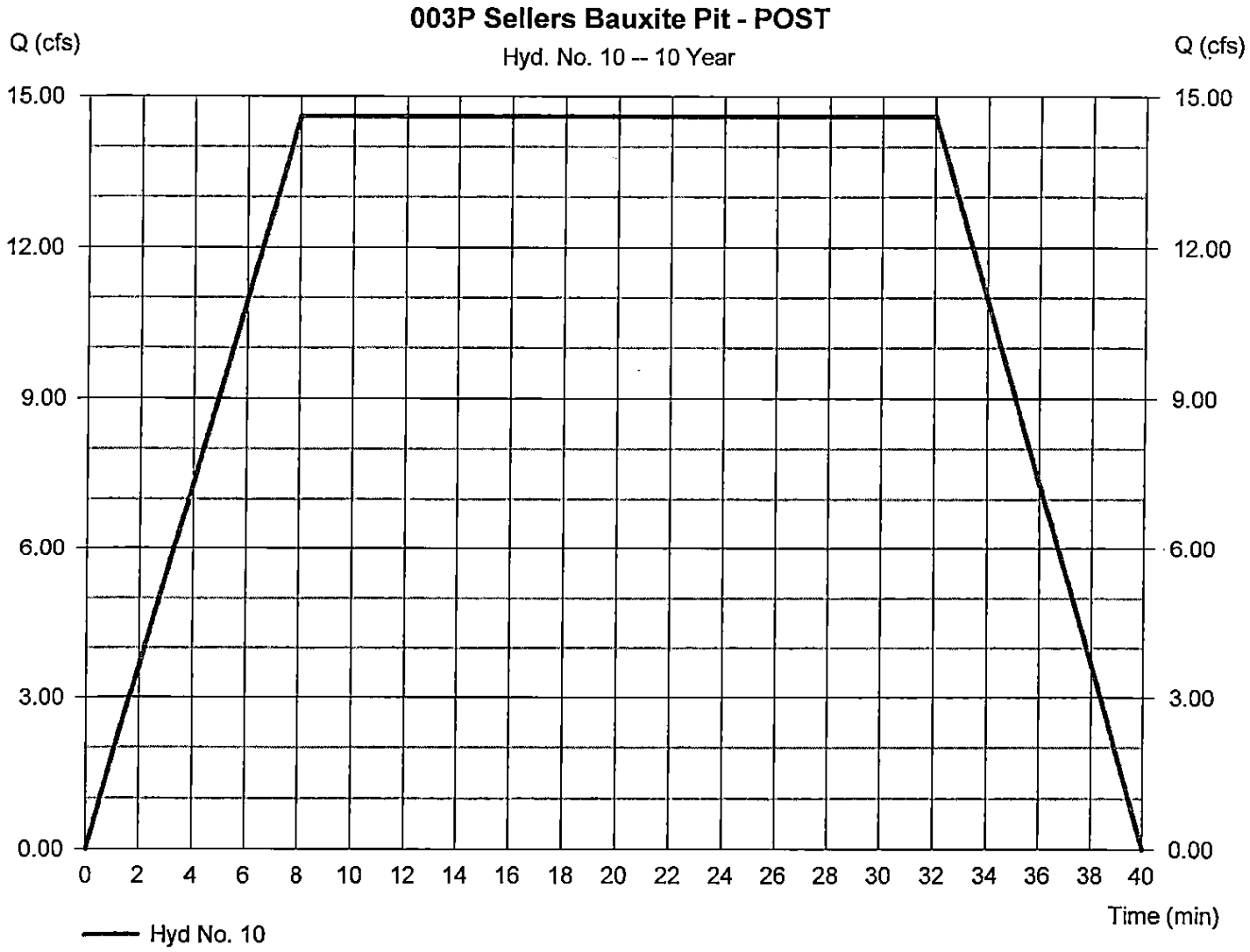


Hydrograph Report

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 14.61 cfs
Storm frequency	= 10 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 28,044 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.75
Intensity	= 3.895 in/hr	Tc by FAA	= 8.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 4.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



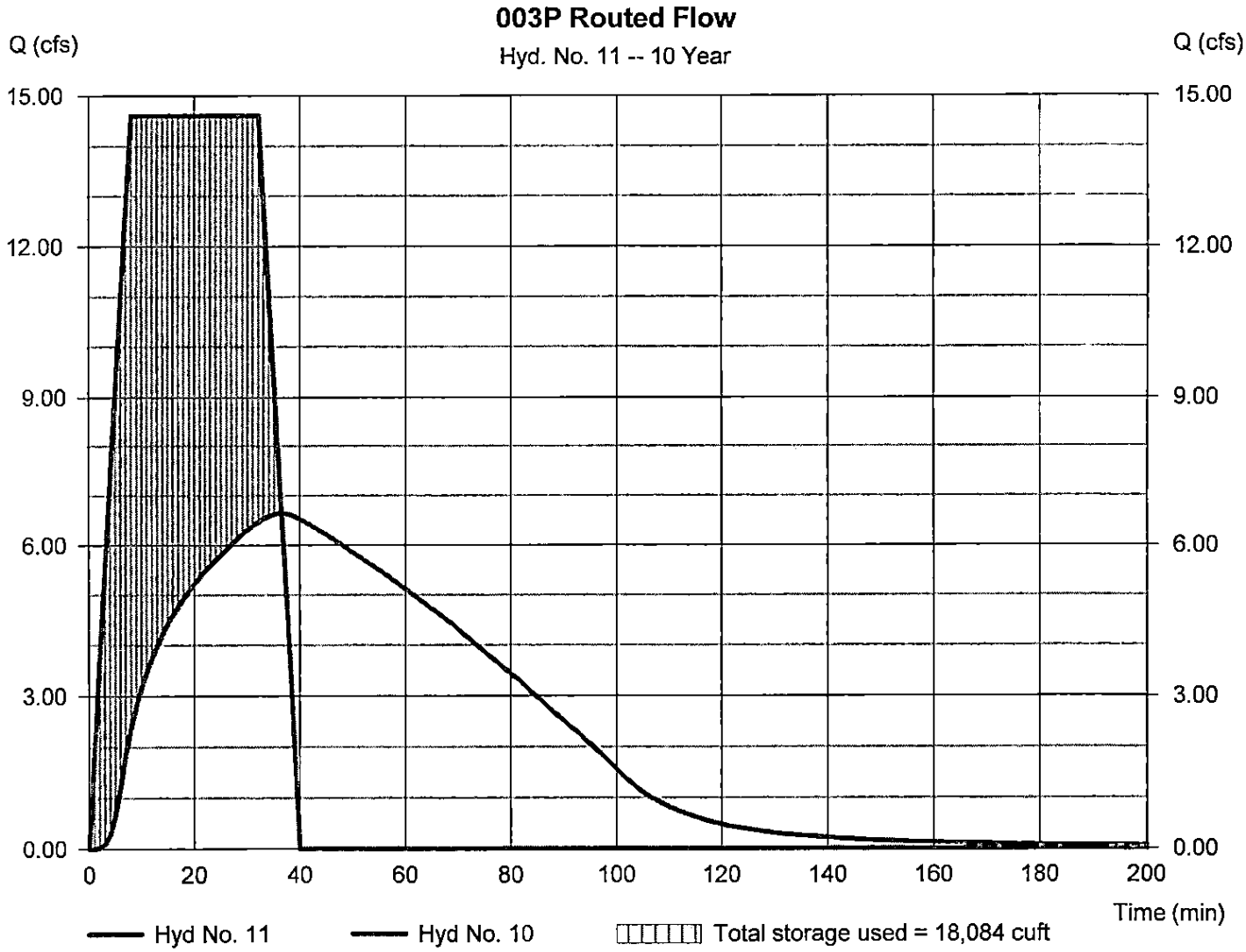
Hydrograph Report

Hyd. No. 11

003P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 6.638 cfs
Storm frequency	= 10 yrs	Time to peak	= 36 min
Time interval	= 1 min	Hyd. volume	= 28,032 cuft
Inflow hyd. No.	= 10 - 003P Sellers Bauxite Pit Max.	Max. Elevation	= 454.43 ft
Reservoir name	= 003P Sediment Pond	Max. Storage	= 18,084 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

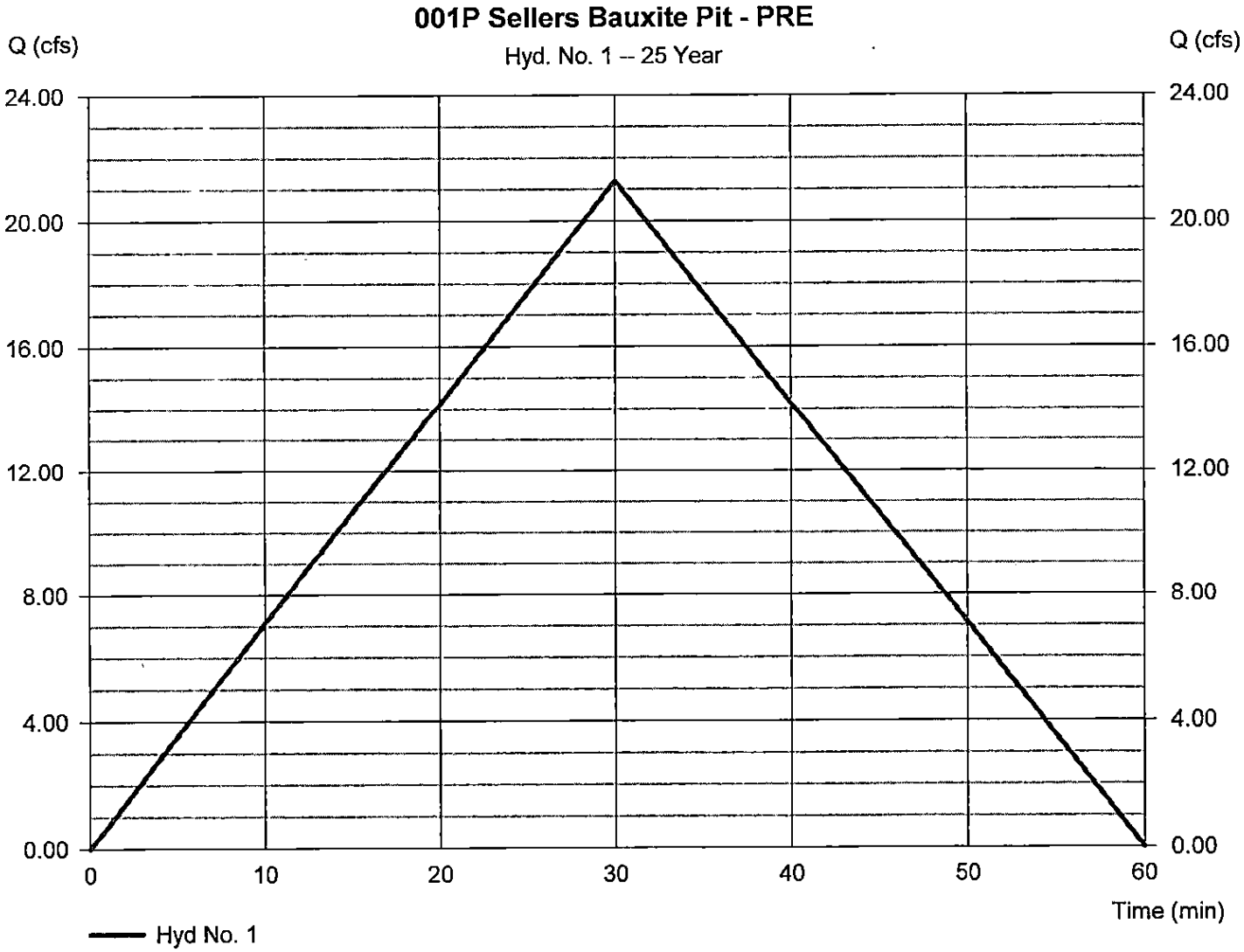
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	21.28	1	30	38,296	-----	-----	-----	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	10.33	1	14	190,842	-----	-----	-----	001P Sellers Bauxite Pit - POST
3	Reservoir	4.506	1	316	182,790	2	321.92	140,873	001P Routed Flow
5	Rational	21.28	1	30	38,296	-----	-----	-----	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	11.06	1	14	185,759	-----	-----	-----	002P Sellers Bauxite Pit - POST
7	Reservoir	4.938	1	288	180,340	6	322.21	134,255	002P Routed Flow
9	Rational	10.58	1	17	10,791	-----	-----	-----	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	16.97	1	8	32,582	-----	-----	-----	003P Sellers Bauxite Pit - POST
11	Reservoir	7.386	1	37	32,570	10	455.02	21,663	003P Routed Flow

Hydrograph Report

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 21.28 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 38,296 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 4.676 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

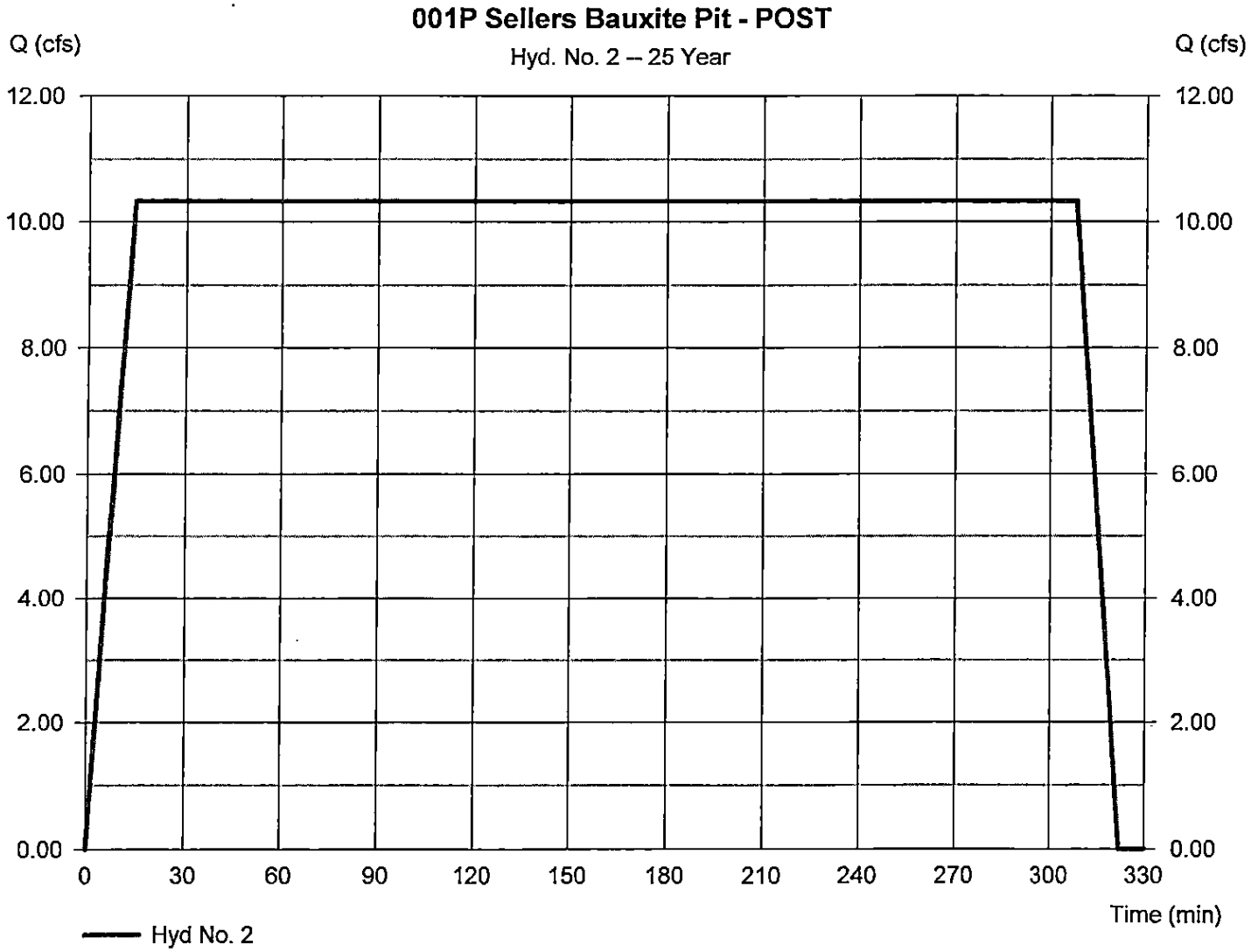


Hydrograph Report

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 10.33 cfs
Storm frequency	= 25 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 190,842 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 1.059 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 22.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



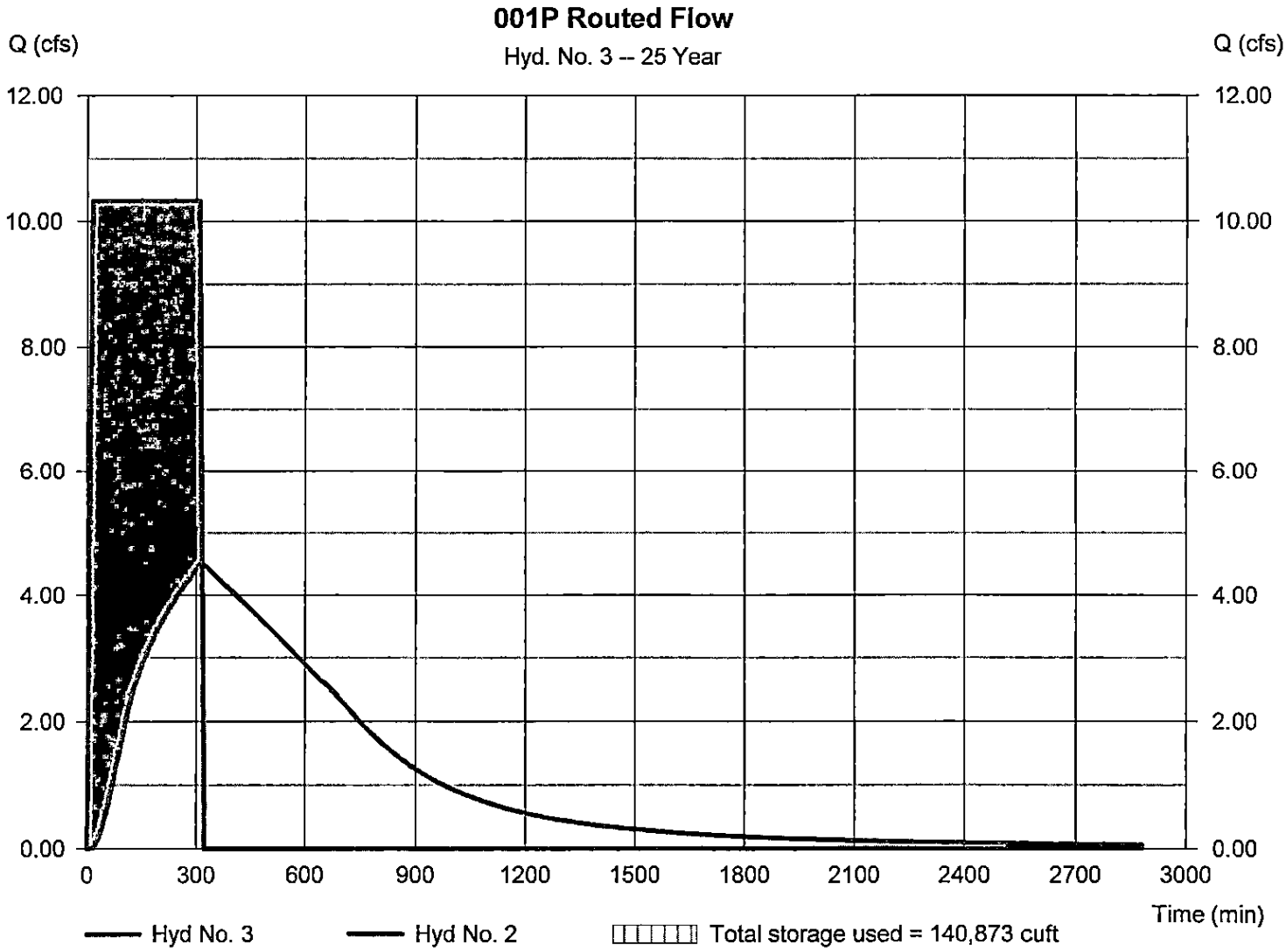
Hydrograph Report

Hyd. No. 3

001P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 4.506 cfs
Storm frequency	= 25 yrs	Time to peak	= 316 min
Time interval	= 1 min	Hyd. volume	= 182,790 cuft
Inflow hyd. No.	= 2 - 001P Sellers Bauxite Pit - Post	Max. Elevation	= 321.92 ft
Reservoir name	= 001P Sediment Pond	Max. Storage	= 140,873 cuft

Storage Indication method used.

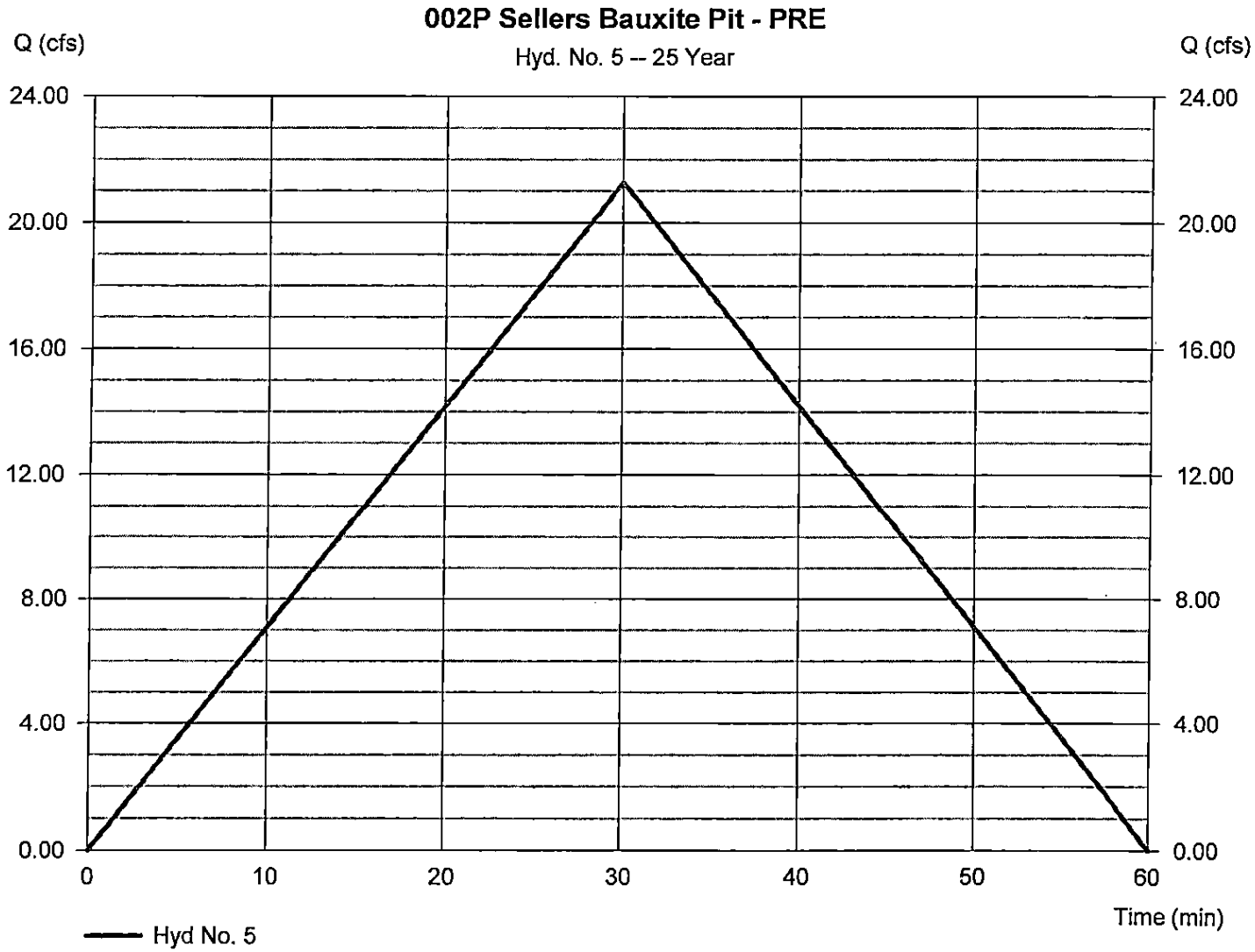


Hydrograph Report

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 21.28 cfs
Storm frequency	= 25 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 38,296 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 4.676 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

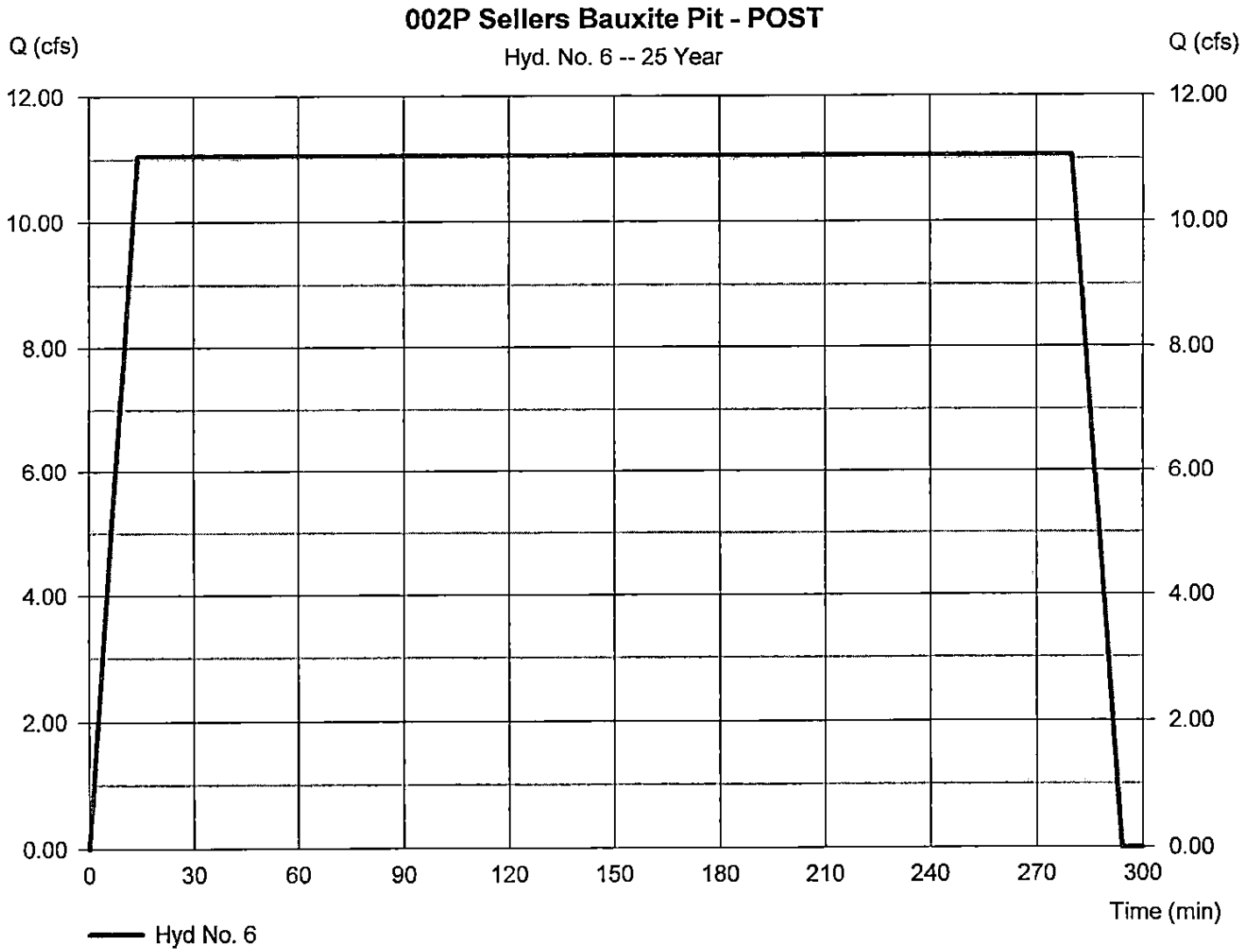


Hydrograph Report

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 11.06 cfs
Storm frequency	= 25 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 185,759 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 1.134 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 20.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



Hydrograph Report

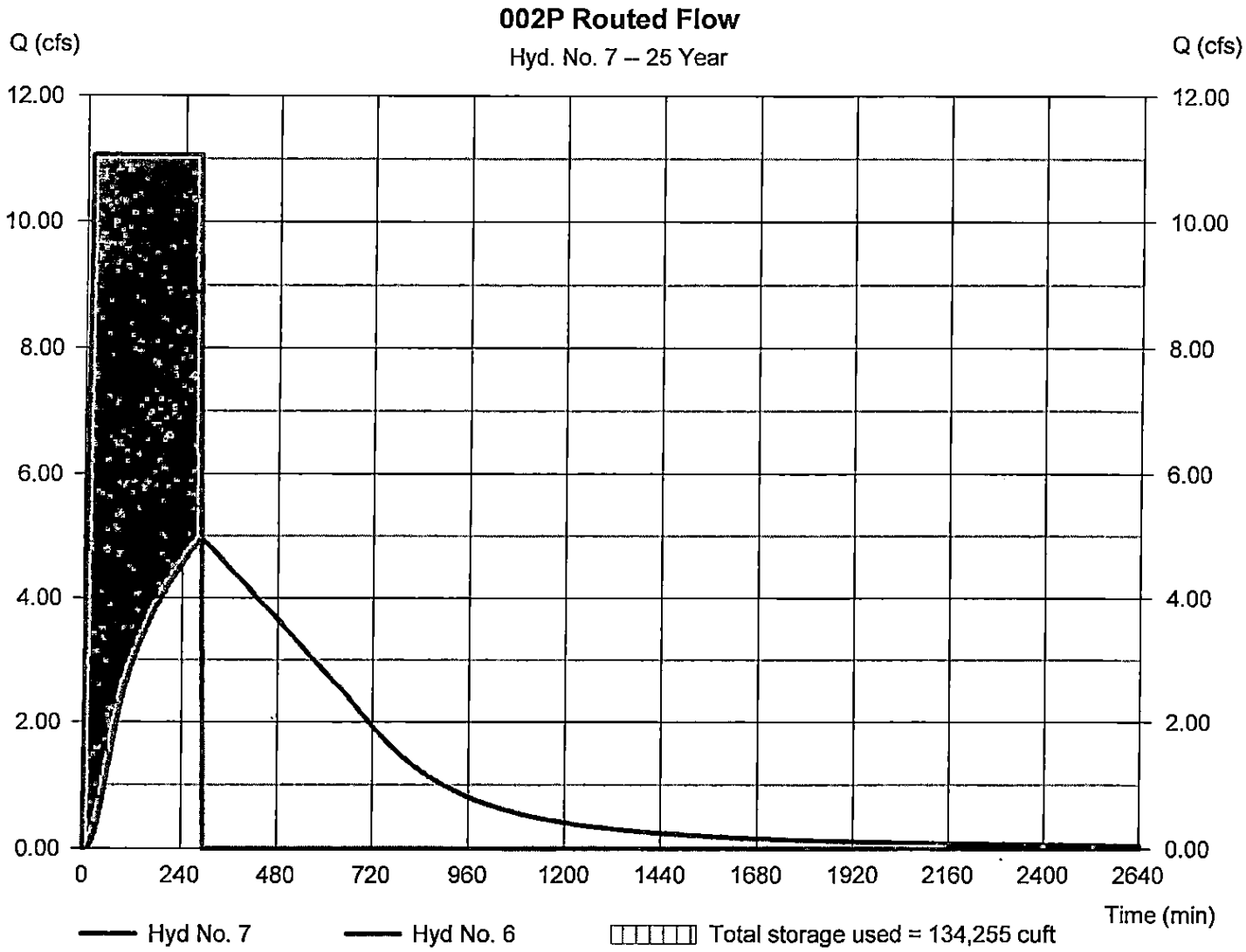
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 09 / 11 / 2014

Hyd. No. 7

002P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 4.938 cfs
Storm frequency	= 25 yrs	Time to peak	= 288 min
Time interval	= 1 min	Hyd. volume	= 180,340 cuft
Inflow hyd. No.	= 6 - 002P Sellers Bauxite Pit - POST	Max. Elevation	= 322.21 ft
Reservoir name	= 002P Sediment Pond	Max. Storage	= 134,255 cuft

Storage Indication method used.

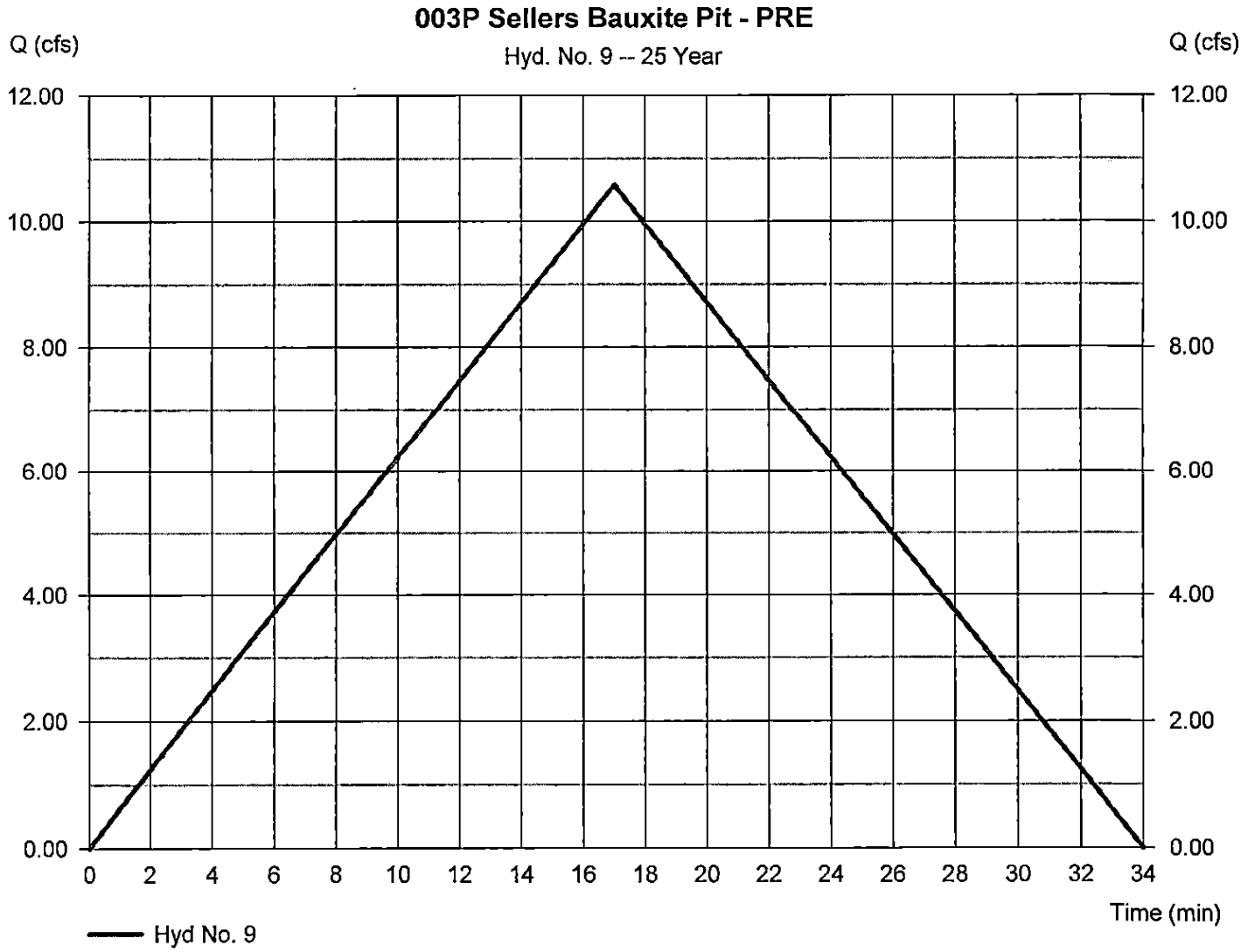


Hydrograph Report

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 10.58 cfs
Storm frequency	= 25 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 10,791 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.35
Intensity	= 6.045 in/hr	Tc by FAA	= 17.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

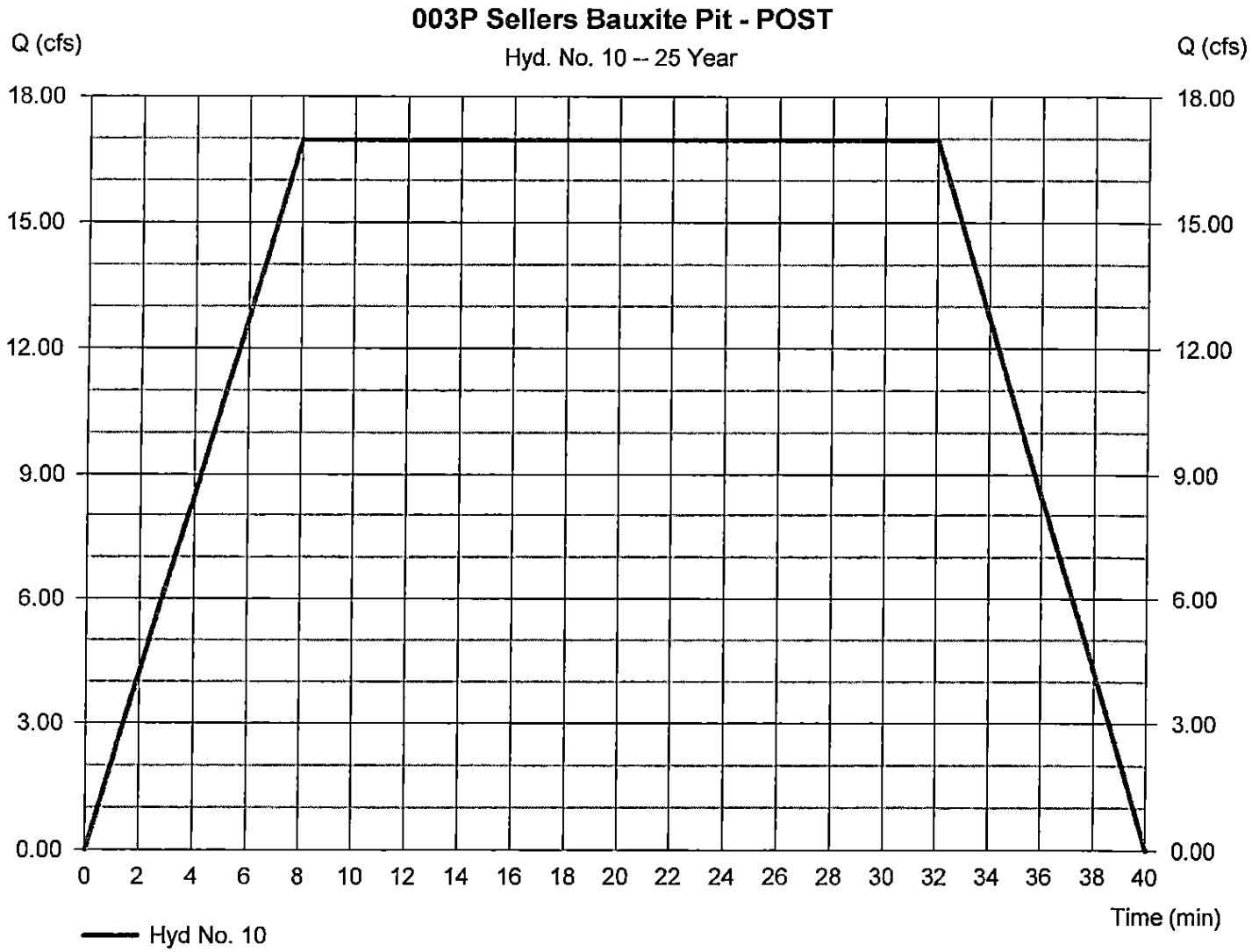


Hydrograph Report

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 16.97 cfs
Storm frequency	= 25 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 32,582 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.75
Intensity	= 4.525 in/hr	Tc by FAA	= 8.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 4.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



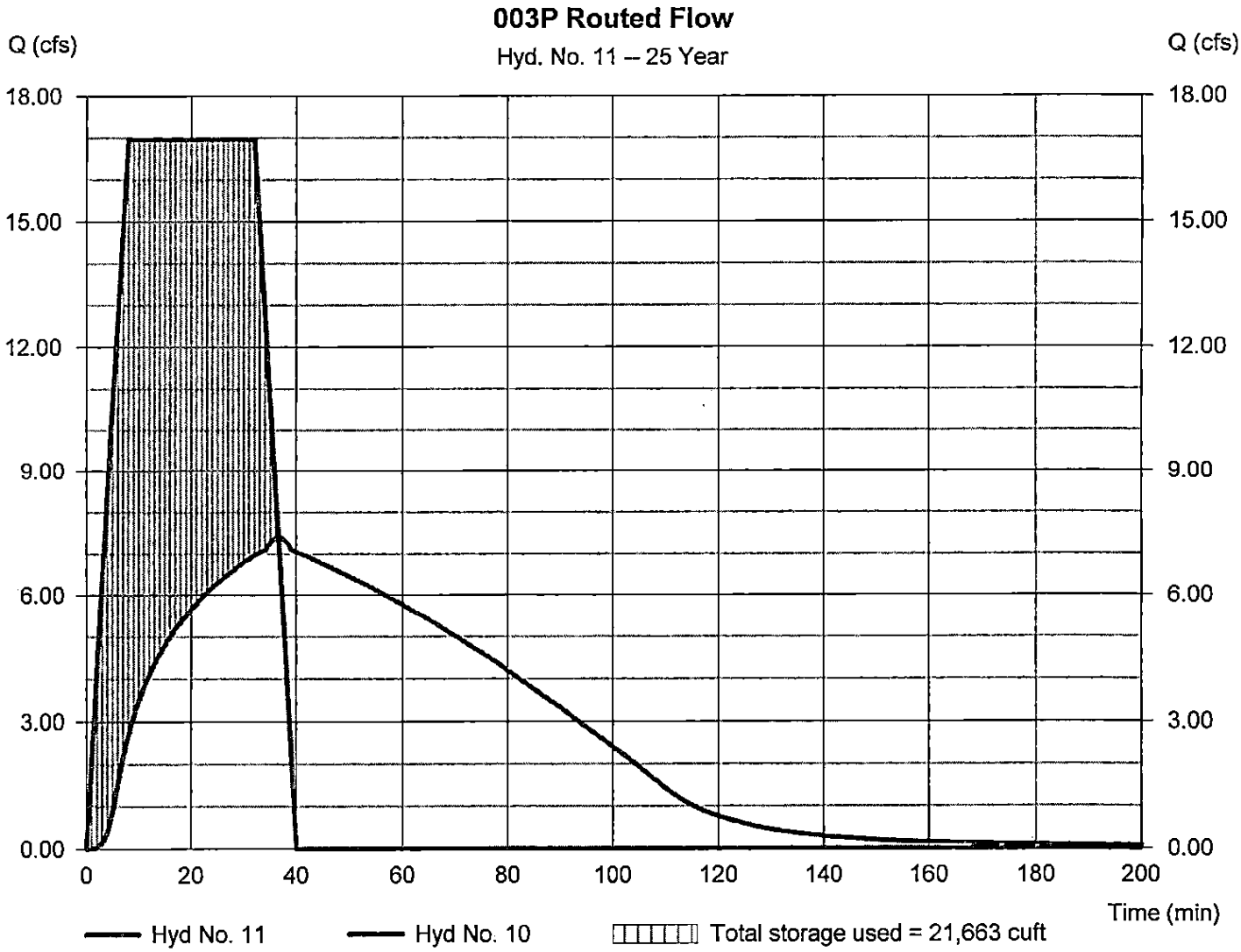
Hydrograph Report

Hyd. No. 11

003P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 7.386 cfs
Storm frequency	= 25 yrs	Time to peak	= 37 min
Time interval	= 1 min	Hyd. volume	= 32,570 cuft
Inflow hyd. No.	= 10 - 003P Sellers Bauxite Pit MBOS	Max. Elevation	= 455.02 ft
Reservoir name	= 003P Sediment Pond	Max. Storage	= 21,663 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

