CERTIFICATE OF AUTHENTICITY

THIS IS TO CERTIFY THAT THE FOLLOWING ELECTRONIC RECORDS ARE TRUE AND ACCURATE REPRODUCTIONS OF THE ORIGINAL RECORDS OF JAMES CITY COUNTY GENERAL SERVICES DEPARTMENT- STORMWATER DIVISION; WERE SCANNED IN THE REGULAR COURSE OF BUSINESS PURSUANT TO GUIDELINES ESTABLISHED BY THE LIBRARY OF VIRGINIA AND ARCHIVES; AND HAVE BEEN VERIFIED IN THE CUSTODY OF THE INDIVIDUAL LISTED BELOW.

BMP NUMBER: **WC078**

DATE VERIFIED: **October 10, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 12, 2010

TO: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: WC078

PIN: 0520600001B

Subdivision, Tract, Business or Owner Name (if known): Stonehouse

Property Description: Richardsons Mill Common Area Section 1

Site Address:

(For internal use only) **Box** 22 **Drawer:** 9

Agreements: (in file as of scan date) **Y** **Book or Doc#:** 020022966 **Page:**

020021127

Comments

BMP #7-1 WC078
7-2 WC077

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 1ST day of OCTOBER, 20 02, between STONEHOUSE DEVELOPMENT COMPANY, LLC, and all successors in interest, ("COVENANTOR(S),") owner(s) of the following property: STONEHOUSE DEVELOPMENT AREA ONE, PHASE I, SECTION VII-A "RICHARDSON'S MILL" SECTION I, project name, PLAT, Document No. 020021127, ~~Deed~~ Book 87, Page No. 58-60; Instrument No. _____, and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

We, the COVENANTOR(S), with full authority to execute deeds, mortgages, other covenants, and all rights, titles and interests in the property described above, do hereby covenant with the COUNTY as follows:

1. The COVENANTOR(S) shall provide maintenance for the drainage system including any runoff control facilities, conveyance systems and associated easements, hereinafter referred to as the "SYSTEM," located on and serving the above-described property to ensure that the SYSTEM is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations. The SYSTEM shall not include any elements located within any Virginia Department of Transportation rights-of-way.

2. If necessary, the COVENANTOR(S) shall levy regular or special assessments against all present or subsequent owners of property served by the SYSTEM to ensure that the SYSTEM is properly maintained.

3. The COVENANTOR(S) shall provide and maintain perpetual access from public right-of-ways to the SYSTEM for the COUNTY, its agent and its contractor.

4. The COVENANTOR(S) shall grant the COUNTY, its agent and its contractor a right of entry to the SYSTEM for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining or repairing the SYSTEM.

5. If, after reasonable notice by the COUNTY, the COVENANTOR(S) shall fail to maintain the SYSTEM in accordance with the approved design standards and with the law and applicable executive regulations, the COUNTY may perform all necessary repair or maintenance work, and the COUNTY may assess the COVENANTOR(S) and/or all property served by the SYSTEM for the cost of the work and any applicable penalties.

Instrument # 020022966

Revised 01/02

Recorded on October 7, 2002

6. The COVENANTOR(S) shall indemnify and save the COUNTY harmless from any and all claims for damages to persons or property arising from the installation, construction, maintenance, repair, operation or use of the SYSTEM.

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S)' responsibilities for the SYSTEM. The COVENANTOR(S)' shall supply the COUNTY with a copy of any document of transfer, executed by both parties.

8. The covenants contained herein shall run with the land and shall bind the COVENANTOR(S) and the COVENANTOR(S)' heirs, executors, administrators, successors and assignees, and shall bind all present and subsequent owners of property served by the SYSTEM.

9. This COVENANT shall be recorded in the County Land Records.

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of the date first above written.

COVENANTOR(S)

Print Name/Title LAWRENCE MYERS / TREASURER

ATTEST:

COVENANTOR(S)

Print Name/Title

ATTEST:

COMMONWEALTH OF VIRGINIA
CITY/COUNTY OF James City County

I hereby certify that on this 1 day of Oct., 2002, before the subscribed, a Notary Public of the State of Virginia, and for the City/County of James City Co, aforesaid personally appeared Lawrence O. Myers and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 1 day of Oct, 2002.

Peggy B. Wells
Notary Public

My Commission expires: My Commission Expires September 30, 2006

Approved as to form:

County Attorney

This Declaration of Covenants prepared by:

JAMES H. BENNETT
(Print Name)

V.P. DOMINION LAND
(Title)

9701 MILL POND RUN
(Address)

TOANO VA 23168
(City) (State) (Zip)

drainage.pre

COPY

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this ~~6TH~~ 11TH JHB day of DECEMBER, 20 02, between STONEHOUSE DEVELOPMENT COMPANY, LLC, and all successors in interest, ("COVENANTOR(S),") owner(s) of the following property: STONEHOUSE DEVELOPMENT AREA ONE, PHASE I, SECTION VII-A, "RICHARDSON'S MILL" SECTION 2 project name, Document No. 990026872, Deed Book _____, Page No. _____; Instrument No. _____, and the County of James City, Virginia ("COUNTY.")

WITNESSETH:

We, the COVENANTOR(S), with full authority to execute deeds, mortgages, other covenants, and all rights, titles and interests in the property described above, do hereby covenant with the COUNTY as follows:

1. The COVENANTOR(S) shall provide maintenance for the drainage system including any runoff control facilities, conveyance systems and associated easements, hereinafter referred to as the "SYSTEM," located on and serving the above-described property to ensure that the SYSTEM is and remains in proper working condition in accordance with approved design standards, and with the law and applicable executive regulations. The SYSTEM shall not include any elements located within any Virginia Department of Transportation rights-of-way.

2. If necessary, the COVENANTOR(S) shall levy regular or special assessments against all present or subsequent owners of property served by the SYSTEM to ensure that the SYSTEM is properly maintained.

3. The COVENANTOR(S) shall provide and maintain perpetual access from public right-of-ways to the SYSTEM for the COUNTY, its agent and its contractor.

4. The COVENANTOR(S) shall grant the COUNTY, its agent and its contractor a right of entry to the SYSTEM for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining or repairing the SYSTEM.

5. If, after reasonable notice by the COUNTY, the COVENANTOR(S) shall fail to maintain the SYSTEM in accordance with the approved design standards and with the law and applicable executive regulations, the COUNTY may perform all necessary repair or maintenance work, and the COUNTY may assess the COVENANTOR(S) and/or all property served by the SYSTEM for the cost of the work and any applicable penalties.

Instrument # 020031122

Recorded Dec. 26, 2002

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 006

6. The COVENANTOR(S) shall indemnify and save the COUNTY harmless from any and all claims for damages to persons or property arising from the installation, construction, maintenance, repair, operation or use of the SYSTEM.

7. The COVENANTOR(s) shall promptly notify the COUNTY when the COVENANTOR(S) legally transfers any of the COVENANTOR(S)' responsibilities for the SYSTEM. The COVENANTOR(S)' shall supply the COUNTY with a copy of any document of transfer, executed by both parties.

8. The covenants contained herein shall run with the land and shall bind the COVENANTOR(S) and the COVENANTOR(S)' heirs, executors, administrators, successors and assignees, and shall bind all present and subsequent owners of property served by the SYSTEM.

9. This COVENANT shall be recorded in the County Land Records.

IN WITNESS WHEREOF, the COVENANTOR(S) have executed this DECLARATION OF COVENANTS as of the date first above written.

COVENANTOR(S)

_____

Print Name/Title _____

ATTEST:

_____

COVENANTOR(S)

Lawrence O. Myers

Print Name/Title LAWRENCE O. MYERS

TREASURER

ATTEST:

COMMONWEALTH OF VIRGINIA
~~CITY~~/COUNTY OF JAMES CITY

I hereby certify that on this 11th day of DECEMBER, 2002, before the subscribed, a Notary Public of the State of Virginia, and for the ~~City~~/County of JAMES CITY, aforesaid personally appeared LAWRENCE O. ~~MEY~~ MYERS MJ and did acknowledge the aforegoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 11th day of DECEMBER, 2002.

Moonah Jangu
Notary Public

My Commission expires: MARCH 31, 2006

Approved as to form:

County Attorney

This Declaration of Covenants prepared by:

JAMES H. BENNETT
(Print Name)

VICE PRESIDENT, DLNAC
(Title)

120 TREDEGAR STREET
(Address)

RICHMOND VA 23219
(City) (State) (Zip)

drainage.pre

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: Stonehouse - Section VII-A (Richardson's Mill Section 1)
Structure/BMP Name: BMP #7.1
Project Location: Stonehouse - Richardson's Mill
BMP Location: CA-45C (Behind lot 19 on Yarding Way)
County Plan No.: JCC Case No. S - 99 - 01

Project Type:
- ☒ Residential
- ☐ Commercial
- ☐ Institutional
- ☐ Public
- ☐ Other
- ☐ Business
- ☐ Office
- ☐ Industrial
- ☐ Roadway

Tax Map/Parcel No.: (6-4) (1-1)
BMP ID Code (if known): WC078
Zoning District: PUD-R
Land Use: Residential
Site Area (sf or acres): 45.63

Brief Description of Stormwater Management/BMP Facility: Timber Structure

Nearest Visible Landmark to SWM/BMP Facility: Open Space on Yarding Way

Nearest Vertical Ground Control (if known):
☒ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name: 303
Datum or Reference Elevation: NGVD 1929
Control Description: NAD 27
Control Location from Subject Facility: 3.5 miles south

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 009

Section 2 – Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☒ Yes ☐ No ☐ Unknown
Approx. Construction Start Date for SWM/BMP Facility: November 2002
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: George Nice & Sons, Inc.
Name of Professional Firm Who Routinely Monitored Construction:
Date of Completion for SWM/BMP Facility:
Date of Record Drawing/Construction Certification Submittal: 08/16/04

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 – Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Stonehouse Development Company
Mailing Address: 9701 Mill Pond Run
Toano, VA 23168
Business Phone: 757-234-5000 Fax:757-234-5091
Contact Person: Jerry Moore Title:President

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220.8994
Responsible Plan Preparer: Marc Bennett
Title: Senior Project Manager
Plan Name: Stonehouse - Development Area One, Phase 1- Section VII-A, "Richardson's Mill" - Section 1
Firm's Project No. 9028-08
Plan Date: October 26, 2001
Sheet No.'s Applicable to SWM/BMP Facility: 9 / 14 / ____ / ____ / ____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: George Nice & Sons, Inc.
Mailing Address: 143 Skimino Road
Williamsburg, VA 23188-2229
Business Phone: (757) 565-2885
Fax: (757) 565-1526
Contact Person: Ray Nice
Site Foreman/Supervisor:
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer of Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220-8994

Name: Marc Bennett
Title: Senior Project Manager

Signature: V. Marc Bennett
Date: 6/13/06

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
6/13/06
No. 26628
PROFESSIONAL ENGINEER

V. Marc Bennett (Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

Construction Certification

Firm Name: _____
Mailing Address: _____
_____
Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this Stormwater Management / BMP facility was monitored and constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