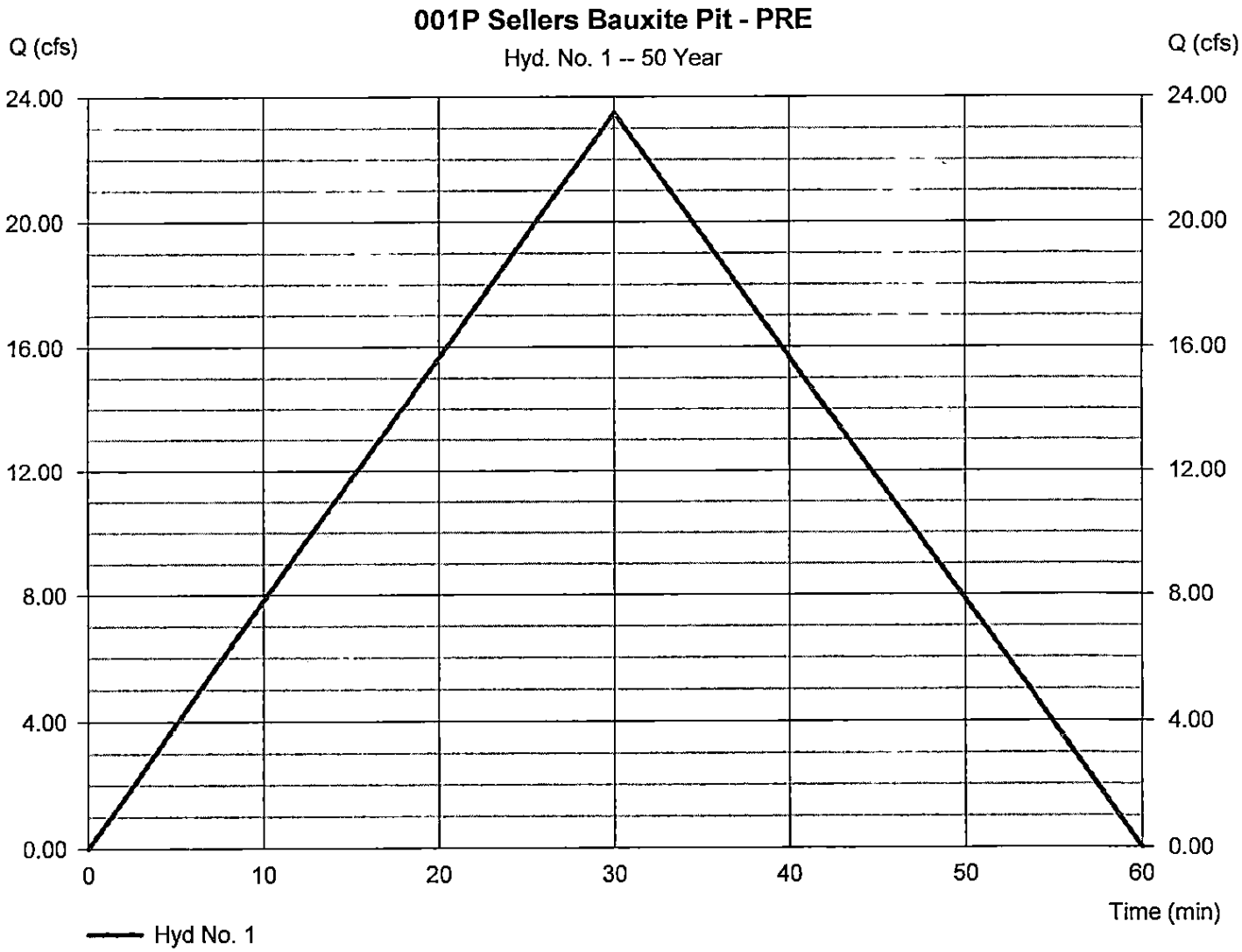
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	23.50	1	30	42,295	-----	-----	-----	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	12.13	1	14	224,169	-----	-----	-----	001P Sellers Bauxite Pit - POST
3	Reservoir	5.016	1	316	215,782	2	322.26	167,062	001P Routed Flow
5	Rational	23.50	1	30	42,295	-----	-----	-----	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	12.95	1	14	217,488	-----	-----	-----	002P Sellers Bauxite Pit - POST
7	Reservoir	5.469	1	288	211,873	6	322.59	159,219	002P Routed Flow
9	Rational	11.61	1	17	11,841	-----	-----	-----	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	18.76	1	8	36,019	-----	-----	-----	003P Sellers Bauxite Pit - POST
11	Reservoir	12.74	1	35	36,007	10	455.26	23,267	003P Routed Flow

Hydrograph Report

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 23.50 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 42,295 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 5.164 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

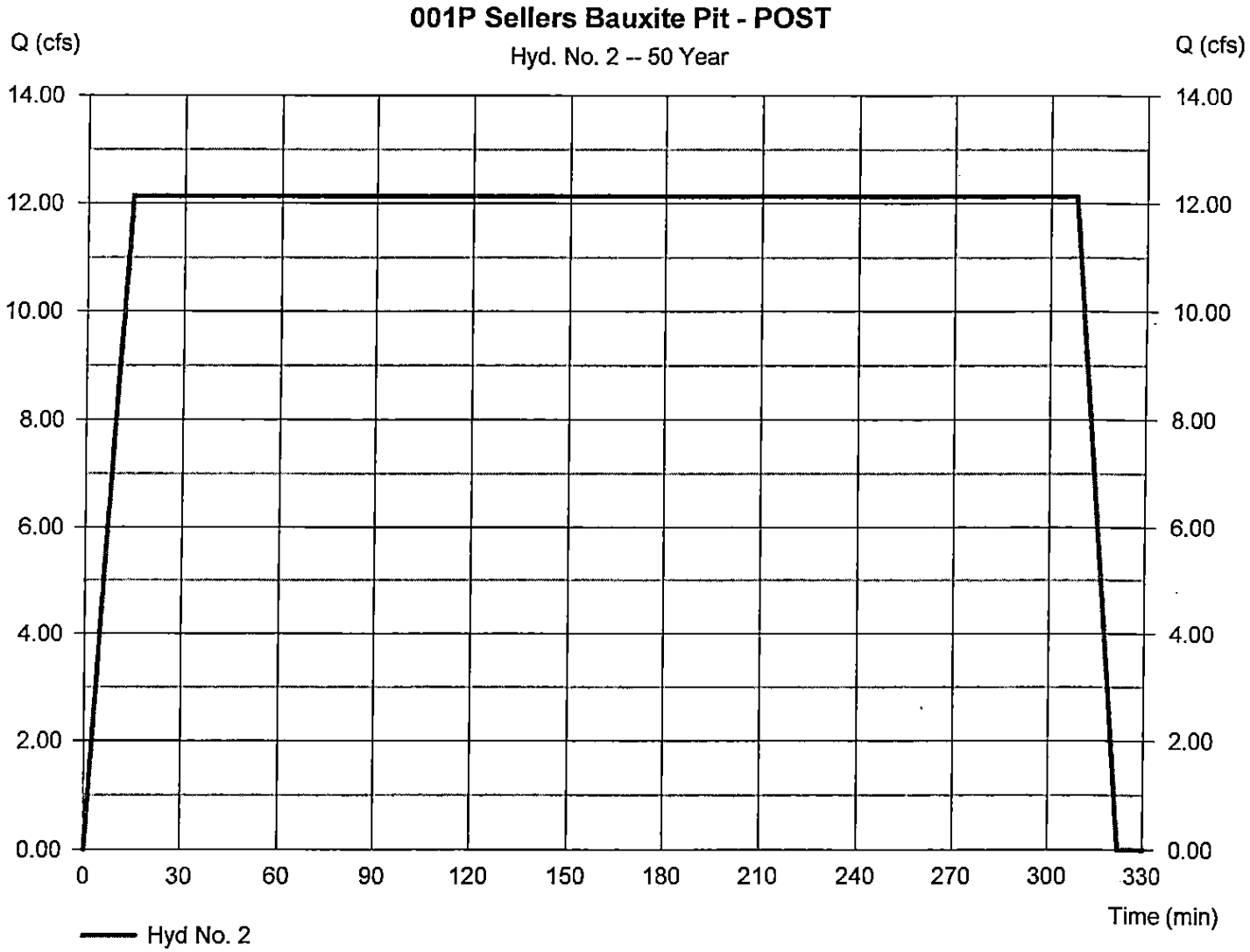


Hydrograph Report

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 12.13 cfs
Storm frequency	= 50 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 224,169 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 1.244 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 22.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



Hydrograph Report

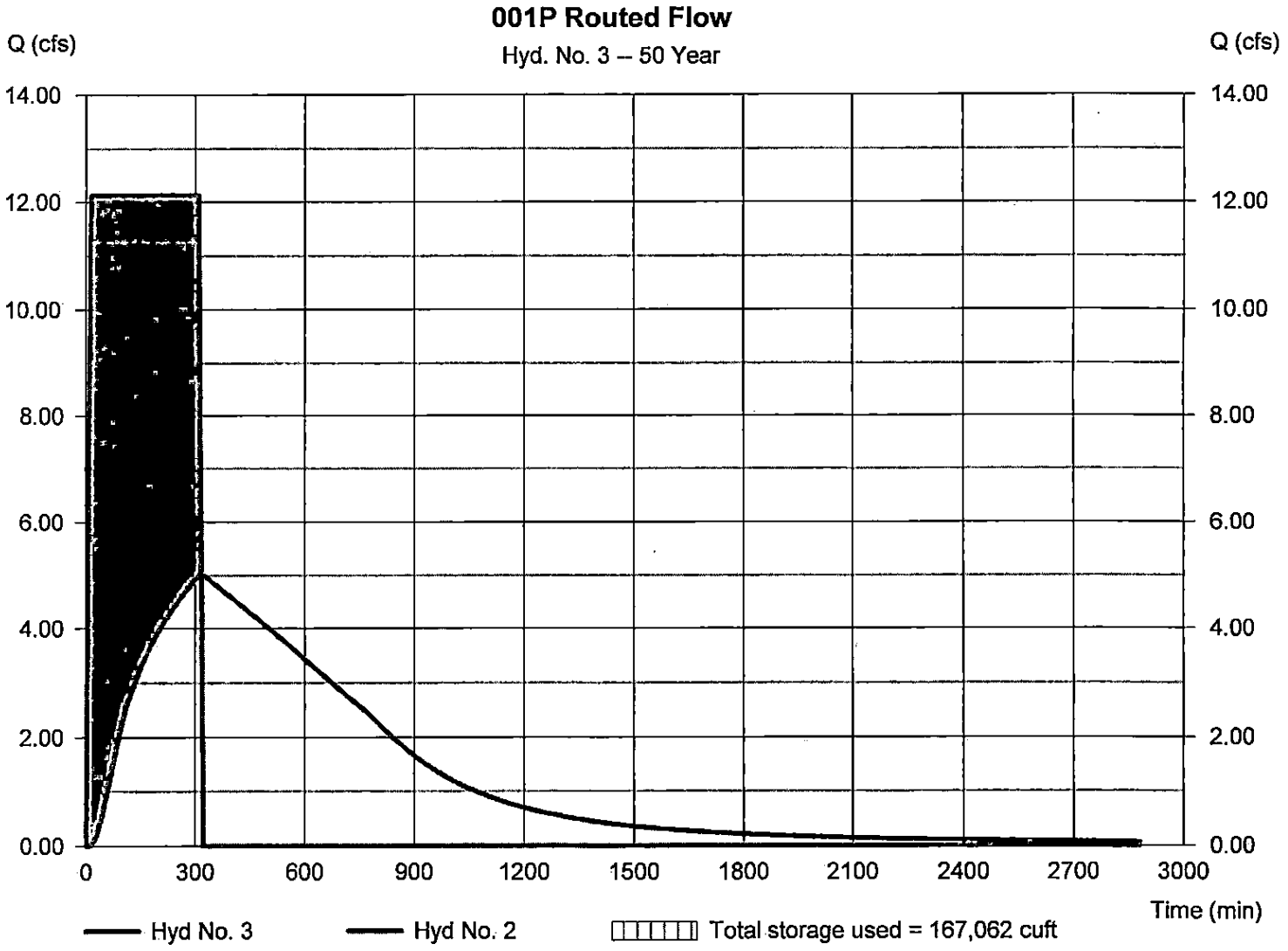
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 09 / 11 / 2014

Hyd. No. 3

001P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 5.016 cfs
Storm frequency	= 50 yrs	Time to peak	= 316 min
Time interval	= 1 min	Hyd. volume	= 215,782 cuft
Inflow hyd. No.	= 2 - 001P Sellers Bauxite Pit - Max	Max. Elevation	= 322.26 ft
Reservoir name	= 001P Sediment Pond	Max. Storage	= 167,062 cuft

Storage Indication method used.

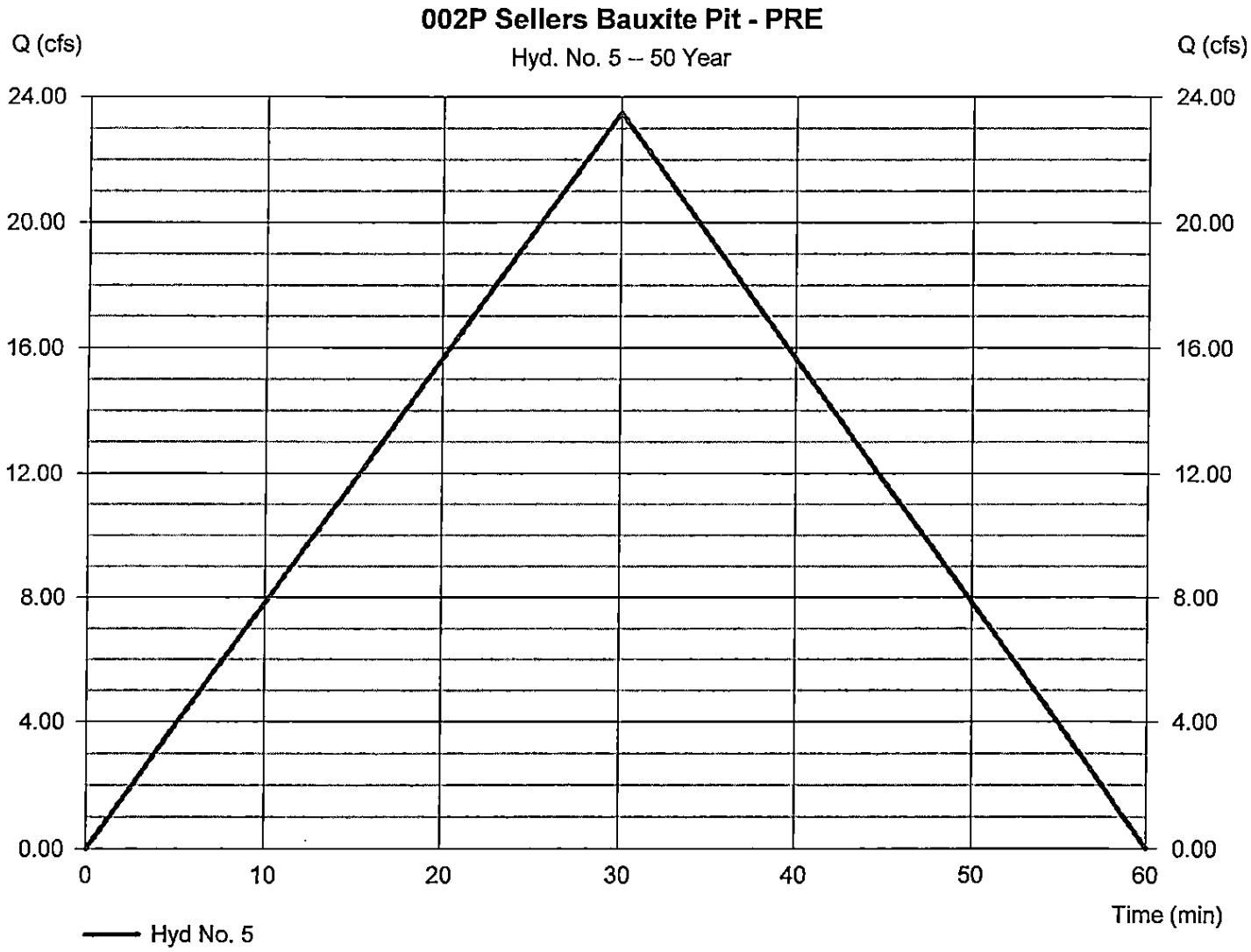


Hydrograph Report

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 23.50 cfs
Storm frequency	= 50 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 42,295 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 5.164 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

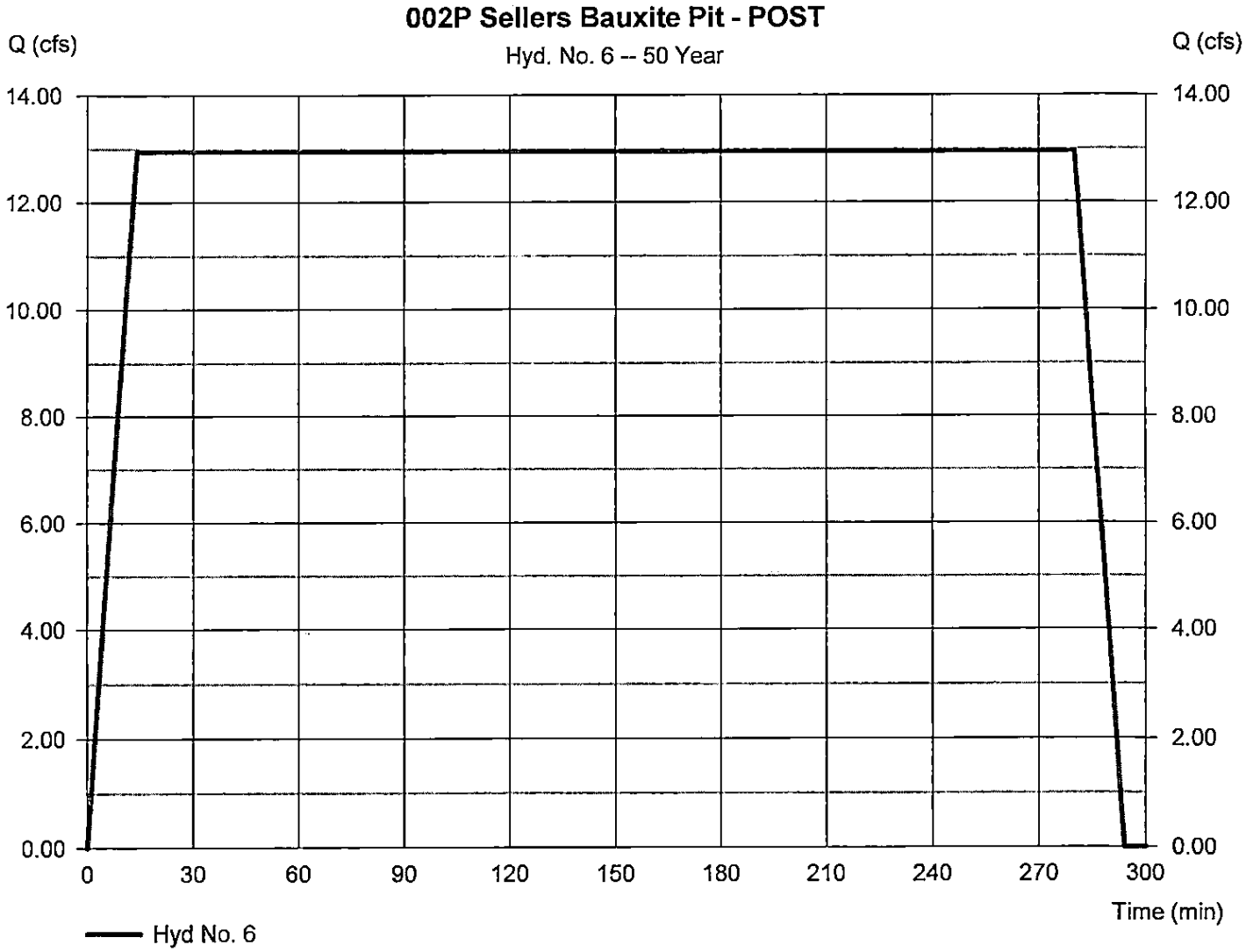


Hydrograph Report

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 12.95 cfs
Storm frequency	= 50 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 217,488 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 1.328 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 20.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



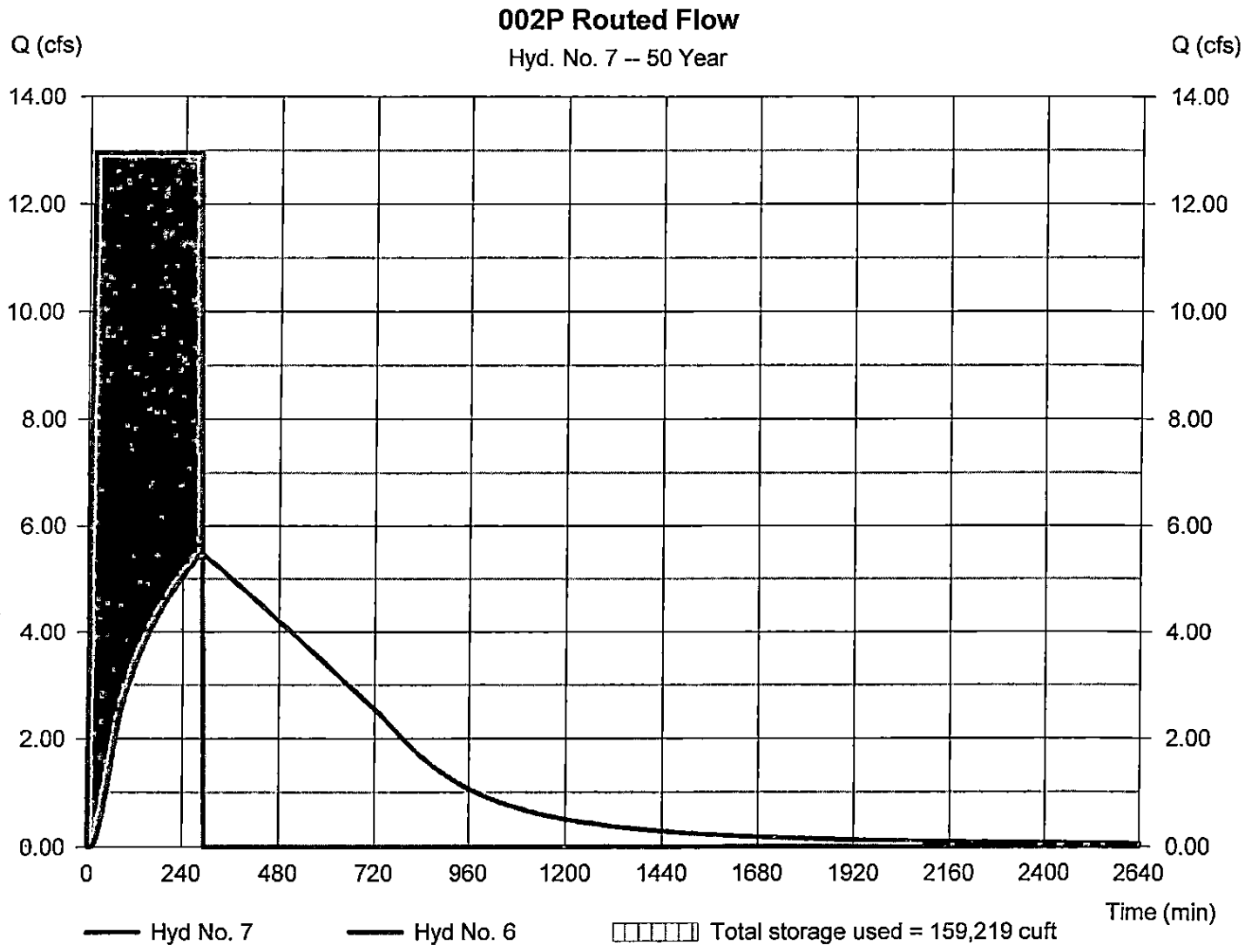
Hydrograph Report

Hyd. No. 7

002P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 5.469 cfs
Storm frequency	= 50 yrs	Time to peak	= 288 min
Time interval	= 1 min	Hyd. volume	= 211,873 cuft
Inflow hyd. No.	= 6 - 002P Sellers Bauxite Pit - Max	Max. Elevation	= 322.59 ft
Reservoir name	= 002P Sediment Pond	Max. Storage	= 159,219 cuft

Storage Indication method used.

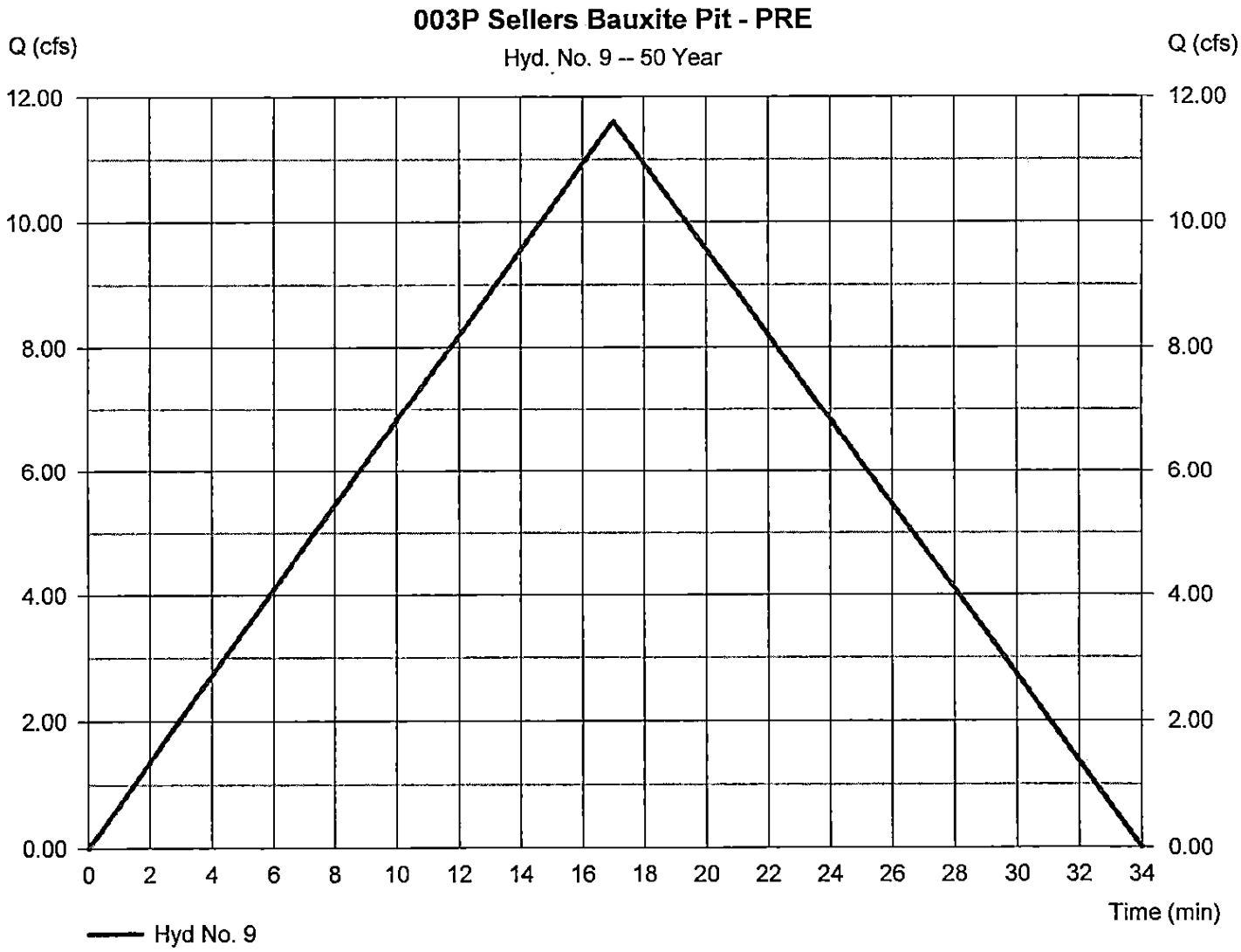


Hydrograph Report

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 11.61 cfs
Storm frequency	= 50 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 11,841 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.35
Intensity	= 6.634 in/hr	Tc by FAA	= 17.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

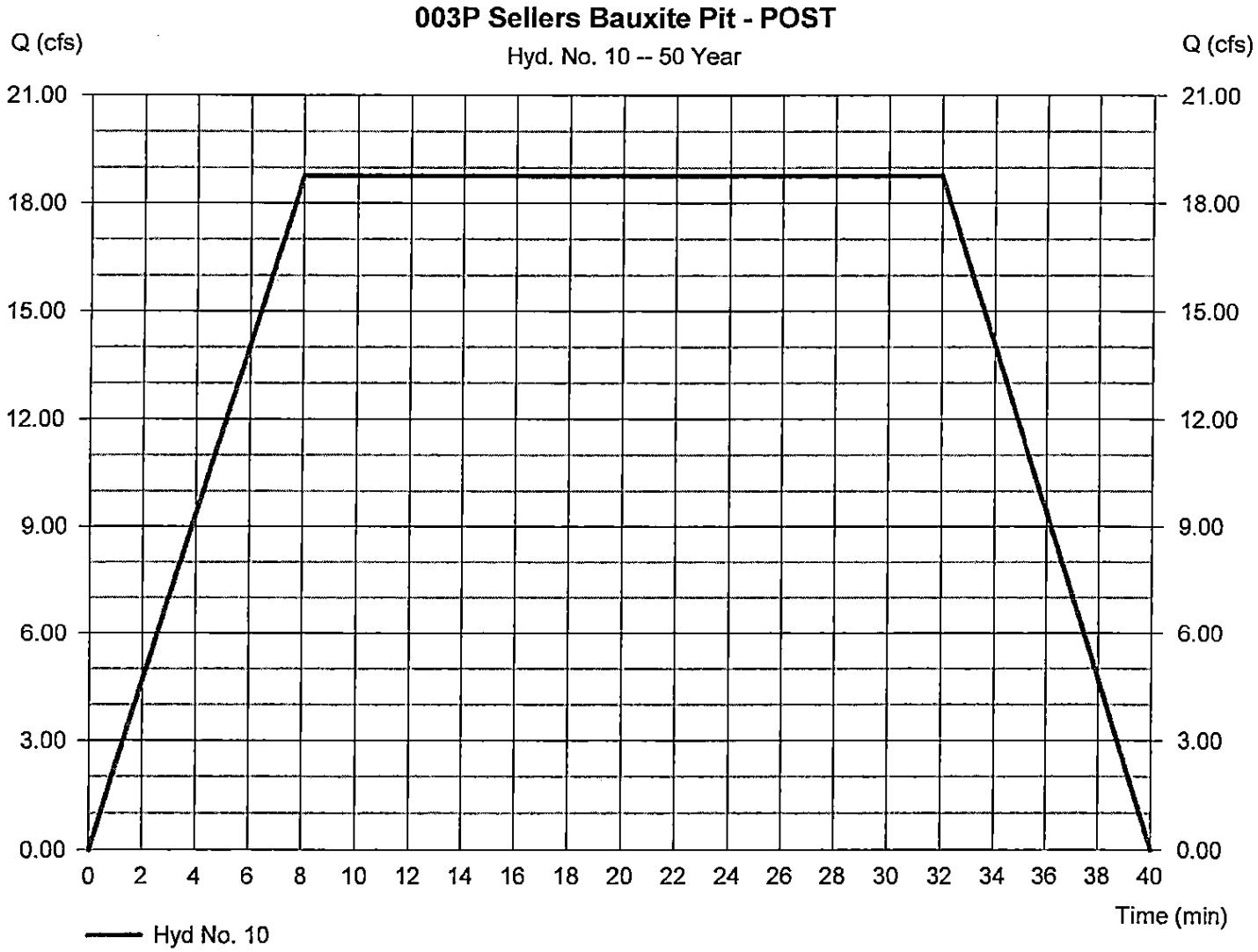


Hydrograph Report

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 18.76 cfs
Storm frequency	= 50 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 36,019 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.75
Intensity	= 5.003 in/hr	Tc by FAA	= 8.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 4.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



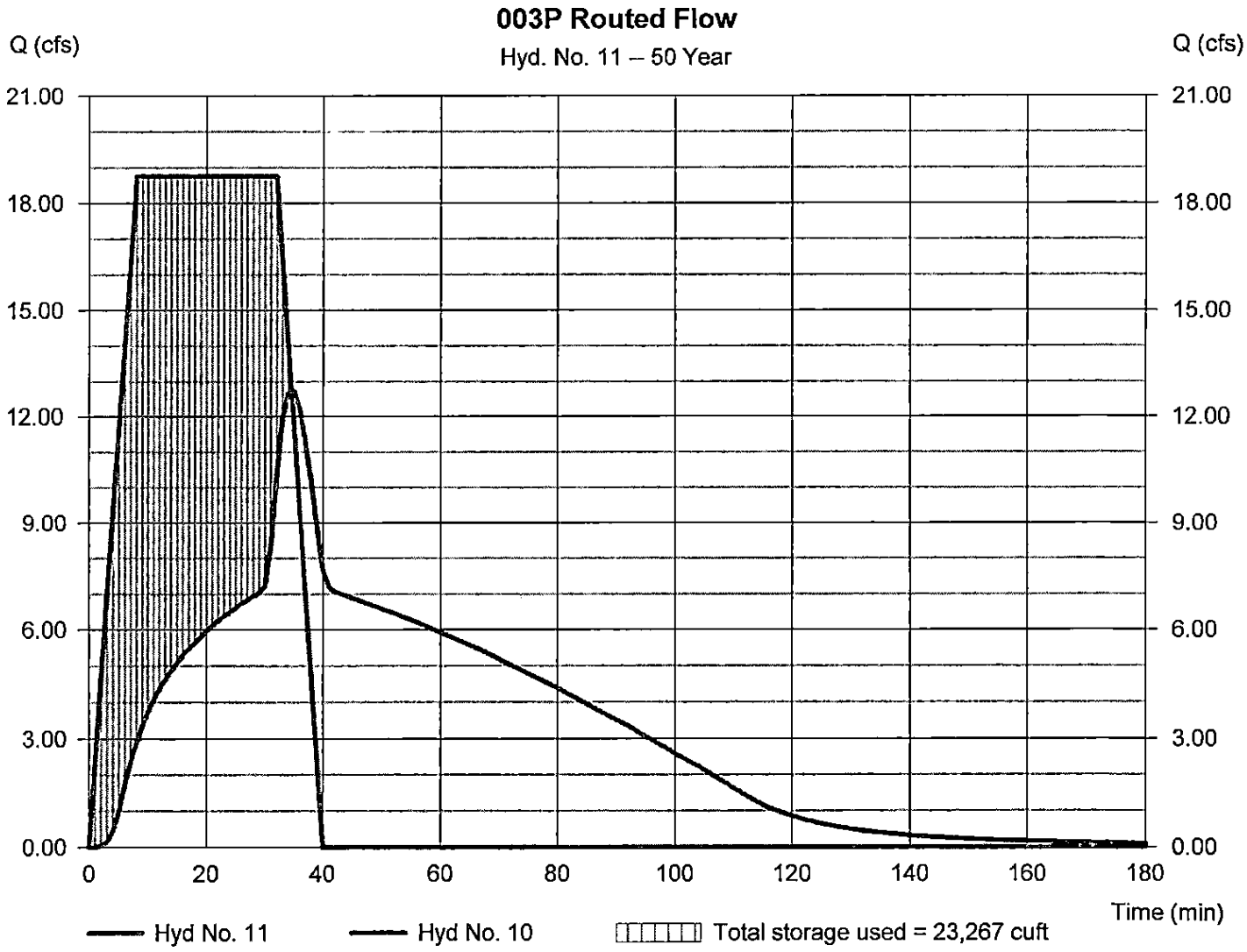
Hydrograph Report

Hyd. No. 11

003P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 12.74 cfs
Storm frequency	= 50 yrs	Time to peak	= 35 min
Time interval	= 1 min	Hyd. volume	= 36,007 cuft
Inflow hyd. No.	= 10 - 003P Sellers Bauxite Pit MBOS	Max. Elevation	= 455.26 ft
Reservoir name	= 003P Sediment Pond	Max. Storage	= 23,267 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

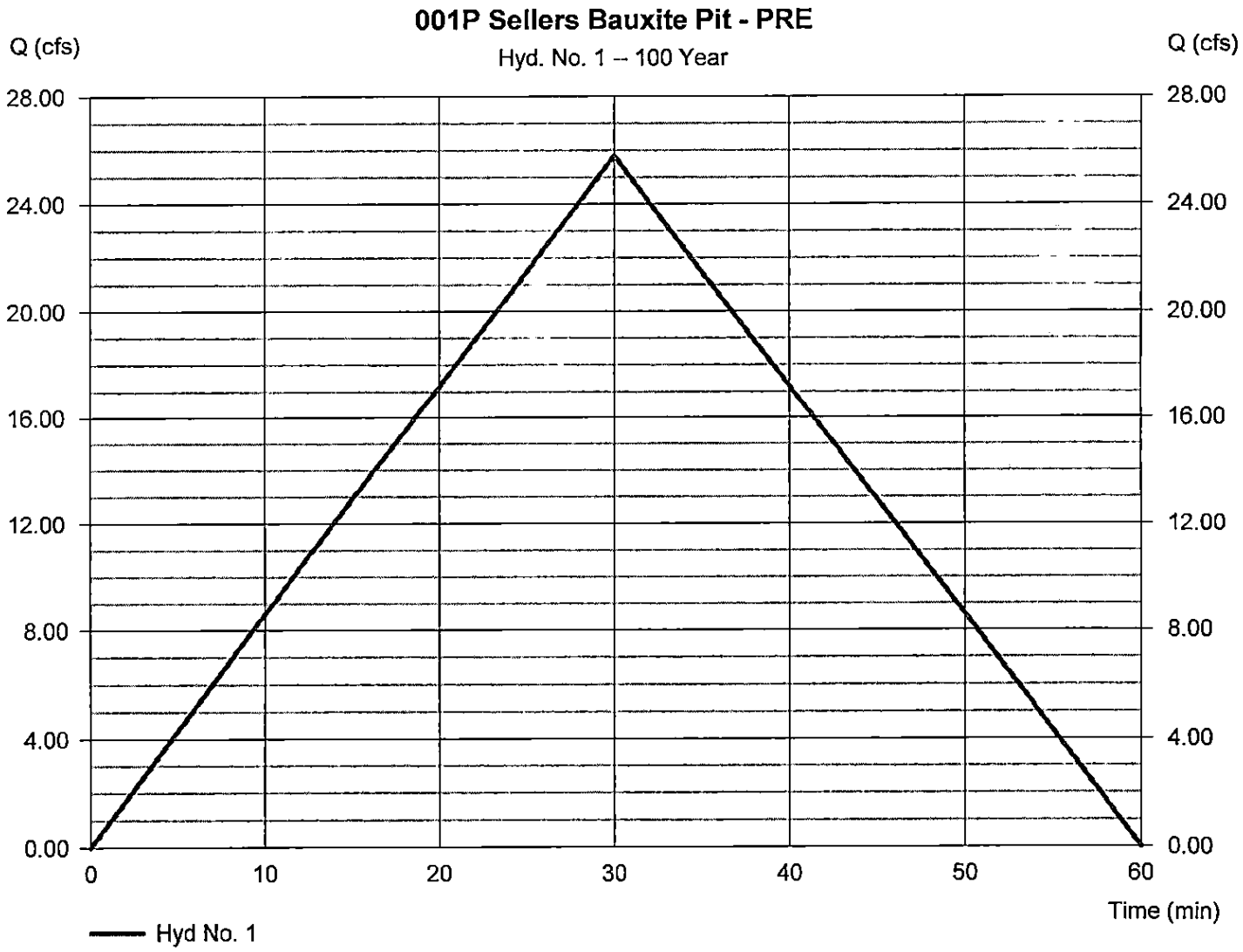
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	25.80	1	30	46,442	-----	-----	-----	001P Sellers Bauxite Pit - PRE
2	Mod. Rational	13.38	1	14	247,184	-----	-----	-----	001P Sellers Bauxite Pit - POST
3	Reservoir	5.344	1	316	238,564	2	322.50	185,504	001P Routed Flow
5	Rational	25.80	1	30	46,442	-----	-----	-----	002P Sellers Bauxite Pit - PRE
6	Mod. Rational	14.28	1	14	239,873	-----	-----	-----	002P Sellers Bauxite Pit - POST
7	Reservoir	5.814	1	288	234,123	6	322.86	177,179	002P Routed Flow
9	Rational	12.68	1	17	12,938	-----	-----	-----	003P Sellers Bauxite Pit - PRE
10	Mod. Rational	20.61	1	8	39,570	-----	-----	-----	003P Sellers Bauxite Pit - POST
11	Reservoir	16.91	1	33	39,558	10	455.42	24,264	003P Routed Flow

Hydrograph Report

Hyd. No. 1

001P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 25.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 46,442 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 5.671 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

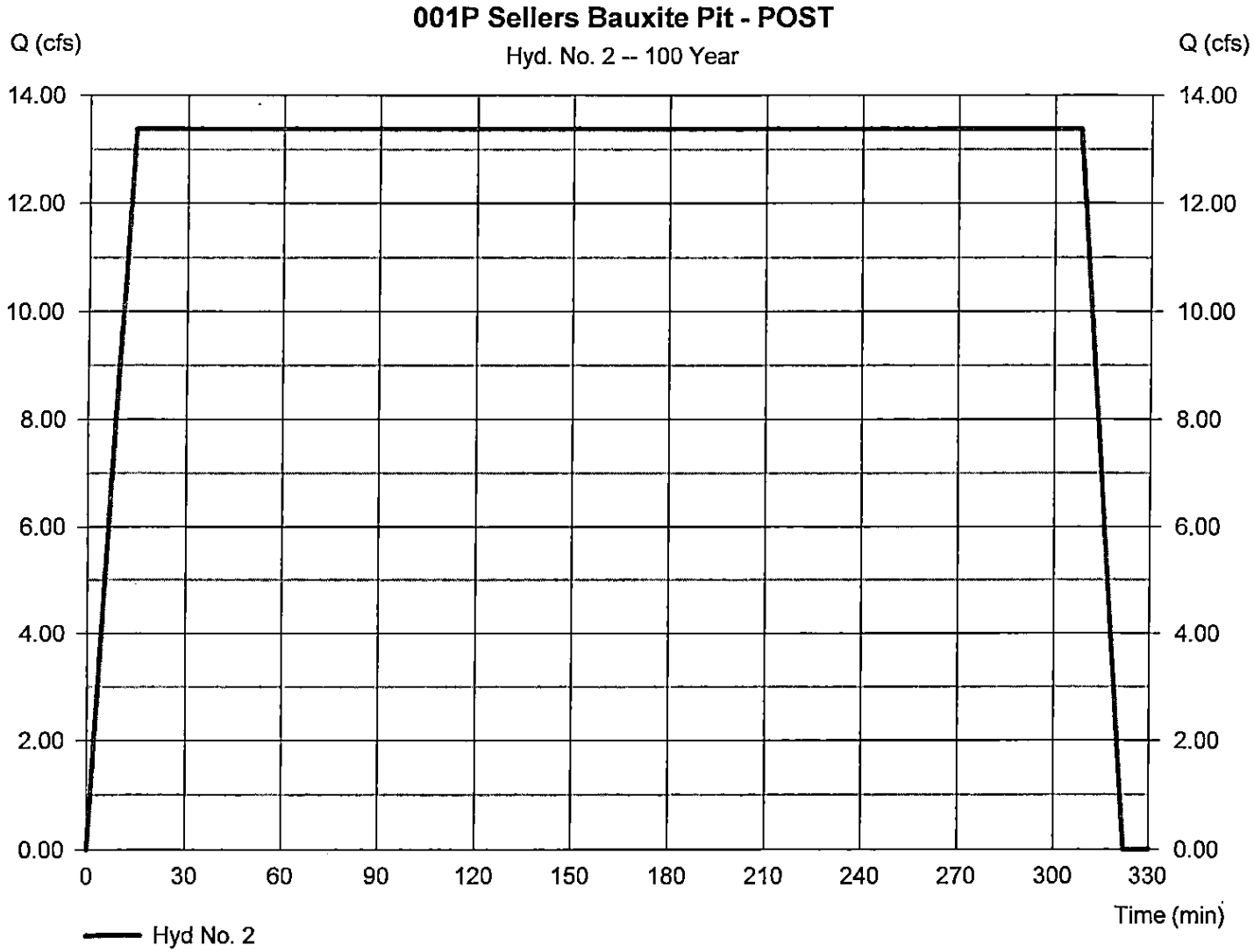


Hydrograph Report

Hyd. No. 2

001P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 13.38 cfs
Storm frequency	= 100 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 247,184 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 1.372 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 22.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



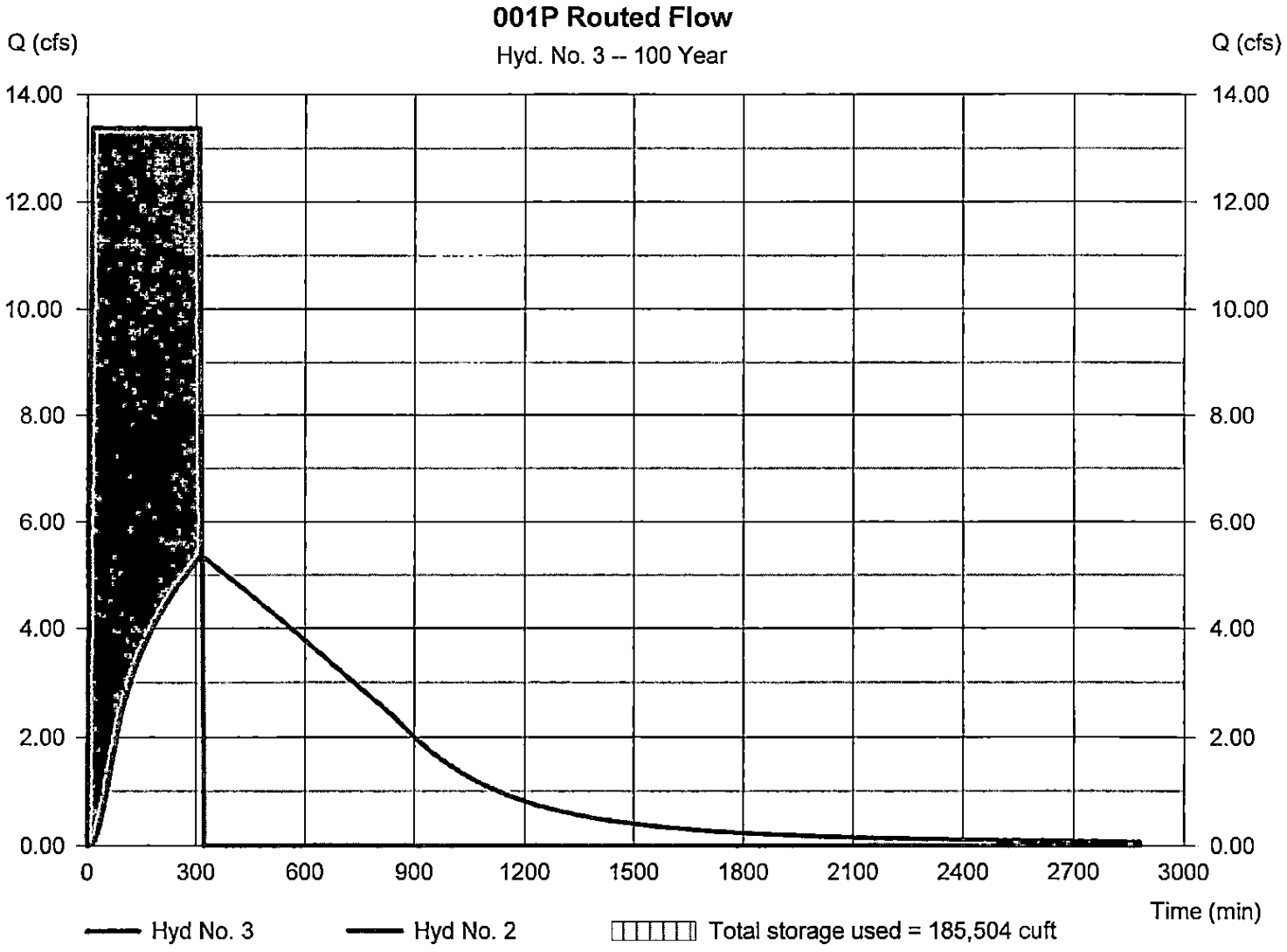
Hydrograph Report

Hyd. No. 3

001P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 5.344 cfs
Storm frequency	= 100 yrs	Time to peak	= 316 min
Time interval	= 1 min	Hyd. volume	= 238,564 cuft
Inflow hyd. No.	= 2 - 001P Sellers Bauxite Pit - Mod	Max. Elevation	= 322.50 ft
Reservoir name	= 001P Sediment Pond	Max. Storage	= 185,504 cuft

Storage Indication method used.