_____ (Seal)

Virginia Registered
Professional Engineer

RECEIVED
JUN 1 8 2008
ENVIRONMENTAL DIVISION

#7.1
WC078
S-99-01

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities Record Drawing and Construction Certification

Standard Forms & Instructions

Contents — Page

Record Drawing and Construction Certification Forms

Section 1 – Site Information		1
Section 2 – Construction Information		2
Section 3 – Owner / Designer / Contractor Information		2
Section 4 – Professional Certifications		3
Section 5 – Certification Requirements and Instructions		4

Record Drawing Checklist

I.	Methods and Presentation	(Required for All Facilities)	6
II.	Minimum Standards	(Required for All Facilities)	6
III.	Group A – Wet Ponds		8
IV.	Group B – Wetlands		9
V.	Group C – Infiltration Practices		10
VI.	Group D – Filtering Systems		11
VII.	Group E – Open Channel Systems		12
VIII.	Group F – Extended Dry Detention		13
IX.	Group G – Open Spaces		14
X.	Storm Drainage Systems	(Associated with BMP's Only)	15
XII.	Other Systems		15
XIII.	References		16

Issue Date
February 1, 2001

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: Stonehouse - Section VII-A (Richardson's Mill Section 1)
Structure/BMP Name: BMP #7.1
Project Location: Stonehouse - Richardson's Mill
BMP Location: CA-45C (Behind lot 19 on Yarding Way)
County Plan No.: JCC Case No. S - 99 - 01

Project Type:
- ☒ Residential
- ☐ Commercial
- ☐ Institutional
- ☐ Public
- ☐ Other
- ☐ Business
- ☐ Office
- ☐ Industrial
- ☐ Roadway

Tax Map/Parcel No.: (6-4) (1-1)
BMP ID Code (if known): WC078
Zoning District: PUD-R
Land Use: Residential
Site Area (sf or acres): 45.63

Brief Description of Stormwater Management/BMP Facility: Timber Structure

Nearest Visible Landmark to SWM/BMP Facility: Open Space on Yarding Way

Nearest Vertical Ground Control (if known):
☒ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name: 303
Datum or Reference Elevation: NGVD 1929
Control Description: NAD 27
Control Location from Subject Facility: 3.5 miles south

Section 2 – Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☒ Yes ☐ No ☐ Unknown
Approx. Construction Start Date for SWM/BMP Facility: November 2002
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: George Nice & Sons, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: _____
Date of Record Drawing/Construction Certification Submittal: 08/16/04

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 – Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Stonehouse Development Company
Mailing Address: 9701 Mill Pond Run
Toano, VA 23168
Business Phone: 757-234-5000 Fax: 757-234-5091
Contact Person: Jerry Moore Title: President

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220.8994
Responsible Plan Preparer: Marc Bennett
Title: Senior Project Manager
Plan Name: Stonehouse - Development Area One, Phase 1- Section VII-A, "Richardson's Mill" - Section 1
Firm's Project No. 9028-08
Plan Date: October 26, 2001
Sheet No.'s Applicable to SWM/BMP Facility: 9 / 14 / ____ / ____ / ____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: George Nice & Sons, Inc.
Mailing Address: 143 Skimino Road
Williamsburg, VA 23188-2229
Business Phone: (757) 565-2885
Fax: (757) 565-1526
Contact Person: Ray Nice
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer of Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220-8994

Name: Marc Bennett
Title: Senior Project Manager

Signature: [signature]
Date: 6/13/06

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
6/13/06
No. 26628
PROFESSIONAL ENGINEER

[signature] (Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

Construction Certification

Firm Name: _____
Mailing Address: _____

Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this Stormwater Management / BMP facility was monitored and constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

_____ (Seal)

Virginia Registered
Professional Engineer

Perm. Pool plan revision

Bond EXS $50,000

James City County Environmental Division
Stormwater Management/BMP Record Drawing & Construction Certification Review
Tracking Form

Project Name: Stonehouse RH / Sec 7-A Richardson Mill Pond Sec /
County Plan No.: S-99-01 / S-100-02
Stormwater Management Facility: BMP # 7.1 Dry Pond Timber Wall
BMP Phase #: ☐ I ☐ II ☒ III
☑ Information Package Received. Date/By: June 13 2006 AES
☐ Completeness Check:
- ☑ Record Drawing Date/By: ~~4/22/06~~ 6/13/06 AES
- ☑ Construction Certification Date/By: 4/22/06 GET
- ☑ RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001Only)
- ☑ Insp/Maint Agreement # / Date: 020022966; OCT 7 2002
- ☐ BMP Maintenance Plan Location:
- ☐ Other:

☐ Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review
☑ Yes ☐ No Location: Note 20 Sheet 16
☐ Assign **County BMP ID Code #**: Code: WC 078
☑ Preliminary Input/Log into Division's "As-Built Tracking Log"
☑ Add Location to GIS Map. Obtain basic site information (GPIN, Owner, Address, etc.)
☑ Preliminary Log into Access Database (BMP ID #, Plan No., GPIN, Project Name, etc.)
☑ Active Project File Review (correspondence, H&H, design computations, etc.).
☑ Initial As-Built File setup (File label, folder, copy plan/details/design information, etc.).
☑ Inspector Check of RD/CC (forward to Inspector using transmittal for cursory review).
☑ Pre-Inspection Drawing Review of Approved Plan (Quick look prior to Field Inspection).
☑ Final Inspection (FI) Performed Date: 5/30/06 Reinspect
☑ Record Drawing (RD) Review Date: 02/13/07
☑ Construction Certification (CC) Review Date: 02/13/07
☐ Actions:
- ☐ No comments.
- ☑ Comments. Letter Forwarded. Date: Email 2/13/06 supporting info.
- ☐ Record Drawing (RD)
- ☐ Construction Certification (CC)
- ☐ Construction-Related (CR)
- ☐ Site Issues (SI)
- ☐ Other :

☐ Second Submission:
☐ Reinspection (if necessary):
☐ Acceptable for SWM Purposes (RD/CC/CR/Other). Ok to proceed with bond release.
☐ Complete "Surety Request Form".
☑ Check/Clean active file of any remaining material and finish "As-Built" file.
☑ Add to County BMP Inventory/Inspection schedule (Phase I, II or III).
☑ Copy Final Inspection Report into County BMP Inspection Program file.
☐ Obtain Digital Photographs of BMP and save into County BMP Inventory.
☑ Request mylar/reproducible from As-Built plan preparer.
☐ Complete "As-built Tracking Log".
☐ Last check of BMP Access Database (County BMP Inventory).
☐ Add BMP to JCC Hydrology & Hydraulic database (optional).
☐ Add BMP to Municipal BMP list (if a County-owned facility)
☐ Add BMP to PRIDE BMP ratings database.

Final Sign-Off

Plan Reviewer: _____ Date: _____

*** See separate checklist, if needed.

WC078 - FINAL

RECEIVED
NOV 16 2001
ENVIRONMENTAL

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities Record Drawing and Construction Certification

Standard Forms & Instructions

Contents — Page

Record Drawing and Construction Certification Forms

Section 1 – Site Information		1
Section 2 – Construction Information		2
Section 3 – Owner / Designer / Contractor Information		2
Section 4 – Professional Certifications		3
Section 5 – Certification Requirements and Instructions		4

Record Drawing Checklist

I.	Methods and Presentation	(Required for All Facilities)	6
II.	Minimum Standards	(Required for All Facilities)	6
III.	Group A – Wet Ponds		8
IV.	Group B – Wetlands		9
V.	Group C – Infiltration Practices		10
VI.	Group D – Filtering Systems		11
VII.	Group E – Open Channel Systems		12
VIII.	Group F – Extended Dry Detention		13
IX.	Group G – Open Spaces		14
X.	Storm Drainage Systems	(Associated with BMP's Only)	15
XII.	Other Systems		15
XIII.	References		16

Issue Date
February 1, 2001

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities
Record Drawing and Construction Certification Forms

(Note: In accordance with the requirements of the Chesapeake Bay Preservation Ordinance, Chapter 23, Section 23-10(4), BMP's shall be designed and constructed in accordance with the manual entitled James City County Guidelines for Design and Construction of Stormwater Management BMP's. Erosion and sediment control policy and approved plans generally require that at the completion of the project and prior to release of surety, an "as-built" plan prepared by a registered Professional Engineer or Certified Land Surveyor must be provided for the drainage system for the project, including any Best Management Practice (BMP) facilities. In addition, for BMP facilities involving the construction of an impounding structure or dam embankment, certification is required by a Professional Engineer who has inspected the structure during its construction. Currently there are over 20 water quality type BMP's accepted by the County.)

Section 1 – Site Information:

Project Name: Stonehouse - Section VII-A (Richardson's Mill Section 1)
Structure/BMP Name: BMP #7.1
Project Location: Stonehouse - Richardson's Mill
BMP Location: CA-45C (Behind lot 19 on Yarding Way)
County Plan No.: JCC Case No. S - 99 - 01

Project Type:
- ☒ Residential
- ☐ Commercial
- ☐ Institutional
- ☐ Public
- ☐ Other
- ☐ Business
- ☐ Office
- ☐ Industrial
- ☐ Roadway

Tax Map/Parcel No.: (6-4) (1-1)
BMP ID Code (if known): WC078
Zoning District: PUD-R
Land Use: Residential
Site Area (sf or acres): 45.63

Brief Description of Stormwater Management/BMP Facility: Timber Structure

Nearest Visible Landmark to SWM/BMP Facility: Open Space on Yarding Way

Nearest Vertical Ground Control (if known):
☒ JCC Geodetic Ground Control ☐ USGS ☐ Temporary ☐ Arbitrary ☐ Other
Station Number or Name: 303
Datum or Reference Elevation: NGVD 1929
Control Description: NAD 27
Control Location from Subject Facility: 3.5 miles south

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 018

Section 2 – Stormwater Management / BMP Facility Construction Information:

PreConstruction Meeting Held for Construction of SWM/BMP Facility: ☒ Yes ☐ No ☐ Unknown
Approx. Construction Start Date for SWM/BMP Facility: November 2002
Facility Monitored by County Representative during Construction: ☐ Yes ☐ No ☐ Unknown
Name of Site Work Contractor Who Constructed Facility: George Nice & Sons, Inc.
Name of Professional Firm Who Routinely Monitored Construction: _____
Date of Completion for SWM/BMP Facility: _____
Date of Record Drawing/Construction Certification Submittal: 08/16/04

(Note: Record Drawing and Construction Certifications are required within thirty (30) days of the completion of Stormwater Management and/or BMP facility construction. Record Drawings and Construction Certifications must be reviewed and approved by the James City County Environmental Division prior to final inspection, acceptance and bond or surety release.)