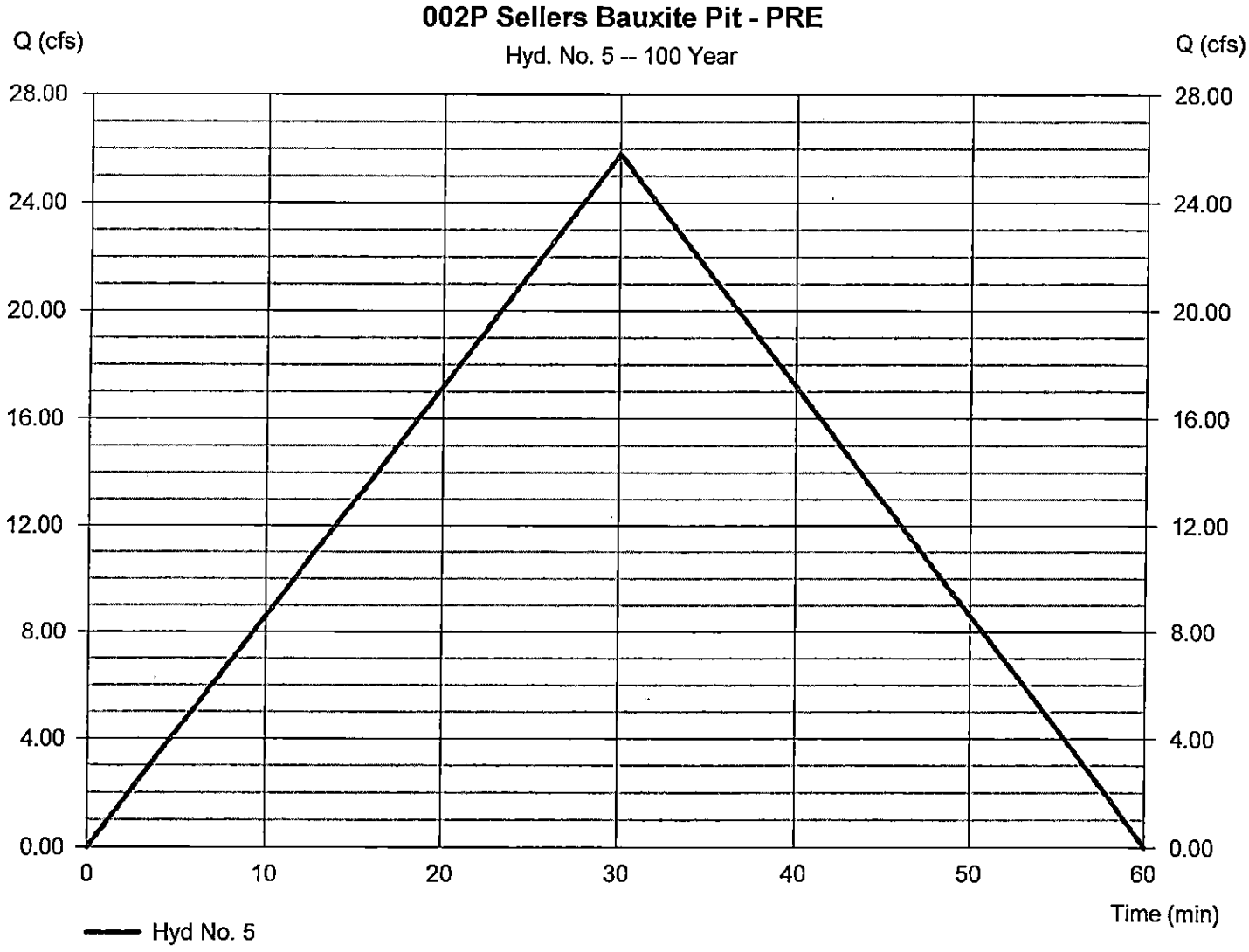


Hydrograph Report

Hyd. No. 5

002P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 25.80 cfs
Storm frequency	= 100 yrs	Time to peak	= 30 min
Time interval	= 1 min	Hyd. volume	= 46,442 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.35
Intensity	= 5.671 in/hr	Tc by FAA	= 30.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1

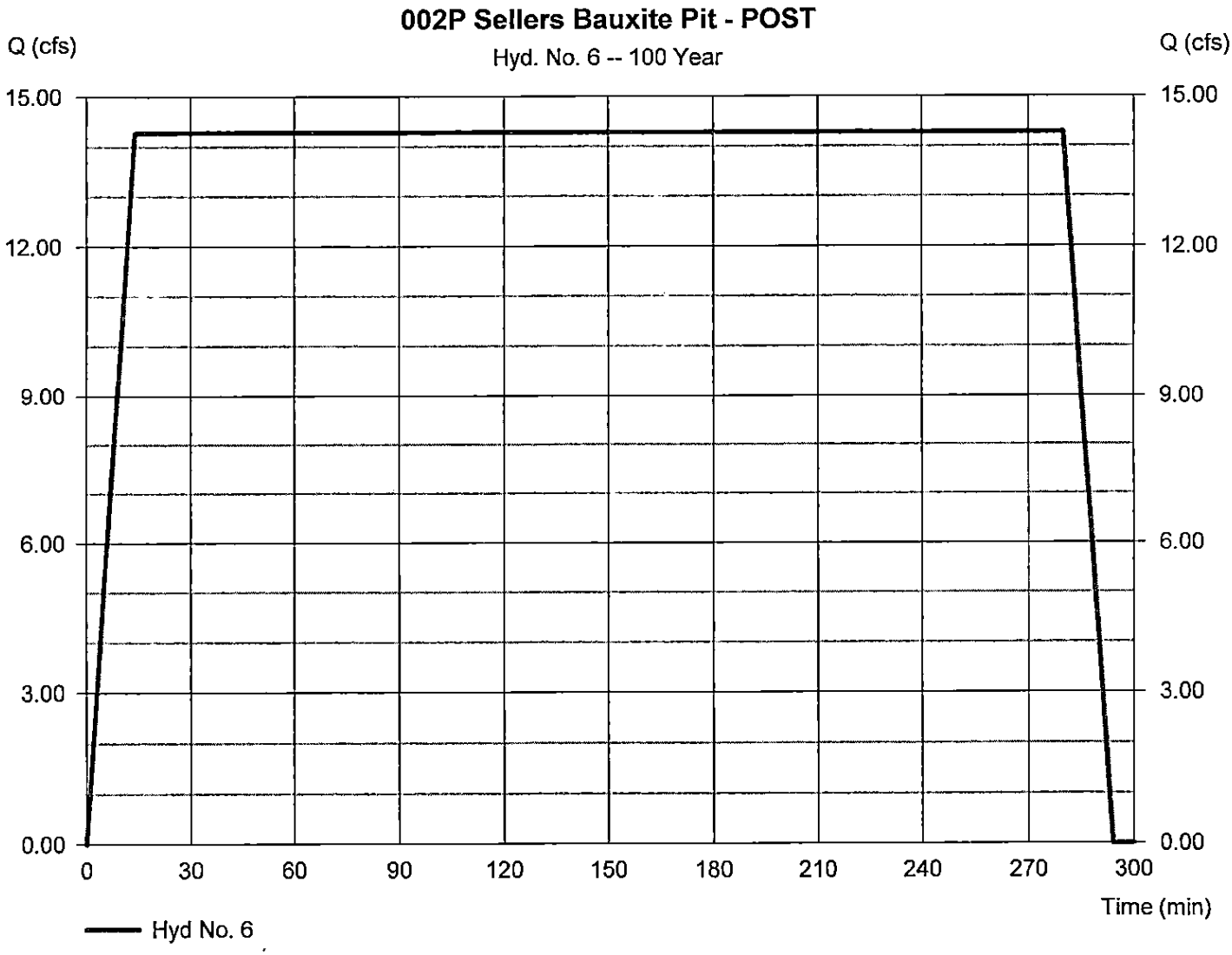


Hydrograph Report

Hyd. No. 6

002P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 14.28 cfs
Storm frequency	= 100 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 239,873 cuft
Drainage area	= 13.000 ac	Runoff coeff.	= 0.75
Intensity	= 1.464 in/hr	Tc by FAA	= 14.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 20.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



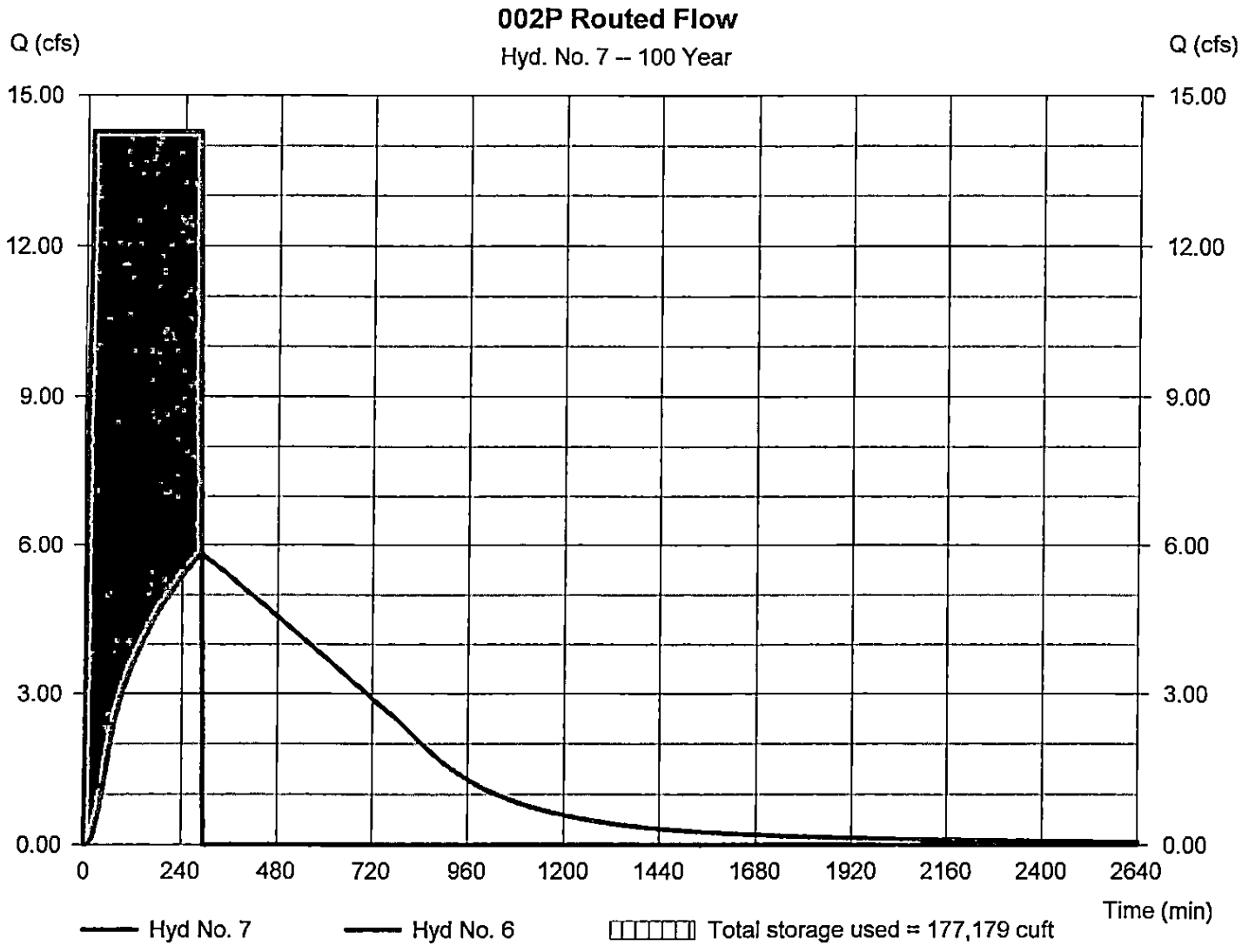
Hydrograph Report

Hyd. No. 7

002P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 5.814 cfs
Storm frequency	= 100 yrs	Time to peak	= 288 min
Time interval	= 1 min	Hyd. volume	= 234,123 cuft
Inflow hyd. No.	= 6 - 002P Sellers Bauxite Pit - Mod	Max. Elevation	= 322.86 ft
Reservoir name	= 002P Sediment Pond	Max. Storage	= 177,179 cuft

Storage Indication method used.

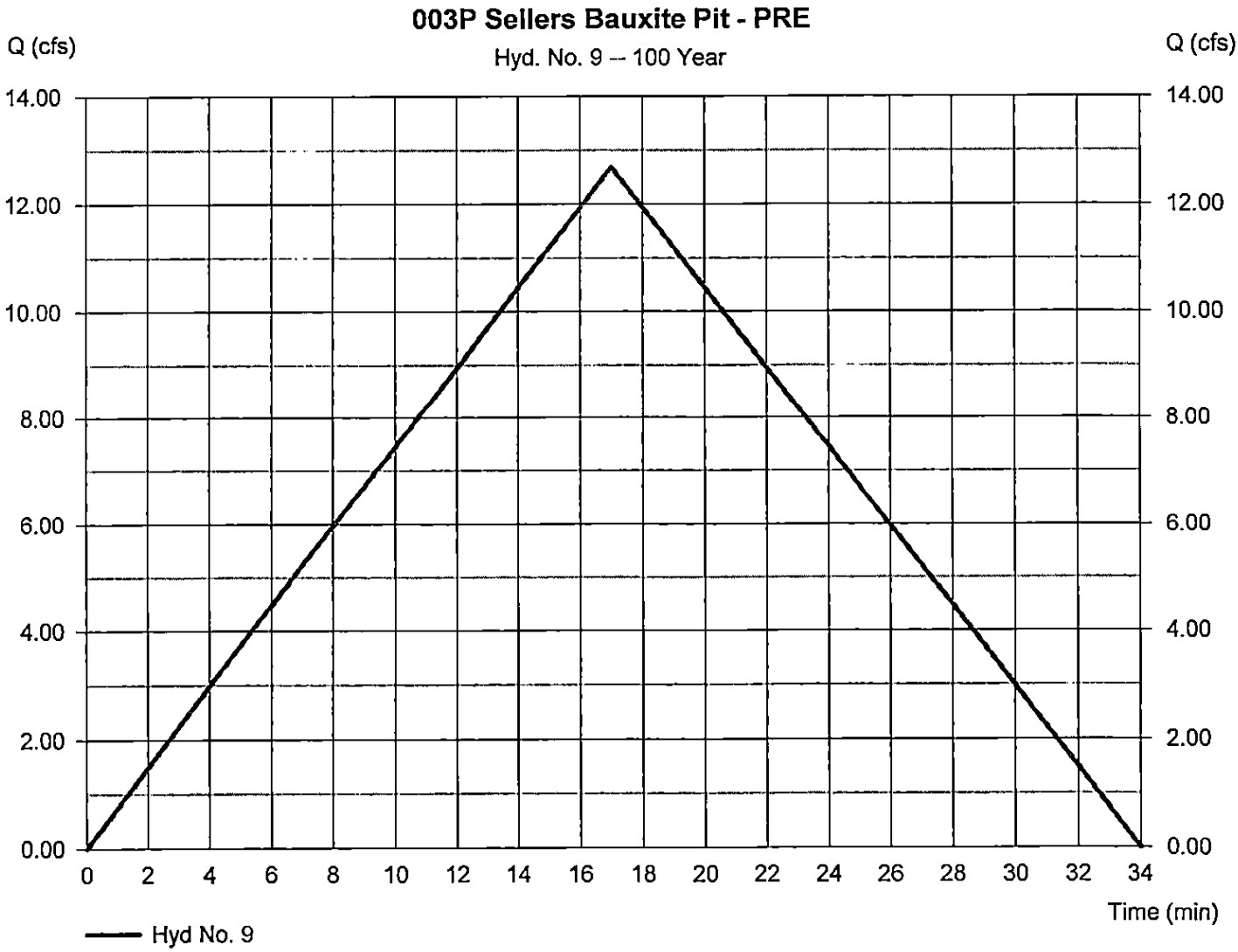


Hydrograph Report

Hyd. No. 9

003P Sellers Bauxite Pit - PRE

Hydrograph type	= Rational	Peak discharge	= 12.68 cfs
Storm frequency	= 100 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 12,938 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.35
Intensity	= 7.248 in/hr	Tc by FAA	= 17.00 min
IDF Curve	= columbus2004.IDF	Asc/Rec limb fact	= 1/1



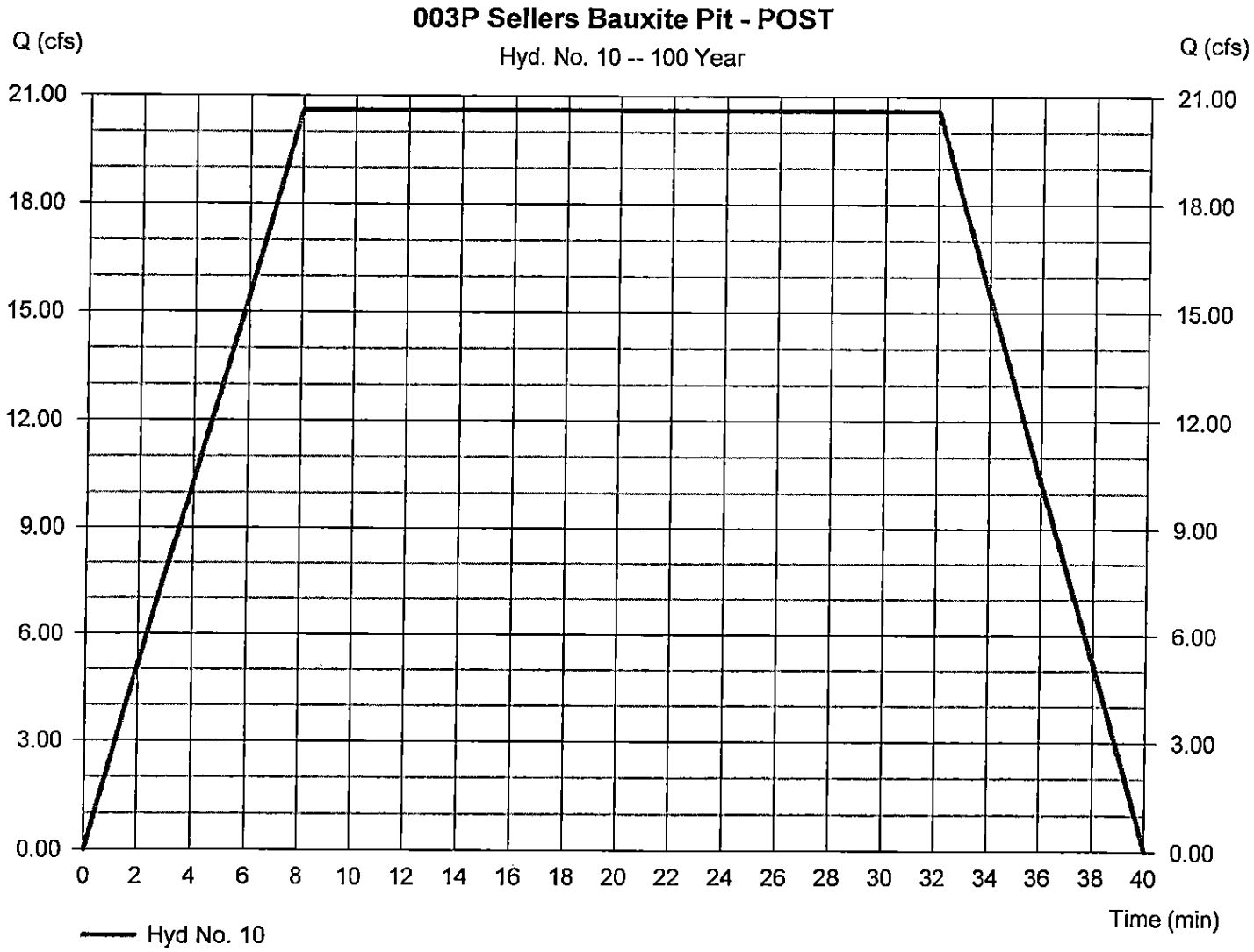
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Thursday, 09 / 11 / 2014

Hyd. No. 10

003P Sellers Bauxite Pit - POST

Hydrograph type	= Mod. Rational	Peak discharge	= 20.61 cfs
Storm frequency	= 100 yrs	Time to peak	= 8 min
Time interval	= 1 min	Hyd. volume	= 39,570 cuft
Drainage area	= 5.000 ac	Runoff coeff.	= 0.75
Intensity	= 5.496 in/hr	Tc by FAA	= 8.00 min
IDF Curve	= columbus2004.IDF	Storm duration	= 4.0 x Tc
Target Q	=n/a	Est. Req'd Storage	=n/a



Hydrograph Report

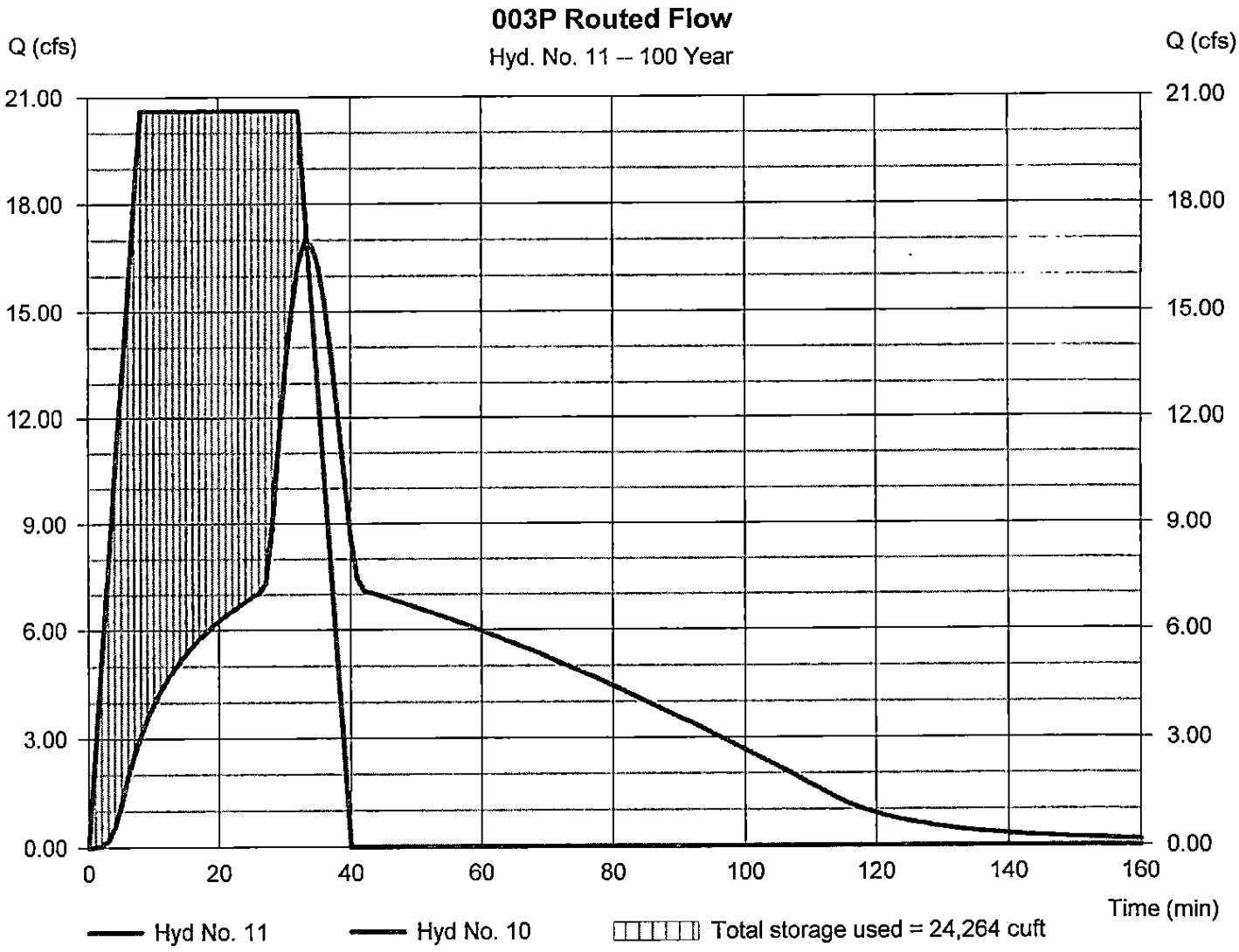
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 09 / 11 / 2014

Hyd. No. 11

003P Routed Flow

Hydrograph type	= Reservoir	Peak discharge	= 16.91 cfs
Storm frequency	= 100 yrs	Time to peak	= 33 min
Time interval	= 1 min	Hyd. volume	= 39,558 cuft
Inflow hyd. No.	= 10 - 003P Sellers Bauxite Pit MBOS	Max. Elevation	= 455.42 ft
Reservoir name	= 003P Sediment Pond	Max. Storage	= 24,264 cuft

Storage Indication method used.



APPENDIX F

TYPICAL BMP'S

APPENDIX F

TYPICAL BMP'S

Construction Exit Pad (CEP)

Practice Description

A construction pad is a stone base pad designed to provide a buffer area where mud and caked soil can be removed from the tires of construction vehicles to avoid transporting it onto public roads. This practice applies anywhere traffic will be leaving a construction site and moving directly onto a public road or street.

Planning Considerations

Roads and streets adjacent to construction sites should be kept clean for the general safety and welfare of the public. A construction exit pad (Figure CEP-1) should be provided where mud can be removed from construction vehicle tires before they enter a public road.

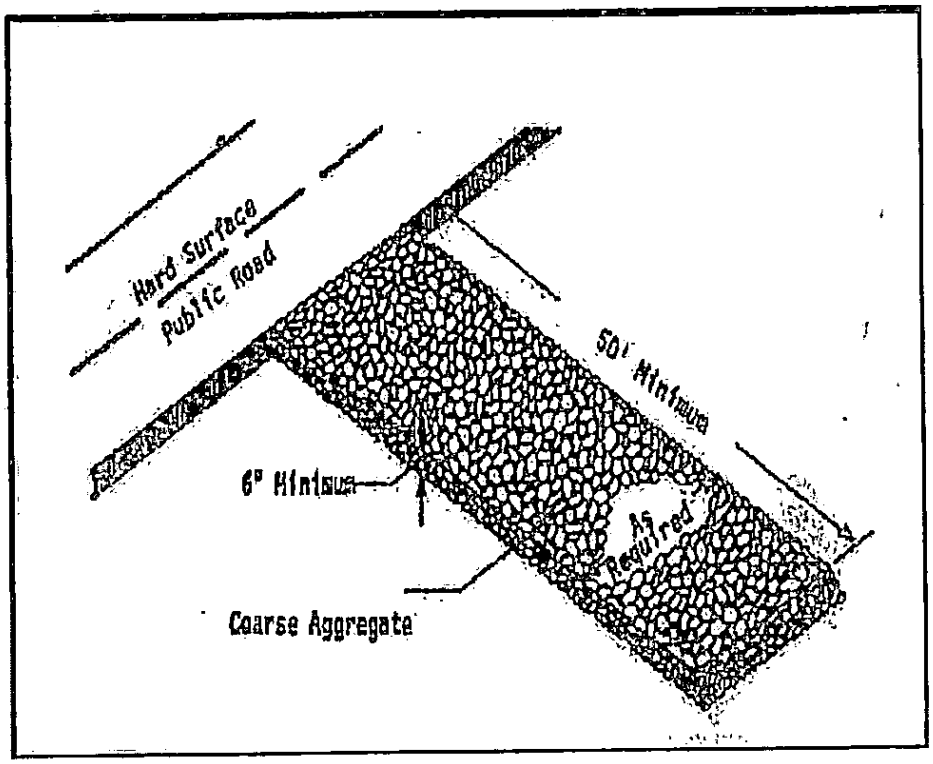


Figure CEP-1 Gravel Construction Exit

Where possible the construction exit pad should be located and constructed at a site where surface runoff from the pad will not transport sediment from the pad off the site. If the pad slope toward the road exceeds 2%, a diversion ridge 6" to 8" high with 3:1 side slopes should be constructed across the foundation approximately 15 feet from the entrance. This diversion ridge should divert surface runoff from the pad away from the road and into a sediment trap or basin.

If the action of the vehicle traveling over the gravel pad does not sufficiently remove the mud or if the site is in a particularly sensitive area, a washing facility should be included with the pad (Figure CEP-2). When a washing facility is required all wash water shall be diverted to a sediment trap or basin.

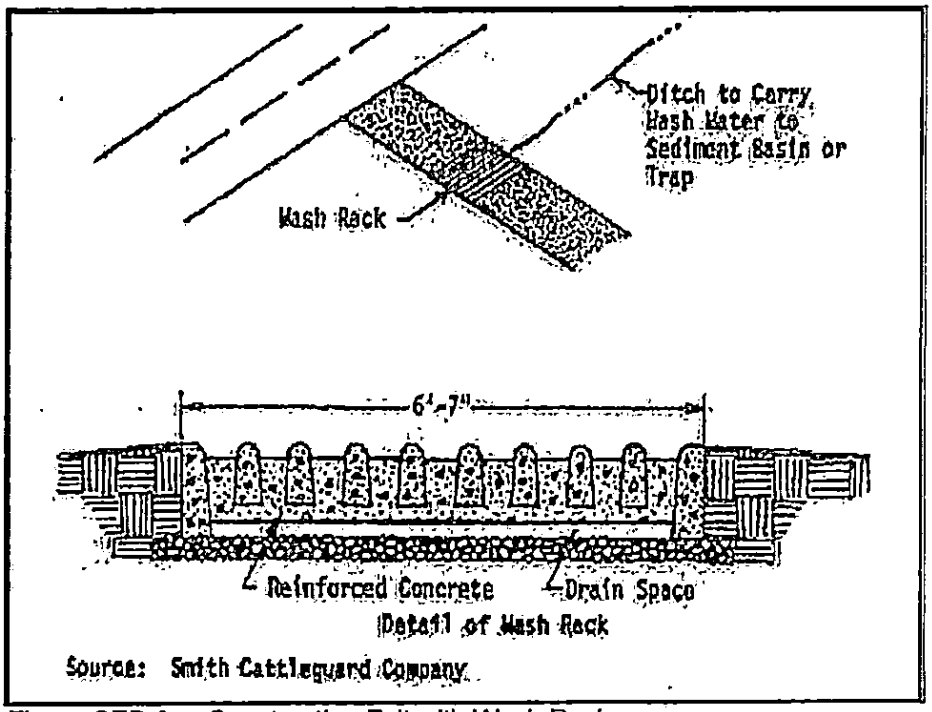


Figure CEP-2 Construction Exit with Wash Rack

If the construction exit pad is located in an area with soils that will not support traffic when wet, an underliner of geotextile will be required to provide stability to the pad.

Construction of stabilized roads throughout the development site should be considered to lessen the amount of mud transported by vehicular traffic. The construction exit pad should be located to provide for maximum use by construction vehicles.

Consideration should be given to limiting construction vehicles to only one ingress and egress point. Measures may be necessary to make existing traffic use the construction exit pad.

Design Criteria

Aggregate size

Aggregate should be Alabama Highway Department coarse aggregate gradation No.1.

Pad Thickness

The exit pad shall have a minimum aggregate thickness of 6".

Pad Length

The exit pad should provide for entering and parking the longest anticipated construction vehicles. A pad is typically 50 feet long but the required length may be longer or shorter.

Pad Width

The exit pad width is typically 20 feet but may be narrower or wider to equal the full width of the vehicular egress.

Geotextiles

A non-woven geotextile meeting the requirements shown in the table below for Class IV geotextiles should be used under the rock when the subgrade is soft or the blow count is less than 10.

Table CEP-1 Requirements for Nonwoven Geotextile

Property	Test method	Class I	Class II	Class III	Class IV [1]
Tensile strength (lb) [2]	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) [2]	ASTM D 4632	≥ 50	≥ 50	≥ 50	≥ 50
Puncture (pounds)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D 4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D 4751	As specified max. #40 [3]	As specified max. #40 [3]	As specified max. #40 [3]	As specified max. #40 [3]
Permitivity sec^{-1}	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

Table copied from NRCS Material Specification 592.

1 Heat-bonded or resin-bonded geotextile may be used for classes III and IV. They are particularly well suited to class IV. Needle-punched geotextile are required for all other classes.

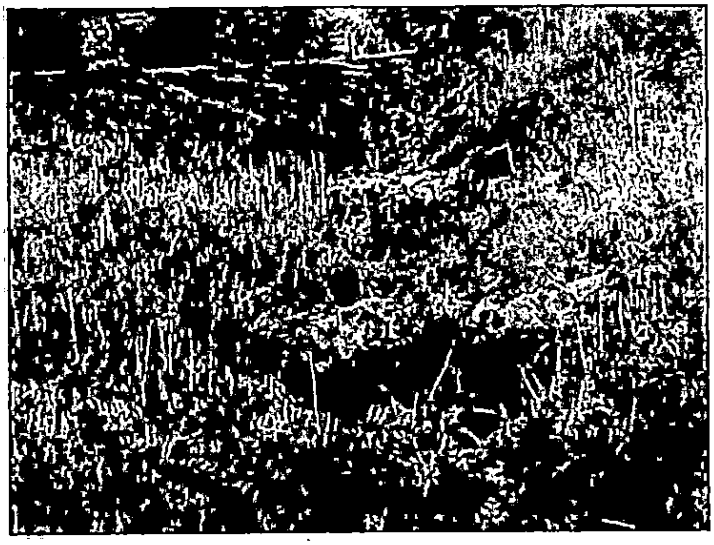
2 Minimum average roll value (weakest principal direction).

3 U.S. standard sieve size.

Washing

A washing facility shall be provided if necessary to prevent mud and caked soil from being transported to public streets and highways. It shall be constructed of concrete, stone, and/or other durable materials. Provisions shall be provided for the mud and other material to be carried away from the washing facility to a sediment trap or basin to allow for settlement of the sediment from the runoff before it is released from the site.

Check Dam (CD)



Practice Description

A check dam is a small barrier or dam constructed across a swale, drainage ditch or other area of concentrated flow for the purpose of reducing channel erosion. Channel erosion is reduced because check dams flatten the gradient of the flow channel and slow the velocity of channel flow. Most check dams are constructed of rock, but hay bales, logs and other materials may be acceptable. Contrary to popular opinion, most check dams trap an insignificant volume of sediment.

This practice applies in small open channels and drainageways, including temporary and permanent swales. It is not to be used in a live stream. Situations of use include areas in need of protection during establishment of grass and areas that cannot receive a temporary or permanent non-erodible lining for an extended period of time.

Planning Considerations

Check dams are utilized in concentrated flow areas to provide temporary channel stabilization during the intense runoff periods associated with construction disturbances. Check dams may be constructed of rock, logs, hay bales or other suitable material. Most check dams are constructed of rock. Rock may not be acceptable in some installations because of aesthetics and hay bales or logs may need to be considered.

Rock check dams (Figures CD-1 and CD-2) are easier to install with backhoes or other suitable equipment. The rock is usually purchased and some locations in the state may not have rock readily available. Rock should be considered carefully in areas to be mowed. Some rock may be washed downstream and should be removed before each mowing operation.

Log check dams (Figure CD-3) are more economical from a material cost standpoint since logs can usually be salvaged from clearing operations. The time and labor required would be greater for log check dams. Increased labor costs would offset the reduced material costs. Log check dams would not be permanent but would last long enough to get grass linings established.

Check dams constructed of hay bales (Figure CD-4) have the shortest life of the materials discussed and are only used as a temporary means to help establish a channel to vegetation. Hay bale check dams should not be used where permanent watercourse protection is needed and should only be used in concentrated flow areas where only minimal runoff occurs.

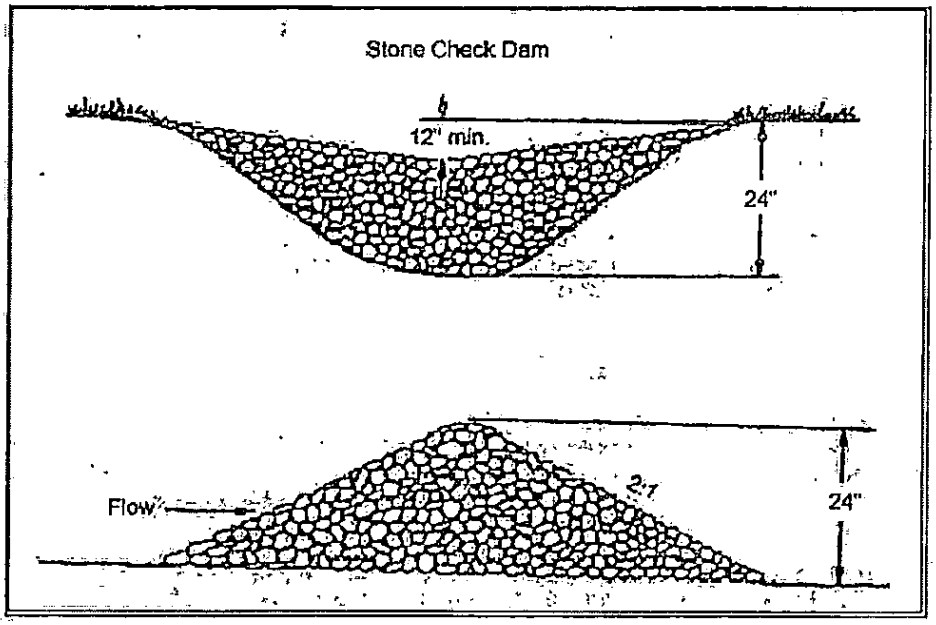


Figure CD-1 Profile of Typical Rock Check Dams

Check dams should be planned to be compatible with the other features such as streets, walks, trails, sediment basins and rights-of-way or property lines. Check dams are normally constructed in series and the dams should be located at a normal interval from other grade controls such as culverts or sediment basins.

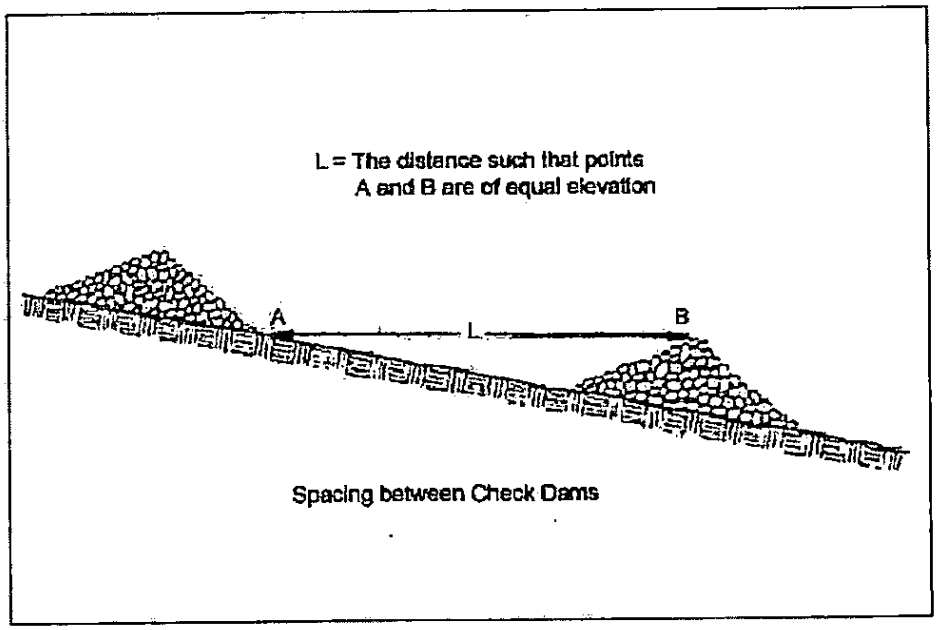


Figure CD-2 Cross Section of Typical Rock Check Dam

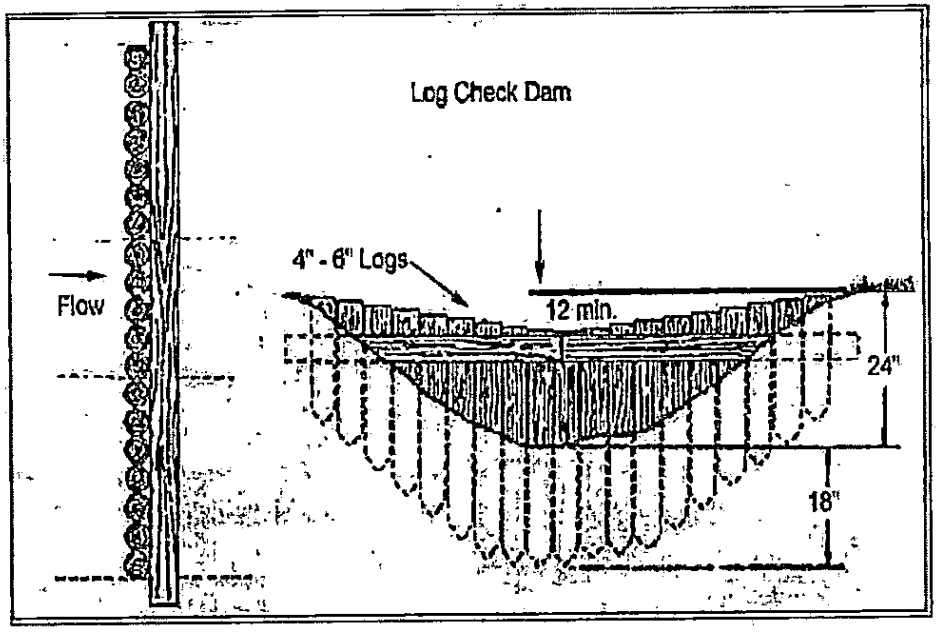


Figure CD-3 Typical Log Check Dam

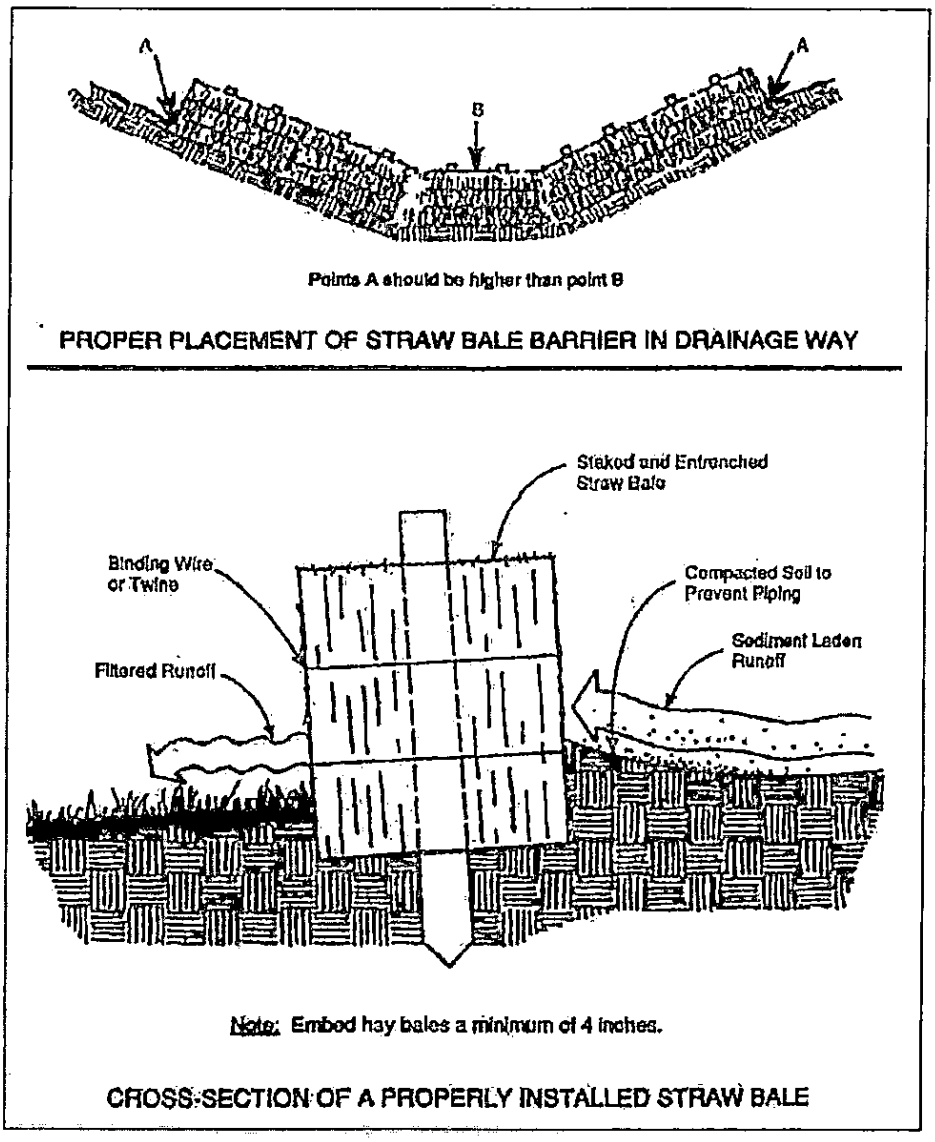


Figure CD-4 Typical Hay Bale Check Dam

Design Criteria

Formal design is not required. The following limiting factors should be adhered to when designing check dams.