Section 3 – Owner / Designer / Contractor Information:

Owner/Developer: *(Note: Site Owner or Applicant responsible for development of the project.)*

Name: Stonehouse Development Company
Mailing Address: 9701 Mill Pond Run
Toano, VA 23168
Business Phone: 757-234-5000 Fax:757-234-5091
Contact Person: Jerry Moore Title:President

Design Professional: *(Note: Professional Engineer or Certified Land Surveyor responsible for the design and preparation of plans and specifications for the Stormwater Management / BMP facility.)*

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220.8994
Responsible Plan Preparer: Marc Bennett
Title: Senior Project Manager
Plan Name: Stonehouse - Development Area One, Phase 1- Section VII-A, "Richardson's Mill" - Section 1
Firm's Project No. 9028-08
Plan Date: October 26, 2001
Sheet No.'s Applicable to SWM/BMP Facility: 9 / 14 / ____ / ____ / ____

BMP Contractor: *(Note: Site Work Contractor directly responsible for construction of the Stormwater Management / BMP facility.)*

Name: George Nice & Sons, Inc.
Mailing Address: 143 Skimino Road
Williamsburg, VA 23188-2229
Business Phone: (757) 565-2885
Fax: (757) 565-1526
Contact Person: Ray Nice
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only):

Section 4 – Professional Certifications:

Certifying Professionals: *(Note: A Registered Professional Engineer of Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional Engineer is responsible for the inspection, monitoring and certification of Stormwater Management / BMP facilities during its construction.)*

Record Drawing and Construction Certifications for Stormwater Management / BMP Facilities

Record Drawing Certification

Firm Name: AES Consulting Engineers
Mailing Address: 5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Business Phone: 757-253-0040
Fax: 757-220-8994

Name: Marc Bennett
Title: Senior Project Manager

Signature: Van Marc Bennett
Date: 6/13/06

I hereby certify to the best of my knowledge and belief that this record drawing represents the actual condition of the Stormwater Management / BMP facility. The facility appears to conform with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
6/13/06
No. 26628
PROFESSIONAL ENGINEER

Van Marc Bennett (Seal)

Virginia Registered Professional Engineer
Or Certified Land Surveyor

Construction Certification

Firm Name: _____
Mailing Address: _____

Business Phone: _____
Fax: _____

Name: _____
Title: _____

Signature: _____
Date: _____

I hereby certify to the best of my knowledge and belief that this Stormwater Management / BMP facility was monitored and constructed in accordance with the provisions of the approved design plan, specifications and stormwater management plan, except as specifically noted.

_____ (Seal)

Virginia Registered
Professional Engineer

GET Solutions, Inc.

Geotechnical · Environmental · Testing

April 22, 2005

To: **AES Consulting Engineers**
5248 Olde Towne Road
Suite 1
Williamsburg, VA 23188

Attn: Ms. Victoria A. Bains

WC 075 7.3
076 7.4
077 7.2
078 7.1

Re: **Richardson's Mill Timber Walls (Sections 1 & 2)**
Stone House Development
James City County, Virginia
G E T Project No. VB02-302T

Dear Ms. Bains:

The purpose of this correspondence is to indicate that **G E T Solutions, Inc.** performed QA/QC inspections during site and earthwork construction activities at Richardson's Mill subdivision Sections 1 & 2, of the Stonehouse development in James City County, Virginia. As part of our inspection services, the construction of the 4 BMP basins was monitored and associated field-testing was performed in accordance with the plans and specifications.

In this respect, it is determined that these 4 basins were constructed in general conformance with the plans and specifications. Additionally, it is our opinion that these basins should hold water, considering the relatively low-permeability characteristics of the fill soils used at these sites, and the design and installation of the timber detention structures.

We appreciate the opportunity to be of continuous service to you on this project, and trust that you will call this office with any questions that you may have.

Respectfully Submitted,
G E T Solutions, Inc.

Camille A. Kattan, P.E.
Principal Engineer
VA Reg. # 018045

COMMONWEALTH OF VIRGINIA
Camille A. Kattan
No.018045
4/22/05
PROFESSIONAL ENGINEER

Copies: (3) Client

204 Grayson Road, Suite B • Virginia Beach, VA 23462 • Phone: (757) 518-1703 • Fax (757) 518-1704
info@getsolutionsinc.com

Engineering, Surveying, and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

Phone: (757) 253-0040
Fax: (757) 220-8994

LETTER OF TRANSMITTAL

ATTN: **Mike Majdeski**

CO.: JCC Environmental Division

Address: 101-E Mounts Bay Road

Williamsburg, VA 23187

cc: file

DATE	JOB NO.
10/16/08	9028-17

FROM: Victoria Bains

RE
Stonehouse
Richardson's Mill Section 1 & 2

RECEIVED
OCT 16 2008
ENVIRONMENTAL DIVISION

WE ARE SENDING YOU THE FOLLOWING ITEMS: ☒ Attached ☐ Under separate cover via

☐ Original(s) ☒ Print(s) ☐ Plan(s) ☐ Specification(s) ☐ Change Order

☐ Copy of letter(s) ☐ Other:

COPIES	DATE	No. of Pages	DESCRIPTION
1	10/16/08	16	4 - BMP Certification

THESE ARE TRANSMITTED as checked below:

☐ For your approval ☐ For your signature ☐ For review and comment

☐ For your use ☒ As you requested ☐ As requested by:

☐ Other:

REMARKS:

If enclosures are not as noted, kindly notify us at once.

File name: S:\Jobs\9028\17 Stonehouse Easement Plats\Wordproc\Document\902817t-10-16-08vab.doc
Form Rev. 7/02

AES CONSULTING ENGINEERS
Engineering, Surveying, and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

Phone: (757) 253-0040
Fax: (757) 220-8994

LETTER OF TRANSMITTAL

RECEIVED
MAR 3 0 2006
ENVIRONMENTAL DIVISION

ATTN: **Scott Thomas**

CO.: JCC Environmental

Address:

cc:

DATE	JOB NO.
03/30/06	9028-08

FROM: Victoria Bains

RE
Stonehouse - Richardson's Mill Section 1 & 2 Timber Wall BMP's
7.1, 7.2, 7.3, 7.4

WE ARE SENDING YOU THE FOLLOWING ITEMS:

☐ Attached
☐ Under separate cover via

☐ Original(s) ☐ Print(s) ☐ Plan(s) ☐ Specification(s) ☐ Change Order

☐ Copy of letter(s) ☐ Other:

COPIES	DATE	No. of Pages	DESCRIPTION
1	03/27/06	3	Letter & Calculations for Timber Walls
1	04/22/06	1	Letter certifying construction of BMP's in Richardson's Mill

THESE ARE TRANSMITTED as checked below:

☐ For your approval ☐ For your signature ☐ For review and comment

☐ For your use ☒ As you requested ☐ As requested by:

☐ Other:

REMARKS:
Scott,
If you need anything else please let me know
Thank you,
Tory

If enclosures are not as noted, kindly notify us at once.

WC 078

VOID

James City County, Virginia
Environmental Division

Stormwater Management / BMP Facilities Record Drawing and Construction Certification

Standard Forms & Instructions

Contents

			Page
Record Drawing and Construction Certification Forms			
	Section 1 – Site Information		1
	Section 2 – Construction Information		2
	Section 3 – Owner / Designer / Contractor Information		2
	Section 4 – Professional Certifications		3
	Section 5 – Certification Requirements and Instructions		4
Record Drawing Checklist			
I.	Methods and Presentation	(Required for All Facilities)	6
II.	Minimum Standards	(Required for All Facilities)	6
III.	Group A – Wet Ponds		8
IV.	Group B – Wetlands		9
V.	Group C – Infiltration Practices		10
VI.	Group D – Filtering Systems		11
VII.	Group E – Open Channel Systems		12
VIII.	Group F – Extended Dry Detention		13
IX.	Group G – Open Spaces		14
X.	Storm Drainage Systems	(Associated with BMP's Only)	15
XII.	Other Systems		15
XIII.	References		16

Issue Date
February 1, 2001

James City County, Virginia
Environmental Division

Erosion and Sediment Control and Stormwater Management Design Plan Checklists

Table of Contents

Contents		Page
Erosion and Sediment Control Plan		
I.	General	1
II.	Site Plan	1
III.	Narrative	3
IV.	Calculations	4
Stormwater Management Design Plan		
I.	General	5
II.	Stormwater Conveyance Systems	7
III.	Stormwater Management / BMP Facilities	8
IV.	Outlet Protections	14
V.	Additional Comments and Information	14

GENERAL INFORMATION

Project Name: RICHARDSON'S MILL SECTION 1
Owner / Applicant: STONEHOUSE DEVELOPMENT Co. L.L.C.
Plan Preparer: RICHARD SMITH Email: rsmith@aesva.com
Project Location: EASTERN END OF MILL POND RUN IN THE STONEHOUSE PROJECT
Tax Map / Parcel: PARCEL #1-0-00024) TAX MAP# (4-4)
County Plan No. (if known): S-99-01
County BMP Type: 2 TIMBER CRIB WALLS (F - 1)
Other information submitted in addition to this checklist (Check all that apply):

- ☑ Design or Construction Drawings (Plans, Profiles, Details, etc.).
- ☑ Erosion & Sediment Control Plan (Plans, Details, etc.).
- ☑ Erosion & Sediment Control Plan Design Report.
- ☑ Stormwater Management Design Plan (Plans, Profiles, Details, etc.).
- ☑ Stormwater Management Design Report.
- ☐ Other, List: _____

Final Draft
August 30, 2000

JAMES CITY COUNTY, VIRGINIA
ENVIRONMENTAL DIVISION

EROSION AND SEDIMENT CONTROL PLAN CHECKLIST

I. *GENERAL:*

Yes	No	N/A	
☑	☐	☐	*FAMILIARITY* with current versions of Chapter 8, Erosion and Sedimentation Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia and the Virginia Erosion and Sediment Control Handbook (VESCH).
☑	☐	☐	*LAND DISTURBING PERMIT AND SILTATION AGREEMENT* with surety are required for the project.
☑	☐	☐	*VARIANCE* if necessary, requested in writing, for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site.

II. *SITE PLAN:*

Yes	No	N/A	
☑	☐	☐	*VICINITY MAP* locating the site in relation to the surrounding area. Include any major landmarks which might assist in physically locating the site.
☑	☐	☐	*INDICATE NORTH* direction in relation to the site.
☑	☐	☐	*LIMITS OF CLEARING AND GRADING* for the site including that required for implementation of erosion and sediment controls, stockpile area and utilities.
☑	☐	☐	*DISTURBED AREA ESTIMATES* in acres or square feet for the project.
☑	☐	☐	*EXISTING TOPOGRAPHY* or contours for the site at no more than 5 foot contour interval.
☑	☐	☐	*FINAL TOPOGRAPHY*, contours or proposed site grading in accordance with the design plan which indicates changes to existing topography and drainage patterns at no more than 2 foot contour interval (or 1 foot contours where required).
☑	☐	☐	*EXISTING AND PROPOSED SPOT ELEVATIONS* to supplement existing and proposed contours, topography or site grading information. Spot elevations may replace final contours in some instances, especially if terrain is in a low lying area or relatively flat.
☑	☐	☐	*EXISTING VEGETATION* including existing tree lines, grassed or unique vegetation areas.

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 026

Yes	No	N/A	
☑	☐	☐	*EXISTING SITE FEATURES* including roads, buildings, homes, utilities, streams, fences, structures and other important surface features of the site.
☑	☐	☐	*SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia.
☑	☐	☐	*ENVIRONMENTAL INVENTORY* in accordance with Section 23-10(2) of the Chesapeake Bay Preservation Ordinance of James City County. Inventory generally includes: tidal shores and wetlands, non-tidal wetlands, resource protection area, hydric soils and slopes steeper than 25 percent. For wetlands, provide a copy of issued permits or satisfactory evidence that appropriate permits are being pursued for the entire project.
☑	☐	☐	*100-YEAR FLOODPLAIN LIMITS* or any special flood hazard areas or flood zones based on appropriate Federal Management Agency Flood Insurance Rate Maps (FIRMs) or Flood Hazard Boundary Maps (FHBMs) of James City County, Virginia.
☑	☐	☐	*DRAINAGE AREAS* for offsite and onsite areas, existing or proposed as applicable. Include drainage divides and directional labels for all subareas at points of interest and size (in acres), weighted runoff coefficient or curve number and times of concentration for each subarea.
☑	☐	☐	*CRITICAL EROSION AREAS* which require special consideration or unique erosion and sediment control measures. Refer to the VESCH, Chapter 6 for criteria.
☑	☐	☐	*DEVELOPMENT PLAN* for the site showing all improvements such as buildings, structures, parking areas, access roadways, above and below ground utilities, stormwater management and drainage facilities, trails or sidewalks, proposed vegetation and landscaping, amenities, etc.
☑	☐	☐	*LOCATION OF PRACTICES* proposed for erosion and sediment control, tree protection and temporary stormwater management due to land disturbance activities at the site. Use standard abbreviations, labels and symbols consistent for plan views based on minimum standards and specifications in Chapter 3 of the VESCH.
☑	☐	☐	*TEMPORARY STOCKPILE AREAS* or staging and equipment storage areas as required for onsite or offsite construction activities or indicate that none are anticipated for this project.
☑	☐	☐	*OFFSITE LAND DISTURBING AREAS* including borrow sites, waste areas, utility extensions, etc. and required erosion and sediment controls. If none are anticipated for the project, then indicate on the plans by general or erosion and sediment control notes.
☑	☐	☐	*DETAILS* or alternately, appropriate reference to current minimum standards and specifications of the VESCH for each measure proposed for the project. Non-modified, standard duplicated details (silt fence, diversion dikes, etc.) may be referenced to the current version of the VESCH. Specific dimensional or modified standards (basins, traps, outlet protections, check dams, etc.) require presentation on detail sheets. Schedules or tables may be used for multiple site measures such as sediment traps, basins, channels, slope drains, etc. Any modification to standard details should be clearly defined, explained and illustrated.

Yes	No	N/A	
☑	☐	☐	*MAINTENANCE PLAN* or alternately, appropriate reference to current minimum standards and specifications of the VESCH, outlining the inspection frequency and maintenance requirements for all erosion and sediment control measures proposed for the project.
☑	☐	☐	*TRENCH DEWATERING* methods and erosion and sediment controls, if anticipated for the project.
☑	☐	☐	*CONSTRUCTION SEQUENCE* outlining the anticipated sequence for installation of erosion and sediment controls and site, grading and utility work to be performed for the project by the site contractor.
☐	☐	☑	*PHASING PLAN* if required for larger project sites that are to be developed in stages or phases.
☑	☐	☐	*STANDARD COUNTY NOTES* are required to be placed on the erosion and sediment control plan. Refer to the standard James City County Erosion and Sediment Control Notes dated May 5, 1999.
☑	☐	☐	*PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved plans, drawings, technical reports and specifications.

III. *NARRATIVE:*

Yes	No	N/A	
☑	☐	☐	*PROJECT DESCRIPTION* briefly describing the nature and purpose of the land disturbing activity and the acreage to be disturbed.
☑	☐	☐	*EXISTING SITE CONDITIONS* description of existing topography, land use, cover and drainage patterns at the site.
☑	☐	☐	*ADJACENT AREA* descriptions of neighboring onsite or offsite areas such as streams, lakes, property, roads, etc. and potential impacts due to concentrated flow or runoff from the land disturbing activity.
☑	☐	☐	*OFFSITE DISTURBED AREA* descriptions of proposed borrow sites, waste or surplus areas, utility extensions and erosion and sediment controls to be implemented.
☑	☐	☐	*SOILS DESCRIPTION* briefly summarizing site, disturbed area and drainage basin soils including name, unit, hydrologic soil group (HSG) classification, surface runoffpotential, erodibility, permeability, depth, texture, structure, erosion hazards, shrink-swell potential, limitations for use and anticipated depths to bedrock and the seasonal water table, as applicable.
☑	☐	☐	*CRITICAL AREAS* on the site which many have potentially serious erosion and sediment control problems and special considerations required (ie. steep slopes, hydric soils, channels, springs, sinkholes, water supply reservoirs, groundwater recharge areas, etc.)

Yes No N/A

☑ ☐ ☐ *PROPOSED EROSION & SEDIMENT CONTROL MEASURES* inclusive to the specific erosion and sediment control plan as proposed for the land disturbing activity. Measures should be consistent with those proposed on the site drawings. Address general use, installation, limitations, sequencing and maintenance requirements for each control measure.

☑ ☐ ☐ *STABILIZATION MEASURES* required for the site, either temporary or permanent, and during and following construction including temporary and permanent seeding and mulching, paving, stone, soil stabilization blankets and matting, sodding, landscaping or special stabilization techniques to be utilized at the site.

☑ ☐ ☐ *STORMWATER MANAGEMENT CONSIDERATIONS* for the site, either of temporary or permanent nature, and strategies, sequences and measures required for control. May reference the stormwater management plan for the site, if prepared, for permanent stormwater management facilities and control of drainage once the site is stabilized.

IV. ***CALCULATIONS:***

Yes No N/A

☑ ☐ ☐ *CALCULATIONS AND COMPUTATIONS* associated with hydrology, hydraulics and design of proposed temporary and permanent erosion and sediment control measures including: sediment traps and basins, diversions, stormwater conveyance channels, culverts, slope drains, outlet protections, etc. Computations are not required on the construction plan and may be attached in a supplemental erosion and sediment control plan design report, if presented in a clear and organized format.

☐ ☐ ☑ *TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET* submitted for each basin along with schematic or sketch cross-section showing applicable design and construction data, storage volumes (wet-dry), dimensions and elevations. Peak design runoff to be based on the 2- or 25-year design storm event based on maximum disturbed site conditions (existing, interim or proposed conditions) in accordance with Minimum Standard 3.14 of the VESCH.

JAMES CITY COUNTY, VIRGINIA
ENVIRONMENTAL DIVISION

STORMWATER MANAGEMENT DESIGN PLAN CHECKLIST

I. *GENERAL:*

Yes	No	N/A	
☑	☐	☐	*FAMILIARITY* with current versions of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual; Chapter 8, Erosion and Sediment Control and Chapter 23, Chesapeake Bay Preservation ordinances of the Code of James City County, Virginia; the Virginia Erosion and Sediment Control Handbook (VESCH); and the Virginia Stormwater Management Handbook (VSMH).
☐	☐	☑	*WAIVER OR EXCEPTION* if necessary, requested in writing, for the plan approving authority to waive or except the requirements of Chapter 23, Chesapeake Bay Preservation ordinance in accordance with procedure established in Sections 23-14 through 23-17 of the ordinance. Applies to this review case only.
☐	☐	☑	*VARIANCE REQUEST* if necessary, requested in writing for the plan approving authority to waive or modify any of the minimum standards and specifications of the VESCH deemed inappropriate based on site conditions specific to this review case only. Variances which are approved shall be properly documented in the plan and become part of the approved erosion and sediment control plan for the site.
☑	☐	☐	*PROFESSIONAL SEAL AND SIGNATURE* required on final and complete approved stormwater management plans, drawings, technical reports and specifications.
☐	☐	☑	*WORKSHEET FOR BMP POINT SYSTEM* to ensure the stormwater management plan for the project attains at least 10 BMP points (New Development) or traditional pollutant load reduction computations per the Chesapeake Bay Local Assistance Manual (Redevelopment Only).
☑	☐	☐	*PROPOSED CONSERVATION EASEMENT AREAS* for any natural open space points claimed in the BMP worksheet.
☑	☐	☐	*INSPECTION/MAINTENANCE AGREEMENT* is required to be prepared and executed with the County for the project.
☑	☐	☐	*FEMA FIRM PANEL* reference with designated special flood hazard areas or zone designations associated with the site, as applicable.
☑	☐	☐	*DRAINAGE AREA MAP* at a maximum scale of 1"=200' scale showing drainage area boundaries for pre- and postdevelopment conditions and associated time of concentration flow paths. Labels to include drainage area size, runoff coefficient or curve number and time of concentration for each subarea shown on the map.

☑ ☐ ☐ *SOILS MAP* with soil symbols, boundaries and legend in accordance with the current Soil Survey of James City and York Counties and the City of Williamsburg, Virginia with approximate locations of the project site, BMPs and applicable drainage basins.

Yes No N/A

☑ ☐ ☐ *STORMWATER MANAGEMENT NARRATIVE* in a brief and simple format which describes the project; location; site and drainage basin soil characteristics; receiving water or drainage facility; existing site and drainage basin conditions (topography, land use, cover, slopes, etc.); proposed site development; proposed stormwater management and drainage plan including County BMP type selected; summary of hydrology and hydraulics; maintenance program; and any special assumptions utilized for development of the stormwater management and drainage design plan or computations.

☑ ☐ ☐ *TEMPORARY STORMWATER MANAGEMENT* (if applicable) for control of stormwater runoff encountered during construction activities in addition to measures provided in the erosion and sediment control plan or stormwater management/drainage plan for the site. Adequate protection measures or sequencing provided.

☑ ☐ ☐ *MODIFICATION PLAN* clearly defined for temporary sediment control structures which will be converted to permanent SWM/BMP structures. Includes appropriate hydrologic and hydraulic computations, conversions, sequencing and cleanout information or details. Normally related to primary control structures associated with dry detention or wet retention ponds. Normally not permitted for Group C or D categories such as bioretention, infiltration and filtering system facilities.

☑ ☐ ☐ *STORMWATER MANAGEMENT and DRAINAGE DESIGN REPORT* in a bound 8-1/2 x 11 inch size format. Report shall generally include a title sheet, date, project identification, owner and preparer information, table of contents, narrative, summaries and computations as required. Computations may include: backwater, closed conduit, headwater, hydraulic, hydraulic grade line, hydrology, inlet, open channel, storm sewer, water quality, extended detention or stream channel protection and muti-stage storm routing calculations, as applicable, for the project. Computation data may include hand or computer generated computations, maps or schematics. All information should be presented in a clear, easy to follow format and should closely match construction plan information.

☑ ☐ ☐ *PLAN VIEW* at 1 inch = 50 ft. scale or less (1" = 40', 1" = 30', etc.)