Drainage Area

Ten acres or less (Rock or logs).

Maximum Height

Two feet when drainage area is less than 5 acres.

Three feet when drainage area is 5 to 10 acres.

Depth of Flow

Six inches when drainage area is less than 5 acres.

Twelve inches when drainage area is 5 to 10 acres.

The top of dam, perpendicular to flow, should be parabolic. The center of the dam should be constructed lower than the ends. The elevation of the center of the dam should be lower than the ends by the depth of flow listed above.

Side Slopes

2:1 or flatter.

Spacing

Elevation of toe of upstream dam is at or below elevation of crest of downstream dam.

Keyway

The rock or log check dam should be keyed into the channel bottom and abutments to a depth of 12 to 24". The keyway width should be at least 12". The keyway is to prevent erosion around the end of and beneath the dam. Hay bale check dams should be embedded into the soil at least 3".

Rock Check Dams

Rock check dams should be constructed of durable rock riprap. Riprap gradation should conform to the requirements of Class I Riprap, Alabama Highway Department, Standard Specification for Highway Construction.

In soils where failure by piping of soils into the rock is likely, a geotextile will be used as a filter to separate the soils from the rock. Geotextile should conform to the requirements of type I geotextile in Table CD-1:

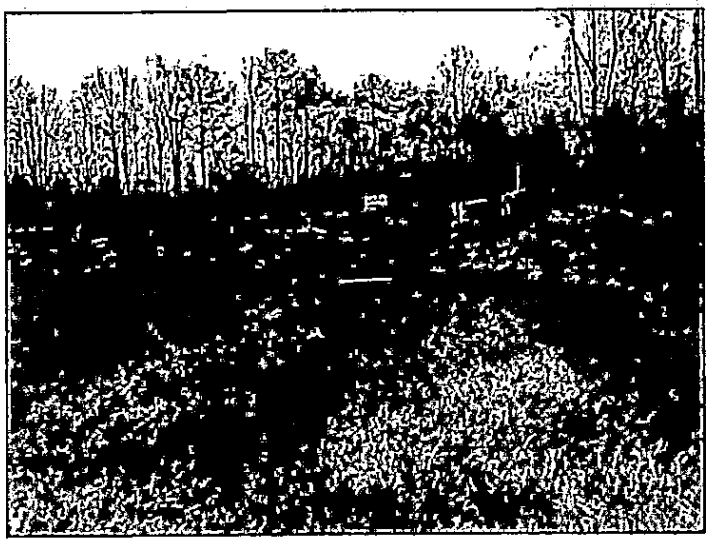
Table CD-1 Requirements for Nonwoven Geotextile

Property	Test method	Class I	Class II	Class III	Class IV [1]
Tensile strength (lb) [2]	ASTM D 4632 grab test	180 minimum	120 minimum	90 minimum	115 minimum
Elongation at failure (%) [2]	ASTM D4632	≥ 50	≥ 50	≥ 50	≥ 50
Puncture (pounds)	ASTM D4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet light (% residual tensile strength)	ASTM D4355 150-hr exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent opening size (AOS)	ASTM D4751	As specified max. no.40 [3]	As specified max. no.40 [3]	As specified max. no.40 [3]	As specified max. no.40 [3]
Permittivity sec^{-1}	ASTM D4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 minimum

Table copied from NRCS Material Specification 592.

1 Heat-bonded or resin-bonded geotextile may be used for classes III and IV. They are particularly well suited to class IV. Needle-punched geotextile are required for all other classes.
2 Minimum average roll value (weakest principal direction).
3 U.S. standard sieve size.

Diversion (DV)



Practice Description

A diversion is a watercourse constructed across a slope consisting of an excavated channel, a compacted ridge or a combination of both. Most diversions are constructed by excavating a channel and using the excavated material to construct a ridge on the downslope side of the channel. Right-of-way diversions and temporary diversions are sometimes constructed by making a ridge, often called a berm, from fill material.

This practice applies to sites where stormwater runoff can be redirected to permanently protect structures or areas downslope from erosion, sediment, and excessive wetness or localized flooding. Diversions may be used to temporarily divert stormwater runoff to protect disturbed areas and slopes or to retain sediment on-site during construction.

Perimeter protection is sometimes used to describe both permanent and temporary diversions used at either the upslope or downslope side of a construction area.

Right-of-way diversions, sometimes referred to as water bars, are used to shorten the flow length on a sloping right-of-way and reduce the erosion potential of the stormwater runoff.

Planning Considerations

Diversions are designed to intercept and carry excess water to a stable outlet.

Diversions can be useful tools for managing surface water flows and preventing soil erosion. On moderately sloping areas, they may be placed at intervals to trap and divert sheet flow before it has a chance to concentrate and cause rill and gully erosion. Simple water bars illustrate this concept (Figure DV-1).

Diversions may be placed at the top of cut or fill slopes to keep runoff from upgradient drainage areas off the slope. Diversions are also typically built at the base of steeper slopes to protect flatter developed areas which cannot withstand runoff water from outside areas. They can also be used to protect structures, parking lots, adjacent properties, and other special areas from flooding.

Diversions are preferable to other types of man-made stormwater conveyance systems because they more closely simulate natural flow patterns and characteristics. Flow velocities are generally kept to a minimum. When properly coordinated into the landscape design of a site, diversions can he visually pleasing as well as functional.

As with any earthen structure, it is very important to establish adequate vegetation as soon as possible after installation. It is usually important to stabilize the drainage area above the diversion so that sediment will not enter and accumulate in the diversion channel.

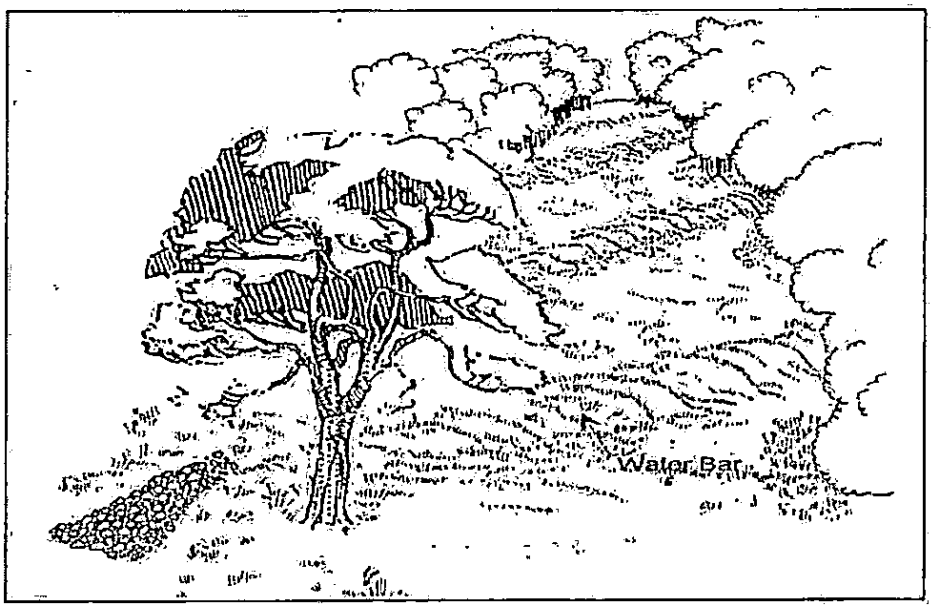


Figure DV-1 Water Bar

Design Criteria

Location

Diversion location should be determined by considering outlet conditions, topography, land use, soil type, length of slope, seepage (where seepage is a problem) and the development layout. Outlets must be stable after the diversion empties stormwater flow into it, therefore, care should be exercised in the location selection of the diversion and its outlet.

Capacity

The diversion channel must have a minimum capacity to carry the runoff expected from a storm frequency meeting the requirements of Table DV-1 with a freeboard of at least 0.3 foot (Figure DV-2).

The storm frequency should be used to determine the required channel capacity, Q (peak rate of runoff). The peak rate of runoff should be determined using the Natural Resources Conservation Service runoff curve no. (RCN) method or other equivalent methods.

Table DV-1 Design Frequency

Diversion Type	Typical Area of Protection	24-Hour Design Storm Frequency
Temporary	Construction Areas	2-year
	Building Sites	5-year
Permanent	Agricultural Land	10-year
	Mined Reclamation Area	10-year
	Recreation Areas	10-year
	Isolated Buildings	25-year
	Urban areas, Residential, School, Industrial Areas, etc.	50-year

Diversions designed to protect homes, schools, industrial buildings, roads, parking lots, and comparable high-risk areas, and those designed to function in connection with other structures, should have sufficient capacity to carry peak runoff expected from a storm frequency consistent with the hazard involved.

Velocities

Diversions should be designed so that the design velocities are as high as will be safe for the planned type of protective vegetation and the expected maintenance, in order to minimize sediment deposition in the channel. Maximum permissible velocities are dependent upon the erosion resistance of the soil (Table DV-2) and the quality of the vegetation maintained.

Table DV-2 Permissible Velocities

Soil Texture	Velocity in Feet/Second		
	Conditions of Vegetation		
	Poor	Fair	Good
Sand, Silt, Sandy Loam, Silt Loam	1.5	2.0	3.0
Silty Clay Loam, Sandy Clay Loam	2.5	3.0	4.0
Clay	3.0	4.0	5.0

Channel Design

The diversion channel may be parabolic, trapezoidal or v-shaped as shown in Figure DV-2 and should be designed in accordance with the procedure shown at the end of this standard. Land slope must be considered when choosing channel dimensions. On steeper slopes, narrow and deep channels may be required. On more gentle slopes, broad, shallow channels can be used to facilitate maintenance.

Ridge Design

The supporting ridge cross section should meet the configuration and requirements of Figure DV-2.

The side slopes should be no steeper than 2:1. Side slopes should be flatter, 5:1 to 10:1, when the diversion is to be permanent with mowing and other maintenance activities performed on or around it.

The width of the ridge at the design water elevation should be a minimum of 4 feet. The minimum freeboard should be 0.3 foot.

The design should include a 10% settlement factor.

Outlet

Diversions should have adequate outlets which will convey concentrated runoff without erosion. Acceptable outlets include practices such as Grassed Swale, Lined Swale, Drop Structure, Sediment Basin, and Stormwater Detention Basins.

Stabilization

Unless otherwise stabilized, the ridge and channel should be seeded within 14 days of installation in accordance with the Permanent Seeding or Temporary Seeding (whichever is applicable) practices.

Disturbed areas draining into the diversion should be seeded and mulched prior to or at the time the diversion is constructed in accordance with the Permanent Seeding or Temporary Seeding (whichever is applicable) practices.

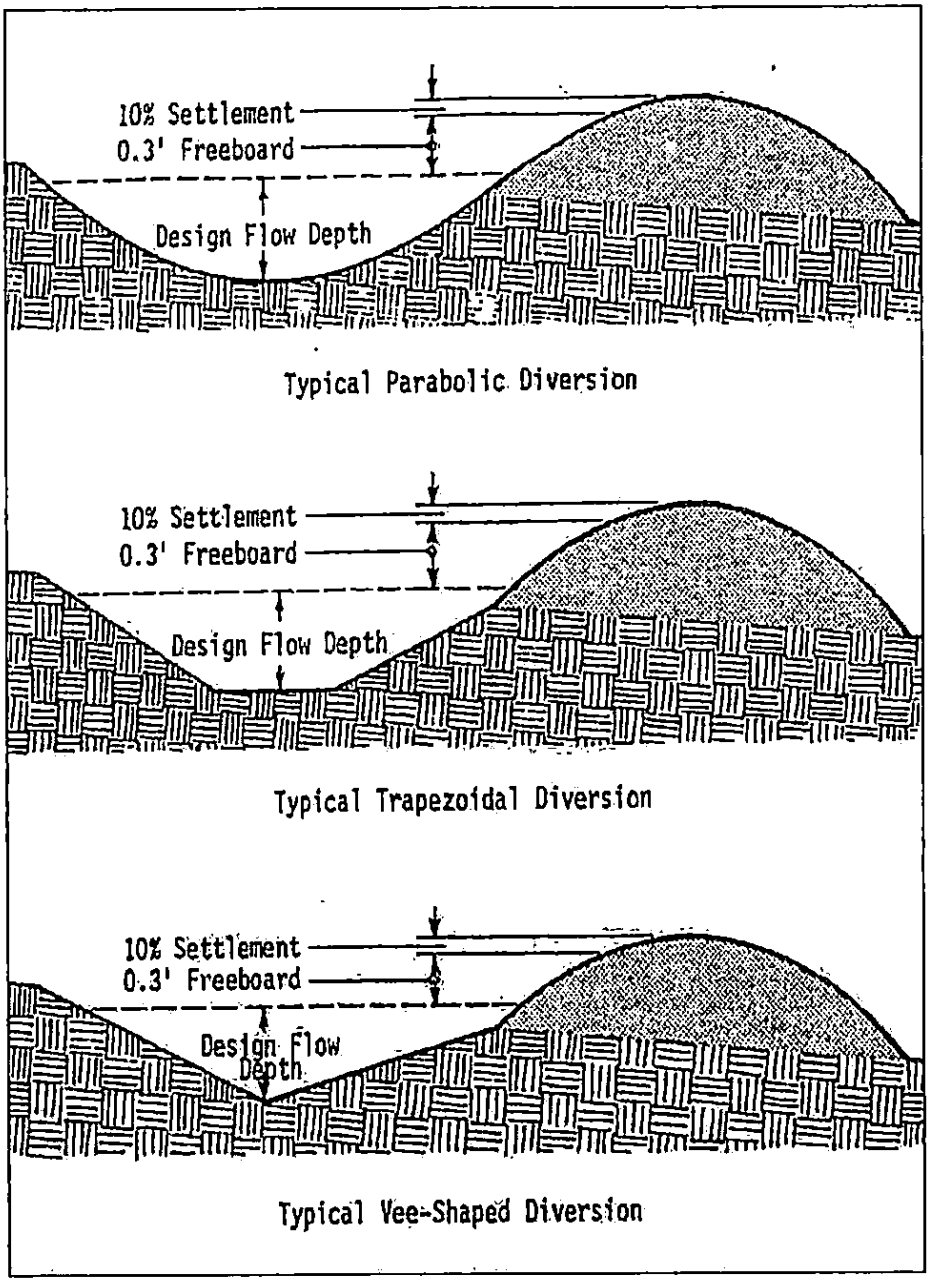


Figure DV-2 Typical Diversions Detail

Diversion Design

Table DV-l through DV-16 may be used to facilitate the design of grass-lined diversions with parabolic cross sections. These tables are based on a retardance of "D" (vegetation newly cut) to determine V_l for stability considerations. To determine channel capacity, choose a retardance of "C" when proper maintenance is expected; otherwise, design channel capacity based on retardance "B". Refer to Table DV-2 for maximum permissible velocities. The permissible velocities guide the selection of V_l and should not be exceeded. It is good practice to use a value for V_l that is significantly less than the maximum allowable when choosing a design cross section. When velocities approach the maximum allowable, flatter grades should be evaluated or a more erosion resistant liner such as riprap should be considered. After the diversion dimensions are selected in the design tables, the top width should be increased by 4 feet. and the depth by 0.3 foot. for freeboard.

Example Problem

Given

Q: 30 cfs
Grade: 1%
Soil: Sandy clay loam Condition of vegetation expected: fair
Maintenance: low; will be cut only twice a year.
Site will allow a top width of 26 feet.

Find

Diversion top width and depth that will be stable and fit site conditions.

Solution

From Table DV-2 use maximum permissible velocity of 3.0 ft./sec.

Since maintenance will be low use "B" retardance for capacity.

From Table DV-4 use retardance "D" and "B";
grade 1% Top width = 21.0 feet.+ 4 feet.= 25.0 feet.

Depth = 1.6 feet.+ 0.3 foot.= 1.9 feet.

V_2 = 1.3 ft./sec.

Note: V_1 < 3.0 ft./sec.; Top width < 26 feet., design O.K.

Note: It is good practice to select a cross section that will give a velocity, V_l, well below the maximum allowable whenever site conditions permit. Wide, shallow cross sections are more stable and require less maintenance. It is always prudent to evaluate flatter design grades in order to best fit diversions to the site and keep velocities well below maximum allowable.

Table DV-3 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 0.50%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

Grade 0.50 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5																											
10																											
15	10.0	2.2	1.0																								
20	13.7	2.1	1.0	6.4	2.7	1.3																					
25	17.4	2.1	1.0	11.3	2.4	1.4																					
30	21.0	2.0	1.0	13.9	2.3	1.4																					
35	24.6	2.0	1.1	18.4	2.3	1.4	10.7	2.8	1.6																		
40	28.5	2.0	1.0	18.9	2.3	1.4	12.8	2.7	1.6																		
45	31.9	2.0	1.1	21.4	2.3	1.4	14.4	2.6	1.6																		
50	35.5	2.0	1.1	23.0	2.2	1.4	16.2	2.5	1.6	9.9	3.4	2.2															
55	39.0	2.0	1.1	25.3	2.2	1.4	17.9	2.5	1.6	11.9	3.1	2.3															
60	42.5	2.0	1.1	28.6	2.2	1.4	19.7	2.5	1.6	13.2	3.0	2.3															
65	46.1	2.0	1.1	31.6	2.2	1.4	21.4	2.5	1.6	14.3	2.9	2.3															
70	49.6	2.0	1.1	34.0	2.2	1.4	23.1	2.5	1.6	15.9	2.9	2.3	11.0	3.6	2.6												
75	53.1	2.0	1.1	36.4	2.2	1.4	24.9	2.5	1.6	17.1	2.8	2.3	12.7	3.4	2.7												
80	56.6	2.0	1.1	38.8	2.2	1.4	26.6	2.5	1.6	18.4	2.8	2.3	13.7	3.3	2.7												
85	60.2	2.0	1.1	41.2	2.2	1.4	28.3	2.5	1.6	19.7	2.8	2.3	14.8	3.2	2.7												
90	63.7	2.0	1.1	43.6	2.2	1.4	30.0	2.4	1.6	20.9	2.8	2.3	15.9	3.2	2.7												
95	67.2	2.0	1.1	46.1	2.2	1.4	31.7	2.4	1.6	22.1	2.8	2.3	16.9	3.1	2.7												
100	70.8	2.0	1.1	48.5	2.2	1.4	33.4	2.4	1.6	23.4	2.8	2.3	17.9	3.1	2.7	12.3	3.9	3.1									
105	74.3	2.0	1.1	50.9	2.2	1.4	35.2	2.4	1.6	24.5	2.7	2.4	18.9	3.1	2.7	13.7	3.7	3.1									
110	77.8	2.0	1.1	53.3	2.2	1.4	37.1	2.4	1.6	25.8	2.7	2.4	19.9	3.1	2.7	14.6	3.6	3.1									
115	81.4	2.0	1.1	55.7	2.2	1.4	38.7	2.4	1.6	27.0	2.7	2.4	20.8	3.0	2.7	15.4	3.6	3.1									
120	84.9	2.0	1.1	58.1	2.2	1.4	40.4	2.4	1.9	28.2	2.7	2.4	21.8	3.0	2.7	16.3	3.5	3.1									
125	88.4	2.0	1.1	60.6	2.2	1.4	42.1	2.4	1.9	29.4	2.7	2.4	22.6	3.0	2.7	17.1	3.5	3.1									
130	92.0	2.0	1.1	63.0	2.2	1.4	43.8	2.4	1.9	30.6	2.7	2.4	23.6	3.0	2.7	17.9	3.5	3.1									
135	95.5	2.0	1.1	65.4	2.2	1.4	45.4	2.4	1.9	31.8	2.7	2.4	24.6	3.0	2.7	18.7	3.4	3.2									
140	99.0	2.0	1.1	67.8	2.2	1.4	47.1	2.4	1.9	33.1	2.7	2.4	25.7	3.0	2.8	19.4	3.4	3.2									
145	102.6	2.0	1.1	70.2	2.2	1.4	48.8	2.4	1.9	34.3	2.7	2.4	26.7	3.0	2.8	20.2	3.4	3.2	13.5	4.4	3.6						
150	106.1	2.0	1.1	72.6	2.2	1.4	50.5	2.4	1.9	35.5	2.7	2.4	27.7	3.0	2.8	21.0	3.4	3.2	14.4	4.3	3.6						

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-4 Parabolic Diversion Design Char (Retardance "D" and "B", Grade 1.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

Grade 1.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5																											
10	9.7	1.6	1.0	8.2	2.0	1.2																					
15	14.8	1.5	1.0	10.2	1.7	1.3	6.5	2.2	1.5																		
20	20.2	1.5	1.0	13.8	1.7	1.3	9.8	1.9	1.6																		
25	25.1	1.5	1.0	17.4	1.7	1.3	12.2	1.9	1.6	8.5	2.2	2.0															
30	30.1	1.5	1.0	21.0	1.8	1.3	14.9	1.8	1.7	10.9	2.1	2.1															
35	35.1	1.5	1.0	24.7	1.8	1.3	17.5	1.8	1.7	12.6	2.0	2.1	8.9	2.4	2.5												
40	40.1	1.5	1.0	28.2	1.8	1.3	20.0	1.8	1.7	14.5	2.0	2.1	10.5	2.3	2.5												
45	45.1	1.5	1.0	31.7	1.8	1.3	22.5	1.8	1.7	16.4	2.0	2.1	12.1	2.2	2.5	8.2	2.8	2.9									
50	50.2	1.5	1.0	35.2	1.8	1.3	25.4	1.8	1.7	18.3	2.0	2.1	13.6	2.2	2.5	10.0	2.8	2.9									
55	55.2	1.5	1.0	38.8	1.8	1.3	27.9	1.8	1.7	20.3	1.9	2.1	15.1	2.2	2.5	11.2	2.5	3.0									
60	60.2	1.5	1.0	42.3	1.8	1.3	30.4	1.8	1.7	22.2	1.9	2.1	16.6	2.1	2.5	12.4	2.4	3.0									
65	65.2	1.5	1.0	45.8	1.8	1.3	32.9	1.8	1.7	24.0	1.9	2.1	18.0	2.1	2.5	13.6	2.4	3.0	8.9	3.1	3.5						
70	70.2	1.5	1.0	49.3	1.8	1.3	35.5	1.8	1.7	25.9	1.9	2.1	19.5	2.1	2.6	14.8	2.4	3.0	10.6	2.8	3.5						
75	75.2	1.5	1.0	52.8	1.8	1.3	38.0	1.8	1.7	28.2	1.9	2.1	20.9	2.1	2.6	16.0	2.3	3.0	11.5	2.8	3.5						
80	80.2	1.5	1.0	56.3	1.8	1.3	40.5	1.8	1.7	30.0	1.9	2.1	22.3	2.1	2.6	17.1	2.3	3.0	12.5	2.7	3.5						
85	85.2	1.5	1.0	59.8	1.8	1.3	43.0	1.8	1.7	31.9	1.9	2.1	23.7	2.1	2.6	18.3	2.3	3.0	13.5	2.7	3.5	9.8	3.3	3.9			
90	90.2	1.5	1.0	63.3	1.8	1.3	45.6	1.8	1.7	33.6	1.9	2.1	25.2	2.1	2.6	19.4	2.3	3.1	14.4	2.6	3.6	10.9	3.1	3.9			
95	95.2	1.5	1.0	66.9	1.8	1.3	48.1	1.8	1.7	35.5	1.9	2.1	26.6	2.1	2.6	20.5	2.3	3.1	15.3	2.6	3.6	12.0	3.0	3.9			
100	100.2	1.5	1.0	70.4	1.8	1.3	50.6	1.8	1.7	37.4	1.9	2.1	28.0	2.1	2.6	21.5	2.3	3.1	16.2	2.6	3.6	12.9	2.9	4.0			
105	105.3	1.5	1.0	73.9	1.8	1.3	53.1	1.8	1.7	39.2	1.9	2.1	29.8	2.1	2.6	22.8	2.3	3.1	17.1	2.6	3.6	13.7	2.9	4.0	10.8	3.4	4.3
110	110.3	1.5	1.0	77.4	1.8	1.3	55.7	1.8	1.7	41.1	1.9	2.1	31.3	2.1	2.6	23.9	2.3	3.1	18.0	2.6	3.6	14.4	2.9	4.0	12.0	3.2	4.3
115	115.3	1.5	1.0	80.9	1.8	1.3	58.2	1.8	1.7	42.9	1.9	2.1	32.7	2.1	2.6	25.0	2.3	3.1	18.9	2.5	3.6	15.2	2.8	4.0	12.7	3.2	4.3
120	120.3	1.5	1.0	84.4	1.8	1.3	60.7	1.8	1.7	44.8	1.9	2.1	34.1	2.1	2.6	26.1	2.2	3.1	19.7	2.5	3.6	16.0	2.8	4.0	13.4	3.1	4.3
125	125.3	1.5	1.0	88.0	1.8	1.3	63.2	1.8	1.7	46.7	1.9	2.1	35.5	2.1	2.6	27.2	2.2	3.1	20.6	2.5	3.6	16.8	2.8	4.0	14.1	3.1	4.3
130	130.3	1.5	1.0	91.5	1.8	1.3	65.8	1.8	1.7	48.5	1.9	2.1	36.9	2.1	2.6	28.4	2.2	3.1	21.5	2.5	3.6	17.4	2.8	4.0	14.8	3.1	4.3
135	135.3	1.5	1.0	95.0	1.8	1.3	68.3	1.8	1.7	50.4	1.9	2.1	38.3	2.1	2.6	29.5	2.2	3.1	22.4	2.5	3.6	18.2	2.8	4.0	15.5	3.0	4.3
140	140.3	1.5	1.0	98.5	1.8	1.3	70.8	1.8	1.7	52.2	1.9	2.1	39.7	2.0	2.6	30.6	2.2	3.1	23.2	2.5	3.6	18.9	2.7	4.0	16.1	3.0	4.4
145	145.3	1.5	1.0	102.0	1.8	1.3	73.3	1.8	1.7	54.1	1.9	2.1	41.1	2.0	2.6	32.1	2.2	3.0	24.1	2.5	3.6	19.7	2.7	4.0	16.8	3.0	4.4
150	150.3	1.5	1.0	105.5	1.8	1.3	75.9	1.8	1.7	56.0	1.9	2.1	42.6	2.0	2.6	33.2	2.2	3.0	25.0	2.5	3.0	20.4	2.7	4.1	17.5	2.9	4.4

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second; Depth "D" does not include allowance for freeboard or settlement.

Table DV-5 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 2.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

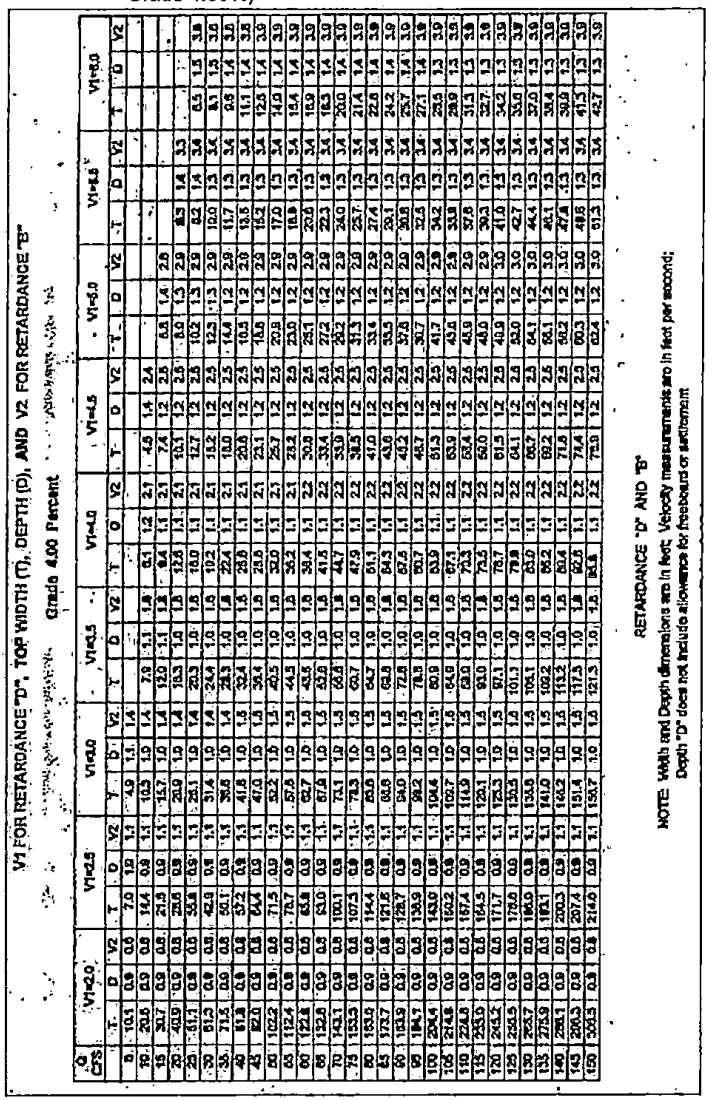
Grade 2.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	7.1	1.2	0.8																								
10	14.7	1.2	0.8	9.5	1.3	1.2	7.0	1.4	1.5																		
15	22.0	1.2	0.9	14.5	1.3	1.2	10.8	1.4	1.5	8.0	1.5	1.6	6.3	1.6	2.1												
20	29.3	1.2	0.9	19.6	1.2	1.2	14.5	1.3	1.5	10.8	1.5	1.8	8.1	1.6	2.3	6.5	2.1	2.6									
25	36.8	1.2	0.9	24.4	1.2	1.2	18.3	1.3	1.5	13.8	1.4	1.9	10.4	1.6	2.3	7.9	1.8	2.7									
30	43.8	1.2	0.9	29.3	1.2	1.2	22.2	1.3	1.6	16.8	1.4	1.9	12.7	1.6	2.3	9.7	1.7	2.7	7.5	2.0	3.1						
35	51.2	1.2	0.9	34.2	1.2	1.2	25.8	1.3	1.6	19.6	1.4	1.9	14.9	1.6	2.3	11.5	1.7	2.7	8.9	1.9	3.2						
40	58.5	1.2	0.9	39.0	1.2	1.2	29.5	1.3	1.6	22.4	1.4	1.9	17.1	1.6	2.3	13.3	1.6	2.8	10.4	1.8	3.2	8.0	2.1	3.6			
45	65.8	1.2	0.9	43.9	1.2	1.2	33.2	1.3	1.6	25.2	1.4	1.9	19.3	1.6	2.3	15.0	1.6	2.8	11.8	1.8	3.2	9.2	2.0	3.7			
50	73.1	1.2	0.9	48.8	1.2	1.2	36.8	1.3	1.6	28.0	1.4	1.9	21.7	1.6	2.3	16.7	1.6	2.8	13.2	1.8	3.2	10.5	1.9	3.7	7.9	2.3	4.1
55	80.4	1.2	0.9	53.6	1.3	1.2	40.5	1.3	1.6	30.7	1.4	1.9	23.9	1.6	2.3	18.5	1.6	2.8	14.6	1.7	3.2	11.7	1.9	3.7	9.2	2.2	4.1
60	87.7	1.2	0.9	58.5	1.3	1.2	44.2	1.3	1.6	33.5	1.4	1.9	26.0	1.6	2.3	20.2	1.6	2.8	16.0	1.7	3.2	12.9	1.9	3.7	10.2	2.1	4.1
65	95.0	1.2	0.9	63.4	1.2	1.2	47.9	1.3	1.6	36.3	1.4	1.9	28.2	1.6	2.3	22.1	1.6	2.8	17.4	1.7	3.3	14.0	1.8	3.7	11.3	2.1	4.2
70	102.3	1.2	0.9	68.2	1.2	1.2	51.6	1.3	1.6	39.1	1.4	1.9	30.3	1.6	2.3	23.8	1.6	2.8	18.8	1.7	3.3	15.2	1.9	3.7	12.3	2.1	4.2
75	109.6	1.2	0.9	73.1	1.2	1.2	55.2	1.3	1.6	41.9	1.4	1.9	32.5	1.6	2.3	25.5	1.6	2.8	20.1	1.7	3.3	16.2	1.8	3.7	13.2	2.0	4.2
80	116.9	1.2	0.9	78.0	1.2	1.2	58.9	1.3	1.6	44.7	1.4	1.9	34.6	1.6	2.3	27.2	1.6	2.8	21.5	1.7	3.3	17.4	1.8	3.6	14.2	2.0	4.2
85	124.2	1.2	0.9	82.9	1.2	1.2	62.6	1.3	1.6	47.4	1.4	1.9	36.8	1.6	2.3	28.9	1.6	2.8	22.9	1.7	3.3	18.6	1.8	3.6	15.1	2.0	4.2
90	131.5	1.2	0.9	87.7	1.2	1.2	66.3	1.3	1.6	50.2	1.4	1.9	39.0	1.6	2.3	30.6	1.6	2.8	24.6	1.7	3.2	19.8	1.8	3.6	16.1	2.0	4.2
95	138.8	1.2	0.9	92.6	1.2	1.2	69.9	1.3	1.6	53.0	1.4	1.9	41.1	1.6	2.3	32.3	1.6	2.8	25.9	1.7	3.3	20.8	1.8	3.6	17.0	2.0	4.2
100	146.1	1.2	0.9	97.5	1.2	1.2	73.6	1.3	1.6	55.8	1.4	1.9	43.3	1.6	2.3	34.0	1.6	2.8	27.3	1.7	3.3	21.9	1.8	3.6	17.8	2.0	4.2
105	153.4	1.2	0.9	102.3	1.3	1.2	77.3	1.3	1.6	58.6	1.4	1.9	45.4	1.6	2.3	35.7	1.6	2.8	28.6	1.7	3.3	23.0	1.8	3.6	18.9	2.0	4.2
110	160.7	1.2	0.9	107.2	1.2	1.2	81.0	1.3	1.6	61.4	1.4	1.9	47.6	1.6	2.3	37.3	1.6	2.8	30.0	1.7	3.3	24.1	1.8	3.6	19.8	2.0	4.2
115	168.0	1.2	0.9	112.1	1.2	1.2	84.7	1.3	1.6	64.2	1.4	1.9	49.8	1.6	2.3	39.0	1.6	2.8	31.3	1.7	3.3	25.3	1.8	3.6	20.8	2.0	4.2
120	175.3	1.2	0.9	117.0	1.2	1.2	88.3	1.3	1.6	67.0	1.4	1.9	51.9	1.6	2.3	40.7	1.6	2.8	32.7	1.7	3.3	26.4	1.8	3.7	21.7	2.0	4.2
125	182.6	1.2	0.9	121.8	1.2	1.2	92.0	1.3	1.6	69.7	1.4	1.9	54.1	1.6	2.3	42.4	1.6	2.8	34.1	1.7	3.3	27.5	1.8	3.7	22.6	1.9	4.3
130	189.9	1.2	0.9	126.7	1.2	1.2	95.7	1.3	1.6	72.5	1.4	1.9	56.2	1.5	2.3	44.1	1.6	2.8	35.4	1.7	3.3	28.6	1.8	3.7	23.5	1.9	4.3
135	197.3	1.2	0.9	131.6	1.2	1.2	99.4	1.3	1.6	75.3	1.4	1.9	58.4	1.5	2.3	45.8	1.6	2.8	36.8	1.7	3.3	30.0	1.8	3.7	24.5	1.9	4.3
140	204.6	1.2	0.9	136.5	1.2	1.2	103.1	1.3	1.6	78.1	1.4	1.9	60.6	1.5	2.3	47.5	1.6	2.8	38.1	1.7	3.3	31.1	1.8	3.7	25.4	1.9	4.3
145	211.9	1.2	0.9	141.3	1.2	1.2	106.7	1.3	1.6	80.9	1.4	1.9	62.7	1.5	2.3	49.2	1.6	2.8	39.5	1.7	3.3	32.3	1.8	3.7	26.4	1.9	4.3
150	219.2	1.2	0.9	146.2	1.2	1.2	110.4	1.3	1.6	83.7	1.4	1.9	64.9	1.5	2.3	50.8	1.6	2.8	40.8	1.7	3.3	33.4	1.8	3.7	27.3	1.9	4.3

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-6 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 4.00%)



V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

Grade 4.00 Percent

Q CFS	V1=2.0		V1=2.5		V1=3.0		V1=3.5		V1=4.0		V1=4.5		V1=5.0		V1=5.5		V1=6.0	
	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D
	V2		V2		V2		V2		V2		V2		V2		V2		V2	
5	10.1	0.9	7.0	1.0	4.9	1.1	1.4											
	0.0		1.1		1.5		1.8											
10	20.6	0.9	14.4	0.9	10.3	1.0	7.8	1.1	5.1	1.2	3.7							
	0.0		1.1		1.4		1.8		2.1		2.4							
15	30.7	0.9	21.9	0.9	15.7	1.0	12.0	1.1	9.4	1.1	7.4	1.2	5.8	1.4	4.5	1.4	3.4	1.5
	0.0		1.1		1.4		1.8		2.1		2.5		2.6					
20	40.9	0.9	29.6	0.9	21.0	1.0	16.3	1.0	12.8	1.1	10.1	1.2	8.0	1.3	6.3	1.4	5.0	1.5
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.3			
25	51.1	0.9	36.8	0.9	26.1	1.0	20.3	1.0	16.0	1.1	12.7	1.2	10.2	1.3	8.2	1.4	6.5	1.5
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.8	
30	61.3	0.9	44.0	0.9	31.4	1.0	24.4	1.0	19.2	1.1	15.2	1.2	12.3	1.3	10.0	1.3	8.1	1.5
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.8	
35	71.5	0.9	51.1	0.9	36.6	1.0	28.5	1.0	22.4	1.1	17.8	1.2	14.4	1.2	11.7	1.3	9.4	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.8	
40	81.8	0.9	58.2	0.9	41.8	1.0	32.5	1.0	25.6	1.1	20.3	1.2	16.5	1.2	13.3	1.3	10.8	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.8	
45	92.0	0.9	65.4	0.9	47.0	1.0	36.4	1.0	28.8	1.1	22.8	1.2	18.5	1.2	15.0	1.3	12.1	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.8	
50	102.2	0.9	71.5	0.9	52.2	1.0	40.5	1.0	32.0	1.1	25.3	1.2	20.6	1.2	17.0	1.3	14.0	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
55	112.4	0.9	78.7	0.9	57.5	1.0	44.5	1.0	35.2	1.1	27.8	1.2	22.6	1.2	18.8	1.3	15.4	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
60	122.8	0.9	85.8	0.9	62.7	1.0	48.5	1.0	38.4	1.1	30.3	1.2	24.6	1.2	20.5	1.3	16.9	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
65	133.2	0.9	93.0	0.9	67.8	1.0	52.5	1.0	41.6	1.1	32.9	1.2	26.7	1.2	22.3	1.3	18.3	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
70	143.1	0.9	100.1	0.9	73.1	1.0	56.6	1.0	44.7	1.1	35.4	1.2	28.7	1.2	24.0	1.3	20.0	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
75	153.5	0.9	107.3	0.9	78.3	1.0	60.7	1.0	47.9	1.1	38.0	1.2	31.3	1.2	25.7	1.3	21.4	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
80	163.9	0.9	114.4	0.9	83.6	1.0	64.7	1.0	51.1	1.1	41.0	1.2	33.4	1.2	27.4	1.3	22.8	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
85	174.7	0.9	121.6	0.9	88.9	1.0	68.8	1.0	54.3	1.1	43.6	1.2	35.5	1.2	29.1	1.3	24.2	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
90	185.9	0.9	128.7	0.9	94.0	1.0	72.8	1.0	57.5	1.1	46.2	1.2	37.6	1.2	30.8	1.3	25.7	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
95	196.7	0.9	136.9	0.9	99.2	1.0	76.9	1.0	60.7	1.1	48.7	1.2	39.7	1.2	32.6	1.3	27.1	1.4
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
100	207.4	0.9	143.0	0.9	104.4	1.0	80.9	1.0	63.9	1.1	51.3	1.2	41.7	1.2	34.2	1.3	28.6	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
105	218.0	0.9	150.2	0.9	109.7	1.0	84.9	1.0	67.1	1.1	53.9	1.2	43.8	1.2	35.9	1.3	29.9	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
110	228.6	0.9	157.4	0.9	114.9	1.0	89.0	1.0	70.3	1.1	56.4	1.2	45.9	1.2	37.6	1.3	31.3	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
115	239.9	0.9	164.5	0.9	120.1	1.0	93.0	1.0	73.5	1.1	59.0	1.2	48.0	1.2	39.3	1.3	32.7	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		2.9		3.4		3.9	
120	249.2	0.9	171.7	0.9	125.3	1.0	97.1	1.0	76.7	1.1	61.5	1.2	50.0	1.2	40.9	1.3	34.2	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	
125	258.5	0.9	178.9	0.9	130.5	1.0	101.1	1.0	79.8	1.1	64.1	1.2	52.0	1.2	42.7	1.3	35.6	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	
130	268.7	0.9	186.0	0.9	135.6	1.0	105.1	1.0	83.0	1.1	66.7	1.2	54.1	1.2	44.4	1.3	37.0	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	
135	278.9	0.9	193.1	0.9	141.0	1.0	109.2	1.0	86.2	1.1	69.2	1.2	56.1	1.2	46.1	1.3	38.4	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	
140	289.1	0.9	200.3	0.9	146.2	1.0	113.3	1.0	89.4	1.1	71.8	1.2	58.2	1.2	47.8	1.3	39.9	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	
145	299.3	0.9	207.4	0.9	151.4	1.0	117.3	1.0	92.6	1.1	74.4	1.2	60.3	1.2	49.6	1.3	41.3	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	
150	309.5	0.9	214.6	0.9	156.7	1.0	121.3	1.0	95.8	1.1	76.9	1.2	62.4	1.2	51.3	1.3	42.7	1.3
	0.0		1.1		1.4		1.8		2.1		2.5		3.0		3.4		3.9	

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet. Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement

Table DV-7 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 6.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

Grade 6.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	12.4	0.7	0.8	8.7	0.8	1.0	6.2	0.9	1.4	4.7	1.0	1.8	3.5	1.2	1.9												
10	24.7	0.7	0.8	17.6	0.8	1.0	12.8	0.9	1.4	9.8	0.9	1.7	7.8	1.0	2.0	6.2	1.0	2.3	4.8	1.1	2.7						
15	37.1	0.7	0.8	26.4	0.8	1.1	19.2	0.8	1.4	15.0	0.9	1.7	11.8	0.9	2.0	9.5	1.0	2.4	7.7	1.1	2.7	6.2	1.2	3.1	5.0	1.3	3.5
20	49.4	0.7	0.8	35.1	0.8	1.1	25.6	0.8	1.4	19.9	0.9	1.7	16.0	0.9	2.0	12.9	1.0	2.4	10.4	1.0	2.8	8.5	1.1	3.2	7.0	1.2	3.6
25	61.8	0.7	0.8	43.9	0.8	1.1	32.0	0.8	1.4	24.9	0.9	1.7	19.9	0.9	2.0	16.1	1.0	2.4	13.1	1.0	2.8	10.8	1.1	3.2	8.9	1.2	3.6
30	74.1	0.7	0.8	52.7	0.8	1.1	38.4	0.8	1.4	29.9	0.9	1.7	23.8	0.9	2.1	19.3	1.0	2.4	15.9	1.0	2.8	13.0	1.1	3.2	10.8	1.1	3.6
35	86.5	0.7	0.8	61.5	0.8	1.1	44.8	0.8	1.4	34.8	0.9	1.7	27.8	0.9	2.1	22.5	1.0	2.4	18.5	1.0	2.8	15.4	1.1	3.2	12.7	1.1	3.6
40	98.9	0.7	0.8	70.2	0.8	1.1	51.2	0.8	1.4	39.8	0.9	1.7	31.8	0.9	2.1	25.7	1.0	2.4	21.2	1.0	2.8	17.8	1.1	3.2	14.8	1.1	3.6
45	111.2	0.7	0.8	79.0	0.8	1.1	57.6	0.8	1.4	44.8	0.9	1.7	35.7	0.9	2.1	29.0	1.0	2.4	23.8	1.0	2.8	19.9	1.1	3.2	16.8	1.1	3.6
50	123.6	0.7	0.8	87.8	0.8	1.1	64.0	0.8	1.4	49.7	0.9	1.7	39.7	0.9	2.1	32.2	1.0	2.4	26.4	1.0	2.8	22.0	1.1	3.2	18.4	1.1	3.6
55	135.9	0.7	0.8	96.6	0.8	1.1	70.4	0.8	1.4	54.7	0.9	1.7	43.6	0.9	2.1	35.4	1.0	2.4	29.1	1.0	2.8	24.2	1.1	3.2	20.2	1.1	3.7
60	148.3	0.7	0.8	105.3	0.8	1.1	76.8	0.8	1.4	59.7	0.9	1.7	47.6	0.9	2.1	38.6	1.0	2.4	31.7	1.0	2.8	26.3	1.1	3.2	22.0	1.1	3.7
65	160.6	0.7	0.8	114.1	0.8	1.1	83.2	0.8	1.4	64.7	0.9	1.7	51.6	0.9	2.1	41.8	1.0	2.4	34.3	1.0	2.8	28.5	1.1	3.2	23.8	1.1	3.7
70	173.0	0.7	0.8	122.9	0.8	1.1	89.6	0.8	1.4	69.6	0.9	1.7	55.5	0.9	2.1	45.0	1.0	2.4	37.0	1.0	2.8	30.7	1.1	3.2	25.6	1.1	3.7
75	185.4	0.7	0.8	131.7	0.8	1.1	96.0	0.8	1.4	74.6	0.9	1.7	59.5	0.9	2.1	48.2	1.0	2.4	39.6	1.0	2.8	32.9	1.1	3.2	27.4	1.1	3.7
80	197.7	0.7	0.8	140.4	0.8	1.1	102.3	0.8	1.4	79.5	0.9	1.7	63.5	0.9	2.1	51.4	1.0	2.4	42.2	1.0	2.8	35.1	1.1	3.2	29.3	1.1	3.7
85	210.1	0.7	0.8	149.2	0.8	1.1	108.7	0.8	1.4	84.5	0.9	1.7	67.4	0.9	2.1	54.7	1.0	2.4	44.9	1.0	2.8	37.5	1.1	3.2	31.1	1.1	3.7
90	222.4	0.7	0.8	158.0	0.8	1.1	115.1	0.8	1.4	89.5	0.9	1.7	71.4	0.9	2.1	57.9	1.0	2.4	47.5	1.0	2.8	39.5	1.1	3.2	32.9	1.1	3.7
95	234.8	0.7	0.8	166.8	0.8	1.1	121.5	0.8	1.4	94.5	0.9	1.7	75.4	0.9	2.1	61.1	1.0	2.4	50.2	1.0	2.8	41.7	1.1	3.2	34.7	1.1	3.7
100	247.1	0.7	0.8	175.5	0.8	1.1	127.9	0.8	1.4	99.5	0.9	1.7	79.3	0.9	2.1	64.3	1.0	2.4	52.8	1.0	2.8	43.9	1.1	3.2	36.5	1.1	3.7
105	259.5	0.7	0.8	184.3	0.8	1.1	134.3	0.8	1.4	104.4	0.9	1.7	83.3	0.9	2.1	67.5	1.0	2.4	55.4	1.0	2.8	46.1	1.1	3.2	38.4	1.1	3.7
110	271.8	0.7	0.8	193.1	0.8	1.1	140.7	0.8	1.4	109.4	0.9	1.7	87.3	0.9	2.1	70.7	1.0	2.4	58.1	1.0	2.8	48.2	1.1	3.2	40.2	1.1	3.7
115	284.2	0.7	0.8	201.9	0.8	1.1	147.1	0.8	1.4	114.4	0.9	1.7	91.2	0.9	2.1	73.9	1.0	2.4	60.7	1.0	2.8	50.4	1.1	3.2	42.0	1.1	3.7
120	296.6	0.7	0.8	210.7	0.8	1.1	153.5	0.8	1.4	119.3	0.9	1.7	95.2	0.9	2.1	77.2	1.0	2.4	63.3	1.0	2.8	52.6	1.1	3.2	43.9	1.1	3.7
125	308.9	0.7	0.8	219.4	0.8	1.1	159.9	0.8	1.4	124.3	0.9	1.7	99.2	0.9	2.1	80.4	1.0	2.4	66.0	1.0	2.8	54.8	1.1	3.2	45.7	1.1	3.7
130	321.3	0.7	0.8	228.2	0.8	1.1	166.3	0.8	1.4	129.3	0.9	1.7	103.1	0.9	2.1	83.6	1.0	2.4	68.6	1.0	2.8	57.0	1.1	3.2	47.5	1.1	3.7
135	333.6	0.7	0.8	237.0	0.8	1.1	172.7	0.8	1.4	134.3	0.9	1.7	107.1	0.9	2.1	86.8	1.0	2.4	71.3	1.0	2.8	59.2	1.1	3.2	49.3	1.1	3.7
140	345.9	0.7	0.8	245.8	0.8	1.1	179.1	0.8	1.4	139.2	0.9	1.7	111.0	0.9	2.1	90.0	1.0	2.4	73.9	1.0	2.8	61.4	1.1	3.2	51.2	1.1	3.7
145	358.3	0.7	0.8	254.5	0.8	1.1	185.5	0.8	1.4	144.2	0.9	1.7	115.0	0.9	2.1	93.2	1.0	2.4	76.5	1.0	2.8	63.6	1.1	3.2	53.0	1.1	3.7
150	370.7	0.7	0.8	263.3	0.8	1.1	191.9	0.8	1.4	149.2	0.9	1.7	119.0	0.9	2.1	96.4	1.0	2.4	79.2	1.0	2.8	65.8	1.1	3.2	54.8	1.1	3.7

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-8 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 8.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

Grade 8.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	14.0	0.7	0.8	10.1	0.7	1.0	7.4	0.8	1.3	6.5	0.8	1.6	4.4	0.8	1.9	3.4	1.0	2.1									
10	23.0	0.7	0.8	20.1	0.7	1.0	18.5	0.8	1.3	11.3	0.8	1.7	8.1	0.8	2.0	7.4	0.9	2.3	6.0	0.9	2.6	4.9	1.0	3.0	3.8	1.2	3.3
15	41.9	0.7	0.8	30.1	0.7	1.0	22.4	0.8	1.3	17.0	0.8	1.7	13.9	0.8	2.0	11.4	0.9	2.3	9.2	0.9	2.7	7.8	1.0	3.0	6.3	1.0	3.4
20	59.9	0.7	0.8	40.1	0.7	1.0	29.9	0.8	1.3	22.8	0.8	1.7	18.5	0.8	2.0	15.1	0.9	2.3	12.5	0.9	2.7	10.3	1.0	3.1	8.6	1.0	3.5
25	69.9	0.7	0.8	50.1	0.7	1.0	37.3	0.8	1.3	28.2	0.8	1.7	23.1	0.8	2.0	18.8	0.9	2.3	15.6	0.9	2.7	13.0	0.9	3.1	10.8	1.0	3.5
30	83.9	0.7	0.8	60.1	0.7	1.0	44.8	0.8	1.3	33.9	0.8	1.7	27.7	0.8	2.0	22.6	0.9	2.3	18.8	0.9	2.7	15.9	0.9	3.1	13.0	1.0	3.5
35	97.9	0.7	0.8	70.1	0.7	1.0	52.3	0.8	1.3	39.5	0.8	1.7	32.3	0.8	2.0	26.3	0.9	2.3	21.7	0.9	2.7	18.2	0.9	3.1	15.1	1.0	3.5
40	111.8	0.7	0.8	80.2	0.7	1.0	59.7	0.8	1.3	45.1	0.8	1.7	36.9	0.8	2.0	30.1	0.9	2.3	24.8	0.9	2.7	20.8	0.9	3.1	17.3	1.0	3.5
45	125.8	0.7	0.8	90.2	0.7	1.0	67.2	0.8	1.3	50.8	0.8	1.7	41.5	0.8	2.0	33.8	0.9	2.3	27.9	0.9	2.7	23.3	0.9	3.1	19.4	1.0	3.5
50	139.8	0.7	0.8	100.2	0.7	1.0	74.7	0.8	1.3	56.4	0.8	1.7	46.1	0.8	2.0	37.6	0.9	2.3	31.0	0.9	2.7	25.9	0.9	3.1	21.6	1.0	3.5
55	153.8	0.7	0.8	110.2	0.7	1.0	82.1	0.8	1.3	62.1	0.8	1.7	50.7	0.8	2.0	41.3	0.9	2.3	34.1	0.9	2.7	28.5	0.9	3.1	24.0	1.0	3.5
60	167.8	0.7	0.8	120.2	0.7	1.0	89.6	0.8	1.3	67.7	0.8	1.7	55.3	0.8	2.0	45.1	0.9	2.3	37.2	0.9	2.7	31.1	0.9	3.1	25.2	1.0	3.5
65	181.7	0.7	0.8	130.3	0.7	1.0	97.0	0.8	1.3	73.3	0.8	1.7	60.0	0.8	2.0	48.8	0.9	2.3	40.3	0.9	2.7	33.7	0.9	3.1	29.4	1.0	3.5
70	195.7	0.7	0.8	140.3	0.7	1.0	104.5	0.8	1.3	79.0	0.8	1.7	64.6	0.8	2.0	52.6	0.9	2.3	43.4	0.9	2.7	36.3	0.9	3.1	30.6	1.0	3.5
75	209.7	0.7	0.8	150.3	0.7	1.0	112.0	0.8	1.3	84.8	0.8	1.7	69.2	0.8	2.0	56.3	0.9	2.3	46.6	0.9	2.7	38.9	0.9	3.1	32.8	1.0	3.5
80	223.7	0.7	0.8	160.3	0.7	1.0	119.4	0.8	1.3	90.5	0.8	1.7	73.8	0.8	2.0	60.1	0.9	2.3	49.8	0.9	2.7	41.4	0.9	3.1	35.0	1.0	3.5
85	237.7	0.7	0.8	170.3	0.7	1.0	126.9	0.8	1.3	95.9	0.8	1.7	78.4	0.8	2.0	63.8	0.9	2.3	52.7	0.9	2.7	44.0	0.9	3.1	37.1	1.0	3.5
90	251.6	0.7	0.8	180.3	0.7	1.0	134.4	0.8	1.3	101.6	0.8	1.7	83.0	0.8	2.0	67.6	0.9	2.3	55.9	0.9	2.7	46.6	0.9	3.1	39.3	1.0	3.5
95	265.6	0.7	0.8	190.4	0.7	1.0	141.8	0.8	1.3	107.2	0.8	1.7	87.6	0.8	2.0	71.5	0.9	2.3	59.0	0.9	2.7	49.2	0.9	3.1	41.5	1.0	3.5
100	279.6	0.7	0.8	200.4	0.7	1.0	149.3	0.8	1.3	112.8	0.8	1.7	92.2	0.8	2.0	75.1	0.9	2.3	62.0	0.9	2.7	51.8	0.9	3.1	43.7	1.0	3.5
105	293.6	0.7	0.8	210.4	0.7	1.0	156.8	0.8	1.3	118.5	0.8	1.7	96.8	0.8	2.0	78.9	0.9	2.3	65.1	0.9	2.7	54.4	0.9	3.1	45.9	1.0	3.5
110	307.6	0.7	0.8	220.4	0.7	1.0	164.2	0.8	1.3	124.1	0.8	1.7	101.4	0.8	2.0	82.6	0.9	2.3	68.2	0.9	2.7	57.0	0.9	3.1	48.0	1.0	3.5
115	321.6	0.7	0.8	230.4	0.7	1.0	171.7	0.8	1.3	129.8	0.8	1.7	106.1	0.8	2.0	86.4	0.9	2.3	71.3	0.9	2.7	59.6	0.9	3.1	50.2	1.0	3.5
120	335.5	0.7	0.8	240.5	0.7	1.0	179.1	0.8	1.3	135.4	0.8	1.7	110.7	0.8	2.0	90.1	0.9	2.3	74.4	0.9	2.7	62.2	0.9	3.1	52.4	1.0	3.5
125	349.5	0.7	0.8	250.5	0.7	1.0	186.6	0.8	1.3	141.0	0.8	1.7	115.3	0.8	2.0	93.9	0.9	2.3	77.5	0.9	2.7	64.7	0.9	3.1	54.6	1.0	3.5
130	363.5	0.7	0.8	260.5	0.7	1.0	194.1	0.8	1.3	146.7	0.8	1.7	119.9	0.8	2.0	97.6	0.9	2.3	80.6	0.9	2.7	67.3	0.9	3.1	56.8	1.0	3.5
135	377.5	0.7	0.8	270.5	0.7	1.0	201.5	0.8	1.3	152.3	0.8	1.7	124.5	0.8	2.0	101.4	0.9	2.3	83.7	0.9	2.7	69.9	0.9	3.1	58.9	1.0	3.5
140	391.5	0.7	0.8	280.5	0.7	1.0	209.0	0.8	1.3	158.0	0.8	1.7	129.1	0.8	2.0	105.1	0.9	2.3	86.8	0.9	2.7	72.5	0.9	3.1	61.1	1.0	3.5
145	405.4	0.7	0.8	290.6	0.7	1.0	216.5	0.8	1.3	163.6	0.8	1.7	133.7	0.8	2.0	108.9	0.9	2.3	89.9	0.9	2.7	75.1	0.9	3.1	63.3	1.0	3.5
150	419.4	0.7	0.8	300.6	0.7	1.0	223.9	0.8	1.3	169.3	0.8	1.7	138.3	0.8	2.0	112.6	0.9	2.3	93.0	0.9	2.7	77.7	0.9	3.1	65.5	1.0	3.5

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second; Depth "D" does not include allowance for freeboard or settlement.

Table DV-9 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 10.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

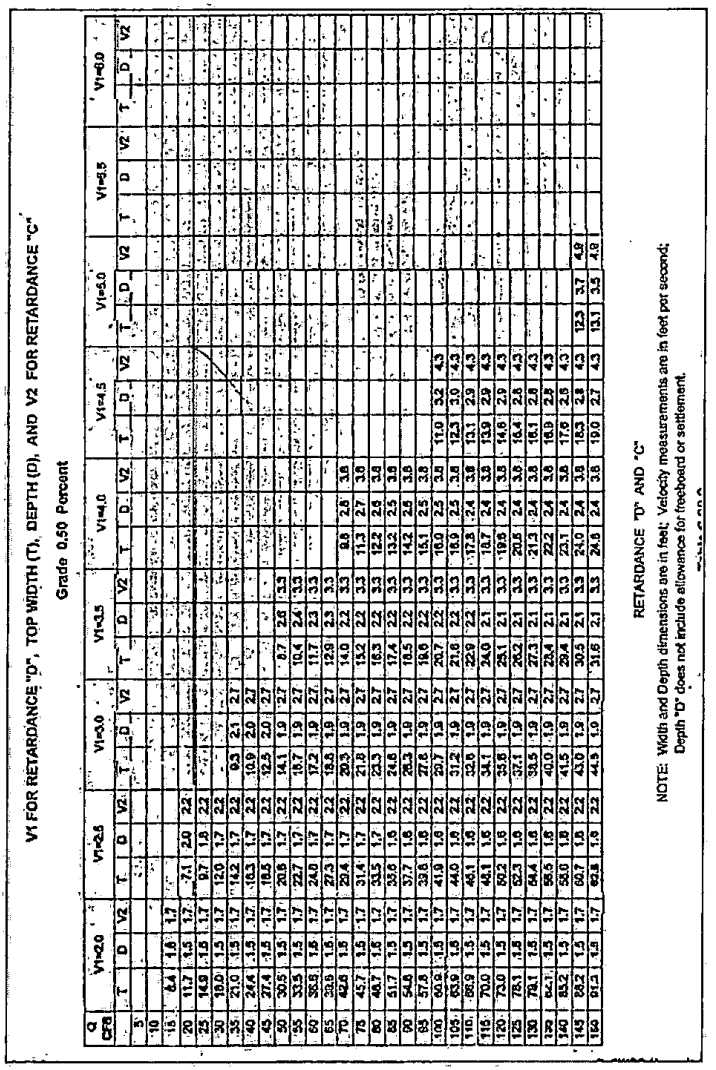
Grade 10.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	15.3	0.5	0.8	11.1	0.7	1.0	10.1	0.7	1.3	9.3	0.7	1.6	8.9	0.8	1.8	8.0	0.8	2.2	8.1	1.0	2.4						
10	30.6	0.6	0.8	22.1	0.7	1.0	18.5	0.7	1.3	17.8	0.7	1.6	16.0	0.8	2.0	8.4	0.8	2.3	8.9	0.8	2.6	8.7	0.9	2.8	4.7	1.0	3.3
15	45.9	0.6	0.8	33.2	0.7	1.0	24.7	0.7	1.3	19.2	0.7	1.6	15.0	0.8	2.0	12.7	0.8	2.2	10.5	0.8	2.6	8.7	0.9	3.0	7.3	0.9	3.3
20	61.2	0.6	0.8	44.2	0.7	1.0	32.9	0.7	1.3	25.6	0.7	1.6	20.0	0.8	2.0	17.0	0.8	2.2	14.1	0.8	2.6	11.6	0.9	3.0	9.8	0.9	3.4
25	76.6	0.6	0.8	55.3	0.7	1.0	41.1	0.7	1.3	32.0	0.7	1.6	25.0	0.8	2.0	21.2	0.8	2.3	17.6	0.8	2.6	14.7	0.9	3.0	12.5	0.9	3.4
30	91.8	0.6	0.8	66.3	0.7	1.0	49.3	0.7	1.3	38.3	0.7	1.6	29.9	0.8	2.0	25.4	0.8	2.3	21.1	0.8	2.6	17.7	0.8	3.0	15.0	0.9	3.3
35	107.1	0.6	0.8	77.4	0.7	1.0	57.6	0.7	1.3	44.7	0.7	1.6	34.9	0.8	2.0	29.7	0.8	2.3	24.6	0.8	2.6	20.6	0.8	3.0	17.5	0.9	3.4
40	122.4	0.6	0.8	88.4	0.7	1.0	65.7	0.7	1.3	51.1	0.7	1.6	39.9	0.8	2.0	33.9	0.8	2.3	28.1	0.8	2.6	23.5	0.8	3.0	20.0	0.8	3.4
45	137.8	0.6	0.8	99.5	0.7	1.0	73.9	0.7	1.3	57.5	0.7	1.6	44.9	0.8	2.0	38.0	0.8	2.3	31.6	0.8	2.6	26.5	0.8	3.0	22.5	0.9	3.4
50	153.1	0.6	0.8	110.6	0.7	1.0	82.1	0.7	1.3	63.9	0.7	1.6	49.9	0.8	2.0	42.2	0.8	2.3	35.1	0.8	2.6	29.4	0.8	3.0	25.0	0.9	3.4
55	168.4	0.6	0.8	121.6	0.7	1.0	90.3	0.7	1.3	70.3	0.7	1.6	54.9	0.8	2.0	46.4	0.8	2.3	38.6	0.8	2.6	32.3	0.8	3.0	27.5	0.9	3.4
60	183.7	0.6	0.8	132.7	0.7	1.0	98.5	0.7	1.3	76.7	0.7	1.6	59.9	0.8	2.0	50.7	0.8	2.3	42.1	0.8	2.6	35.3	0.8	3.0	30.0	0.9	3.4
65	199.0	0.6	0.8	143.7	0.7	1.0	106.7	0.7	1.3	83.1	0.7	1.6	64.9	0.8	2.0	54.9	0.8	2.3	45.6	0.8	2.6	38.2	0.8	3.0	32.5	0.9	3.4
70	214.3	0.6	0.8	154.8	0.7	1.0	115.0	0.7	1.3	89.4	0.7	1.6	69.8	0.8	2.0	59.1	0.8	2.3	49.1	0.8	2.6	41.2	0.8	3.0	35.0	0.9	3.4
75	229.6	0.6	0.8	165.8	0.7	1.0	123.2	0.7	1.3	95.8	0.7	1.6	74.8	0.8	2.0	63.3	0.8	2.3	52.6	0.8	2.6	44.1	0.8	3.0	37.4	0.9	3.4
80	244.9	0.6	0.8	176.8	0.7	1.0	131.4	0.7	1.3	102.2	0.7	1.6	79.8	0.8	2.0	67.6	0.8	2.3	56.1	0.8	2.6	47.0	0.8	3.0	39.9	0.9	3.4
85	260.2	0.6	0.8	187.9	0.7	1.0	139.6	0.7	1.3	108.6	0.7	1.6	84.8	0.8	2.0	71.8	0.8	2.3	59.6	0.8	2.6	50.0	0.8	3.0	42.5	0.9	3.4
90	275.5	0.6	0.8	199.0	0.7	1.0	147.8	0.7	1.3	115.0	0.7	1.6	89.8	0.8	2.0	76.0	0.8	2.3	63.1	0.8	2.6	52.9	0.8	3.0	44.9	0.9	3.4
95	290.8	0.6	0.8	210.0	0.7	1.0	156.0	0.7	1.3	121.4	0.7	1.6	94.8	0.8	2.0	80.2	0.8	2.3	66.6	0.8	2.6	55.8	0.8	3.0	47.5	0.9	3.4
100	306.1	0.6	0.8	221.1	0.7	1.0	164.2	0.7	1.3	127.8	0.7	1.6	99.8	0.8	2.0	84.4	0.8	2.3	70.1	0.8	2.6	58.8	0.8	3.0	49.7	0.9	3.4
105	321.4	0.6	0.8	232.2	0.7	1.0	172.4	0.7	1.3	134.2	0.7	1.6	104.7	0.8	2.0	88.7	0.8	2.3	73.6	0.8	2.6	61.7	0.8	3.0	52.2	0.9	3.4
110	336.7	0.6	0.8	243.2	0.7	1.0	180.6	0.7	1.3	140.5	0.7	1.6	109.7	0.8	2.0	92.9	0.8	2.3	77.1	0.8	2.6	64.7	0.9	3.0	54.7	0.9	3.4
115	352.0	0.6	0.8	254.3	0.7	1.0	188.8	0.7	1.3	146.9	0.7	1.6	114.7	0.8	2.0	97.1	0.8	2.3	80.6	0.8	2.6	67.6	0.8	3.0	57.2	0.9	3.4
120	367.3	0.6	0.8	265.3	0.7	1.0	197.1	0.7	1.3	153.3	0.7	1.6	119.7	0.8	2.0	101.3	0.8	2.3	84.1	0.8	2.6	70.5	0.8	3.0	59.7	0.9	3.4
125	382.6	0.6	0.8	276.4	0.7	1.0	205.3	0.7	1.3	159.7	0.7	1.6	124.7	0.8	2.0	105.6	0.8	2.3	87.6	0.8	2.6	73.5	0.8	3.0	62.2	0.9	3.4
130	397.9	0.6	0.8	287.4	0.7	1.0	213.5	0.7	1.3	166.1	0.7	1.6	129.7	0.8	2.0	109.8	0.8	2.3	91.1	0.8	2.6	76.4	0.8	3.0	64.7	0.9	3.4
135	413.2	0.6	0.8	298.5	0.7	1.0	221.7	0.7	1.3	172.5	0.7	1.6	134.7	0.8	2.0	114.0	0.8	2.3	94.6	0.8	2.6	79.3	0.8	3.0	67.2	0.9	3.4
140	428.6	0.6	0.8	309.5	0.7	1.0	229.9	0.7	1.3	178.9	0.7	1.6	139.7	0.8	2.0	118.2	0.8	2.3	98.1	0.8	2.6	82.3	0.8	3.0	69.6	0.9	3.4
145	443.9	0.6	0.8	320.6	0.7	1.0	238.1	0.7	1.3	185.3	0.7	1.6	144.6	0.8	2.0	122.4	0.8	2.3	101.7	0.8	2.6	85.2	0.8	3.0	72.1	0.9	3.4
150	459.2	0.6	0.8	331.7	0.7	1.0	246.3	0.7	1.3	191.6	0.7	1.6	149.6	0.8	2.0	126.7	0.8	2.3	105.2	0.8	2.6	88.2	0.8	3.0	74.6	0.9	3.4

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet. Velocity measurements are in feet per second; Depth "D" does not include allowance for freeboard or sediment.

Table DV-10 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade .50%)



V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

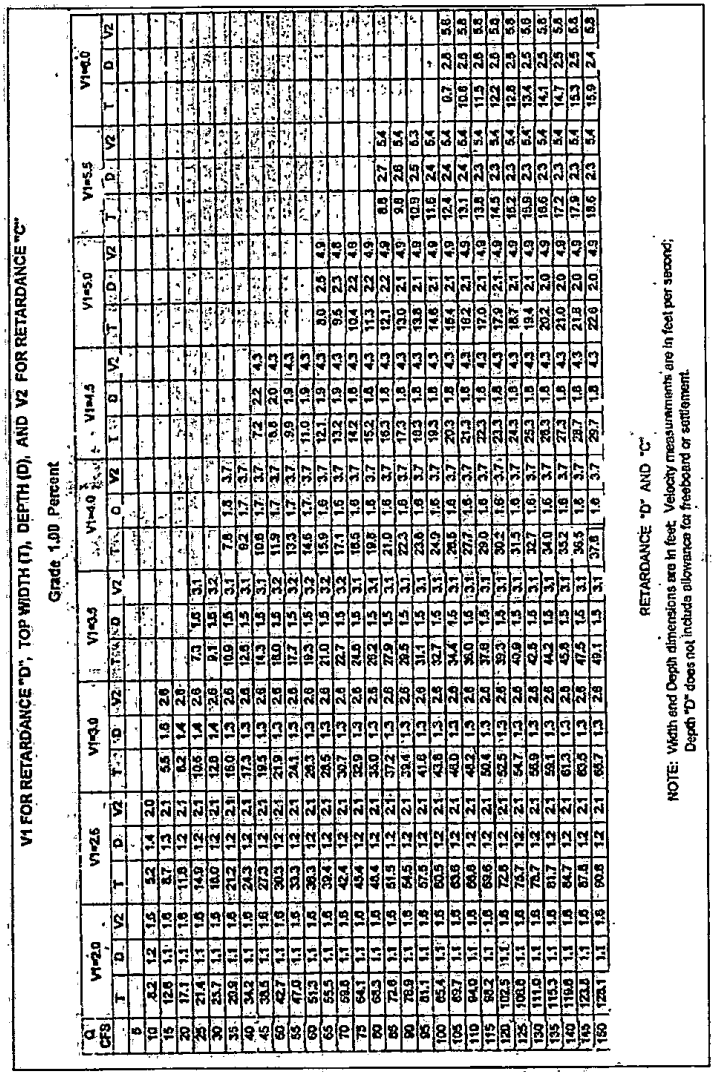
Grade 0.50 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5																											
10																											
15	8.4	1.6	1.7																								
20	11.7	1.5	1.7	7.1	2.0	2.2																					
25	14.9	1.5	1.7	9.7	1.8	2.2																					
30	18.0	1.5	1.7	12.0	1.7	2.2																					
35	21.0	1.5	1.7	14.2	1.7	2.2	9.3	2.1	2.7																		
40	24.4	1.5	1.7	16.3	1.7	2.2	10.9	2.0	2.7																		
45	27.4	1.5	1.7	18.5	1.7	2.2	12.5	2.0	2.7																		
50	30.5	1.5	1.7	20.6	1.7	2.2	14.1	1.9	2.7	8.7	2.6	3.3															
55	33.5	1.5	1.7	22.7	1.7	2.2	15.7	1.9	2.7	10.4	2.4	3.3															
60	36.5	1.5	1.7	24.0	1.7	2.2	17.2	1.9	2.7	11.7	2.3	3.3															
65	39.5	1.5	1.7	27.3	1.7	2.2	18.8	1.9	2.7	12.9	2.3	3.3															
70	42.8	1.5	1.7	29.4	1.7	2.2	20.3	1.9	2.7	14.0	2.2	3.3	8.6	2.6	3.8												
75	45.7	1.5	1.7	31.4	1.7	2.2	21.8	1.9	2.7	15.2	2.2	3.3	11.3	2.7	3.8												
80	48.7	1.5	1.7	33.5	1.7	2.2	23.3	1.9	2.7	16.3	2.2	3.3	12.2	2.6	3.8												
85	51.7	1.5	1.7	35.6	1.6	2.2	24.8	1.9	2.7	17.4	2.2	3.3	13.2	2.5	3.8												
90	54.6	1.5	1.7	37.7	1.6	2.2	26.3	1.9	2.7	18.5	2.2	3.3	14.2	2.5	3.8												
95	57.6	1.5	1.7	39.6	1.6	2.2	27.6	1.9	2.7	19.6	2.2	3.3	15.1	2.5	3.8												
100	60.6	1.5	1.7	41.9	1.6	2.2	29.7	1.9	2.7	20.7	2.2	3.3	16.0	2.5	3.8	11.0	3.2	4.3									
105	63.9	1.5	1.7	44.0	1.6	2.2	31.2	1.9	2.7	21.8	2.2	3.3	16.9	2.5	3.8	12.3	3.0	4.3									
110	66.9	1.5	1.7	46.1	1.6	2.2	32.6	1.9	2.7	22.9	2.2	3.3	17.8	2.4	3.8	13.1	2.9	4.3									
115	70.0	1.5	1.7	48.1	1.6	2.2	34.1	1.9	2.7	24.0	2.1	3.3	18.7	2.4	3.8	13.9	2.9	4.3									
120	73.0	1.5	1.7	50.2	1.6	2.2	35.6	1.9	2.7	25.1	2.1	3.3	19.6	2.4	3.8	14.6	2.9	4.3									
125	76.1	1.5	1.7	52.3	1.6	2.2	37.1	1.9	2.7	26.2	2.1	3.3	20.5	2.4	3.8	16.4	2.8	4.3									
130	79.1	1.5	1.7	54.4	1.6	2.2	38.5	1.9	2.7	27.3	2.1	3.3	21.3	2.4	3.8	16.1	2.8	4.3									
135	82.1	1.5	1.7	56.5	1.6	2.2	40.0	1.9	2.7	28.4	2.1	3.3	22.2	2.4	3.8	16.9	2.9	4.3									
140	85.2	1.5	1.7	58.6	1.6	2.2	41.5	1.9	2.7	29.4	2.1	3.3	23.1	2.4	3.8	17.6	2.8	4.3									
145	88.2	1.5	1.7	60.7	1.6	2.2	43.0	1.9	2.7	30.5	2.1	3.3	24.0	2.4	3.8	18.3	2.8	4.3	12.5	3.7	4.8						
150	91.3	1.5	1.7	62.8	1.6	2.2	44.5	1.9	2.7	31.6	2.1	3.3	24.8	2.4	3.8	19.0	2.7	4.3	13.1	3.5	4.8						

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-11 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 1.00%)



V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

Grade 1.00 Percent

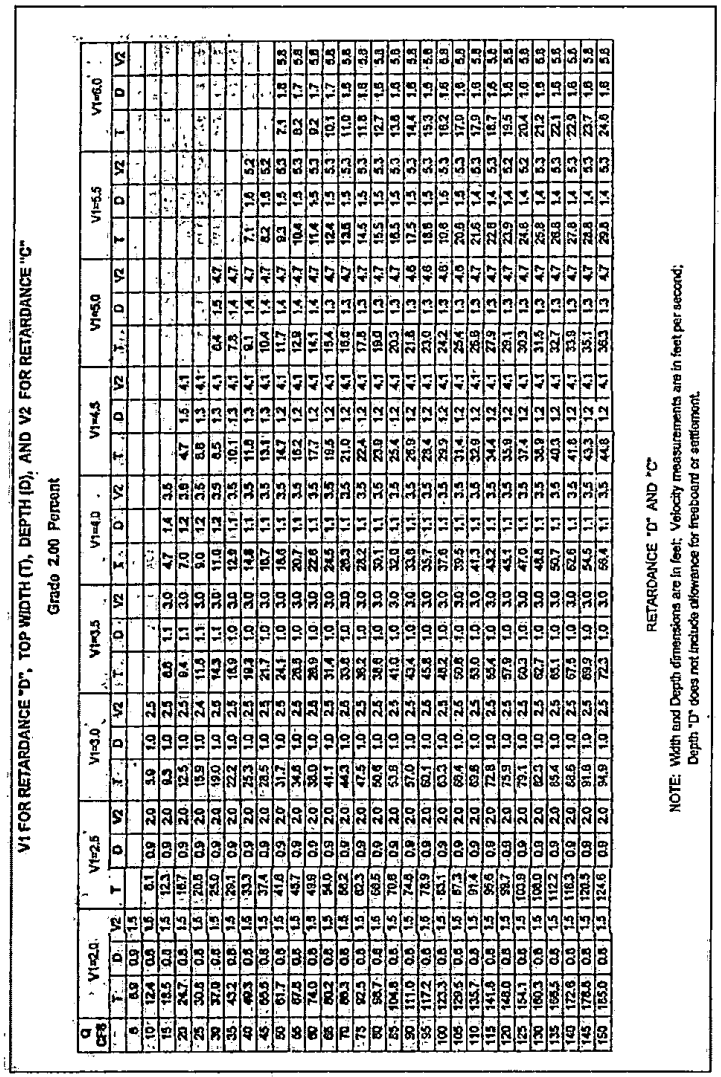
Q CFS	V1=2.0		V1=2.5		V1=3.0		V1=3.5		V1=4.0		V1=4.5		V1=5.0		V1=5.5		V1=6.0		
	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	T	D	V2
5																			
10	8.2	1.2	5.2	1.4	2.0														
15	12.6	1.1	8.7	1.3	2.1		5.5	1.6	2.6										
20	17.1	1.1	11.9	1.2	2.1		8.2	1.4	2.6										
25	21.4	1.1	14.9	1.2	2.1		10.6	1.4	2.6		7.3	1.6	3.1						
30	25.7	1.1	18.0	1.2	2.1		12.9	1.4	2.6		9.1	1.6	3.2						
35	29.9	1.1	21.2	1.2	2.1		15.0	1.3	2.6		10.9	1.5	3.1		7.8	1.8	3.7		
40	34.2	1.1	24.3	1.2	2.1		17.3	1.3	2.6		12.6	1.5	3.1		9.2	1.7	3.7		
45	38.5	1.1	27.3	1.2	2.1		19.5	1.3	2.6		14.3	1.6	3.1		10.6	1.7	3.7	7.2	2.2
50	42.7	1.1	30.3	1.2	2.1		21.9	1.3	2.6		16.0	1.5	3.2		11.9	1.7	3.7	8.6	2.0
55	47.0	1.1	33.3	1.2	2.1		24.1	1.3	2.6		17.7	1.5	3.2		13.3	1.7	3.7	9.9	1.9
60	51.3	1.1	36.3	1.2	2.1		26.3	1.3	2.6		19.3	1.5	3.2		14.6	1.7	3.7	11.0	1.9
65	55.5	1.1	39.4	1.2	2.1		28.5	1.3	2.6		21.0	1.5	3.2		15.9	1.6	3.7	12.1	1.9
70	59.8	1.1	42.4	1.2	2.1		30.7	1.3	2.6		22.7	1.5	3.2		17.1	1.6	3.7	13.2	1.9
75	64.1	1.1	45.4	1.2	2.1		32.9	1.3	2.6		24.5	1.5	3.1		18.5	1.6	3.7	14.2	1.8
80	68.3	1.1	48.4	1.2	2.1		35.0	1.3	2.6		26.2	1.5	3.1		19.8	1.6	3.7	15.2	1.8
85	72.6	1.1	51.5	1.2	2.1		37.2	1.3	2.6		27.9	1.5	3.1		21.0	1.6	3.7	16.3	1.8
90	76.9	1.1	54.5	1.2	2.1		39.4	1.3	2.6		29.5	1.5	3.1		22.3	1.6	3.7	17.3	1.8
95	81.1	1.1	57.5	1.2	2.1		41.6	1.3	2.6		31.1	1.5	3.1		23.6	1.6	3.7	18.3	1.8
100	85.4	1.1	60.5	1.2	2.1		43.8	1.3	2.6		32.7	1.5	3.1		24.9	1.6	3.7	19.3	1.8
105	89.7	1.1	63.6	1.2	2.1		46.0	1.3	2.6		34.4	1.5	3.1		26.6	1.6	3.7	20.3	1.8
110	94.0	1.1	66.6	1.2	2.1		48.2	1.3	2.6		36.0	1.6	3.1		27.7	1.6	3.7	21.3	1.8
115	98.2	1.1	69.6	1.2	2.1		50.4	1.3	2.6		37.6	1.6	3.1		29.0	1.6	3.7	22.3	1.8
120	102.5	1.1	72.6	1.2	2.1		52.5	1.3	2.6		39.3	1.6	3.1		30.2	1.6	3.7	23.3	1.8
125	106.8	1.1	75.7	1.2	2.1		54.7	1.3	2.6		40.9	1.5	3.1		31.5	1.6	3.7	24.3	1.8
130	111.0	1.1	78.7	1.2	2.1		56.9	1.3	2.6		42.5	1.6	3.1		32.7	1.6	3.7	25.3	1.8
135	115.3	1.1	81.7	1.2	2.1		59.1	1.3	2.6		44.2	1.6	3.1		34.0	1.6	3.7	26.3	1.8
140	119.6	1.1	84.7	1.2	2.1		61.3	1.3	2.6		45.8	1.5	3.1		35.2	1.6	3.7	27.3	1.8
145	123.8	1.1	87.8	1.2	2.1		63.5	1.3	2.6		47.5	1.5	3.1		36.5	1.6	3.7	28.7	1.8
150	128.1	1.1	90.8	1.2	2.1		65.7	1.3	2.6		49.1	1.5	3.1		37.8	1.6	3.7	29.7	1.8

Q CFS	V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2
120	22.6	2.0	4.9	18.6	2.3	5.4	15.9	2.4	5.8

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet. Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-12 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 2.00%)



V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

Grade 2.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	5.9	0.9	1.5																								
10	12.4	0.9	1.5	8.1	0.9	2.0	5.9	1.0	2.5																		
15	18.5	0.9	1.5	12.3	0.9	2.0	9.3	1.0	2.5	6.6	1.1	3.0	4.7	1.4	3.5												
20	24.7	0.9	1.5	16.7	0.9	2.0	12.5	1.0	2.5	9.4	1.1	3.0	7.0	1.2	3.5	4.7	1.5	4.1									
25	30.8	0.9	1.5	20.5	0.9	2.0	15.9	1.0	2.4	11.6	1.1	3.0	9.0	1.2	3.5	6.8	1.3	4.1									
30	37.0	0.9	1.5	25.0	0.9	2.0	19.0	1.0	2.5	14.3	1.1	3.0	11.0	1.2	3.5	8.5	1.3	4.1	6.4	1.5	4.7						
35	43.2	0.9	1.5	29.1	0.9	2.0	22.2	1.0	2.5	16.9	1.0	3.0	12.9	1.1	3.5	10.1	1.3	4.1	7.8	1.4	4.7	7.1	1.6	5.2			
40	49.3	0.9	1.6	33.3	0.9	2.0	25.3	1.0	2.5	19.4	1.0	3.0	14.8	1.1	3.5	11.6	1.3	4.1	9.1	1.4	4.7	8.2	1.6	5.2			
45	55.5	0.9	1.6	37.4	0.9	2.0	28.5	1.0	2.5	21.7	1.0	3.0	16.7	1.1	3.5	13.1	1.3	4.1	10.4	1.4	4.7	9.2	1.6	5.2			
50	61.7	0.9	1.5	41.8	0.9	2.0	31.7	1.0	2.5	24.1	1.0	3.0	18.6	1.1	3.5	14.7	1.2	4.1	11.7	1.4	4.7	9.3	1.5	5.3	7.1	1.8	5.8
55	67.8	0.9	1.5	45.7	0.9	2.0	34.8	1.0	2.5	26.9	1.0	3.0	20.7	1.1	3.5	16.2	1.2	4.1	12.9	1.4	4.7	10.4	1.5	5.3	8.2	1.7	5.8
60	74.0	0.9	1.5	49.8	0.9	2.0	38.0	1.0	2.5	29.9	1.0	3.0	22.6	1.1	3.5	17.7	1.2	4.1	14.1	1.4	4.7	11.4	1.5	5.3	9.2	1.7	5.8
65	80.2	0.9	1.5	54.0	0.9	2.0	41.1	1.0	2.5	31.4	1.0	3.0	24.5	1.1	3.5	19.2	1.2	4.1	15.4	1.3	4.7	12.4	1.5	5.3	10.1	1.7	5.8
70	86.3	0.8	1.4	58.2	0.9	2.0	44.3	1.0	2.6	33.8	1.0	3.0	26.3	1.1	3.5	21.0	1.2	4.1	16.6	1.3	4.7	13.5	1.5	5.3	11.0	1.8	5.8
75	92.5	0.8	1.5	62.3	0.9	2.0	47.5	1.0	2.5	36.2	1.0	3.0	28.2	1.1	3.5	22.4	1.2	4.1	17.8	1.3	4.7	14.5	1.5	5.3	11.8	1.8	5.8
80	98.7	0.8	1.6	66.5	0.9	2.0	50.6	1.0	2.5	38.6	1.0	3.0	30.1	1.1	3.5	23.9	1.2	4.1	19.0	1.3	4.7	15.5	1.5	5.3	12.7	1.8	5.8
85	104.8	0.8	1.5	70.8	0.9	2.0	53.8	1.0	2.5	41.0	1.0	3.0	32.0	1.1	3.5	25.4	1.2	4.1	20.3	1.3	4.7	16.5	1.5	5.3	13.6	1.8	5.8
90	111.0	0.8	1.5	74.9	0.9	2.0	57.0	1.0	2.5	43.4	1.0	3.0	33.8	1.1	3.5	26.9	1.2	4.1	21.5	1.3	4.6	17.5	1.5	5.3	14.4	1.8	5.8
95	117.2	0.8	1.5	78.9	0.9	2.0	60.1	1.0	2.5	45.8	1.0	3.0	35.7	1.1	3.5	28.4	1.2	4.1	23.0	1.3	4.6	18.5	1.5	5.3	15.3	1.8	5.8
100	123.3	0.8	1.5	83.1	0.9	2.0	63.3	1.0	2.5	48.2	1.0	3.0	37.6	1.1	3.5	29.9	1.2	4.1	24.2	1.3	4.6	19.6	1.5	5.3	16.2	1.8	5.8
105	129.5	0.8	1.5	87.3	0.9	2.0	66.4	1.0	2.5	50.6	1.0	3.0	39.5	1.1	3.5	31.4	1.2	4.1	25.4	1.3	4.6	20.6	1.5	5.3	17.0	1.8	5.8
110	135.7	0.8	1.5	91.4	0.9	2.0	69.6	1.0	2.5	53.0	1.0	3.0	41.3	1.1	3.5	32.9	1.2	4.1	26.6	1.3	4.7	21.6	1.4	5.3	17.9	1.8	5.8
115	141.8	0.8	1.5	95.6	0.9	2.0	72.8	1.0	2.5	55.4	1.0	3.0	43.2	1.1	3.5	34.4	1.2	4.1	27.9	1.3	4.7	22.6	1.4	5.3	18.7	1.8	5.8
120	148.0	0.8	1.5	99.7	0.9	2.0	75.9	1.0	2.5	57.8	1.0	3.0	45.1	1.1	3.5	35.9	1.2	4.1	29.1	1.3	4.7	23.9	1.4	5.2	19.5	1.8	5.8
125	154.1	0.8	1.5	103.9	0.9	2.0	79.1	1.0	2.5	60.3	1.0	3.0	47.0	1.1	3.5	37.4	1.2	4.1	30.3	1.3	4.7	24.8	1.4	5.2	20.4	1.8	5.8
130	160.3	0.8	1.5	108.0	0.9	2.0	82.3	1.0	2.5	62.7	1.0	3.0	48.8	1.1	3.5	38.9	1.2	4.1	31.5	1.3	4.7	25.8	1.4	5.3	21.2	1.8	5.8
135	166.5	0.8	1.5	112.2	0.9	2.0	85.4	1.0	2.5	65.1	1.0	3.0	50.7	1.1	3.5	40.3	1.2	4.1	32.7	1.3	4.7	26.8	1.4	5.3	22.1	1.8	5.8
140	172.6	0.8	1.5	116.3	0.9	2.0	88.6	1.0	2.5	67.5	1.0	3.0	52.6	1.1	3.5	41.8	1.2	4.1	33.9	1.3	4.7	27.8	1.4	5.3	22.9	1.8	5.8
145	178.8	0.8	1.5	120.5	0.9	2.0	91.8	1.0	2.5	69.9	1.0	3.0	54.5	1.1	3.5	43.3	1.2	4.1	35.1	1.3	4.7	28.8	1.4	5.3	23.7	1.8	5.8
150	185.0	0.8	1.5	124.6	0.9	2.0	94.9	1.0	2.5	72.3	1.0	3.0	56.4	1.1	3.5	44.8	1.2	4.1	36.3	1.3	4.7	29.8	1.4	5.3	24.6	1.8	5.8