- ☑ ☐ ☐ North arrow and plan legend.
- ☑ ☐ ☐ Property lines.
- ☑ ☐ ☐ Adjacent property information.
- ☑ ☐ ☐ Existing site features and existing impervious cover areas.
- ☑ ☐ ☐ Impervious cover tabulations.
- ☑ ☐ ☐ Existing drainage facilities (natural or manmade).
- ☑ ☐ ☐ Existing environmentally sensitive areas (RPA, wetlands, floodplain, steep slopes, critical soils, buffers, etc.).
- ☑ ☐ ☐ Existing and proposed contours (1' or 2' contour interval) and spot elevations as necessary to define high and low topography.
- ☑ ☐ ☐ Existing and proposed easement locations.

Yes	No	N/A	
☑	☐	☐	Proposed site improvements and proposed impervious cover areas.
☑	☐	☐	Proposed stormwater conveyance, drainage and management facilities with appropriate labeled construction data and information.
☑	☐	☐	Proposed landscaping and seeding plans (disturbed areas, pond interior, etc.).
☑	☐	☐	Proposed slope stabilization areas (riprap, blankets, mattings, walls, etc.).
☑	☐	☐	Delineation of permanent pools and the 1-, 2-, 10- and 100-year Design Water Surface Elevations.
☐	☐	☑	Delineation of ponding, headwater, surcharge or backwater areas which may affect adjacent existing or proposed buildings, structures or upstream adjacent properties.
☐	☑	☐	Test boring locations with reference surface elevations (if known).
☐	☐	☑	Risers, barrels, underdrains, overflows and outlet protections.
☐	☐	☑	Emergency spillway level section and outlet channel.
☑	☐	☐	Existing and proposed site utilities and protection measures.
☑	☐	☐	Erosion and sediment control measures (for site or BMP).
☑	☐	☐	Maintenance or access corridors to permanent stormwater management, BMP or drainage facilities.

II. *STORMWATER CONVEYANCE SYSTEMS:*

Yes	No	N/A	
☑	☐	☐	*PLAN VIEWS*
☑	☐	☐	Storm drain lengths, sizes, types, classes and slopes for all segments. Label directly on plan or use structure/pipe schedule.
☑	☐	☐	Access structure (inlets, manholes, junctions, etc.) rim elevations, inverts, type and required grate or top unit and lengths labeled.
☑	☐	☐	All structure numbers labeled.
☑	☐	☐	Adequate horizontal clearance from other site utilities or structures.
☑	☐	☐	*PROFILES* generally are not required but are encouraged to expedite review. If not provided, ensure all pipe segments have adequate minimum cover, do not exceed maximum depths of cover for the type/class of pipe specified and do not conflict with other site utilities or excavation areas.
☑	☐	☐	*DETAILS*
☑	☐	☐	Typical storm drain bedding details or reference note.
☑	☐	☐	Standard details or reference note for all proposed access structure types (inlets, manholes, junctions, etc.).
☑	☐	☐	Inlet shaping detail or applicable reference note.
☐	☐	☑	Step detail or applicable reference note (if depth 4 ft. or more).
☑	☐	☐	Typical open channel details with designation, location, shape, type, bottom width, top width, lining, slope, length, side slope, and installation depth required for construction. Channel design data as necessary may also be included.
☑	☐	☐	Outlet protections at all pipe outfalls.

Yes No N/A

☑ ☐ ☐ *STORMWATER CONVEYANCE SYSTEM COMPUTATIONS*

- ☑ ☐ ☐ Storm Sewer Design computations based on 10-year design event.
- ☑ ☐ ☐ Hydraulic Grade Line computations based on 10-year design event.
- ☑ ☐ ☐ Inlet computations based on current VDOT procedure for spread, ponding depth and grate size required.
- ☑ ☐ ☐ Culvert Headwater computations. Design based on 10-year design storm event and check only for 100-year storm event.
- ☑ ☐ ☐ Open Channel computations based on 2-year design event for velocity and 10-year design event for capacity.
- ☑ ☐ ☐ Standard outlet protection or special energy dissipators.
- ☑ ☐ ☐ Pipe thickness design computations, as required, for selected pipe type (live load, minimum cover, maximum height of cover, etc.).
- ☑ ☐ ☐ Adequate channel computations for receiving channels (based on field measured channel section data).

III. *STORMWATER MANAGEMENT / BMP FACILITIES:*

Yes No N/A

☑ ☐ ☐ *HYDROLOGY* - An SCS based methodology is required for the design of stormwater management/BMP facilities with watersheds exceeding 20 acres. Under 20 acres, other generally accepted methodologies such as the modified rational, critical storm are allowable. Refer to Chapter 5 of the VESCH or Chapter 5 of the VSMH.

- ☑ ☐ ☐ RCN determinations: predeveloped and ultimate development land use scenarios.
- ☑ ☐ ☐ Time of concentration: predeveloped and ultimate development indicating overland, shallow concentrated, and channel flow components (200 ft. maximum length for overland flow).
- ☑ ☐ ☐ Hydrograph generation (tabular or graphical): pre- and postdevelopment conditions for the 1-, 2-, 10-, and 100-year design storm events.

☑ ☐ ☐ *FACILITY CONFIGURATION and MINIMUM SEPARATIONS*

- ☐ ☐ ☑ Screening and layout consistent with Section 24-98(d) of the Chapter 24 Zoning ordinance (landscaping, screening, visibility, etc.).
- ☐ ☐ ☑ Basic considerations for safety and unauthorized entry.
- ☑ ☐ ☐ Proper length to width ratio (Typically 2H:1V).
- ☐ ☐ ☑ Facilities with deep pools (4 feet or more in depth) provided with two benches. Fifteen (15) ft. safety bench outward from normal pool at maximum 6 percent slope and aquatic bench inward from normal shoreline below normal pool. Narrower widths may be considered on a case-by-case basis.
- ☑ ☐ ☐ Pond buffer minimum 25 feet outward from maximum design WSEL. Additional setbacks may be required to permanent structures.
- ☑ ☐ ☐ No trees, shrubs or woody plants within 15 feet of embankment toe or 25 feet from principal spillway structure.

Yes	No	N/A	
☑	☐	☐	Infiltration and filtering system facilities generally located at least 100 feet horizontally from any water supply well; 100 feet from any downslope building; and 25 feet from any upslope buildings, unless site specific investigation allows for reduced separation.

Yes	No	N/A	
☑	☐	☐	*HYDRAULIC COMPUTATIONS*
☑	☐	☐	Elevation or Stage - Storage curve and tabular data.
☑	☐	☐	Weir / Orifice control - Extended Detention Control.
☑	☐	☐	Weir / Orifice Control - riser 1-year control for stream protection.
☑	☐	☐	Weir / Orifice Control - riser 2 year control for quantity (if required).
☐	☐	☐	Weir / Orifice Control - riser 10 year control for quantity.
☑	☐	☐	Inlet / Outlet (barrel) control - (All Storms).
☑	☐	☐	Check for barrel control prior to riser orifice flow to prevent slug flow-water hammer conditions.
☐	☐	☑	Emergency spillway capacity and depth of flow.
☑	☐	☐	Elevation - Discharge (Outlet Rating) table and curve. Provide all supporting calculations and/or design assumptions.
☑	☐	☐	Adequate channel computations for receiving channel. May be waived if facility is designed based on current Stream Channel Protection criteria.
☑	☐	☐	*POND or RESERVOIR ROUTING*
☑	☐	☐	Storage-Indication Routing of postdeveloped inflow hydrographs for the 1-, 2-, 10-, and 100-year design storms. Preference is for structure to discharge up to the 10-year storm through the principal spillway and pass the 100-year storm with a minimum 1 foot of freeboard through a combination principal and emergency spillways. If no emergency spillway is provided, riser must be large enough to pass the design high water flow and trash without overtopping the facility, have 3 square feet or more of cross-sectional area, contain a hood type inlet and have a minimum freeboard of 2 feet. Token spillways with minimum 8 ft. width are also recommended at or above the design 100-year storm elevation.
☑	☐	☐	Downstream hydrographs at established study points, if conditions warrant (ie. facility discharge combined with uncontrolled bypass).
☑	☐	☐	*MISCELLANEOUS COMPUTATIONS*
☑	☐	☐	Water quality volume for permanent pool based on selected BMP treatment volume (WQv).
☑	☐	☐	Water quality volume for extended detention based on selected BMP treatment volume (WQv) with drawdown computations.
☑	☐	☐	Drawdown computations for the 1-year, 24 hour detention for stream channel protection criteria.
☑	☐	☐	Pond drain computations (within 24 hours).
☐	☐	☑	Anti-seep collar design. (concrete preferred) or match material type.
☐	☐	☑	Filter diaphragm design (or alternative method of controlling seepage).

Yes No N/A

☐ ☐ ☑ Riser / base structure flotation analyses. FS = 1.25 minimum.

☐ ☐ ☑ Downstream danger reach study and/or emergency action plan (if conditions warrant).

☐ ☐ ☑ Upstream backwater analyses onto offsite adjacent property (if conditions warrant).

☑ ☐ ☐ 100 year floodplain impacts (if conditions warrant).

Yes No N/A

☐ ☐ ☐ *GEOTECHNICAL REQUIREMENTS*

☐ ☐ ☐ Geotechnical report with recommendations specific to BMP facility type selected. Report prepared by a registered professional engineer. Requires submission, review and approval prior to issuance of Land Disturbance Permit.

☐ ☐ ☐ Initial Feasibility Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).

☐ ☐ ☐ Concept Design Testing requirements satisfied as per Appendix E of the James City County Guidelines for Design and Construction of Stormwater Management BMPs manual. (Infiltration, Bioretention and Filtering System BMP types only).

☐ ☐ ☐ Minimum Boring locations: borrow area, pool area, principal control structure, top of facility near one abutment or emergency spillway if provided.

☐ ☐ ☐ Boring logs with Unified Soil Classification (ASTM D2487), soils descriptions and depths to bedrock and the seasonal water table indicated.

☐ ☐ ☐ Standard County Record Drawing/Construction Certification note provided on plan. *Note: It is understood that preparation of record drawings and construction certifications as required for project facilities may not necessarily be performed by the plan preparer. These components may be performed by others.*

☐ ☐ ☑ *PRINCIPAL SPILLWAY PROFILE AND ASSOCIATED DETAILS*

☐ ☐ ☑ *EXISTING GROUND AND PROPOSED GRADE*

☐ ☐ ☐ Embankment or excavation side slopes labeled (3H:1V maximum).

☐ ☐ ☐ Minimum top width labeled (per VESCH or VSMH requirements).

☐ ☐ ☐ Removal of unsuitable material under proposed facility (per geotechnical report requirements).

Yes No N/A

☐ ☐ ☑ *CORE TRENCH*

- ☐ ☐ ☐ Material (per plan or Geotechnical Report).
- ☐ ☐ ☐ Bottom width (4' minimum or greater as dictated by geotechnical report recommendations).
- ☐ ☐ ☐ Side slopes (1:1 maximum steepness)
- ☐ ☐ ☐ Depth (4' minimum or greater as dictated by Geotechnical Report).

☐ ☐ ☑ *PRINCIPAL CONTROL STRUCTURE. RISER OR SIMILAR STRUCTURE (DETAILS REQUIRED FOR ALL ITEMS)*

- ☐ ☐ ☐ Durable, watertight, resistant material (concrete preferred).
- ☐ ☐ ☐ Riser diameter is at least 1.25 times larger than barrel diameter.
- ☐ ☐ ☐ All pertinent dimensions and elevations shown.
- ☐ ☐ ☐ Control orifice or weir dimensions and elevations shown.
- ☐ ☐ ☐ Trash rack - removable - for each release.
- ☐ ☐ ☐ Anti-vortex device, baffle or plate.
- ☐ ☐ ☐ Riser base structure with dimensions and embedment specifications (concrete preferred).
- ☐ ☐ ☐ Interior access (steps, ladders, etc.) for maintenance for structures over 4 feet in height. Excessively high risers may need some form of exterior access on top portion.
- ☐ ☐ ☐ Low flow orifice with trash rack device.

☐ ☐ ☑ *PRINCIPAL CONTROL STRUCTURE OUTLET BARREL*

- ☐ ☐ ☐ Material (ASTM C-361 reinforced concrete pipe) with watertight joints. Prior approval required for all other pipe material (other RCP types, CMP, CPP, PVC, etc.).
- ☐ ☐ ☐ Support and bedding requirements for barrel - concrete cradles, etc. or as recommended by the Geotechnical Report.
- ☐ ☐ ☐ Pipe inverts, length, size, class and slope shown.
- ☐ ☐ ☐ Flared end section or endwall provided on barrel outlet.

☐ ☐ ☑ *SEEPAGE CONTROL*

- ☐ ☐ ☐ Phreatic line shown (4:1 slope measured from the intersection of the embankment and the principal spillway design high water).

☐ ☐ ☑ *ANTI-SEEP COLLARS*

- ☐ ☐ ☐ Anti-seep collar, concrete preferred.
- ☐ ☐ ☐ Size - 15 percent increase in length of saturation using outside pipe diameter.
- ☐ ☐ ☐ Spacing and location on barrel (located at least 2 feet from a pipe joint).

☐ ☐ ☑ *FILTER DIAPHRAGMS*

☐ ☐ ☐ Design based on latest NRCS design methods and certified by a professional engineer.

Yes No N/A

☑ ☐ ☐ *ELEVATION AND DIMENSIONAL DESIGN DATA*

- ☑ ☐ ☐ Top of facility - construction height and settled height (10 percent settlement).
- ☑ ☐ ☐ Crest of principal control structure spillway at least one (1) foot below crest of emergency spillway, if provided.
- ☐ ☐ ☑ Minimum freeboard of one (1) foot above the 100-year design high water elevation for facilities <u>with</u> an emergency spillway.
- ☐ ☐ ☑ Minimum freeboard of two (2) feet above the 100-year design high water elevation for facilities <u>without</u> an emergency spillway or in accordance with the SCS National Engineering Handbook (prior approval required).
- ☐ ☐ ☐ Basin Sediment Clean-Out elevation (permanent mode). Typically 10 to 25 percent of water quality volume.

☑ ☐ ☐ *CROSS SECTION THROUGH FACILITY*

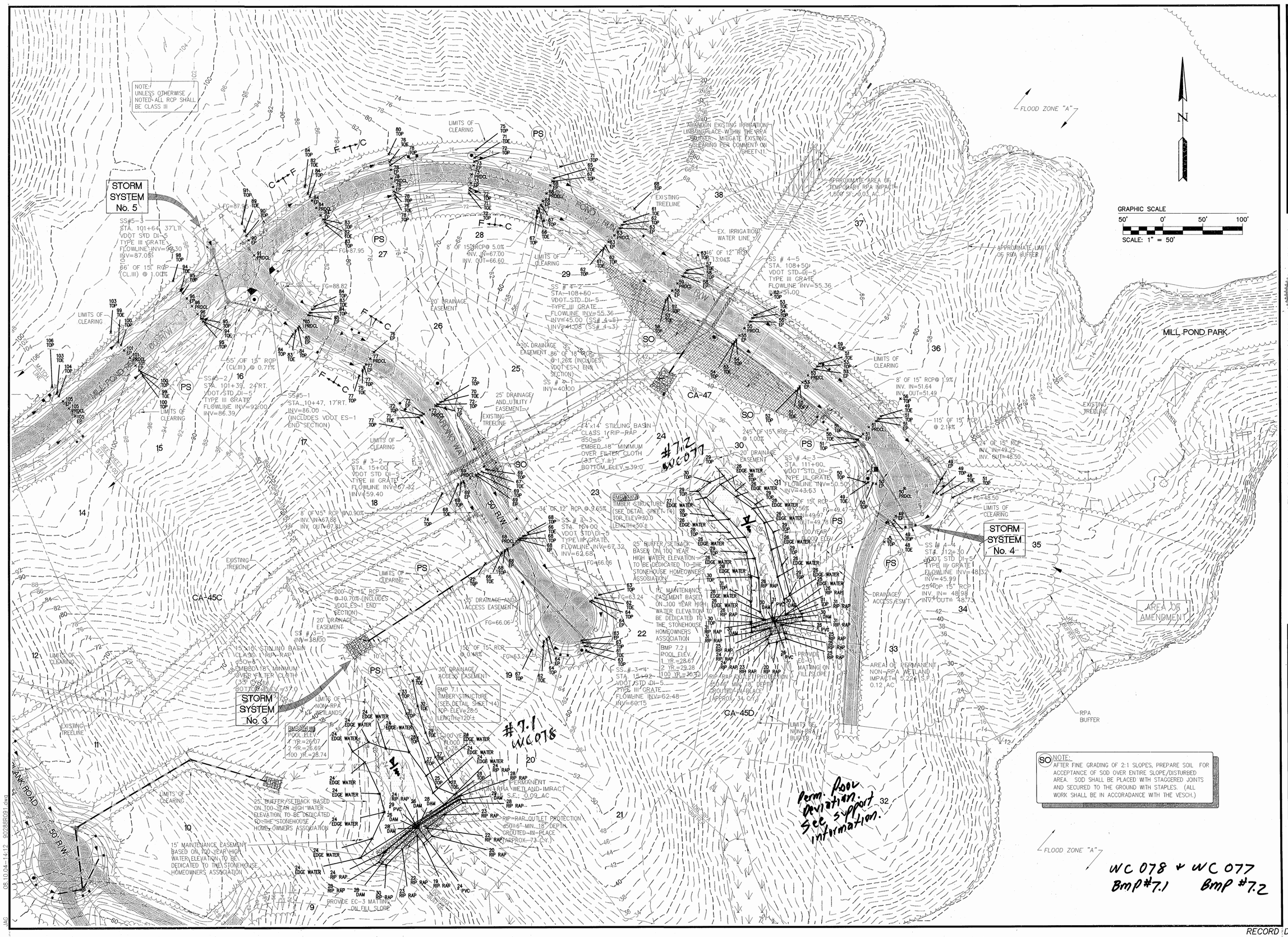
- ☑ ☐ ☐ Existing Ground.
- ☑ ☐ ☐ Proposed grade.
- ☑ ☐ ☐ Top of facility - constructed and settled.
- ☐ ☐ ☑ Location of emergency spillway with side slopes labeled (emergency spillway in cut).
- ☐ ☐ ☑ Bottom of core trench (4' minimum).
- ☐ ☐ ☑ Location of each soil boring.
- ☑ ☐ ☐ Barrel location.
- ☐ ☐ ☑ Existing and proposed utility location/protection.

☐ ☐ ☑ *EMERGENCY SPILLWAY PROFILE*

- ☐ ☐ ☐ Existing ground.
- ☐ ☐ ☐ Inlet, level (control) and outlet sections per SCS.
- ☐ ☐ ☐ Spillway and crest elevations.

☐ ☐ ☑ *PRETREATMENT DEVICES* of adequate depth and properly designed using required pretreatment volumes for the selected County BMP facility type. Including, but not limited to: sediment forebays, sediment basins, sumps, grass channels, gravel diaphragms, plunge pools, chamber separators, manufactured systems or other acceptable methods.

Yes	No	N/A	
☑	☐	☐	*CONSTRUCTION SPECIFICATIONS and NOTES*
☑	☐	☐	Anticipated sequence of construction for BMP (consistent with erosion and sediment control plan).
☑	☐	☐	Provisions to control base stream or storm flow conditions encountered during construction.
☑	☐	☐	Site and subgrade preparation requirements.
☐	☐	☑	Embankment, fill and backfill material soil and placement (lift) thickness requirements.
☐	☐	☑	Compaction and soil moisture content requirements.
☐	☐	☑	Geosynthetics for drainage, filtration, moisture barrier, separation, and reinforcement purposes.
☐	☐	☑	Clay or synthetic (PVC or HDPE) pond liners.
☑	☐	☐	Storm drain, underdrain and pipe conduit requirements.
☐	☐	☑	Minimum depth of pipe cover for temporary (construction) and final cover conditions.
☐	☐	☑	Permanent shutoff valve and pond drain.
☐	☐	☑	Concrete requirements for structural components.
☑	☐	☐	Riprap and slope protection.
☐	☐	☑	Access or maintenance road surface, base, subbase.
☑	☐	☐	Temporary and permanent stabilization measures.
☐	☐	☑	Temporary or permanent safety fencing.
☐	☐	☑	BMP Landscaping (deep, shallow, fringe, perimeter,etc.)
☐	☐	☑	Dust and traffic control (if warranted).
☐	☐	☐	Construction monitoring and certification by professional.
☐	☐	☐	Other: _____
☐	☐	☐	Other: _____.
☑	☐	☐	*MAINTENANCE PROVISIONS*
☑	☐	☐	Entity responsible for maintenance identified..
☑	☐	☐	Maintenance Plan which outlines the long-term schedule for inspection/maintenance of the facility and forebays
☐	☐	☑	Maintenance access from public right-of-way or publicly traveled road.
☑	☐	☐	Maintenance easement provided encompassing high water pool and buffer, principal and emergency spillways, outlet structures, forebays, embankment area and possible sediment-removal stockpile areas.
☐	☐	☑	Minimum 6 foot wide public safety shelf (landing) or alternative fencing.



SO NOTE:
AFTER FINE GRADING OF 2:1 SLOPES, PREPARE SOIL FOR ACCEPTANCE OF SOD OVER ENTIRE SLOPE/DISTURBED AREA. SOD SHALL BE PLACED WITH STAGGERED JOINTS AND SECURED TO THE GROUND WITH STAPLES. (ALL WORK SHALL BE IN ACCORADANCE WITH THE VESCH.)

No.	DATE	REVISION / COMMENT / NOTE	BY
2	8/16/04	RECORD DRAWING	TCS
1	12/9/02	NO CHANGES THIS SHEET	VMB

COMMONWEALTH OF VIRGINIA
VAUGHAN MARC BENNETT
No. 0408
12/10/02
PROFESSIONAL ENGINEER

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

DRAINAGE AND GRADING PLAN
SECTION VII-A "RICHARDSON'S MILL" SECTION I
AT STONEHOUSE FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.

STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
VMB/RDS	AWT
Scale	Date
1"=50'	10/26/01

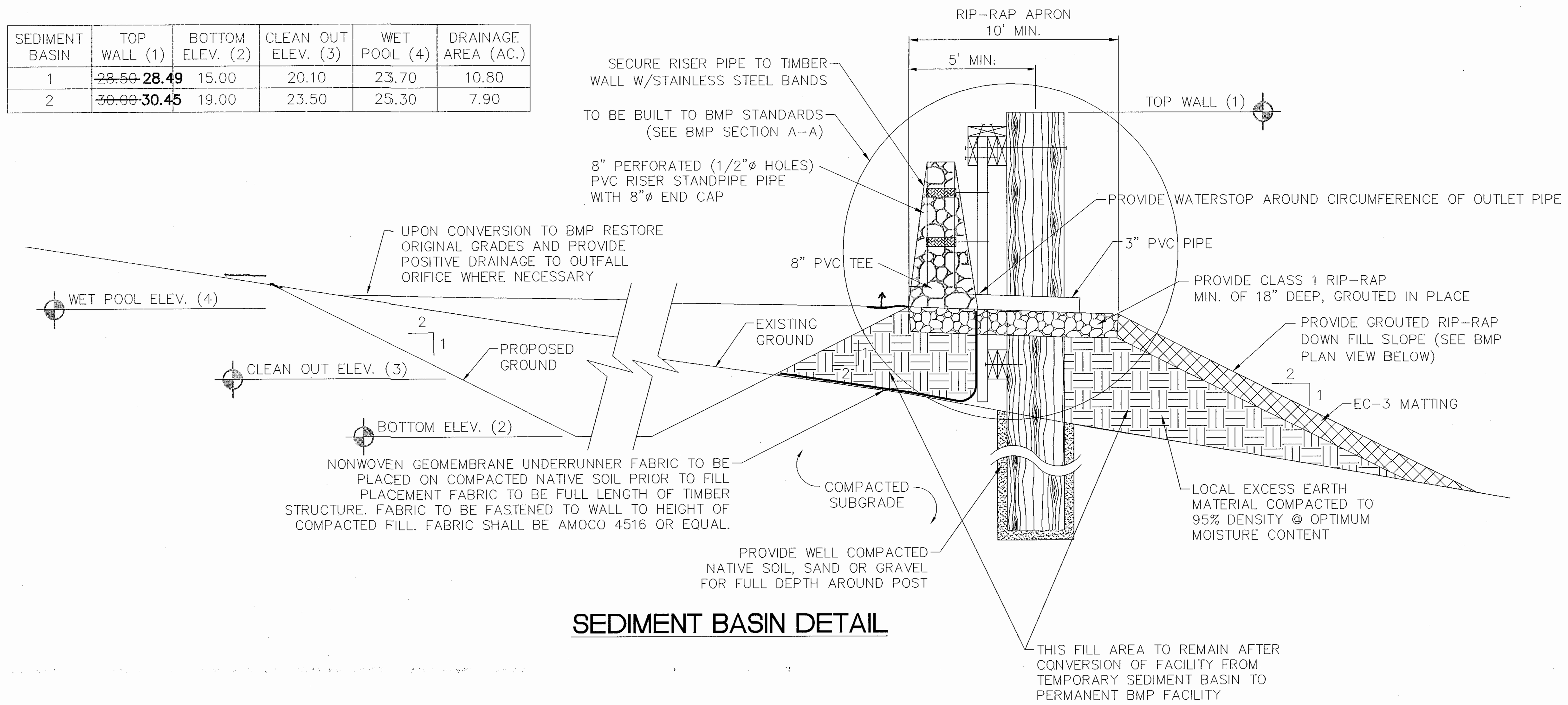
Project No. 9028-08

Drawing No. 9

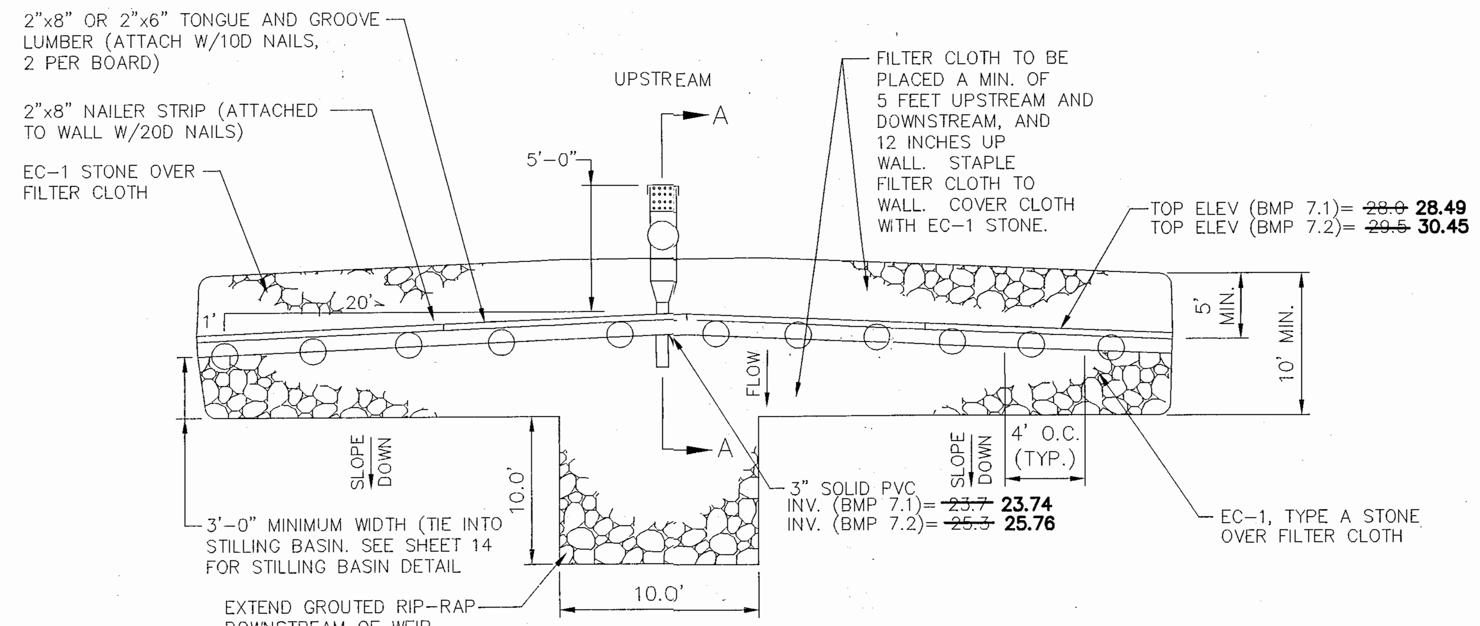
RECORD DRAWING–8/16/04

08.10.04-14:12 9028SR091.dwg
WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 039

SEDIMENT BASIN	TOP WALL (1)	BOTTOM ELEV. (2)	CLEAN OUT ELEV. (3)	WET POOL (4)	DRAINAGE AREA (AC.)
1	~~28.50~~ **28.49**	15.00	20.10	23.70	10.80
2	~~30.00~~ **30.45**	19.00	23.50	25.30	7.90



SEDIMENT BASIN DETAIL



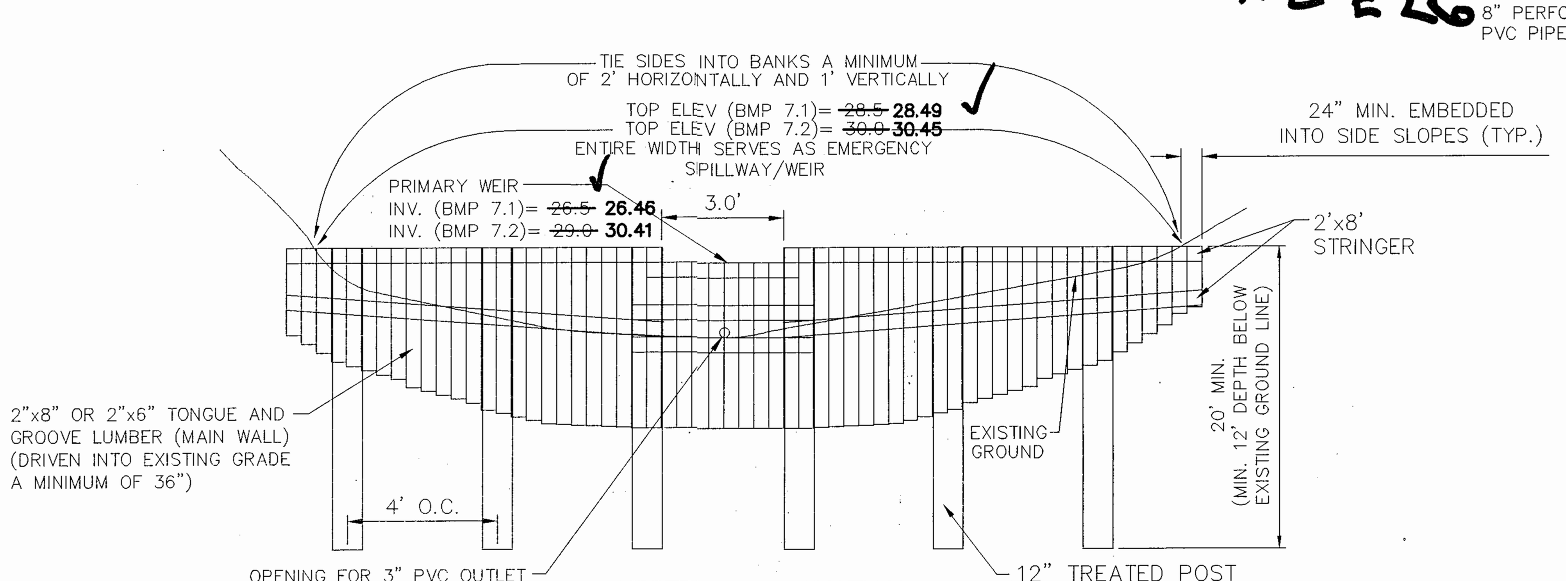
NOTE:
CONSTRUCT TIMBER STRUCTURE TO BE CONVEX UPSTREAM (AS SHOWN)