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-13 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 4.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

Grade 4.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	8.5	0.6	1.4	5.9	0.7	1.8	4.1	0.8	2.3																		
10	17.2	0.6	1.4	12.1	0.7	1.8	8.8	0.7	2.3	6.7	0.8	2.8	5.2	0.9	3.3	3.8	1.0	3.9									
15	25.8	0.6	1.4	18.1	0.7	1.8	13.4	0.7	2.3	10.3	0.8	2.8	8.1	0.8	3.4	6.4	0.9	3.9	4.9	1.0	4.5						
20	34.4	0.6	1.4	24.2	0.7	1.8	17.8	0.7	2.3	13.9	0.8	2.8	10.9	0.8	3.4	8.7	0.9	3.9	6.9	1.0	4.5	6.5	1.1	5.0			
25	43.0	0.6	1.4	30.2	0.7	1.9	22.3	0.7	2.3	17.4	0.8	2.8	13.6	0.8	3.3	10.9	0.9	3.9	8.6	1.0	4.5	7.1	1.0	5.1	5.7	1.2	5.6
30	51.6	0.6	1.4	36.3	0.7	1.9	26.7	0.7	2.3	20.8	0.8	2.8	16.5	0.8	3.3	13.2	0.9	3.9	10.7	0.9	4.5	8.7	1.0	5.1	7.1	1.1	5.6
35	60.2	0.6	1.4	42.3	0.7	1.9	31.1	0.7	2.3	24.3	0.8	2.8	19.3	0.8	3.4	15.6	0.9	3.9	12.5	0.9	4.5	10.3	1.0	5.0	8.4	1.1	5.6
40	68.8	0.6	1.4	48.3	0.7	1.9	35.6	0.7	2.3	27.8	0.8	2.8	22.0	0.8	3.4	17.8	0.9	3.9	14.4	0.9	4.5	11.8	1.0	5.0	9.8	1.1	5.7
45	77.4	0.6	1.4	54.4	0.7	1.9	40.0	0.7	2.4	31.2	0.8	2.8	24.8	0.8	3.4	20.0	0.9	3.9	16.4	0.9	4.4	13.3	1.0	5.0	11.1	1.1	5.7
50	86.0	0.6	1.4	60.4	0.7	1.9	44.5	0.7	2.4	34.7	0.8	2.8	27.5	0.8	3.4	22.2	0.9	3.9	18.2	0.9	4.4	14.9	1.0	5.0	12.3	1.1	5.7
55	94.6	0.6	1.4	66.5	0.7	1.9	48.9	0.7	2.4	38.2	0.8	2.8	30.3	0.8	3.4	24.4	0.9	3.9	20.0	0.9	4.4	16.6	1.0	5.0	13.6	1.1	5.7
60	103.2	0.6	1.4	72.5	0.7	1.9	53.4	0.7	2.4	41.7	0.9	2.8	33.0	0.8	3.4	26.6	0.9	3.9	21.8	0.9	4.5	18.1	1.0	5.0	14.9	1.1	5.7
65	111.8	0.6	1.4	78.5	0.7	1.9	57.8	0.7	2.4	45.1	0.8	2.8	35.8	0.8	3.4	28.9	0.9	3.9	23.6	0.9	4.5	19.6	1.0	5.0	16.2	1.1	5.7
70	120.4	0.6	1.4	84.6	0.7	1.9	62.3	0.7	2.4	48.6	0.8	2.8	38.6	0.8	3.4	31.1	0.9	3.9	25.4	0.9	4.5	21.1	1.0	5.0	17.7	1.1	5.6
75	129.0	0.6	1.4	90.6	0.7	1.9	66.7	0.7	2.4	52.1	0.8	2.8	41.3	0.8	3.4	33.3	0.9	3.9	27.2	0.9	4.5	22.6	1.0	5.0	19.0	1.1	5.6
80	137.5	0.6	1.4	96.7	0.7	1.9	71.2	0.7	2.4	55.6	0.8	2.8	44.1	0.8	3.4	35.5	0.9	3.9	29.1	0.9	4.5	24.1	1.0	5.0	20.2	1.1	5.6
85	146.2	0.6	1.4	102.7	0.7	1.9	75.6	0.7	2.4	59.0	0.8	2.8	46.8	0.8	3.4	37.7	0.9	3.9	30.9	0.9	4.5	25.6	1.0	5.0	21.5	1.1	5.6
90	154.8	0.6	1.4	108.7	0.7	1.9	80.0	0.7	2.4	62.5	0.8	2.8	49.6	0.8	3.4	39.9	0.9	3.9	32.7	0.9	4.5	27.1	1.0	5.0	22.8	1.1	5.6
95	163.4	0.6	1.4	114.8	0.7	1.9	84.5	0.7	2.4	65.9	0.8	2.8	52.3	0.8	3.4	42.2	0.9	3.9	34.5	0.9	4.5	28.6	1.0	5.0	24.0	1.1	5.6
100	172.0	0.6	1.4	120.8	0.7	1.9	88.9	0.7	2.4	69.4	0.8	2.8	55.1	0.8	3.4	44.4	0.9	3.9	36.3	0.9	4.5	30.1	1.0	5.0	25.3	1.1	5.6
105	180.6	0.6	1.4	126.9	0.7	1.9	93.4	0.7	2.4	72.9	0.8	2.8	57.8	0.8	3.4	46.6	0.9	3.9	38.1	0.9	4.5	31.6	1.0	5.0	26.5	1.1	5.6
110	189.2	0.6	1.4	132.9	0.7	1.9	97.8	0.7	2.4	76.3	0.8	2.8	60.6	0.8	3.4	48.8	0.9	3.9	39.9	0.9	4.5	33.1	1.0	5.0	27.8	1.1	5.6
115	197.8	0.6	1.4	138.9	0.7	1.9	102.3	0.7	2.4	79.8	0.8	2.8	63.3	0.8	3.4	51.0	0.9	3.9	41.7	0.9	4.5	34.6	1.0	5.0	29.0	1.1	5.6
120	206.4	0.6	1.4	145.0	0.7	1.9	106.7	0.7	2.4	83.3	0.8	2.8	66.1	0.8	3.4	53.3	0.9	3.9	43.6	0.9	4.5	36.1	1.0	5.0	30.2	1.1	5.7
125	215.0	0.6	1.4	151.0	0.7	1.9	111.2	0.7	2.4	86.8	0.8	2.8	68.8	0.8	3.4	55.5	0.9	3.9	45.4	0.9	4.5	37.6	1.0	5.0	31.5	1.1	5.7
130	223.7	0.6	1.4	157.1	0.7	1.9	115.6	0.7	2.4	90.2	0.8	2.8	71.6	0.8	3.4	57.7	0.9	3.9	47.2	0.9	4.5	39.1	1.0	5.0	32.7	1.1	5.7
135	232.3	0.6	1.4	163.1	0.7	1.9	120.1	0.7	2.4	93.7	0.8	2.8	74.3	0.8	3.4	59.9	0.9	3.9	49.0	0.9	4.5	40.6	1.0	5.0	34.0	1.1	5.7
140	240.9	0.6	1.4	169.1	0.7	1.9	124.5	0.7	2.4	97.2	0.8	2.8	77.1	0.8	3.4	62.1	0.9	3.9	50.8	0.9	4.5	42.1	1.0	5.0	35.2	1.1	5.7
145	249.5	0.6	1.4	175.2	0.7	1.9	129.0	0.7	2.4	100.6	0.8	2.8	79.8	0.8	3.4	64.3	0.9	3.9	52.6	0.9	4.5	43.6	1.0	5.0	36.5	1.1	5.7
150	258.1	0.6	1.4	181.2	0.7	1.9	133.4	0.7	2.4	104.1	0.8	2.8	82.9	0.8	3.4	66.6	0.9	3.9	54.4	0.9	4.5	45.1	1.0	5.0	37.8	1.1	5.7

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-14 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 6.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

Grade 6.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	10.6	0.5	1.3	7.3	0.6	1.8	5.3	0.6	2.3	4.0	0.7	2.8	2.9	0.8	3.2												
10	21.1	0.6	1.3	14.7	0.8	1.8	10.9	0.8	2.3	8.4	0.7	2.8	6.6	0.7	3.2	5.3	0.8	3.8	4.2	0.8	4.3						
15	31.8	0.6	1.3	22.1	0.8	1.8	16.3	0.8	2.3	12.7	0.8	2.7	10.1	0.7	3.3	8.2	0.7	3.8	6.8	0.8	4.3	5.4	0.9	4.9	4.3	1.0	5.5
20	42.1	0.5	1.3	29.5	0.8	1.8	21.7	0.8	2.3	17.0	0.8	2.7	13.6	0.7	3.2	11.1	0.7	3.7	9.0	0.8	4.3	7.4	0.8	4.9	6.1	0.9	5.5
25	52.7	0.6	1.3	36.8	0.8	1.8	27.1	0.8	2.3	21.2	0.8	2.8	17.0	0.7	3.2	13.9	0.7	3.8	11.3	0.8	4.3	9.3	0.8	4.9	7.6	0.9	5.5
30	63.2	0.5	1.3	44.2	0.8	1.8	32.5	0.8	2.3	25.4	0.8	2.8	20.4	0.7	3.2	16.6	0.7	3.8	13.7	0.8	4.3	11.3	0.8	4.9	9.4	0.9	5.5
35	73.7	0.5	1.3	51.6	0.8	1.8	38.0	0.8	2.3	29.7	0.8	2.8	23.8	0.7	3.2	19.4	0.7	3.8	16.0	0.8	4.3	13.4	0.8	4.9	11.1	0.9	5.5
40	84.2	0.5	1.3	58.9	0.8	1.8	43.4	0.8	2.3	33.9	0.8	2.8	27.2	0.7	3.3	22.2	0.7	3.8	18.3	0.8	4.3	15.3	0.8	4.9	12.7	0.9	5.5
45	94.8	0.5	1.3	66.3	0.8	1.8	48.8	0.8	2.3	38.2	0.8	2.8	30.7	0.7	3.3	24.9	0.7	3.8	20.6	0.8	4.3	17.2	0.8	4.9	14.5	0.9	5.4
50	105.3	0.5	1.3	73.6	0.8	1.8	54.2	0.8	2.3	42.4	0.8	2.8	34.1	0.7	3.3	27.7	0.7	3.8	22.8	0.8	4.3	19.1	0.8	4.9	16.1	0.9	5.4
55	115.8	0.5	1.3	81.0	0.8	1.8	59.7	0.8	2.3	46.6	0.8	2.8	37.5	0.7	3.3	30.5	0.7	3.8	25.1	0.8	4.3	21.0	0.8	4.9	17.7	0.9	5.4
60	126.4	0.5	1.3	88.4	0.8	1.8	65.1	0.8	2.3	50.9	0.8	2.8	40.9	0.7	3.3	33.3	0.7	3.8	27.4	0.8	4.3	22.9	0.8	4.9	19.3	0.9	5.4
65	136.9	0.5	1.3	95.7	0.8	1.8	70.5	0.8	2.3	55.1	0.8	2.8	44.3	0.7	3.3	36.0	0.7	3.8	29.7	0.8	4.3	24.8	0.8	4.9	20.9	0.9	5.4
70	147.4	0.5	1.3	103.1	0.8	1.8	75.9	0.8	2.3	59.3	0.8	2.8	47.7	0.7	3.3	38.8	0.7	3.8	32.0	0.8	4.3	26.7	0.8	4.9	22.5	0.9	5.4
75	158.0	0.5	1.3	110.5	0.8	1.8	81.3	0.8	2.3	63.6	0.8	2.8	51.1	0.7	3.3	41.6	0.7	3.8	34.3	0.8	4.3	28.6	0.8	4.9	24.1	0.9	5.4
80	168.5	0.5	1.3	117.8	0.8	1.8	86.8	0.8	2.3	67.8	0.8	2.8	54.5	0.7	3.3	44.3	0.7	3.8	36.5	0.8	4.3	30.5	0.8	4.9	25.7	0.9	5.5
85	179.0	0.5	1.3	125.2	0.8	1.8	92.2	0.8	2.3	72.0	0.8	2.8	57.9	0.7	3.3	47.1	0.7	3.8	38.8	0.8	4.3	32.4	0.8	4.9	27.3	0.9	5.5
90	189.6	0.5	1.3	132.6	0.8	1.8	97.6	0.8	2.3	76.3	0.8	2.8	61.3	0.7	3.3	49.9	0.7	3.8	41.1	0.8	4.3	34.3	0.8	4.9	28.9	0.9	5.5
95	200.1	0.5	1.3	139.9	0.8	1.8	103.0	0.8	2.3	80.5	0.8	2.8	64.7	0.7	3.3	52.6	0.7	3.8	43.4	0.8	4.3	36.2	0.8	4.9	30.5	0.9	5.5
100	210.6	0.5	1.3	147.3	0.8	1.8	108.5	0.8	2.3	84.8	0.8	2.8	68.1	0.7	3.3	55.4	0.7	3.8	45.7	0.8	4.3	38.1	0.8	4.9	32.1	0.9	5.5
105	221.1	0.5	1.3	154.6	0.8	1.8	113.9	0.8	2.3	89.0	0.8	2.8	71.5	0.7	3.3	58.2	0.7	3.8	47.9	0.8	4.3	40.0	0.8	4.9	33.7	0.9	5.5
110	231.7	0.5	1.3	162.0	0.8	1.8	119.3	0.8	2.3	93.2	0.8	2.8	74.9	0.7	3.3	60.8	0.7	3.8	50.2	0.8	4.3	41.9	0.8	4.9	35.3	0.9	5.5
115	242.2	0.5	1.3	169.4	0.8	1.8	124.7	0.8	2.3	97.5	0.8	2.8	78.3	0.7	3.3	63.7	0.7	3.8	52.5	0.8	4.3	43.8	0.8	4.9	36.9	0.9	5.5
120	252.7	0.5	1.3	176.7	0.8	1.8	130.2	0.8	2.3	101.7	0.8	2.8	81.7	0.7	3.3	66.5	0.7	3.8	54.8	0.8	4.3	45.7	0.8	4.9	38.5	0.9	5.5
125	263.3	0.5	1.3	184.1	0.8	1.8	135.6	0.8	2.3	106.0	0.8	2.8	85.1	0.7	3.3	69.3	0.7	3.8	57.1	0.8	4.3	47.6	0.8	4.9	40.1	0.9	5.5
130	273.8	0.5	1.3	191.5	0.8	1.8	141.0	0.8	2.3	110.2	0.8	2.8	88.5	0.7	3.3	72.0	0.7	3.8	59.4	0.8	4.3	49.5	0.8	4.9	41.7	0.9	5.5
135	284.3	0.5	1.3	198.8	0.8	1.8	146.4	0.8	2.3	114.4	0.8	2.8	91.9	0.7	3.3	74.8	0.7	3.8	61.6	0.8	4.3	51.4	0.8	4.9	43.3	0.9	5.5
140	294.9	0.5	1.3	206.2	0.8	1.8	151.8	0.8	2.3	118.7	0.8	2.8	95.3	0.7	3.3	77.6	0.7	3.8	63.9	0.8	4.3	53.3	0.8	4.9	44.9	0.9	5.5
145	305.4	0.5	1.3	213.6	0.8	1.8	157.3	0.8	2.3	122.9	0.8	2.8	98.7	0.7	3.3	80.3	0.7	3.8	66.2	0.8	4.3	55.2	0.8	4.9	46.5	0.9	5.5
150	315.9	0.5	1.3	220.9	0.8	1.8	162.7	0.8	2.3	127.1	0.8	2.8	102.1	0.7	3.3	83.1	0.7	3.8	68.5	0.8	4.3	57.1	0.8	4.9	48.1	0.9	5.5

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-15 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 8.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

Grade 8.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	12.0	0.5	1.3	8.5	0.5	1.7	6.2	0.5	2.2	4.8	0.6	2.7	3.7	0.6	3.2	2.9	0.7	3.6									
10	24.1	0.5	1.3	16.9	0.5	1.7	12.6	0.5	2.2	9.8	0.6	2.7	7.8	0.6	3.2	6.3	0.6	3.7	5.1	0.7	4.2	4.2	0.8	4.8	3.2	0.9	5.3
15	36.1	0.5	1.3	25.3	0.5	1.7	18.9	0.5	2.2	14.4	0.6	2.7	11.6	0.6	3.2	9.7	0.6	3.7	7.9	0.7	4.2	6.5	0.7	4.8	5.4	0.8	5.3
20	48.1	0.5	1.3	33.8	0.5	1.7	25.2	0.5	2.2	19.2	0.6	2.7	15.5	0.6	3.2	12.9	0.6	3.7	10.7	0.7	4.2	8.8	0.7	4.8	7.4	0.8	5.3
25	60.1	0.5	1.3	42.2	0.5	1.7	31.5	0.5	2.2	24.0	0.6	2.7	19.7	0.6	3.2	16.2	0.6	3.7	13.4	0.7	4.2	11.2	0.7	4.7	9.3	0.8	5.3
30	72.1	0.5	1.3	50.6	0.5	1.7	37.8	0.5	2.2	28.9	0.6	2.7	23.6	0.6	3.2	19.4	0.6	3.7	16.1	0.7	4.2	13.5	0.7	4.8	11.5	0.7	5.3
35	84.1	0.5	1.3	59.1	0.5	1.7	44.1	0.5	2.2	33.6	0.6	2.7	27.6	0.6	3.2	22.6	0.6	3.7	18.7	0.7	4.2	15.7	0.7	4.8	13.3	0.7	5.3
40	96.2	0.5	1.3	67.5	0.5	1.7	50.4	0.5	2.2	38.4	0.6	2.7	31.5	0.6	3.2	25.9	0.6	3.7	21.4	0.7	4.2	17.9	0.7	4.8	15.2	0.7	5.3
45	108.2	0.5	1.3	76.0	0.5	1.7	56.7	0.5	2.2	43.2	0.6	2.7	35.4	0.6	3.2	29.0	0.6	3.7	24.1	0.7	4.2	20.2	0.7	4.8	17.1	0.7	5.3
50	120.2	0.5	1.3	84.4	0.5	1.7	63.0	0.5	2.2	48.0	0.6	2.7	39.4	0.6	3.2	32.3	0.6	3.7	26.8	0.7	4.2	22.4	0.7	4.8	19.0	0.7	5.3
55	132.2	0.5	1.3	92.8	0.5	1.7	69.3	0.5	2.2	52.8	0.6	2.7	43.3	0.6	3.2	35.5	0.6	3.7	29.4	0.7	4.2	24.7	0.7	4.8	20.9	0.7	5.3
60	144.2	0.5	1.3	101.3	0.5	1.7	75.6	0.5	2.2	57.6	0.6	2.7	47.2	0.6	3.2	38.7	0.6	3.7	32.1	0.7	4.2	26.9	0.7	4.8	22.8	0.7	5.3
65	156.3	0.5	1.3	109.7	0.5	1.7	81.8	0.5	2.2	62.4	0.6	2.7	51.2	0.6	3.2	41.9	0.6	3.7	34.8	0.7	4.2	29.1	0.7	4.8	24.7	0.7	5.3
70	168.3	0.5	1.3	118.2	0.5	1.7	88.1	0.5	2.2	67.2	0.6	2.7	55.1	0.6	3.2	45.2	0.6	3.7	37.5	0.7	4.2	31.4	0.7	4.8	26.6	0.7	5.3
75	180.3	0.5	1.3	126.6	0.5	1.7	94.4	0.5	2.2	72.0	0.6	2.7	59.0	0.6	3.2	48.4	0.6	3.7	40.1	0.7	4.2	33.6	0.7	4.8	28.5	0.7	5.3
80	192.3	0.5	1.3	135.0	0.5	1.7	100.7	0.5	2.2	76.8	0.6	2.7	63.0	0.6	3.2	51.6	0.6	3.7	42.8	0.7	4.2	35.9	0.7	4.8	30.3	0.7	5.3
85	204.3	0.5	1.3	143.5	0.5	1.7	107.0	0.5	2.2	81.6	0.6	2.7	66.9	0.6	3.2	54.9	0.6	3.7	45.5	0.7	4.2	38.1	0.7	4.8	32.2	0.7	5.3
90	216.4	0.5	1.3	151.9	0.5	1.7	113.3	0.5	2.2	86.4	0.6	2.7	70.8	0.6	3.2	58.1	0.6	3.7	48.1	0.7	4.2	40.3	0.7	4.8	34.1	0.7	5.3
95	228.4	0.5	1.3	160.3	0.5	1.7	119.6	0.5	2.2	91.2	0.6	2.7	74.8	0.6	3.2	61.3	0.6	3.7	50.8	0.7	4.2	42.6	0.7	4.8	36.0	0.7	5.3
100	240.4	0.5	1.3	168.8	0.5	1.7	125.9	0.5	2.2	96.0	0.6	2.7	78.7	0.6	3.2	64.5	0.6	3.7	53.5	0.7	4.2	44.8	0.7	4.8	37.9	0.7	5.3
105	252.4	0.5	1.3	177.2	0.5	1.7	132.2	0.5	2.2	100.8	0.6	2.7	82.6	0.6	3.2	67.8	0.6	3.7	56.2	0.7	4.2	47.1	0.7	4.8	39.8	0.7	5.3
110	264.4	0.5	1.3	185.7	0.5	1.7	138.5	0.5	2.2	105.6	0.6	2.7	86.6	0.6	3.2	71.0	0.6	3.7	58.8	0.7	4.2	49.3	0.7	4.8	41.7	0.7	5.3
115	276.5	0.5	1.3	194.1	0.5	1.7	144.8	0.5	2.2	110.4	0.6	2.7	90.5	0.6	3.2	74.2	0.6	3.7	61.5	0.7	4.2	51.5	0.7	4.8	43.6	0.7	5.3
120	288.5	0.5	1.3	202.5	0.5	1.7	151.1	0.5	2.2	115.2	0.6	2.7	94.4	0.6	3.2	77.4	0.6	3.7	64.2	0.7	4.2	53.8	0.7	4.8	45.5	0.7	5.3
125	300.5	0.5	1.3	211.0	0.5	1.7	157.4	0.5	2.2	120.0	0.6	2.7	98.4	0.6	3.2	80.7	0.6	3.7	66.9	0.7	4.2	56.0	0.7	4.8	47.4	0.7	5.3
130	312.5	0.5	1.3	219.4	0.5	1.7	163.7	0.5	2.2	124.8	0.6	2.7	102.3	0.6	3.2	83.9	0.6	3.7	69.5	0.7	4.2	58.3	0.7	4.8	49.3	0.7	5.3
135	324.5	0.5	1.3	227.9	0.5	1.7	170.0	0.5	2.2	129.6	0.6	2.7	106.2	0.6	3.2	87.1	0.6	3.7	72.2	0.7	4.2	60.5	0.7	4.8	51.2	0.7	5.3
140	336.6	0.5	1.3	236.3	0.5	1.7	176.3	0.5	2.2	134.4	0.6	2.7	110.2	0.6	3.2	90.3	0.6	3.7	74.9	0.7	4.2	62.7	0.7	4.8	53.1	0.7	5.3
145	348.6	0.5	1.3	244.7	0.5	1.7	182.6	0.5	2.2	139.2	0.6	2.7	114.1	0.6	3.2	93.6	0.6	3.7	77.6	0.7	4.2	65.0	0.7	4.8	55.0	0.7	5.3
150	360.6	0.5	1.3	253.2	0.5	1.7	188.9	0.5	2.2	144.0	0.6	2.7	118.0	0.6	3.2	96.8	0.6	3.7	80.2	0.7	4.2	67.2	0.7	4.8	56.9	0.7	5.3

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second.
Depth "D" does not include allowance for freeboard or settlement

Table DV-16 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 10.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"

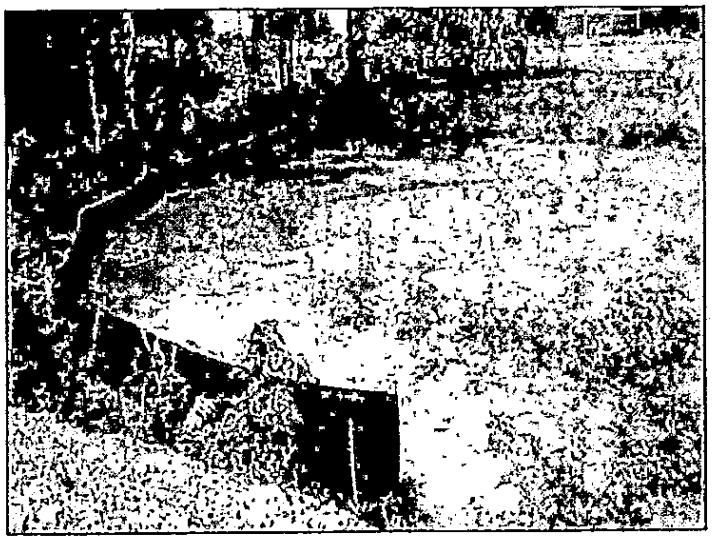
Grade 10.00 Percent

Q CFS	V1=2.0			V1=2.5			V1=3.0			V1=3.5			V1=4.0			V1=4.5			V1=5.0			V1=5.5			V1=6.0		
	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2	T	D	V2
5	13.3	0.4	1.3	9.4	0.5	1.7	6.6	0.5	2.2	5.3	0.5	2.6	4.1	0.6	3.2	3.4	0.6	3.6	2.6	0.7	4.1						
10	26.6	0.4	1.3	18.7	0.5	1.7	13.6	0.5	2.2	10.9	0.5	2.6	8.5	0.6	3.2	7.1	0.6	3.6	5.9	0.6	4.1	4.9	0.7	4.7	4.0	0.7	5.3
15	39.9	0.4	1.3	28.0	0.5	1.7	20.7	0.5	2.2	16.3	0.5	2.6	12.6	0.6	3.2	10.9	0.6	3.6	9.0	0.6	4.1	7.5	0.6	4.7	6.3	0.7	5.2
20	53.2	0.4	1.3	37.4	0.5	1.7	27.6	0.5	2.2	21.7	0.5	2.7	17.0	0.6	3.2	14.5	0.6	3.6	12.1	0.6	4.1	10.2	0.6	4.6	8.5	0.7	5.2
25	66.5	0.4	1.3	46.7	0.5	1.7	34.5	0.5	2.2	27.1	0.5	2.7	21.3	0.6	3.2	18.1	0.6	3.6	15.1	0.6	4.1	12.7	0.6	4.7	10.6	0.7	5.2
30	79.8	0.4	1.3	56.1	0.5	1.7	41.4	0.5	2.2	32.5	0.5	2.7	25.5	0.6	3.2	21.7	0.6	3.6	18.1	0.6	4.1	15.2	0.6	4.7	12.9	0.7	5.2
35	93.1	0.4	1.3	65.4	0.5	1.7	48.3	0.5	2.2	37.9	0.5	2.7	29.8	0.6	3.2	25.3	0.6	3.6	21.1	0.6	4.1	17.8	0.6	4.7	15.1	0.7	5.2
40	106.4	0.4	1.3	74.7	0.5	1.7	55.2	0.5	2.2	43.3	0.5	2.7	34.0	0.6	3.2	29.0	0.6	3.6	24.1	0.6	4.1	20.3	0.6	4.7	17.2	0.7	5.2
45	119.7	0.4	1.3	84.1	0.5	1.7	62.1	0.5	2.2	48.8	0.5	2.7	38.3	0.6	3.2	32.6	0.6	3.6	27.2	0.6	4.1	22.8	0.6	4.7	19.4	0.7	5.2
50	133.0	0.4	1.3	93.4	0.5	1.7	69.0	0.5	2.2	54.2	0.5	2.7	42.5	0.6	3.2	36.2	0.6	3.6	30.2	0.6	4.1	25.4	0.6	4.7	21.5	0.7	5.2
55	146.3	0.4	1.3	102.8	0.5	1.7	75.9	0.5	2.2	59.6	0.5	2.7	46.8	0.6	3.2	39.8	0.6	3.6	33.2	0.6	4.1	27.9	0.6	4.7	23.7	0.7	5.2
60	159.6	0.4	1.3	112.1	0.5	1.7	82.8	0.5	2.2	65.0	0.5	2.7	51.0	0.6	3.2	43.4	0.6	3.6	36.2	0.6	4.1	30.5	0.6	4.7	25.9	0.7	5.2
65	172.9	0.4	1.3	121.4	0.5	1.7	89.7	0.5	2.2	70.4	0.5	2.7	55.3	0.6	3.2	47.1	0.6	3.6	39.2	0.6	4.1	33.0	0.6	4.7	28.0	0.7	5.2
70	186.2	0.4	1.3	130.8	0.5	1.7	96.6	0.5	2.2	75.8	0.5	2.7	59.5	0.6	3.2	50.7	0.6	3.6	42.2	0.6	4.1	35.5	0.6	4.7	30.2	0.7	5.2
75	199.5	0.4	1.3	140.1	0.5	1.7	103.5	0.5	2.2	81.2	0.5	2.7	63.8	0.6	3.2	54.3	0.6	3.6	45.2	0.6	4.1	38.1	0.6	4.7	32.3	0.7	5.2
80	212.8	0.4	1.3	149.5	0.5	1.7	110.5	0.5	2.2	86.7	0.5	2.7	68.0	0.6	3.2	57.9	0.6	3.6	48.3	0.6	4.1	40.6	0.6	4.7	34.5	0.7	5.2
85	226.1	0.4	1.3	158.8	0.5	1.7	117.4	0.5	2.2	92.1	0.5	2.7	72.3	0.6	3.2	61.5	0.6	3.6	51.3	0.6	4.1	43.1	0.6	4.7	36.6	0.7	5.2
90	239.4	0.4	1.3	168.1	0.5	1.7	124.3	0.5	2.2	97.5	0.5	2.7	76.5	0.6	3.2	65.2	0.6	3.6	54.3	0.6	4.1	45.7	0.6	4.7	38.8	0.7	5.2
95	252.7	0.4	1.3	177.5	0.5	1.7	131.2	0.5	2.2	102.9	0.5	2.7	80.8	0.6	3.2	68.8	0.6	3.6	57.3	0.6	4.1	48.2	0.6	4.7	40.9	0.7	5.2
100	266.0	0.4	1.3	186.8	0.5	1.7	138.1	0.5	2.2	108.3	0.5	2.7	85.0	0.6	3.2	72.4	0.6	3.6	60.3	0.6	4.1	50.7	0.6	4.7	43.1	0.7	5.2
105	279.3	0.4	1.3	196.2	0.5	1.7	145.0	0.5	2.2	113.7	0.5	2.7	89.3	0.6	3.2	76.0	0.6	3.6	63.3	0.6	4.1	53.3	0.6	4.7	45.2	0.7	5.2
110	292.5	0.4	1.3	205.5	0.5	1.7	151.9	0.5	2.2	119.2	0.5	2.7	93.5	0.6	3.2	79.6	0.6	3.6	66.4	0.6	4.1	55.8	0.6	4.7	47.4	0.7	5.2
115	305.9	0.4	1.3	214.9	0.5	1.7	158.8	0.5	2.2	124.6	0.5	2.7	97.8	0.6	3.2	83.3	0.6	3.6	69.4	0.6	4.1	58.3	0.6	4.7	49.5	0.7	5.3
120	319.2	0.4	1.3	224.2	0.5	1.7	165.7	0.5	2.2	130.0	0.5	2.7	102.0	0.6	3.2	86.9	0.6	3.6	72.4	0.6	4.1	60.9	0.6	4.7	51.7	0.7	5.3
125	332.5	0.4	1.3	233.5	0.5	1.7	172.6	0.5	2.2	135.4	0.5	2.7	106.3	0.6	3.2	90.5	0.6	3.6	75.4	0.6	4.1	63.4	0.6	4.7	53.8	0.7	5.3
130	345.8	0.4	1.3	242.9	0.5	1.7	179.5	0.5	2.2	140.8	0.5	2.7	110.5	0.6	3.2	94.1	0.6	3.6	78.4	0.6	4.1	66.0	0.6	4.7	56.0	0.7	5.3
135	359.1	0.4	1.3	252.2	0.5	1.7	186.4	0.5	2.2	146.2	0.5	2.7	114.8	0.6	3.2	97.7	0.6	3.6	81.4	0.6	4.1	68.5	0.6	4.7	58.1	0.7	5.3
140	372.4	0.4	1.3	261.6	0.5	1.7	193.3	0.5	2.2	151.7	0.5	2.7	119.0	0.6	3.2	101.3	0.6	3.6	84.4	0.6	4.1	71.0	0.6	4.7	60.3	0.7	5.3
145	385.7	0.4	1.3	270.9	0.5	1.7	200.2	0.5	2.2	157.1	0.5	2.7	123.3	0.6	3.2	105.0	0.6	3.6	87.5	0.6	4.1	73.6	0.6	4.7	62.5	0.7	5.3
150	399.0	0.4	1.3	280.2	0.5	1.7	207.1	0.5	2.2	162.5	0.5	2.7	127.5	0.6	3.2	108.6	0.6	3.6	90.5	0.6	4.1	76.1	0.6	4.7	64.6	0.7	5.3

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second; Depth "D" does not include allowance for freeboard or settlement.

Sediment Barrier (SB)



Practice Description

A sediment barrier is a temporary structure used across a landscape to reduce the quantity of sediment that is moving farther downslope. Commonly used barriers include silt fence (a geotextile fabric which is trenched into the ground and attached to supporting posts) or hay bales trenched into the ground. Other barrier materials include sand bags, brush piles and various man-made materials that can be used in a similar manner as silt fence and hay bales.

This practice applies where sheet and rill erosion occurs on small disturbed areas. Barriers intercept runoff from upslope to form ponds that temporarily store runoff and allow sediment to settle out of the water and stay on the construction site. Barriers can also prevent sheet erosion by decreasing the velocity of the runoff.

Planning Considerations

Sediment barriers may be used on developing sites. They should be installed on the contour so that flow will not concentrate and cause bypassing, overtopping and/or failure.

The 2 most commonly used sediment barriers are silt fences and hay bales. Silt fences are usually preferable to hay bales because silt fences can trap a much higher percentage of suspended solids. The design and installation of hay bale sediment

barrier is the same as the installation for Straw Bale Sediment Traps. Silt fence is the only barrier covered in this edition of the handbook.

The success of silt fences depends on a proper installation so as to develop maximum efficiency of trapping. Silt fences should be carefully installed to meet the intended purpose.

A silt fence is specifically designed to retain sediment transported by sheet flow from disturbed areas, while allowing water to pass through the fence. Silt fences should be installed to be stable under the flows expected from the site. Silt fences should not be installed across streams, ditches, waterways, or other concentrated flow areas.

Silt fences are composed of woven geotextile supported between steel or wooden posts. Silt fences are commercially available with geotextile attached to the post and can be rolled out and installed by driving the post into the ground. This type of silt fence is simple to install, but more expensive than some other installations. Silt fences must be trenched in at the bottom to prevent runoff from undermining the fence and developing rills under the fence. Locations with high runoff flows or velocities should use wire reinforcement.

Design criteria

Silt fences are normally limited to situations in which only sheet or overland flow is expected. They normally cannot filter the volumes of water generated by channel flow. Silt fences are normally constructed of synthetic fabric (woven geotextile) and the life is expected to be the duration of most construction projects. Silt fence fabric should conform to the requirements of Table SB-1.

The drainage area behind the silt fence should not exceed ¼ acre per 100 linear feet of silt fence for non-reinforced fence and ½ acre per 100 feet of wire reinforced fence. When all runoff from the drainage area is to be stored behind the fence (i.e. there is no stormwater disposal system in place) the maximum slope length behind the fence should not exceed those shown in the table below:

Type A Silt Fence

Type A fence is 36" wide with wire reinforcements. The wire reinforcement is necessary because this fabric allows almost 3 times the flow rate as type B silt fence. Type A silt fence should be used where runoff flows or velocities are particularly high or where slopes exceed a vertical height of 10 feet.

Provide a riprap splash pad or other outlet protection device for any point where flow may overtop the sediment fence. Ensure that the maximum height of the fence at a protected, reinforced, outlet does not exceed 1foot and that support post spacing does not exceed 4 feet.

The silt fence should be installed as shown in Figure SB-1 Materials for posts and fasteners are shown in Tables SB-3 and SB-4. Details for overlap of the silt fence and fastener placement are shown in Figure SB-4.

Table SB-1 Specifications for Silt Fence

Specifications	Type A	Type B	Type C
Tensile Strength (Lbs. Min.[1] ASTM D-4632)	Warp – 260 Fill – 100	Warp – 120 Fill – 100	Warp – 120 Fill – 100
Elongation (% Max.) (ASTM D-4632)	40	40	40
AOS (Apparent Opening Size) (Max. Sieve Size) (ASTM D-4751)	no.30	no.30	no.30
Flow Rate (Gal/Min/Sq. Ft.) (GDT-87)	70	25	25
Ultraviolet Stability[2] (ASTM D-4632 after 300 hours weathering in accordance with ASTM D-4355)	80	80	80
Bursting Strength (PSI Min.) (ASTM D-3786 Diaphragm Bursting Strength Tester)	175	175	175
Minimum Fabric Width (Inches)	36	36	22

1 Minimum roll average of 5 specimens.
2 Percent of required initial minimum tensile strength.

Table SB-2 Slope Limitations for Silt Fence

Land Slope (Percent)	Maximum Slope Length Above Fence (Feet)
<2	100
2 to 5	75
5 to 10	50
10 to 20*	25
>20	15

*In areas where the slope is greater than 10%, a flat area length of 10 feet between the toe of the slope to the fence should be provided.

Type B Silt Fence

This 36" wide filter fabric should be used on developments where the life of the project is greater than or equal to 6 months.

The silt fence should be installed as shown in Figure SB-2. Materials for posts and fasteners are shown in Tables SB-3 and SB-4. Details for overlap of the silt fence and fastener placement are shown in Figure SB-4.

Type C Silt Fence

Though only 22" wide, this filter fabric allows the same flow rate as Type B silt fence. Type C silt fence should be limited to use on minor projects, such as residential home sites or small commercial developments where permanent stabilization will be achieved in less than 6 months.

The silt fence should be installed as shown in Figure SB-3. Materials for posts and fasteners are shown in Tables SB-3 and SB-4. Details for overlap of the silt fence and fastener placement are shown in Figure SB-4.

Table SB-3 Post Size for Silt Fence

	Minimum Length	Type of Post	Size of Post
Type A	4'	Steel	1.3lb./ft. min.
Type B	4'	Soft Wood Oak Steel	3" diameter or 2X4 1.5" X 1.5" 1.3lb./ft. min.
Type C	3'	Soft Wood Oak Steel	2" diameter or 2X2 1" X 1" .75lb./ft. min.

Table SB-4 Wood Post Fasteners for Silt Fence

	Gauge	Crown	Legs	Staples/Post
Wire Staples	17 min.	¾" wide	½" long	5 min.
	Gauge	Length	Button Heads	Nail/Post
Nails	14 min.	1"	¾" long	4 min.

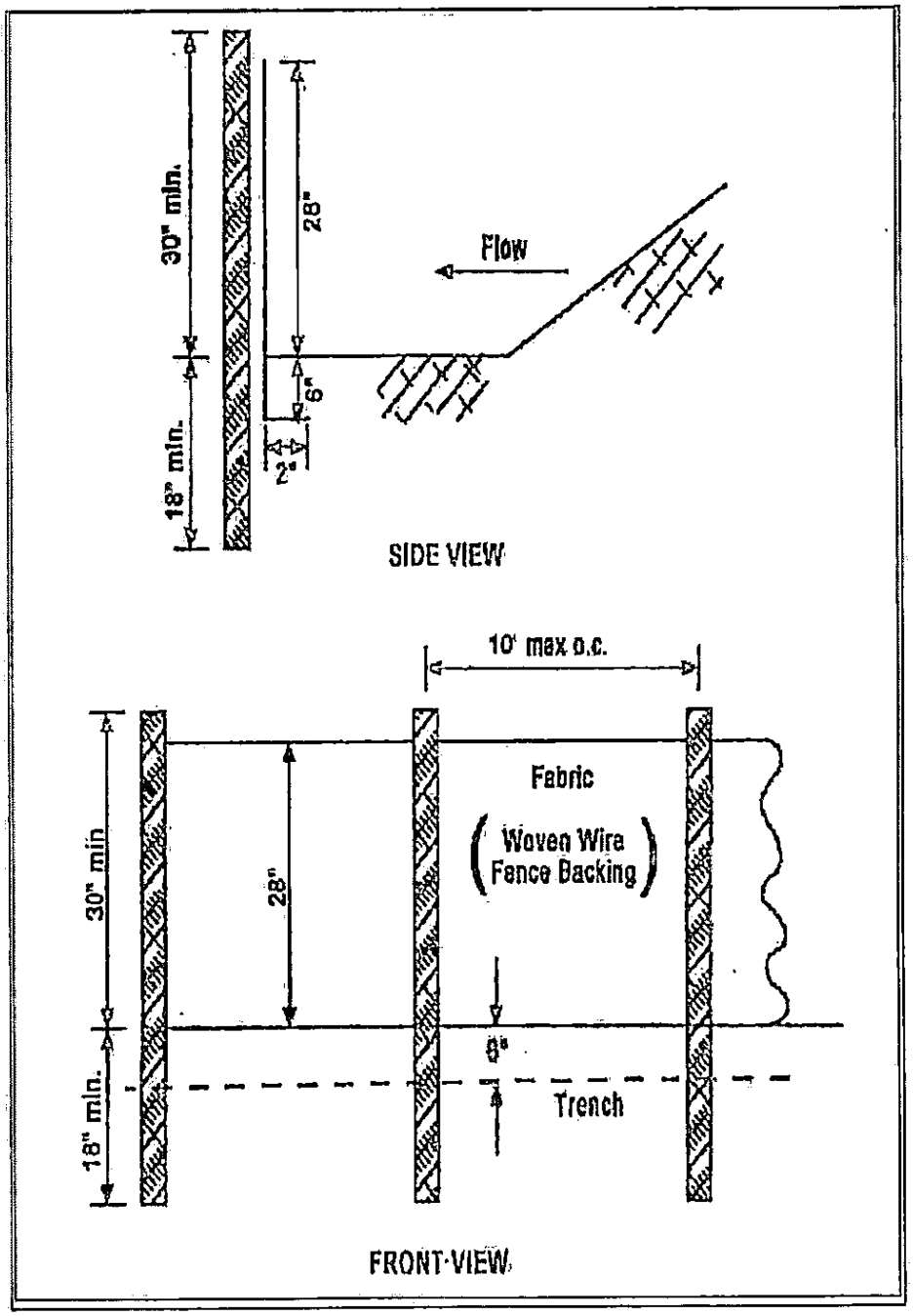


Figure SB-1 Silt Fence-Type A

(1) For fabric material requirements see Table SB-1
(2) For post material requirements see Tables SB-3 and SB-4

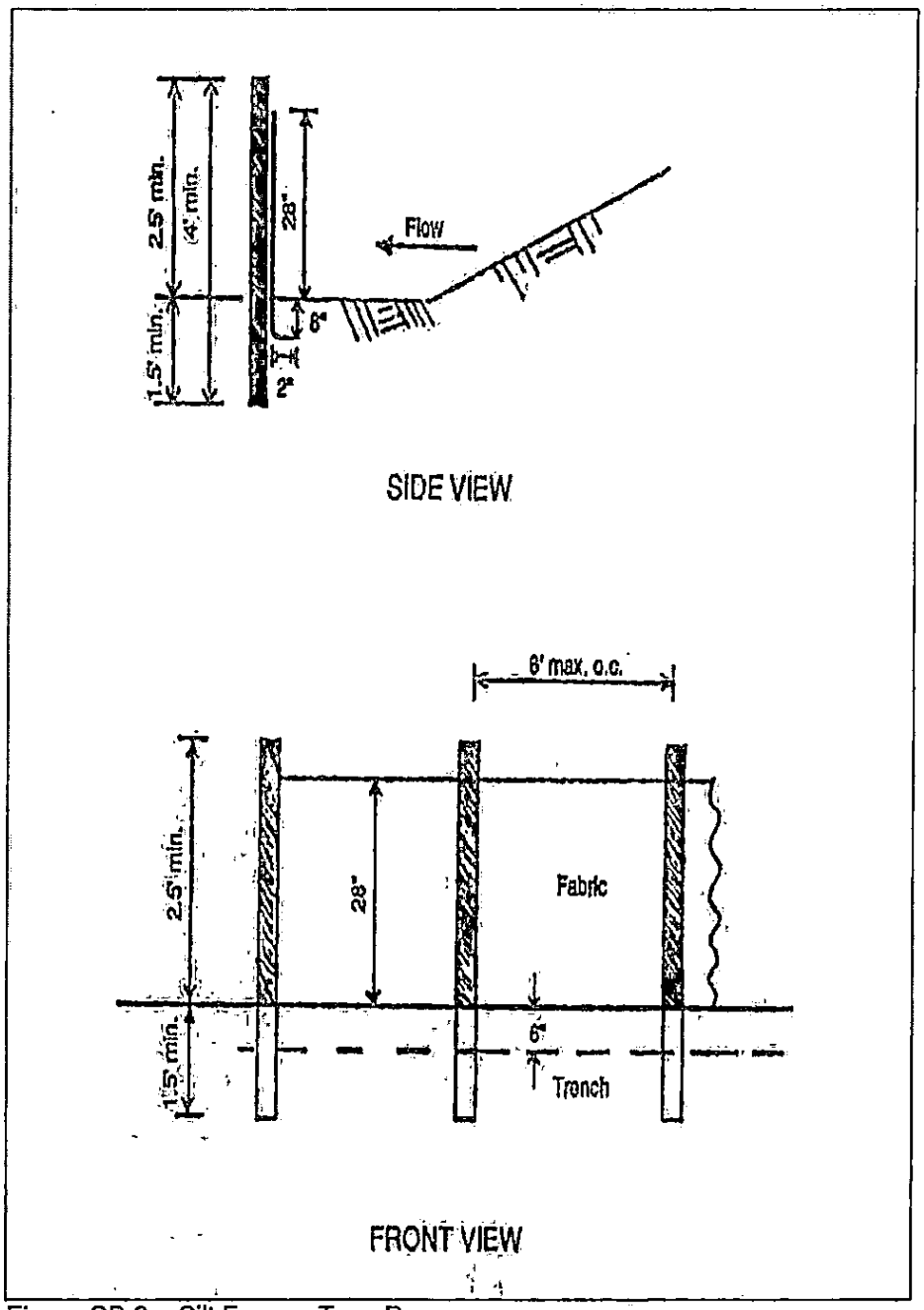


Figure SB-2 Silt Fence - Type B

(1) For fabric material requirements see Table SB-1
(2) For post material requirements see Tables SB-3 and SB-4

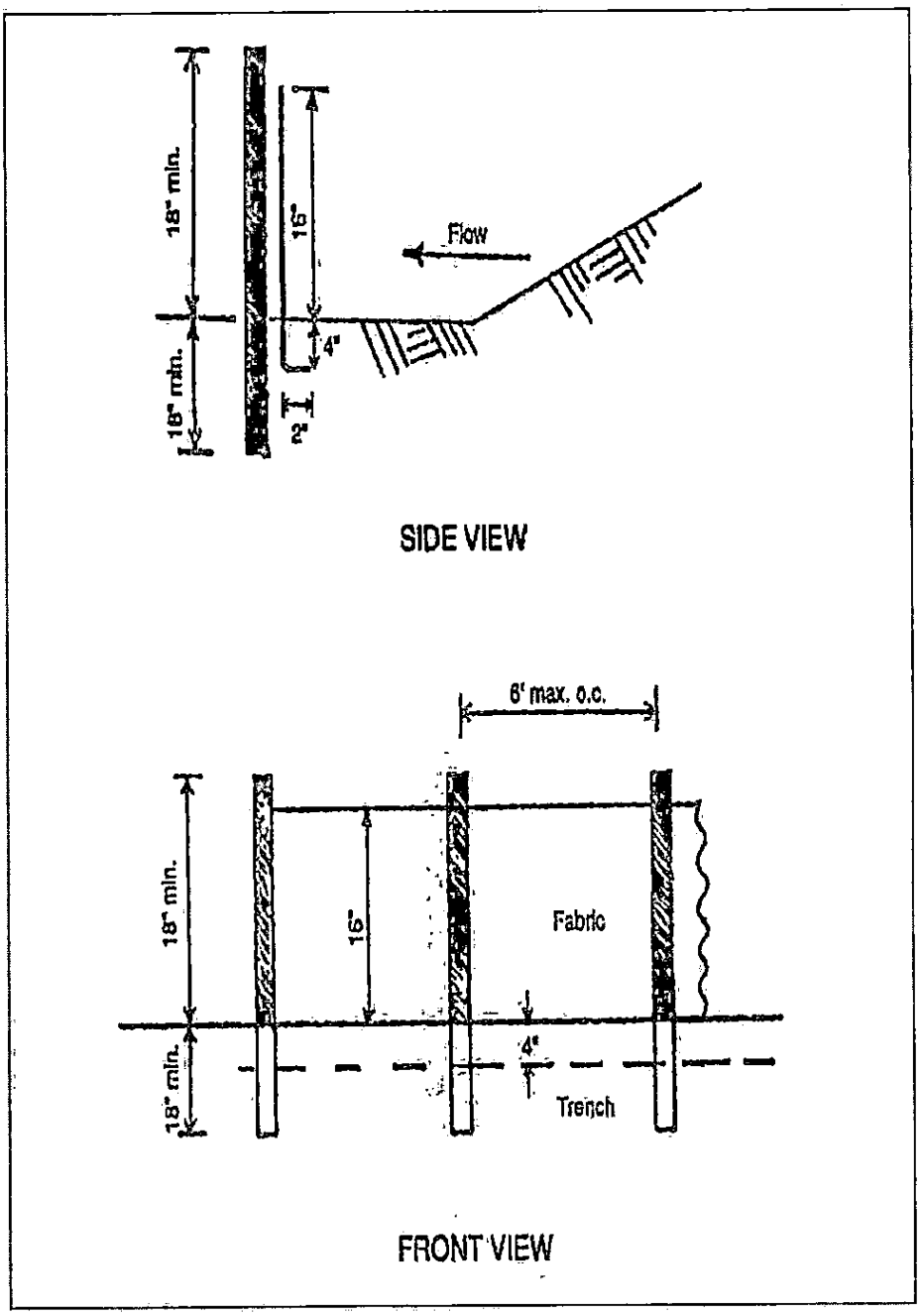


Figure SB-3 Silt Fence – Type C

(1) For fabric material requirements see Table SB-1
(2) For post material requirements see Tables SB-3 and SB-4

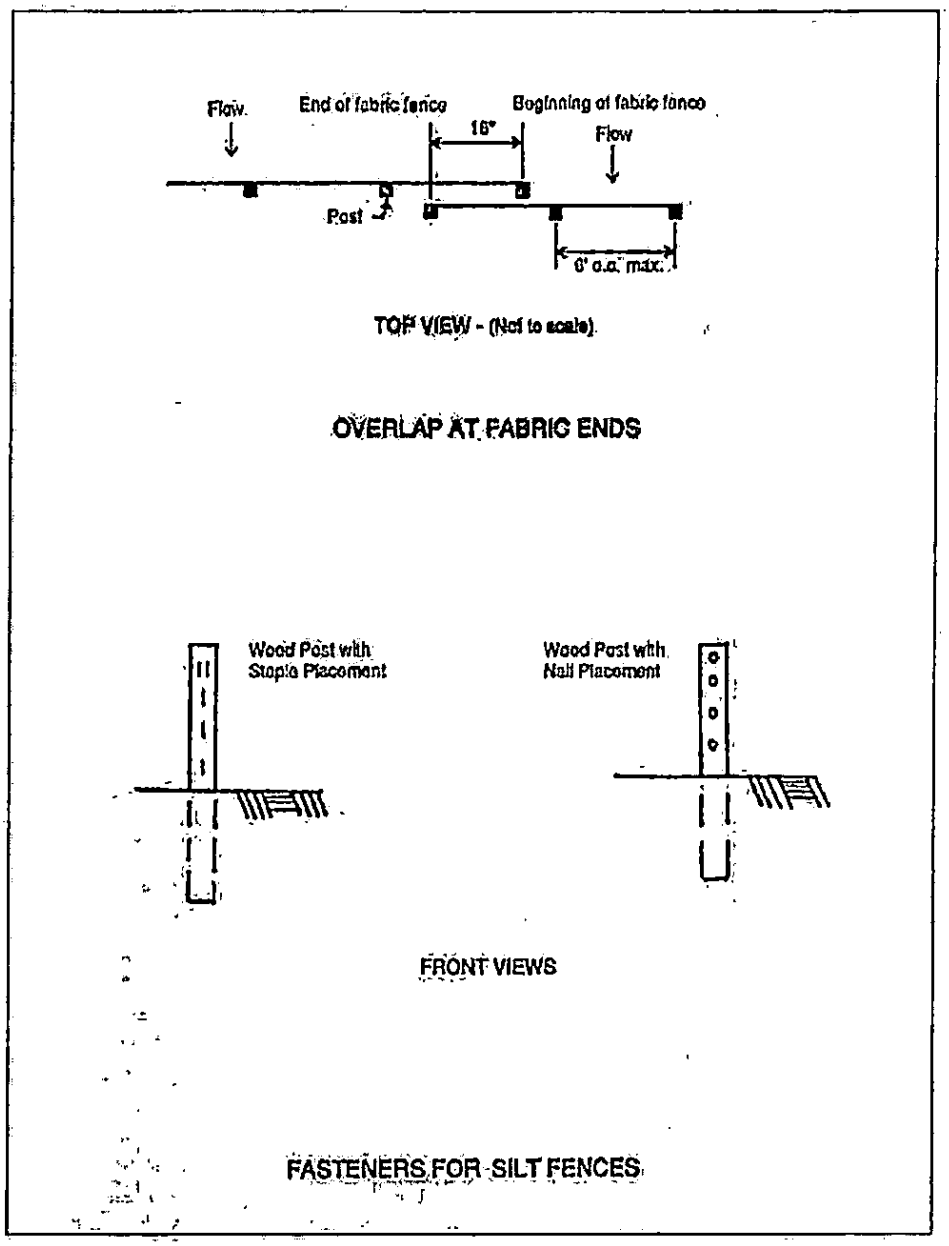
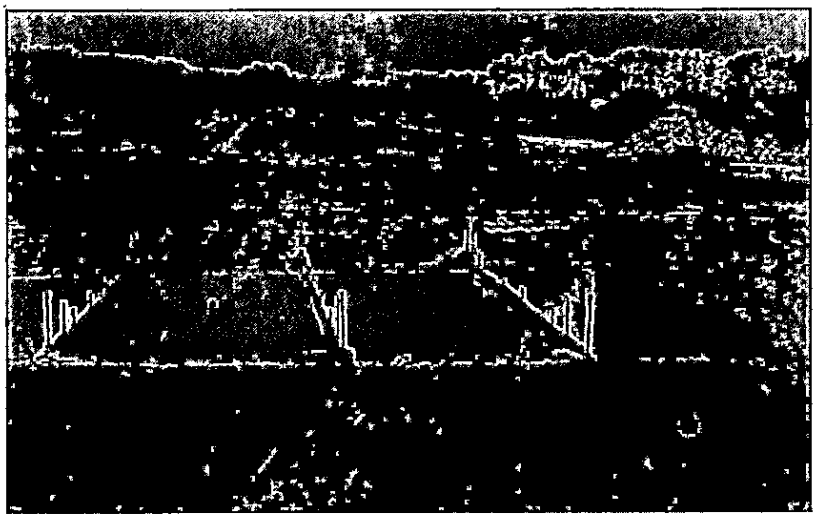


Figure SB-4 Silt Fence Installation Details

Sediment Basin (SBN)



Practice Description

An earthen embankment suitably located to capture runoff, with an emergency spillway lined to prevent spillway erosion, interior porous baffles to reduce turbulence and evenly distribute flows, and equipped with a floating skimmer for dewatering. Sediment basins are designed to provide an area for runoff to pool and settle out a portion of the sediment. Old technology utilized a perforated riser for dewatering, which allowed water to leave the basin from all depths. One way to improve the sediment capture rate is to have an outlet which dewaters the basin from the top of the water column where the water is cleanest. A skimmer is probably the most common method to dewater a sediment basin from the surface. The basic concept is that the skimmer does not dewater the basin as fast as runoff enters it, but instead allows the basin to fill and then slowly drain over multiple days. This process has two effects. First, the sediment in the runoff has more time to settle out prior to discharge. Second, a pool of water forms early in a storm event and this further increases sedimentation rates in the basin. Many of the storms will produce more volume than the typical sediment basin capacity and flow rates in excess of the skimmer capability, resulting in flow over the emergency spillway. This water is also coming from the top of the water column and has thereby been "treated" to remove sediment as much as possible. (Adapted from SoilFacts: Dewatering Sediment Basins Using Surface Outlets. N. C. State University, Soil Science Department.)

Planning Considerations

Sediment basins are needed where drainage areas are too large for other sediment control practices.

Select locations for basins during initial site evaluation. Locate basin so that sudden failure should not cause loss of life or serious property damage. Install sediment basins before any site grading takes place within the drainage area.

Select sediment basin sites to capture sediment from all areas that are not treated adequately by other sediment control measures. Always consider access for cleanout and disposal of the trapped sediment. Locations where a pond can be formed by constructing a low dam across a natural swale are generally preferred to sites that require excavation. Where practical, divert sediment-free runoff away from the basin.

Because the emergency spillway is actually used relatively frequently, it is generally stabilized using geotextile and riprap that can withstand the expected flows without erosive velocities. The spillway should be placed as far from the inlet of the basin as possible to maximize sedimentation before discharge. The spillway should be located in natural ground (not over the embankment) to the greatest extent possible.

The use of *Chemical Stabilization* (PAM) properly introduced into the turbid runoff water at the inlet of the basin and/or at the first baffle should be considered to help polish the discharge from the basin for meeting turbidity requirements.

Where heavy loads of coarse sediment is expected, a fore bay or sump area prior to the basin should be considered for capture of heavier particles.

Baffles

Porous baffles effectively spread the flow across the entire width of a sediment basin or trap and cause increased deposition within the basin. Water flows through the baffle material, but is slowed sufficiently to back up the flow, causing it to spread across the entire width of the baffle (Figure SBN-1). Spreading the flow in this manner utilizes the full cross section of the basin and reduces turbulence which shortens the time required for sediment to be deposited.

The installation should be similar to a sediment barrier (silt fence) (Figure SBN-2) utilizing posts and wire backing. The most proven material for a baffle is 700 - 900 g/m^2 coir erosion blanket (Figure SBN-3). Other materials proven by research to be equivalent in this application may be used. A support wire or rope across the top will help prevent excessive sagging if the material is attached to it with appropriate ties. Another option is to use a sawhorse type of support with the legs stabilized with rebar inserted into the basin floor. These structures work well and can be prefabricated off site and quickly installed.

Baffles need to be installed correctly in order to fully provide their benefits. Refer to Figure SBN-2 and the following key points:

- The baffle material needs to be secured at the bottom and sides by staking, trenching, or securing horizontally to the bottom. Flow should not be allowed under the baffle.
- Most of the sediment will accumulate in the first bay, so this should be readily accessible for maintenance.

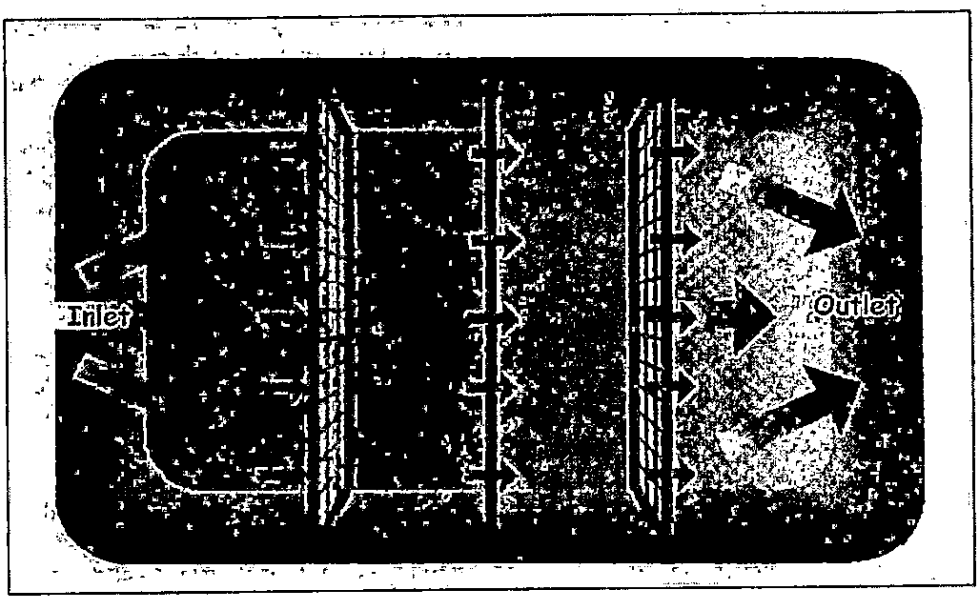


Figure SBN-1 Porous baffle in a sediment basin
(from North Carolina Erosion and Sediment Control Planning and Design Manual.)

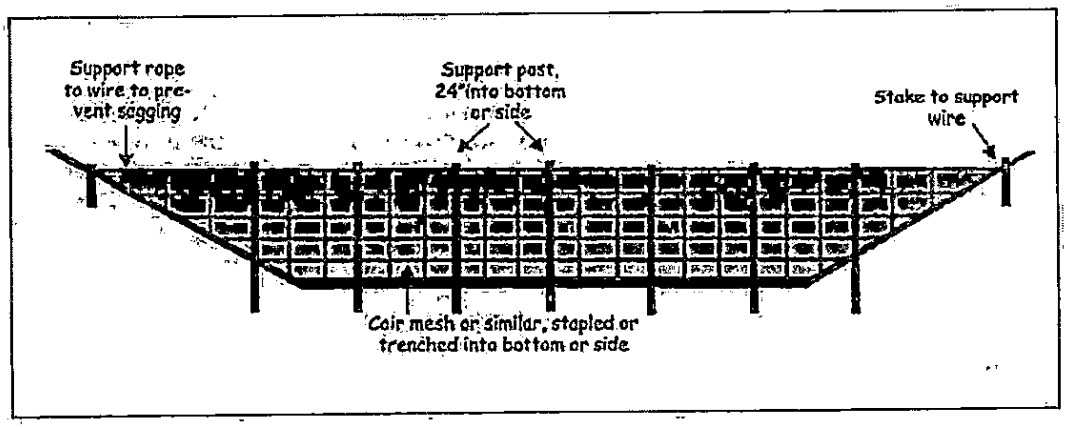


Figure SBN-2 Cross-section of a porous baffle in a sediment basin
Note there is no weir because the water flows through the baffle material
(from North Carolina Erosion and Sediment Control Planning and Design Manual.)

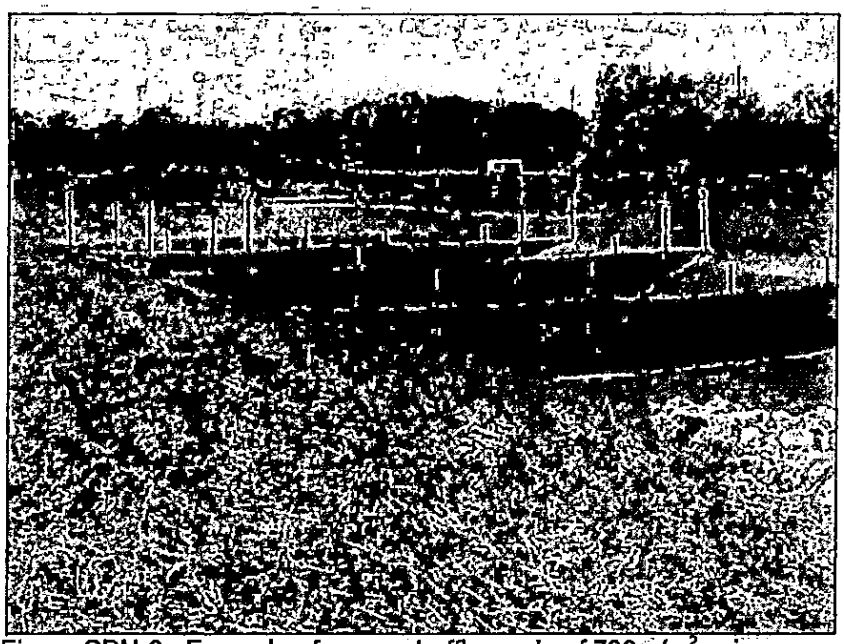


Figure SBN-3 Example of porous baffle made of 700 g/m^2 coir erosion blanket as viewed from the inlet

Skimmer

A skimmer is a sediment basin dewatering control device that withdraws water from the basin's water surface, thus removing the highest quality water for delivery to the uncontrolled environment. A skimmer is shown in Figure SBN-4. By properly sizing the skimmer's control orifice, the skimmer can be made to dewater a design hydrologic event in a prescribed period.

The costs of using a skimmer system are similar, or occasionally less, than a conventional rock outlet or perforated riser. However, the basin is more efficient in removing sediment. Another advantage of the skimmer is that it can be reused on future projects. Skimmers are generally maintenance free, but may require occasional maintenance to remove debris from the orifice.

A skimmer must dewater the basin from the top of the water surface. The rate of dewatering must be controlled. A dewatering time of 48 to 120 hours (2 to 5 days) is required for the basin to function properly.

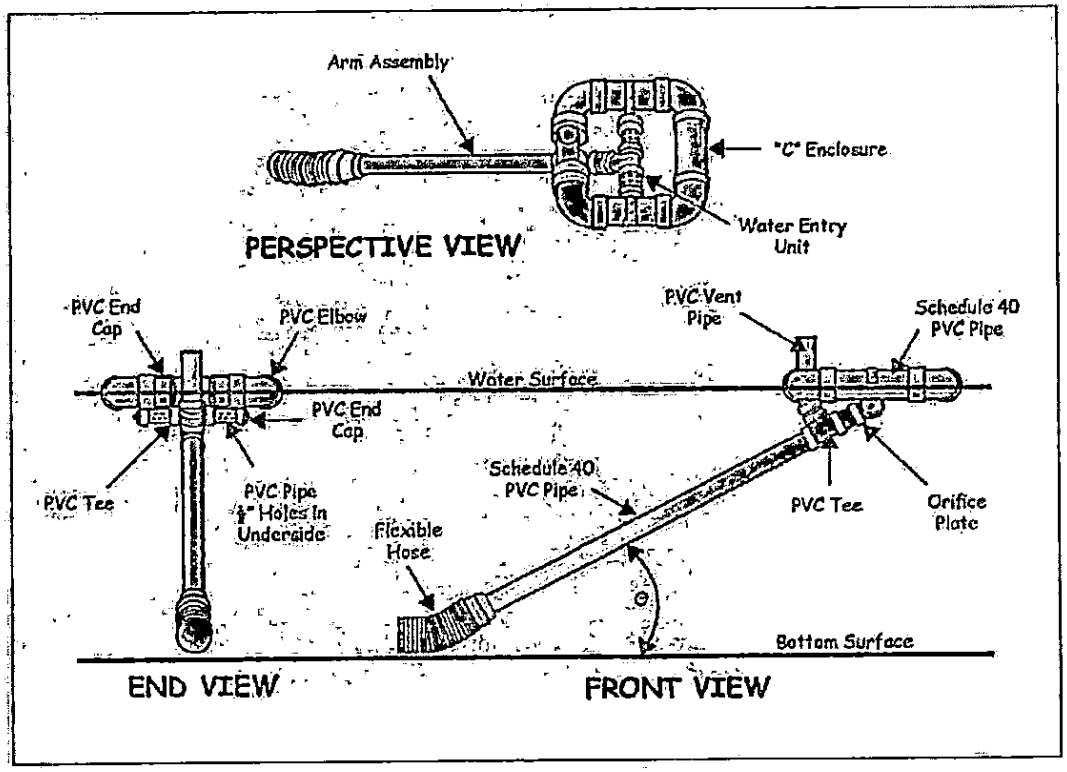


Figure SBN-4 Schematic of a skimmer
(from Pennsylvania Erosion and Sediment Pollution Control Manual, March, 2000)

Design Criteria

Summary:	Temporary Sediment Trap
Emergency Spillway:	Trapezoidal spillway with non-erosive lining. 10 – year, 24 – hour rainfall event
Maximum Drainage Area:	10 acres
Minimum Volume:	3,600 cubic feet per acre of drainage area
Minimum L/W Ratio:	2:1
Minimum Depth:	2 feet
Dewatering Mechanism:	Skimmer(s) attached at bottom of barrel pipe
Dewatering Time:	2 – 5 days
Baffles Required:	3

Compliance with Laws and Regulations

Design and construction should comply with state and local laws, ordinances, rules and regulations.

Design Basin Life

Structures intended for more than 3 years of use should be designed as permanent structures. Procedures outlined in this section do not apply to permanent structures.

Dam Height

Maximum height should be 10 feet, measured from the designed (settled) top elevation of the dam to the lowest point of the original ground surface.

Basin Locations

Select areas that:

- Are not intermittent or perennial streams
- Allow a maximum amount of construction runoff to be brought into the structure
- Provide capacity for storage of sediment from as much of the planned disturbed area as practical
- Exclude runoff from undisturbed areas where practical
- Provide access for sediment removal throughout the life of the project
- Interfere minimally with construction activities

Basin Shape

Ensure that the flow length to basin width ratio is 2:1 or larger to improve trapping efficiency. Length is measured at the elevation associated with the minimum storage volume. Generally, the bottom of the basin should be level to ensure the baffles function properly. The area between the inlet and first baffle (fore bay) can be designed with reverse grade to improve the trapping efficiency.

Storage Volume

Ensure that the sediment storage volume of the basin is at least 3,600 cubic feet per acre for the area draining into the basin. Volume is measured below the emergency spillway crest. Remove sediment from the basin when approximately one-half of the storage volume has been filled.

Baffles

Space the baffles to create equal zones of volume within the basin.

The top of the baffle should be the same elevation as the maximum water depth flowing through the emergency spillway.

Baffles should be designed to go up the sides of the basin banks so water does not flow around the baffles. Most of the sediment will be captured in the inlet zone. Smaller particle size sediments are captured in the latter cells.

The design life of the fabric can be up to 3 years, but may need to be replaced more often if damaged or clogged.

Spillway Capacity

The emergency spillway system must carry the peak runoff from the 10-year 24-hour storm with a minimum 1 foot of freeboard (distance between the surface of the water with the spillway flowing full and the top of the embankment). Base runoff computations on the most severe soil cover conditions expected in the drainage area during the effective life of the structure.

Sediment Cleanout Elevation

Determine the elevation at which the invert of the basin would be half-full. This elevation should also be marked in the field with a permanent stake set at this ground elevation (not the top of the stake).

Basin Dewatering

The basin should be provided with a surface outlet. A floating skimmer should be attached to a Schedule 40 PVC barrel pipe of the same diameter as the skimmer arm. The skimmer apparatus will control the rate of dewatering. The skimmer should be sized to dewater the basin in 48-120 hours (2-5 days). The barrel pipe should be located under the embankment with at least one anti-seep collar at the center of the embankment projecting a minimum of 1.5 ft in all directions from the pipe. The barrel pipe outlet must be stable and not cause erosion.

Skimmer Orifice Diameter

Faircloth Skimmer Selection Procedure

The skimmer performance charts (Table SBN-1) are recommended for use in selecting Faircloth Skimmers for use in dewatering sediment control basins. Always verify performance with the manufacturer's information.

Required input data:
Basin volume = _____ ft^3
Desired dewatering time = _____ days

Procedure:

1. First use the basin volume (ft^3) and the desired dewatering time (days) and determine the required skimmer outflow rate in cubic feet per day (ft^3/d) from the following equation

$$Q = \frac{V}{t_d}$$

2. Scan the skimmer performance charts (Table SBN-1) and select the (a) skimmer size and (b) the skimmer orifice diameter (in inches) if desired.

Table SBN-1. Faircloth Skimmer Selection Charts

1.5-inch skimmer (H = 0.125 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	2,079
1.0	809
0.5	193

2-inch skimmer (H = 0.167 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	5,429
1.0	924
0.5	231

2.5-inch skimmer (H = 0.167 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	9,548
1.0	1,039
0.5	250

3-inch skimmer (H = 0.25 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	10,588
1.5	2,541
1.0	1,136
0.5	289

4-inch skimmer (H = 0.333 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	16,863
2.5	8,181
2.0	5,236
1.5	2,945
1.0	1,309
0.5	327

5-inch skimmer (H = 0.333 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	26,276
3.5	16,035
3.0	11,781
2.5	8,181
2.0	5,236
1.5	3,715
1.0	1,309
0.5	327

6-inch skimmer (H = 0.417 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	44,371
4.5	29,645
4.0	23,427
3.5	17,941
3.0	13,186
2.5	9,144
2.0	5,852
1.5	3,292
1.0	1,463
0.5	366

8-inch skimmer (H = 0.5 ft)

Orifice (in)	Outflow Rate (ft^3/d)
None	127,416
5.5	48,510
5.0	40,098
4.5	32,475
4.0	25,660
3.5	19,654
3.0	14,438
2.5	10,029
2.0	6,410
1.5	3,619
1.0	1,598
0.5	404

Example: Select a skimmer that will dewater a 20,000 ft^3 sediment basin in 3 days.

Solution: First compute the required outflow rate as

$$Q = \frac{V}{t_d} = \frac{20000 ft^3}{3d} = 6670 ft^3 / d$$

Now go the Selection Charts (Table SBN-1) and select an appropriate skimmer. If the 2-inch skimmer with no orifice is chosen, the outflow rate will be 5,429 ft^3/d, which will require about 3.5 days to dewater the basin. An alternative might be to use a 4-inch skimmer with a 2.5 inch diameter orifice, which will have an outflow rate of 8,181 ft^3/d and dewater the basin in about 2.5 days.

Example: A More Precise Alternative: Each skimmer comes with a plastic plug that can be drilled forming a hole that will limit the skimmer's outflow to any desired rate. Thus, for a specific skimmer the orifice that will dewater a basin in a more precisely chosen time can be determined. The flow through an orifice can be computed as

$$Q = CA\sqrt{2gH}$$

where C is the orifice coefficient (usually taken to be 0.6), A is the orifice cross-sectional area in ft^2, g is the acceleration of gravity (32.2 ft/sec^2), and H is the driving head on the orifice center in feet. The orifice equation can be simplified to yield the orifice flow in gpm using the diameter D (in inches) and the head in feet as

$$Q = 12D^2\sqrt{H}\ .$$

Or the orifice flow in ft^3/d using the diameter D (in inches) and the head in feet as

$$Q = 2310D^2\sqrt{H}\ .$$

If we solve the orifice equation for the orifice diameter using the desired outflow rate (6670 ft^3/d) and the head driving water through the skimmer (0.333 ft for a 4-inch skimmer) as

$$D = \sqrt{\frac{Q}{2310\sqrt{H}}} = \sqrt{\frac{6670}{2310\sqrt{0.333}}} = 2.24 inches$$

We see that if the plastic plug were drilled to a diameter of 2.24 inches and placed in a 4-inch skimmer, the dewater rate would be 6,670 ft^3/d and the 20,000 ft^3 basin would dewater in 3 days.

Outlet Protection

Provide outlet protection to ensure erosion does not occur at the pipe outlet.

Basin Emergency Spillway

The emergency spillway should carry the peak runoff from a 10-year storm. The spillway should have a minimum 10 foot bottom width, 0.5 foot flow depth, and 1 foot freeboard above the design water surface.

Construct the entire flow area of the spillway in undisturbed soil to the greatest extent possible. Cross section should be trapezoidal, with side slopes 3:1 or flatter for grass spillways (Figure SBN-5) and 2:1 for riprap. Select vegetated lining to meet flow requirements and site conditions.

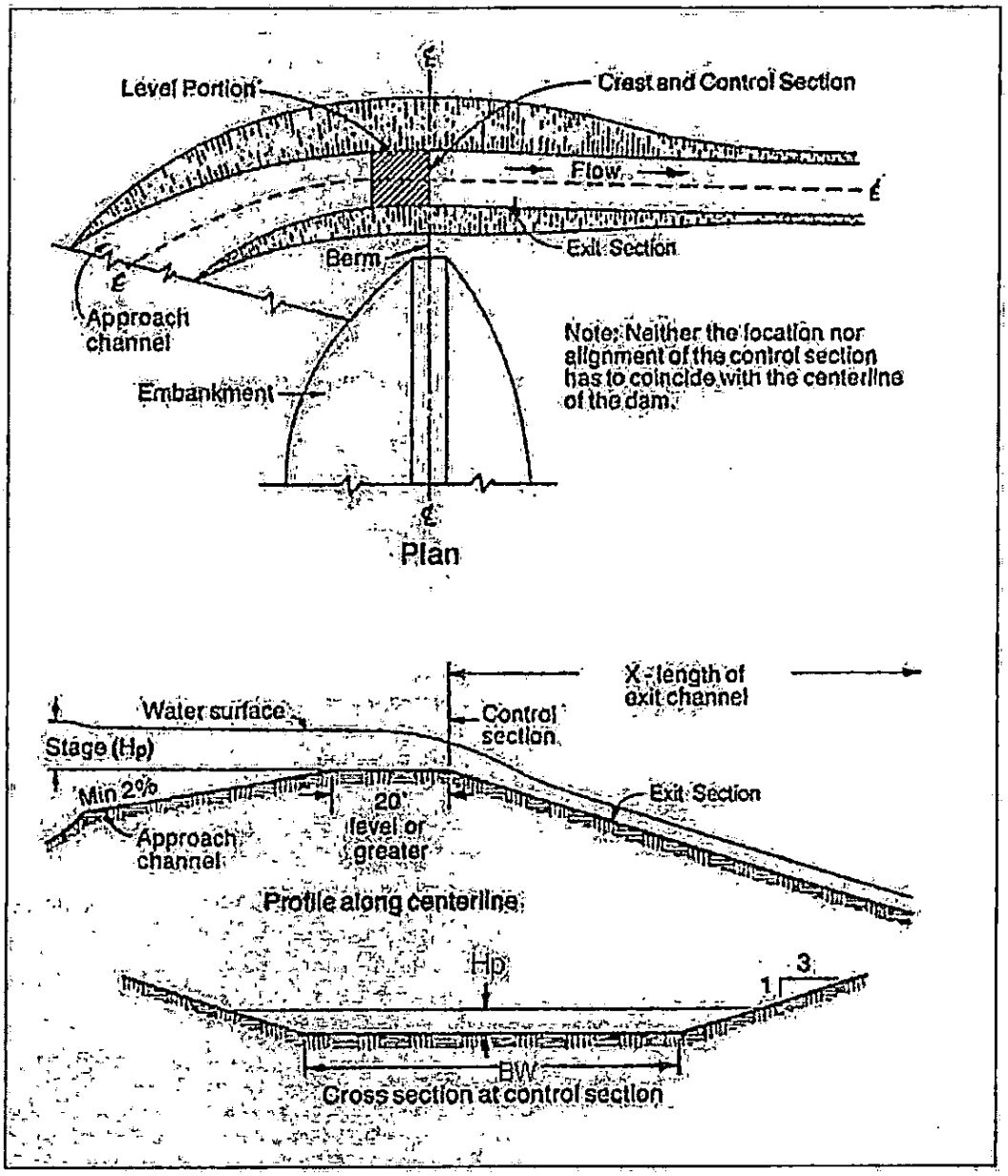


Figure SBN-5 Excavated grass spillway views

Inlet Section
Ensure that the approach section has a slope toward the impoundment area of not less than 2% and is flared at its entrance, gradually reducing to the design width of the control section. The inlet portion of the spillway may be curved to improve alignment.

The Control Section
The control section of the spillway should be level and straight and at least 20 ft long for grass spillways and 10 feet for riprap. Determine the width and depth for the required capacity and site conditions. Wide, shallow spillways are preferred because they reduce outlet velocities.

The Outlet Section
The outlet section of the spillway should be straight, aligned and sloped to assure supercritical flow with exit velocities not exceeding values acceptable for site conditions.

Outlet Velocity
Ensure that the velocity of flow from the basin is nonerosive for existing site conditions. It may be necessary to stabilize the downstream areas or the receiving channels.

Embankment

Embankments should not exceed 10 feet in height, measured at the center line from the original ground surface to the designed (settled) top elevation of the embankment. Keep a minimum of 1 foot between the designed (settled) top of the dam and the design water level in the emergency spillway. Additional freeboard may be added to the embankment height which allows flow through a designated bypass location. Construct embankments with a minimum top width of 8 feet and side slopes of 2.5:1 or flatter.

There should be a cutoff trench in stable soil material under the dam at the centerline. The trench should be at least 2 feet deep with 1.5:1 side slopes, and sufficiently wide (at least 8 ft.) to allow compaction by machine.

Embankment material should be a stable mineral soil, free of roots, woody vegetation, rocks or other objectionable materials, with adequate moisture for compaction. Place fill in 9-inch layers through the length of dam and compact by routing construction hauling equipment over it. Maintain moisture and compaction requirements according to the plans and specifications. Hauling or compaction equipment must traverse each layer so that the entire surface has been compacted by at least one pass of the equipment wheels or tracks.

Excavation

Where sediment pools are formed or enlarged by excavation, keep side slopes at 2:1 or flatter for safety.

Erosion Protection

Minimize the area disturbed during construction. Divert surface water from disturbed areas. When possible, delay clearing the sediment impoundment area until the dam is in place. Keep the remaining temporary pool area undisturbed. Stabilize the spillway, embankment, and all disturbed areas with permanent vegetation. The basin bottom should also be established to a vegetative cover as this promotes sediment deposition.

Trap Efficiency

Improve sediment basin trapping efficiency by employing the following considerations in the basin design:

- Surface area—In the design of the settling pond, allow the largest surface area possible. The shallower the pool, the better.
- Length—Maximize the length-to-width ratio of the basin to provide the longest flow path possible.
- Baffles—Provide a minimum of three porous baffles to evenly distribute flow across the basin and reduce turbulence.
- Inlets—Area between the sediment inlets and the basin bottom should be stabilized by geotextile material, riprap with geotextile, a pipe drop, or other similar methods (Figure SBN-6 shows the area with rocks). Inlets to basin should be located the greatest distance possible from the spillway.
- Dewatering—Allow the maximum reasonable detention period before the basin is completely dewatered (at least 48 hours).
- Inflow rate—Reduce the inflow velocity to nonerosive rates and divert all sediment-free runoff
- Establish permanent vegetation in the bottom and side slopes of the basin.
- Introduce the appropriate PAM material either at the turbulent entrance of the runoff water into the basin and/or apply to the first baffle. Apply the PAM according to manufacturer's recommendations.

Safety

Avoid steep side slopes. Fence basins properly and mark them with warning signs if trespassing is likely. Follow all State and local safety requirements.

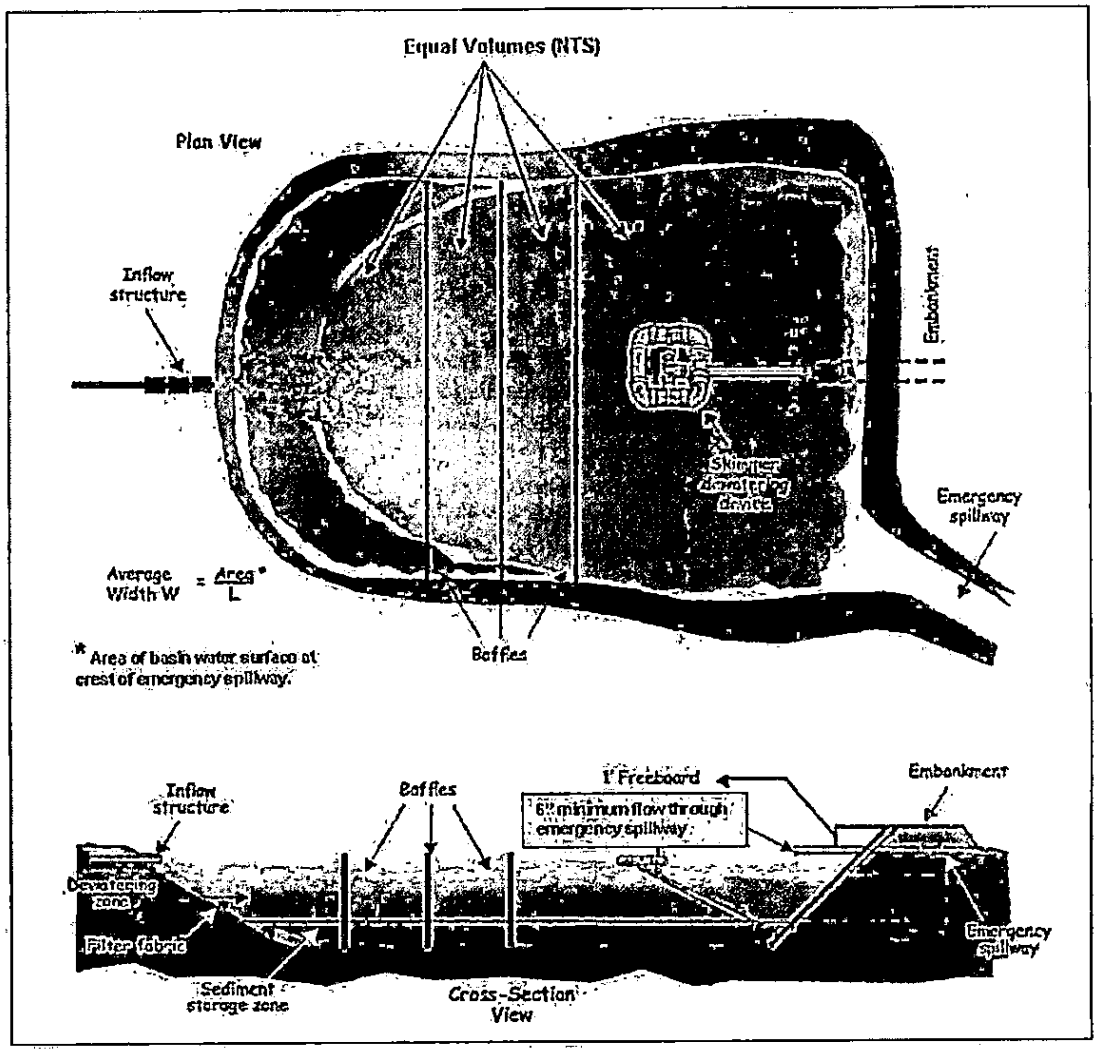


Figure SBN-6 Example of a sediment basin with a skimmer outlet and emergency spillway
(modified from Pennsylvania Erosion and Sediment Control Manual, March, 2000)

Design Procedure

Step 1. Determine peak flow, Q_{10}, for the basin drainage area utilizing the NRCS runoff curve number method.

Step 2. Determine any site limitations for the sediment pool elevation, emergency spillway or top of the dam.

Step 3. Determine basin volumes:

- Compute minimum volume required (3,600 ft^3/acre of drainage area).
- Specify sediment cleanout level to be clearly marked (one-half the design volume). Specify that the basin area is to be cleared after the dam is built.

Step 4. Determine area of basin, shape of basin, and baffles:

- Check length/width ratio (should be 2:1 or larger).
- Ensure the bottom of the basin is level.
- Design and locate a minimum of 3 coir baffles. The baffle spacing should produce equal volumes of storage within the basin when the basin if full. The top elevation of the baffles will be set in Step 7.

Step 5. Size the skimmer, skimmer orifice, and barrel pipe.

Use Table SBN-1 or the precise alternative design to size the orifice. Generally, a Schedule 40 PVC barrel pipe the same size as the skimmer arm is used under the embankment.

Step 6. Design the anti-seep collar.

Ensure that antiseep collar is no closer than 2 ft from a pipe joint and as close to the center of the embankment as possible. Collar must project at least 1.5 ft from the pipe and be watertight.

Step 7. Determine the emergency spillway dimensions.

Size the spillway bottom width and flow depth to handle the Q_{10} peak flow. Tables SBN-2 and SBN-3 can be used for the design process for grassed emergency spillways. Use appropriate design procedures for spillways with other surfaces. Set top of baffles at the elevation of the designed maximum flow depth of the emergency spillway.

Step 8. Spillway approach section.

Adjust the spillway alignment so that the control section and outlet section are straight. The entrance width should be 1.5 times the width of the control section with a smooth transition to the width of the control section. Approach channel should slope toward the reservoir no less than 2%.

Step 9. Spillway control section.

- Locate the control section in natural ground to the greatest extent possible.
- Keep a level area to extend at least 20 ft (grass) or 10 ft (riprap) upstream from the outlet end of the control section to ensure a straight alignment.
- Side slopes should be 3:1 (grass) or 2:1 (riprap).

Step 10. Design spillway exit section.

- Spillway exit should align with the control section and have the same bottom width and side slopes.
- Slope should be sufficient to maintain supercritical flow, but make sure it does not create erosive velocities for site conditions. (Stay within slope ranges in appropriate design tables.)
- Extend the exit channel to a point where the water may be released without damage.

Step 11. Size the embankment.

- Set the design elevation of the top of the dam a minimum of 1 ft above the water surface for the design flow in the emergency spillway.
- Constructed height should be 10% greater than the design to allow for settlement.
- Set side slopes 2.5:1 or flatter.
- Determine depth of cutoff trench from site borings. It should extend to a stable, tight soil layer (a minimum of 2 ft deep).
- Select borrow site remembering that the spillway cut may provide a significant amount of fill.

Step 12. Erosion control

- Select surface stabilization measures to control erosion.
- Select groundcover for emergency spillway to provide protection for design flow velocity and site conditions. Riprap stone over geotextile fabric may be required in erodible soils or when the spillway is not in undisturbed soils.
- Establish all disturbed areas including the basin bottom and side slopes to vegetation.

Step 13. Safety.

- Construct a fence and install warning signs as needed.

Table SBN-2 Design Table for Vegetated Spillways Excavated in Erosion Resistant Soils (side slopes 3 horizontal: 1 vertical)

Discharge Q CFS	Slope Range Minimum Percent	Slope Range Maximum Percent	Bottom Width Feet	Stage Feet
15	3.3	12.2	8	.83
	3.5	16.2	12	.69
20	3.1	8.8	8	.97
	3.2	13.0	12	.81
	3.3	17.3	16	.70
25	2.9	7.1	8	1.09
	3.2	9.0	12	.91
	3.3	13.2	16	.79
	3.3	17.2	20	.70
30	2.9	6.0	8	1.20
	3.0	8.2	12	1.01
	3.0	10.7	16	.88
	3.3	13.6	20	.78
35	2.8	5.1	8	1.30
	2.9	6.9	12	1.10
	3.1	9.0	16	.94
	3.1	11.3	20	.85
	3.2	14.1	24	.77
40	2.7	4.5	8	1.40
	2.8	6.0	12	1.18
	2.9	7.6	16	1.03
	3.1	9.7	20	.91
	3.1	11.9	24	.83
45	2.6	4.1	8	1.49
	2.8	5.3	12	1.25
	2.9	6.7	16	1.09
	3.0	8.4	20	.98
	3.0	10.4	24	.89
50	2.7	3.7	8	1.57
	2.8	4.7	12	1.33
	2.8	6.0	16	1.16
	2.9	7.3	20	1.03
	3.1	9.0	24	.94
60	2.6	3.1	8	1.73
	2.7	3.9	12	1.47
	2.7	4.8	16	1.28
	2.9	5.9	20	1.15
	2.9	7.3	24	1.05
	3.0	8.6	28	.97
70	2.6	2.8	8	1.88
	2.6	3.3	12	1.60
	2.6	4.1	16	1.40
	2.7	5.0	20	1.26
	2.8	6.1	24	1.15
	2.9	7.0	28	1.05
80	2.5	2.8	12	1.72
	2.6	3.6	16	1.51
	2.7	4.3	20	1.35

Discharge Q CFS	Slope Range Minimum Percent	Slope Range Maximum Percent	Bottom Width Feet	Stage Feet
90	2.6	5.2	24	1.24
	2.6	5.9	28	1.14
	2.9	7.0	32	1.06
90	2.5	2.6	12	1.84
	2.5	3.1	16	1.61
	2.6	3.6	20	1.45
	2.7	4.5	24	1.32
	2.8	5.3	28	1.22
	2.8	6.1	32	1.14
100	2.5	2.8	16	1.71
	2.6	3.3	20	1.54
	2.6	4.0	24	1.41
	2.7	4.8	28	1.30
	2.7	5.3	32	1.21
	2.8	10.1	36	1.13
120	2.5	2.8	20	1.71
	2.6	3.2	24	1.55
	2.7	3.8	28	1.44
	2.7	4.2	32	1.34
	2.7	4.8	36	1.26
140	2.5	2.7	24	1.71
	2.5	3.2	28	1.58
	2.6	3.6	32	1.47
	2.6	4.0	36	1.38
	2.7	4.5	40	1.30
160	2.5	2.7	28	1.70
	2.5	3.1	32	1.59
	2.6	3.4	36	1.49
	2.6	3.8	40	1.40
	2.7	4.3	44	1.33
180	2.4	2.7	32	1.72
	2.4	3.0	36	1.60
	2.5	3.4	40	1.51
	2.6	3.7	44	1.43
200	2.5	2.7	36	1.70
	2.5	2.9	40	1.60
	2.6	3.3	44	1.52
	2.6	3.6	48	1.46
220	2.4	2.6	40	1.70
	2.5	2.9	44	1.61
	2.5	3.2	48	1.53
240	2.5	2.6	44	1.70
	2.6	2.9	48	1.62
	2.6	3.2	52	1.54
260	2.4	2.6	48	1.70
	2.5	2.9	52	1.62
280	2.4	2.6	52	1.70
300	2.5	2.6	56	1.69

Example of Table Use:

Given: Discharge, Q_{10} = 87 cfs, Spillway slope (exit section) = 4%.

Find: Bottom Width and Stage in Spillway.

Procedure: Using a discharge of 90 cfs, note that the spillway (exit section) slope falls within slope ranges corresponding to bottom widths of 24, 28, and 32 ft. Use bottom width of 32 ft, to minimize velocity. Stage in the spillway is 1.14 ft.

Note: Computations are based on: Roughness coefficient, n = 0.40 and a maximum velocity of 5.50 ft. per sec.

Table SBN-3 Design Table for Vegetated Spillways Excavated in Very Erodible Soils (side slopes 3 horizontal: 1 vertical)

Discharge Q CFS	Slope Range		Bottom Width Feet	Stage Feet
	Minimum Percent	Maximum Percent		
10	3.5	4.7	8	.88
15	3.4	4.4	12	.69
	3.4	6.9	16	.60
20	3.3	3.3	12	.80
	3.3	4.1	16	.70
	3.5	5.3	20	.62
25	3.3	3.3	16	.79
	3.3	4.0	20	.70
	3.5	4.9	24	.64
30	3.3	3.3	20	.78
	3.3	4.0	24	.71
	3.4	4.7	28	.65
	3.4	5.5	32	.61
35	3.2	3.2	24	.77
	3.3	3.9	28	.71
	3.5	4.6	32	.66
	3.6	5.2	36	.62
40	3.3	3.3	28	.76
	3.4	3.8	32	.71
	3.4	4.3	36	.67
	3.4	5.0	40	.64
45	3.3	3.3	32	.76
	3.4	3.8	36	.71
	3.4	4.3	40	.67
	3.4	4.8	44	.64
50	3.3	3.3	36	.75
	3.3	3.8	40	.71
	3.3	4.3	44	.68
60	3.2	3.2	44	.75
	3.2	3.7	48	.72
70	3.3	3.3	52	.75
80	3.1	3.1	56	.78

Example of Table Use:

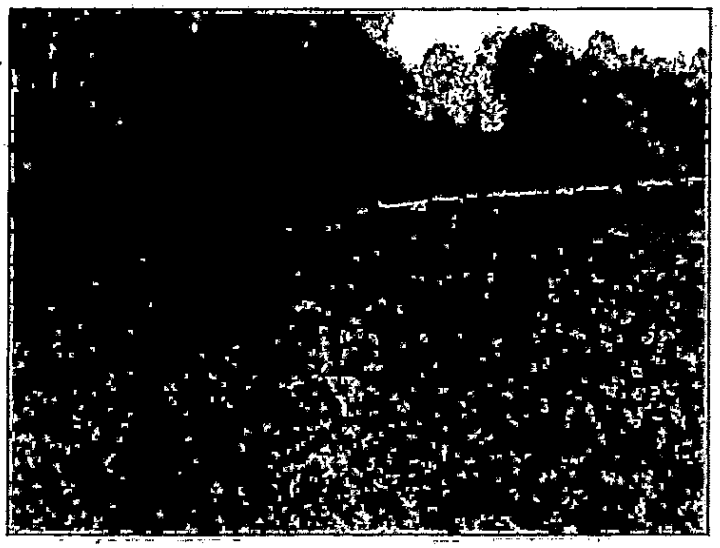
Given: Discharge, Q_{10} = 38 cfs, Spillway slope (exit section) = 4%.

Find: Bottom Width and Stage in Spillway.

Procedure: Using a discharge of 40 cfs, note that the spillway (exit section) slope falls within slope ranges corresponding to bottom widths of 36 and 40 ft. Use bottom width of 40 ft, to minimize velocity. Stage in the spillway is 0.64 ft.

Note: Computations are based on: Roughness coefficient, n = 0.40 and a maximum velocity of 3.50 ft. per sec.

Mulching (MU)



Practice Description

Mulching is the application of plant residues such as straw or other suitable materials to the soil surface. Mulch protects the soil surface from the erosive force of raindrop impact and reduces the velocity of overland flow. It helps seedlings germinate and grow by conserving moisture, protecting against temperature extremes and controlling weeds. Mulch also maintains the infiltration capacity of the soil. Mulch can be applied to seeded areas to help establish plant cover. It can also be used in unseeded areas to protect against erosion over the winter or until final grading and shaping can be accomplished except in areas with concentrated flow.

Planning Considerations

Surface mulch is the most effective, practical means of controlling runoff and erosion on disturbed land prior to vegetation establishment. Mulch absorbs the energy associated with raindrops and thereby minimizes soil particle detachment, which is the initiation step of erosion.

Mulch also reduces soil moisture loss by evaporation, prevents crusting and sealing of the soil surface, moderates soil temperatures, and provides a suitable microclimate for seed germination.

Organic mulches such as straw, wood chips and shredded bark have been found to be very effective mulch materials. Materials containing weed and grass seeds which may compete with establishing vegetation should not be used. Also, decomposition of some wood products can tie up significant amounts of soil nitrogen, making it necessary to modify fertilization rates or add fertilizer with the mulch.

A variety of erosion control blankets have been developed in recent years for use as mulch, particularly in critical areas such as waterways and channels. Various types of netting materials are also available to anchor organic mulches.

The choice of materials for mulching should be based on soil conditions, season, type of vegetation to establish, and size of the area. Properly applied and tacked mulch is always beneficial. Mulching is especially important when conditions of germination are not optimum, such as midsummer and early winter, and on difficult sites such as cut slopes, fill slopes and droughty soils.

Straw is the most commonly used material in conjunction with seeding. Wheat straw is the mostly commonly used straw, and can be spread by hand or with a mulch blower. If the site is susceptible to blowing wind, the straw should be tacked down with a tackifier, a crimper or a disk to prevent loss.
Some site developers always require that straw mulch be tacked by an approved method.

Wood chips are suitable for areas that will not be closely mowed, and around ornamental plantings. Chips do not require tacking. Because they decompose slowly they must be treated with 12 pounds of nitrogen per ton to prevent nutrient deficiency in plants. They can be an inexpensive mulch if the chips are obtained from trees cleared on the site.

Wood fiber refers to short cellulose fibers applied as a slurry in hydroseeding operations. Wood fiber hydroseeder slurries may be used to tack straw mulch on steep slopes, critical areas, and where harsh climatic conditions exist.

Compost, peanut hulls, and pine straw are organic materials that potentially make excellent mulches but may only be available locally or seasonally. Creative use of these materials may reduce costs.

Jute mesh or the various types of netting is very effective in holding mulch in place on waterways and slopes before grasses become established.

Erosion control blankets promote seedling growth in the same way as organic mulches and are suited for use in areas with concentrated flows (see Erosion Control Blanket practice).

Design Criteria

Site Preparation

Before mulching, complete the required site preparation. Site preparation includes grading, if needed, and seedbed preparation and fertilizing, liming and seeding if a planting is being made by means other than hydroseeding.

Spreading the Mulch

Select a mulch material based on the site and practice requirements, availability of material, and availability of labor and equipment. Table MU-1 lists commonly used mulches.

Uniformly spread organic mulches by hand or with a mulch blower at a rate which provides about 75% ground cover. When spreading straw mulch by hand, divide the area to be mulched into sections of approximately 1000 sq. ft. and place 70-90 pounds of straw (1 ½ to 2 bales) in each section to facilitate uniform distribution. Caution, an over-application of wheat straw will reduce stand success – do not over-apply wheat straw when mulching a seeding!

When straw mulch is subject to be blown away by wind, it must be anchored immediately after spreading. It can be anchored with a mulch anchoring tool or a regular farm disk, by setting the disk to run straight and adding weight to the disk. The disk should not be sharp enough to cut the straw. Disks can generally not be used on land with steep slopes. Application of a commercial tackifier through a hydroseeder is most practical for steep slopes and can be effective on any site.

Table MU-1 Mulching Materials and Application Rates

Material	Rate Per Acre and (Per 1000 ft.^{2})	Notes
Straw with Seed	1 ½-2 tons (70 lbs-90 lbs)	Spread by hand or machine to attain 75% groundcover; anchor when subject to blowing.
Straw Alone (no seed)	2 ½-3 tons (115 lbs-160 lbs)	Spread by hand or machine; anchor when subject to blowing.
Wood Chips	5-6 tons (225 lbs-270 lbs)	Treat with 12 lbs. nitrogen/ton.
Bark	35 cubic yards (0.8 cubic yard)	Can apply with mulch blower.
Pine Straw	1-2 tons (45 lbs-90 lbs)	Spread by hand or machine; will not blow like straw.
Peanut Hulls	10-20 tons (450 lbs-900 lbs)	Will wash off slopes. Treat with 12 lbs. nitrogen/ton.

Liquid mulch binders can also be used to tack mulch subject to being blown away by wind. Applications of liquid mulch binders and tackifiers should be heaviest at the edges of areas and at crests of ridges and banks, to resist wind. Binders should be applied uniformly to the rest of the area. Binders may be applied after mulch is spread or may be sprayed into the mulch as it is being blown onto the soil. Applying straw and binder together is the most effective method. Liquid binders include asphalt and an array of commercially available synthetic binders.

Emulsified asphalt is the most commonly used mulch binder. Any type thin enough to be blown from spray equipment is satisfactory. Asphalt is classified according to the time it takes to cure. Rapid setting (RS or CRS designation) is formulated for curing in less than 24 hours, even during periods of high humidity; it is best used in spring and fall. Medium setting (MS or CMS) is formulated for curing within 24 to 48 hours, and slow setting (SS or CSS) is formulated for use during hot, dry weather, requiring 48 hours or more curing time.

Asphalt must not be used if significant precipitation is predicted within the optimum curing time for the specified emulsion.

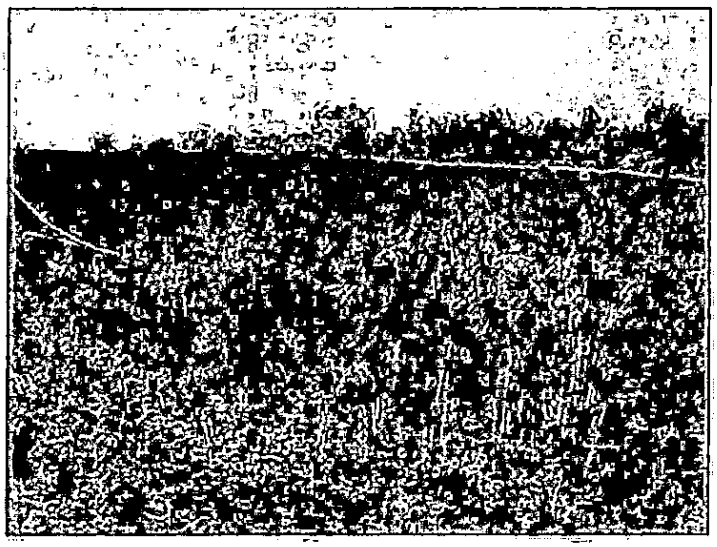
Apply asphalt at 10 gallons per 1000 sq. ft. (500 gallons per acre). Heavier applications will cause straw to bridge over rills.

Straw mulch may also be anchored with lightweight plastic, cotton, jute, wire or paper netting which is stapled over the mulch. The manufacturer's recommendations on stapling netting should be followed.

Maintenance

Inspect all mulches periodically, and after rainstorms to check for rill erosion, dislocation, or failure. Where erosion is observed, apply additional mulch or if washout has occurred, repair the slope grade, reseed, and reinstall mulch. Continue inspections until vegetation is firmly established.

Temporary Seeding (TS)



Practice Description

Temporary seeding is the establishment of fast-growing annual vegetation from seed on disturbed areas. Temporary vegetation provides economical erosion control for up to a year and reduces the amount of sediment moving off the site.

This practice applies where short-lived vegetation can be established before final grading or in a season not suitable for planting the desired permanent species. It helps prevent costly maintenance operations on other practices such as sediment basins and sediment barriers. In addition, it reduces problems of mud and dust production from bare soil surfaces during construction. Temporary or permanent seeding is necessary to protect earthen structures such as dikes, diversions, grass-lined channels and the banks and dams of sediment basins.

Planning Considerations

Temporary vegetative cover can provide significant short-term erosion and sediment reduction before establishing perennial vegetation.

Temporary vegetation will reduce the amount of maintenance associated with sediment basins.

Temporary vegetation is used to provide cover for no more than 1 year. Permanent vegetation should be established at the proper planting time for permanent vegetative cover.

Certain plants species used for temporary vegetation will produce large quantities of residue which can provide mulch for establishment of the permanent vegetation.

Proper seedbed preparation and selection of appropriate species are important with this practice. Failure to follow establishment guidelines and recommendations carefully may result in an inadequate or short-lived stand of vegetation that will not control erosion.

The selection of plants for temporary vegetation must be site specific. Factors that should be considered are type of soils, climate, establishment rate, and management requirements of the vegetation. Other factors that may be important are wear, mowing tolerance, and salt tolerance of vegetation.

Seeding properly carried out within the optimum dates has a higher probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as plantings are deviated from the optimum dates, the probability of failure increases rapidly. Seeding dates should be taken into account in scheduling land-disturbing activities.

Site quality impacts both short-term and long-term plant success. Sites that have compacted soils should be modified whenever practical to improve the potential for plant growth.

The operation of equipment is restricted on slopes steeper than 3:1, severely limiting the quality of the seedbed that can be prepared. Provisions for establishment of vegetation on steep slopes can be made during final grading. In construction of fill slopes, for example, the last 4-6" might not be compacted. A loose, rough seedbed with irregularities that hold seeds and fertilizer is essential for hydroseeding. Cut slopes should be roughened (see practice Land Grading).

Good mulching practices are critical to protect against erosion on steep slopes. When using straw, anchor with netting or asphalt. On slopes steeper than 2:1, jute, excelsior, or synthetic matting may be required to protect the slope.

The use of irrigation (temporary or permanent) will greatly improve the success of vegetation establishment.

Design Criteria

Plant Selection

Select plants that can be expected to meet planting objectives. To simplify plant selection, use Table TS-1, Commonly Used Plants for Temporary Cover and Figure TS-1, Geographical Areas for Species Adaptation and Seeding Dates. Seeding mixtures commonly specified by the Alabama Department of Transportation are an appropriate alternative for plantings on rights-of-ways. Additional information related to plantings in Alabama is found in Chapter 2 in the section Non-woody Vegetation for Erosion and Sediment Control.

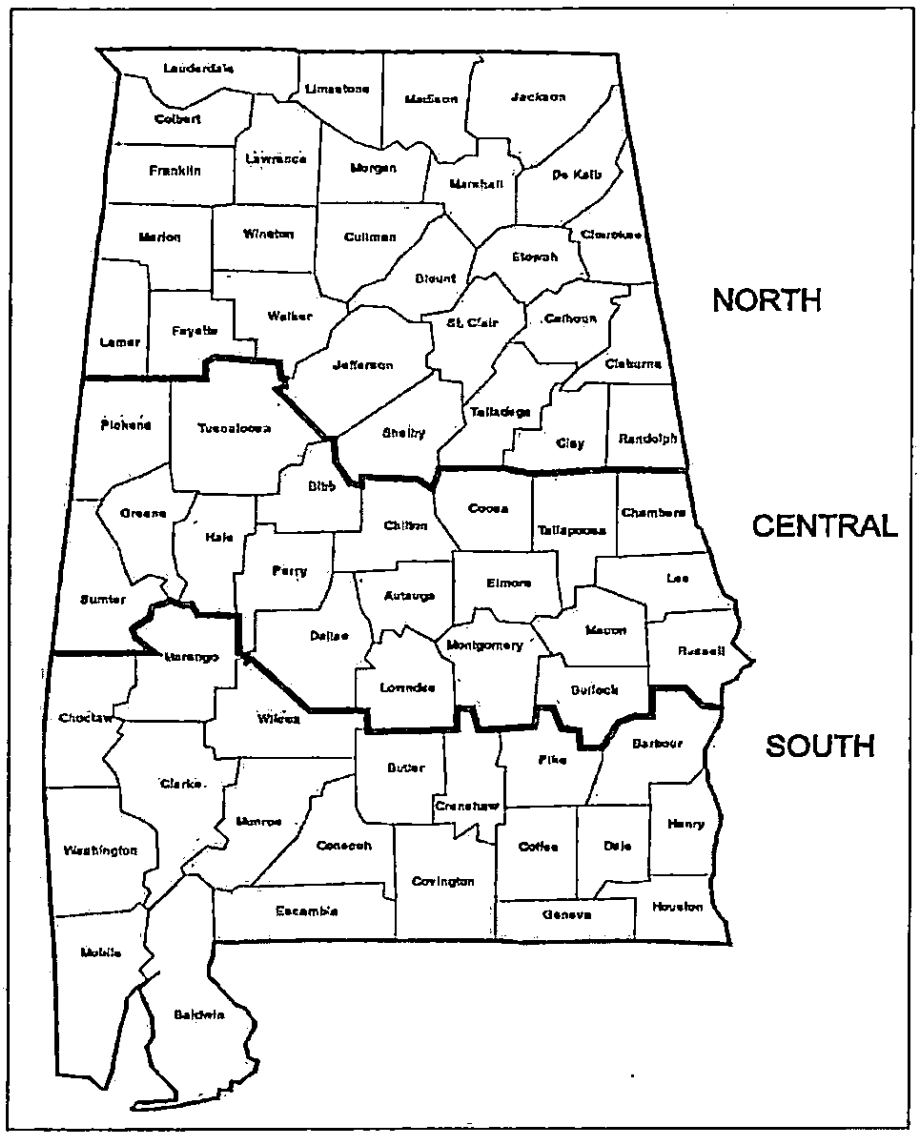


Figure TS-1 Geographical Areas for Species Adaptation and Seeding Dates

Table TS-I Commonly Used Plants for Temporary Cover

Species	Seeding Rate/AC PLS	North	Central	South
			Seeding Dates	
Millet, Browntop or German	40 lbs	May1-Aug 1	Apr1- Aug 15	Apr 1-Aug 15
Rye	3 bu	Sep I-Nov 15	Sep 15-Nov 15	Sep 15-Nov 15
Ryegrass	30 lbs	Aug I-Sep 15	Sep I-Oct 15	Sep 1-Oct 15
Sorghum-Sudan Hybrids	40 lbs	May I-Aug 1	Apr 15-Aug 1	Apr I-Aug 15
Sudangrass	40 lbs	May I-Aug I	Apr 15-Aug	Apr I-Aug 15
Wheat	3 bu	Sep I-Nov 1	Sep 15-Nov 15	Sep 15-Nov 15
Common Bermudagrass	10 lbs	Apr 1-July 1	Mar 15-July 15	Mar 1-July 15
Crimson Clover	10lbs	Sept 1-Nov 1	Sept 1-Nov 1	Sept 1-Nov 1

Site Preparation and Soil Amendments

Complete grading and shaping before applying soil amendments if needed to provide a surface on which equipment can safely and efficiently be used to apply soil amendments and accomplish seedbed preparation and seeding.

Lime

Apply lime according to soil test recommendations. If a soil test is not available, use 1 ton of agricultural limestone or equivalent per acre on coarse textured soils and 2 tons per acre on fine textured soils. Do not apply lime to alkaline soils or to areas which have been limed during the preceding 2 years. Other liming materials that may be selected should be provided in amounts that provide equal value to the criteria listed for agricultural lime or be used in combination with agricultural limestone or Selma chalk to provide equivalent values to agricultural limestone.

Fertilizer

Apply fertilizer according to soil test results. If a soil test is not available, apply 8-24-24 fertilizer.

When vegetation has emerged to a stand and is growing, 30 to 40 lbs/acre (approximately 0.8 lbs/1000 ft^2) of additional nitrogen fertilizer should be applied.

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Application of Soil Amendments

Incorporate lime and fertilizer into the top 6" of soil during seedbed preparation.

Seedbed Preparation

Good seedbed preparation is essential to successful plant establishment. A good seedbed is well pulverized, loose, and smooth. If soils become compacted during grading, loosen them to a depth of 6" to 8" using a ripper or chisel plow.

If rainfall has caused the surface to become sealed or crusted, loosen it just prior to seeding by disking, raking, harrowing, or other suitable methods. When hydroseeding methods are used, the surface should be left with a more irregular surface of clods.

Planting Methods

Seeding

Evenly apply seed using a cyclone seeder (broadcast), drill seeder, cultipacker seeder, or hydroseeder. Broadcast seeding and hydroseeding are appropriate for steep slopes where equipment cannot operate safely. Small grains should be planted no more than 1" deep, and grasses and legumes no more than ½" deep. Seed that are broadcast must be covered by raking or chain dragging, and then lightly firmed with a roller or cultipacker.

Hydroseeding

Surface roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydroseeding operations; large clods, stones, and irregularities provide cavities in which seeds can lodge.

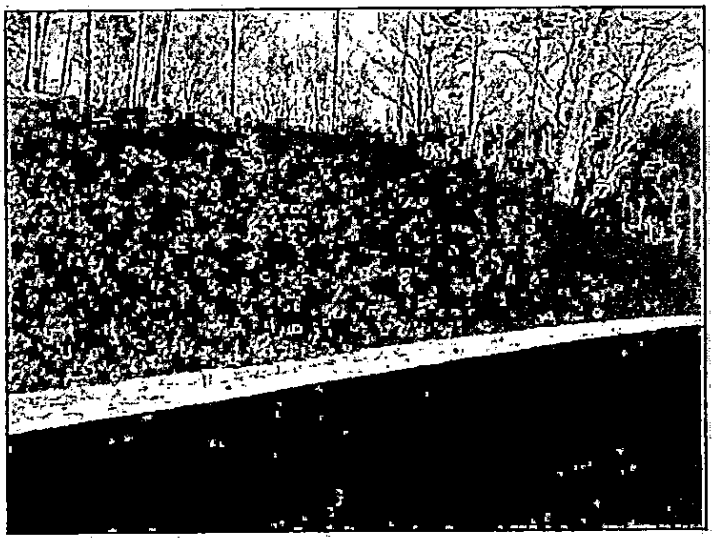
Mix seed, inoculant if required, and a seed carrier with water and apply as slurry uniformly over the area to be treated. The seed carrier should be a cellulose fiber, natural wood fiber or other approved fiber mulch material which is dyed an appropriate color to facilitate uniform application of seed. Use the correct legume inoculant at 4 times the recommended rate when adding inoculant to hydroseeder slurry. The mixture should be applied within one hour after mixing to reduce damage to seed.

Fertilizer should not be mixed with the seed-inoculant mixture because fertilizer salts may damage seed and reduce germination and seedling vigor. Fertilizer may be applied with a hydro seeder as a separate operation after seedlings are established.

Mulching

The use of an appropriate mulch provides instant cover and helps ensure establishment of vegetative cover under normal conditions and is essential to seeding success under harsh site conditions (see the Mulching practice for guidance). Harsh site conditions include the following: slopes steeper than 3:1 and adverse soils (soils that are shallow to rock, rocky, or high in clay or sand). Areas with concentrated flow should be treated differently and require a hydromulch formulated for channels or an appropriate erosion control blanket.

Permanent Seeding (PS)



Practice Description

Permanent seeding is the establishment of perennial vegetation on disturbed areas from seed. Permanent vegetation provides economical long-term erosion control and helps prevent sediment from leaving the site. This practice is used when vegetation is desired and appropriate to permanently stabilize the soil.

Planning Considerations

The advantages of seeding over other means of establishing plants include the smaller initial cost, lower labor input, and greater flexibility of method.

Disadvantages of seeding include potential for erosion during the establishment stage, seasonal limitations on suitable seeding dates, and weather-related problems such as droughts.

The probability of successful plant establishment can be maximized through good planning. The selection of plants for permanent vegetation must be site specific. Factors that should be considered are type of soils, climate, establishment rate, and management requirements of the vegetation. Other factors that may be important are wear, mowing tolerance, and salt tolerance of vegetation.

Plant selection for permanent vegetation should be based on plant characteristics, site and soil conditions, time of year of planting, method of planting, and the intended use of the vegetated area. Climate factors can vary widely in Alabama. Important plant attributes are discussed in Vegetation Establishment for Erosion and Sediment Control in Chapter 2.

Plant selection may include companion plants to provide quick cover on difficult sites, late seedings, or where the desired permanent cover may be slow to establish. Annuals are usually used for companion plants and should be selected carefully to prevent using a species that provide so much competition that it prevents the establishment of the desired species.

Seeding properly carried out within the optimum dates has a higher probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as plantings are deviated from the optimum dates, the probability of failure increases rapidly. Seeding dates should be taken into account in scheduling land-disturbing activities.

Site quality impacts both short-term and long-term plant success. Sites that have compacted soils, soils that are shallow to rock or have textures that are too clayey or too sandy should be modified whenever practical to improve the potential for plant growth and long-term cover success.

The operation of equipment is restricted on slopes steeper than 3:1, severely limiting the quality of the seedbed that can be prepared. Provisions for establishment of vegetation on steep slopes can be made during final grading. In construction of fill slopes, for example, the last 4-6" might not be compacted. A loose, rough seedbed with irregularities that hold seeds and lime and fertilizer is essential for hydroseeding. Cut slopes should be roughened (see Land Grading practice).

Proper mulching is critical to protect against erosion on steep slopes. When using straw, anchor with netting or asphalt. On slopes steeper than 2:1, jute, excelsior, or synthetic matting may be required.

The use of irrigation (temporary or permanent) will greatly improve the success of vegetation establishment.

Design Criteria

Plant Selection

Select plants that can be expected to meet planting objectives. To simplify plant selection, use Figure PS-1 Geographical Areas for Species Adaptation and Seeding Dates and Table PS-1, Commonly Used Plants for Permanent Cover. Mixtures commonly specified by the Alabama Department of Transportation are an appropriate alternative for plantings on rights-of-ways. Additional information related to plantings in Alabama is found in Chapter 2 under the section Vegetation for Erosion and Sediment Control.

The plants used for temporary vegetation may be used for companion plants provided the seeding rate is reduced by one half. See the Temporary Seeding practice for additional information on establishing temporary vegetation. **Ryegrass or other highly competitive plants should not be used as a companion plant.**

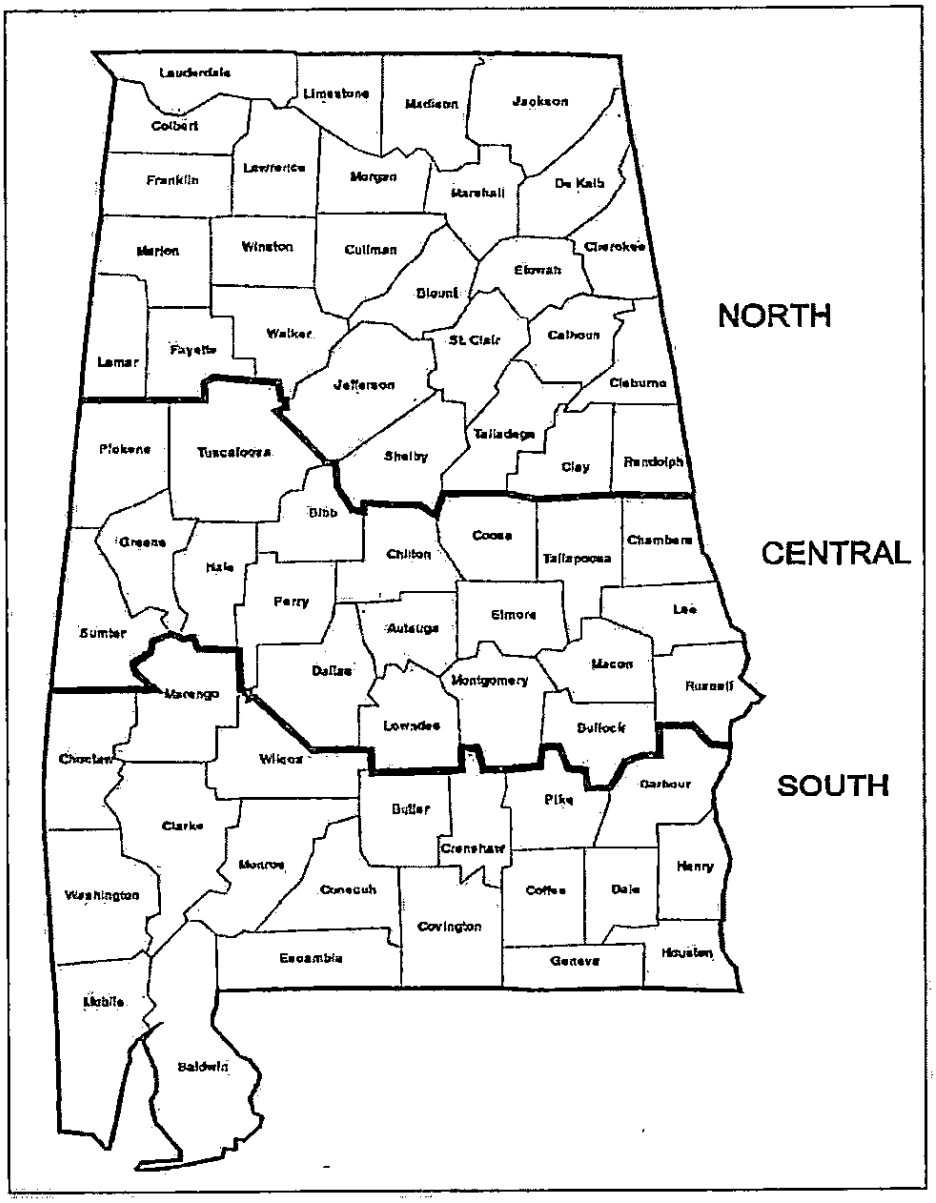


Figure PS-1 Geographical Areas for Species Adaptation and Seeding Dates

Table PS-1 Commonly Used Plants for Permanent Cover with Seeding Rates and Dates

Species	Seeding Rates/Ac PLS	North	Central	South
			Seeding Dates	
Bahiagrass, Pensacola	40 lbs	--	Mar 1-July 1	Feb 1-Nov 1
Bermudagrass, Common	10 lbs	Apr 1-July 1	Mar 15-July 15	Mar 1-July 15
Bahiagrass, Pensacola Bermudagrass, Common	30 lbs 5 lbs	--	Mar 1-July 1	Mar 1-July 15
Bermudagrass, Hybrid (Lawn Types)	Solid Sod	Anytime	Anytime	Anytime
Bermudagrass, Hybrid (Lawn Types)	Sprigs 1/sq ft	Mar 1-Aug 1	Mar 1-Aug 1	Feb 15-Sep 1
Fescue, Tall	40-50 lbs	Sep 1-Nov 1	Sep 1-Nov 1	--
Sericea	40-60 lbs	Mar 15-July 15	Mar 1-July 15	Feb 15-July 15
Sericea & Common Bermudagrass	40-60 lbs 10 lbs	Mar 15-July 15	Mar 1-July 15	Feb 15-July 15
Switchgrass, Alamo	4 Lbs	Apr 1-Jun 15	Mar 15-Jun 15	Mar 15-Jun15

PLS means pure live seed and is used to adjust seeding rates. For example, to plant 10 lbs PLS of a species with germination of 80% and 10% inert material, 10 lbs PLS = 10 lbs/ % live seed = 10/ 0.70 = 14.3 lbs.

Seedbed Requirements

Establishment of vegetation should not be attempted on sites that are unsuitable due to compaction or inappropriate soil texture, poor drainage, concentrated overland flow, or steepness of slope until measures have been completed to correct these problems. To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. A good growth medium should have these attributes:

- Sufficient pore space to permit root penetration.
- Enough fine-grained soil material (silt and clay) to maintain adequate moisture and nutrient supply.
- Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 12" or more, except on slopes steeper than 2:1 where topsoiling is not feasible.
- A favorable pH range for plant growth, usually 6.0-6.5.

- Sufficient nutrients (nitrogen, phosphorus and potassium) for initial plant establishment.

- Freedom from large roots, branches, stones, or large clods. Clods and stones may be left on slopes steeper than 3:1 if they are to be hydroseeded.

If any of the above attributes are not met: i.e., if the existing soil is too dense, coarse, shallow or acidic to foster vegetation – chiseling, topsoil, or special amendments should be used to improve soil conditions. The soil conditioners described below may be beneficial or topsoil may be applied (for guidance on topsoiling see Topsoiling practice). These amendments should only be necessary where soils have limitations that make them poor for plant growth or for turf establishment.

- Peat-appropriate types are sphagnum moss peat, reed-sedge peat, or peat humus, all from fresh-water sources. Peat should be shredded and conditioned in storage piles for at least 6 months after excavation.

- Sand-should be clean and free of toxic materials.

- Vermiculite-use horticultural grade.

- Rotted manure-use stable or cattle manure not containing undue amounts of straw or other bedding materials.

- Thoroughly rotted sawdust-should be free of stones and debris. Add 6 lbs of nitrogen to each cubic yard.

Soil Amendments

Liming Materials

Lime (Agricultural limestone) should have a neutralizing value of not less than 90 percent calcium carbonate equivalent and 90 percent will pass through a 10 mesh sieve and 50 percent will pass through a 60 mesh sieve.

Selma chalk should have a neutralizing value of not less than 80 percent calcium carbonate equivalent and 90 percent will pass through a 10 mesh sieve.

Other liming materials that may be selected should be provided in amounts that provide equal value to the criteria listed for agricultural lime or be used in combination with agricultural limestone or Selma chalk to provide equivalent values to agricultural limestone.

Plant Nutrients

Commercial grade fertilizers that comply with current Alabama Fertilizer Laws should be used to supply nutrients required to establish vegetation.

Rates of Soil Amendments
Lime and fertilizer needs should be determined by soil tests. Soil testing is performed by the Auburn University Soil Testing Laboratory and provides recommendations based on field tests on Alabama soils. The local county

Cooperative Extension Service can provide information on obtaining soil tests. Commercial laboratories that make recommendations based on soil analysis may be used.

When soil tests are not available, use the following rates for application of soil amendments.

Lime (Agricultural Limestone or Equivalent – see Liming Materials)
Sandy soils: Use 1 ton/acre (exception on sandy soils – if the cover will be tall fescue and clover) use 2 tons/acre.
Clayey soils: 2 tons/acre.
(Do not apply lime to alkaline soils).

Fertilizer
Grasses alone: Use 400 lbs/acre of 8-24-24 or the equivalent. Apply 30 lbs of additional nitrogen when grass has emerged and begun growth (approximately 0.8lbs/1000 ft^2).
Grass-legume mixtures: Use 800 to 1200 lbs/acre of 5-10-10 or the equivalent.
Legumes Alone: Use 800 to 1200 lbs/acre of 0-10-10 or the equivalent.

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Application of Soil Amendments

Apply lime and fertilizer evenly and incorporate into the top 6" of soil by disking, chiseling or other suitable means during seedbed preparation. Operate machinery on the contour.

Seedbed Preparation

If needed, grade and shape to provide a surface on which equipment can safely and efficiently be used for seedbed preparation and seeding.

Install necessary sediment control practices before seedbed preparation and complete grading according to the approved plan.

Prepare a friable seedbed with tillage to a depth of at least 6". Break up large clods, alleviate compaction, and smooth and firm the soil into a uniform surface. Fill in or level depressions that can collect water.

Planting Methods

Seeding

Use certified seed for permanent seeding whenever possible. Certified seed is inspected by the Alabama Crop Improvement Association to meet high quality standards and will be tagged with a "Certified Seed" tag. (Note: all seed sold in Alabama is required by law to be tagged to identify seed purity, germination, and presence of weed seeds. Seed must meet state standards for content of noxious weeds.)

Seeding dates are determined using Figure PS-1 and Table PS-1.

Inoculate legume seed with the Rhizobium bacteria appropriate to the species of legume. Details of legume inoculation are located in Chapter 2 in the part on Vegetation for Erosion and Sediment Control under Inoculation of Legumes.

Plant seed uniformly with a cyclone seeder, a drill seeder, a cultipacker seeder, or by hand on a fresh, firm, friable seedbed. If the seedbed has been sealed by rainfall, it should be disked so the seed will be sown into a freshly prepared seedbed.

When using broadcast-seeding methods, subdivide the area into workable sections and determine the amount of seed needed for each section. Apply one-half the seed while moving back and forth across the area, making a uniform pattern; then apply the second half in the same way, but moving at right angles to the first pass.

Cover broadcast seed by raking or chain dragging; then firm the surface with a roller or cultipacker to provide good seed contact. Small grains should be planted no more than 1" deep and grasses and legume seed no more than ½" deep.

Hydroseeding

Surface roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydroseeding operations; large clods, stones, and irregularities provide cavities in which seeds can lodge.

Mix seed, inoculant if required, and a seed carrier with water and apply as a slurry uniformly over the area to be treated. The seed carrier should be a cellulose fiber, natural wood fiber or other approved fiber mulch material which is dyed an appropriate color to facilitate uniform application of seed. Use the correct legume inoculant at 4 times the recommended rate when adding inoculant to a hydroseeder slurry. The mixture should be applied within one hour after mixing to reduce damage to seed.

Fertilizer should not be mixed with the seed-inoculant mixture because fertilizer salts may damage seed and reduce germination and seedling vigor.

Fertilizer may be applied with a hydroseeder as a separate operation after seedlings are established.

Lime is not normally applied with a hydraulic seeder because it is abrasive but if necessary it can be added to the seed slurry and applied at seeding or it may be applied with the fertilizer mixture. Also lime can be blown onto steeper slopes in dry form.

Sprigging

Hybrid bermudagrass cannot be grown from seed and must be planted vegetatively. Vegetative methods of establishing common and hybrid bermudagrass, centipedegrass and zoysia include sodding, plugging and sprigging (see Sodding practice).

When sprigs are planted with a sprigging machine, furrows should be 4-6" deep and 2 feet apart. Place sprigs no farther than 2 feet apart in the row and so that at least one rooting node is in the furrow.

When broadcasting is used for sprig planting, broadcast sprigs at the specified rate (Table PS-1). Press into the top ½" to 2" of soil with a cultipacker or with a disk set nearly straight so that the sprigs are not brought back to the surface. A mulch tacking machine may be used to press sprigs into the soil.

Mulching

The use of mulch provides instant cover and helps ensure establishment of vegetation under normal conditions and is essential to seeding success under harsh site conditions (see Mulching practice). Harsh site conditions include: slopes steeper than 3:1 and adverse soils (shallow, rocky, or high in clay or sand). Areas with concentrated flow should be treated differently and require sod, a hydromulch formulated for channels or an appropriate erosion control blanket.

Irrigation

Moisture is essential for seed germination and vegetation establishment. Supplemental irrigation can be very helpful in assuring adequate stands in dry seasons or to speed development of full cover. It is a requirement for establishment of vegetation from sod and sprigs and should be used elsewhere when feasible. However, irrigation is rarely critical for low-maintenance vegetation planted at the appropriate time of the year.

Water application rates must be carefully controlled to prevent runoff. Inadequate or excessive amounts of water can be more harmful than no supplemental water.

Maintenance

Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for 1 full year from planting. Inspect vegetated areas for failure and make necessary repairs and vegetate as soon as possible.

If a stand has inadequate cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed

preparation or over-seed the stand. Consider a temporary seeding if the time of year is not appropriate for establishment of permanent vegetation (see Temporary Seeding practice).

If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

To attain complete establishment, fertilization is usually required in the second growing season. Turf grasses require annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixtures.

Protect vegetation during its establishing period from traffic that will be harmful. If appropriate, use either temporary fences or barriers to protect areas that may be damaged by excessive traffic.

RAINFALL DATA

APPENDIX G

RAINFALL DATA

Carbo Ceramics, Inc. - Carbo-Sellers Bauxite Pit

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Totals												

405526

CARBO CERAMICS INC. • 4701 W. Admiral Doyle Drive • New Iberia, LA 70560

ALABAMA DEPT OF | **July 15, 2021** | **Check No 405526**

Document No.	Date	Control No.	Amount	Discount	Net Amount
ADEMMININGP2021A	04/22/2021	5105618393	540.00	0.00	540.00
	Total				**540.00**

R#21-53446

RECEIVED
JUL 16 2021
STORM WATER
MANAGEMENT BRANCH

405321

CARBO CERAMICS INC. • 4701 W. Admiral Doyle Drive • New Iberia, LA 70560

ALABAMA DEPT OF | **May 13, 2021** | **Check No 405321**

Document No.	Date	Control No.	Amount	Discount	Net Amount
ADEMMININGPE2021	04/22/2021	5105616415	5,280.00	0.00	5,280.00
	Total				**5,280.00**

R#21-53294

RECEIVED
JUN 17 2021
STORM WATER
MANAGEMENT BRANCH

CARBO
CERAMICS

June 14, 2021

ADEM
1400 Coliseum Blvd.
P.O. Box 301463
Montgomery, Al 36130-1463
Attn: Amber Powell

Dear Amber: I have enclosed a new Permit application and payment in response to your letter of February 23, 2021 regarding the Carbo-Sellers Bauxite Pit. Please let me know, if you need anything else.

Regards,

Jim Bevill
Carbo Ceramics

CARBO Ceramics Inc.
1880 Dent Road
Toomsboro, Georgia 31090
Telephone 478/943-2300
Fax 478/943-2380

CARBO
CERAMICS

June 21, 2021

ADEM
1400 Coliseum Blvd.
P.O. Box 301463
Montgomery, Al 36130-1463
Attn: Amber Powell

Dear Amber: I forgot to send the PAP along with the Permit Application on our the Carbo-Sellers Bauxite Pit. Please let me know, if you need anything else.

Regards,

Jim Bevill
Carbo Ceramics

RECEIVED

JUN 24 2021

STORM WATER
MANAGEMENT BRANCH

CARBO Ceramics Inc.
1880 Dent Road
Toomsboro, Georgia 31090
Telephone 478/943-2300
Fax 478/943-2380