PLAN VIEW
SCALE: NONE

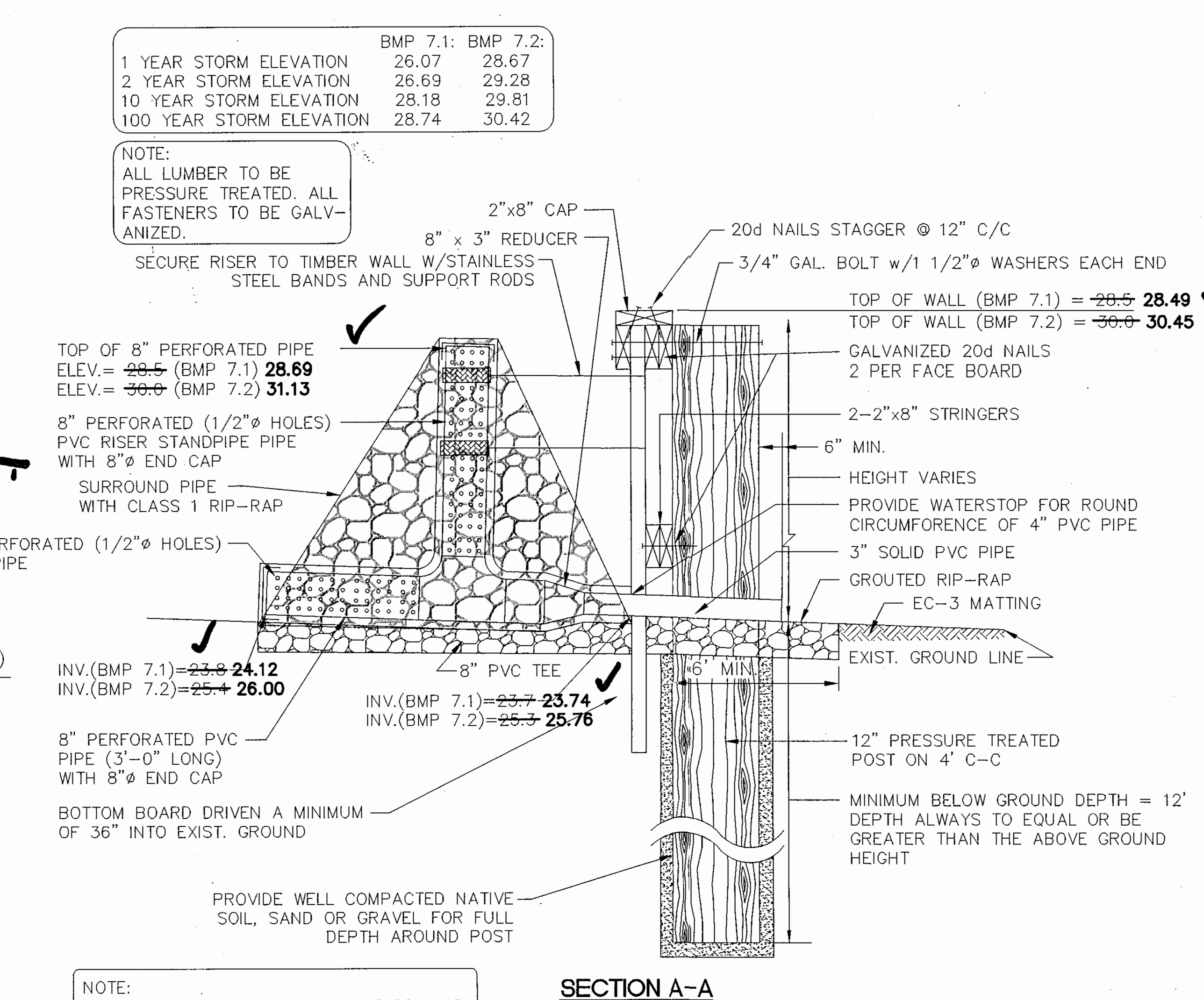
	BMP 7.1:	BMP 7.2:
1 YEAR STORM ELEVATION	26.07	28.67
2 YEAR STORM ELEVATION	26.69	29.28
10 YEAR STORM ELEVATION	28.18	29.81
100 YEAR STORM ELEVATION	28.74	30.42

NOTE:
ALL LUMBER TO BE PRESSURE TREATED. ALL FASTENERS TO BE GALVANIZED.

7.1 EL24
7.2 E26



UPSTREAM ELEVATION
SCALE: NONE



NOTE:
ALL PVC PIPING USED SHOULD BE SCH. 40.

SECTION A-A
NOT TO SCALE

PRESSURE TREATED WOOD DRY DETENTION STRUCTURE

GENERAL NOTES FOR CONSTRUCTION OF STORMWATER BASINS

1. THE CONTRACTOR SHALL PROVIDE ALL WORK AND MATERIALS NEEDED TO CONSTRUCT THE STORMWATER BASIN, STORMWATER MANAGEMENT PONDS, BEST MANAGEMENT PRACTICES, SEDIMENT BASINS AND SEDIMENT TRAPS. THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT AND MATERIALS NEEDED FOR THE COMPLETION OF GRADING AND EARTHWORK ASSOCIATED WITH THE CONSTRUCTION.

2. THE OWNER SHALL CONSULT AND PROVIDE FOR THE SERVICES OF A GEOTECHNICAL ENGINEER. THE GEOTECHNICAL ENGINEER SHALL PROVIDE TEST RESULTS ON PLACED FILL MATERIALS, IDENTIFYING SOIL CLASSIFICATION, PERMEABILITY, PLASTICITY INDEX, AND COMPACTION. ALL TESTS SHALL BE IN CONFORMANCE WITH ASTM STANDARDS. THE COST OF THE SERVICES OF THE GEOTECHNICAL ENGINEER SHALL BE THE RESPONSIBILITY OF THE OWNER. SATISFACTORY GEOTECHNICAL RESULTS ARE NEEDED PRIOR TO FINAL APPROVAL.

3. ALL INSPECTIONS REQUIRED FOR THE WORK SHALL BE PERFORMED BY A GEOTECHNICAL ENGINEER AT THE EXPENSE OF THE OWNER.

4. ON-SITE EXCAVATED MATERIAL, IF DETERMINED SUITABLE FOR USE AS FILL MATERIAL BY A GEOTECHNICAL ENGINEER, MAY BE USED FOR CONSTRUCTION. SHOULD ADDITIONAL MATERIAL BE REQUIRED, THE CONTRACTOR SHALL IDENTIFY THE NEED FOR MATERIAL TO THE OWNER, AS ADDITIONAL BORROW MATERIAL MAY BE AVAILABLE ON THE STONEHOUSE PROPERTY. ALL EXCAVATED MATERIAL DETERMINED BY THE GEOTECHNICAL ENGINEER TO BE UNSUITABLE SHALL BE DISPOSED OF PROPERLY AT THE CONTRACTOR'S EXPENSE. ALL EXCAVATED MATERIAL NOT REQUIRED FOR BACKFILLING SHALL EITHER BE DEPOSITED ON SITE AND SPREAD BY THE CONTRACTOR, OR SHALL BE DEPOSITED IN AN AREA ON THE STONEHOUSE PROPERTY AS DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE PROPER STABILIZATION, AND EROSION AND SEDIMENT CONTROL MEASURES NEEDED TO CONTROL AS PER THE VESCH THIRD EDITION.

5. RECORD DRAWINGS (AS-BUILTS) OF THE STORMWATER MANAGEMENT FACILITY PROPOSED ON THESE DRAWINGS MUST BE SUPPLIED TO THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION WITHIN 30 DAYS OF COMPLETION OF THE SWM/BMP FACILITY. A CONSTRUCTION CERTIFICATE OF THE SWM/BMP SHALL BE SUPPLIED WITH THE RECORD DRAWINGS. RECORD DRAWINGS AND SWM/BMP CERTIFICATION SHALL BE SUBMITTED, REVIEWED AND APPROVED BY THE STAFF OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION PRIOR TO THE RELEASE OF POSTED BONDS AND/OR SURETIES.

STORMWATER MANAGEMENT/ BMP FACILITY MAINTENANCE PLAN FOR BMP 7.1 AND 7.2

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT IN TO THE FACILITY, SPILLWAY(S) AND DOWNSTREAM WATERWAYS. FOLLOWING INSTALLATION OF THE FACILITY AND ESTABLISHMENT OF VEGETATION IN DISTURBED AREAS, INSPECTIONS FOR SEDIMENT BUILDUPS WILL BE PERFORMED AT LEAST QUARTERLY. IT IS ANTICIPATED THAT UNDER NORMAL CONDITIONS, SEDIMENT REMOVAL FROM THE FACILITY WILL BE REQUIRED ONCE EVERY 10 YEARS. IF OTHER CONSTRUCTION OR RELATED ACTIVITIES ARE PERFORMED ON UPSLOPE PARCELS, ADEQUATE PROTECTION SHOULD BE PROVIDED AND INSPECTIONS PERFORMED AT LEAST ONCE WEEKLY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE SWM STRUCTURE AFTER EACH SIGNIFICANT RAINFALL EVENT OR THE FOLLOWING WORKING DAY IF A WEEKEND OR HOLIDAY OCCURS. A SIGNIFICANT RAINFALL FOR THIS STRUCTURE IS DEFINED AS ONE (1) INCH OR MORE OF GAUGED RAINFALL WITHIN A 24 HOUR PERIOD. ONCE PER YEAR, A REPRESENTATIVE OF THE COUNTY MAY JOINTLY INSPECT THE STRUCTURE. APPROPRIATE ACTION, PERFORMED AT THE COST OF THE OWNER, WILL BE TAKEN TO ENSURE APPROPRIATE MAINTENANCE. WHERE STRUCTURES ARE TO BE MAINTAINED JOINTLY, ALLOCATION OF MAINTENANCE COSTS WILL BE IN ACCORDANCE WITH THE TERMS ESTABLISHED IN MAINTENANCE AGREEMENTS. KEYS TO LOCKED ACCESS POINTS SHALL BE MADE AVAILABLE TO COUNTY INSPECTION PERSONNEL UPON REQUEST.

INSPECTION AND MAINTENANCE OF THE FACILITY WILL CONSIST OF THE FOLLOWING ADDITIONAL MEASURES:

1. THE INSPECTION FOR SEDIMENT BUILDUP WILL BE PERFORMED BY VISUAL INSPECTION AND A PHYSICAL DETERMINATION OF SEDIMENT DEPTH WITHIN THE STORAGE AREA. IF THE DEPTH OF SEDIMENT REACHES THE DEPTH OF 1.0 ft. ABOVE THE BOTTOM OF THE LOW FLOW ORIFICE IN THE TIMBER WALL, REMOVAL IS REQUIRED USING A RUBBER-WHEELED BACKHOE. AT THIS TIME, THE STILLING BASINS LOCATED AT THE OUTFALLS OF THE STORM SEWER PIPE SYSTEMS SHALL ALSO BE INSPECTED. IF THE DEPTH OF SEDIMENT WITHIN THE STILLING BASINS REACHES A DEPTH OF 18" ABOVE THE BOTTOM OF THE BASIN OR 6" ABOVE THE INVERT OF THE OUTFALL PIPE, REMOVAL OF THE MATERIAL IS REQUIRED. AT THE SAME TIME, OR AT LEAST ONCE PER YEAR, CLEAN THE OUTLET PIPES WITHIN THE TIMBER WALL DETENTION BASINS OF ACCUMULATED SEDIMENTS. DISPOSE OF SEDIMENTS REMOVED FROM THE FACILITY AT AN ACCEPTABLE DISPOSAL AREA.

2. PERFORM QUARTERLY INSPECTIONS OF THE TIMBER STRUCTURE AND SPILLWAY DEVICES FOR THE OBSERVANCE OF COLLECTED DEBRIS. IMMEDIATELY REMOVE ANY DEBRIS TO MAINTAIN THE INTEGRITY OF THE STRUCTURE AND PROVIDE AN ATTRACTIVE APPEARANCE.

3. PERFORM YEARLY STRUCTURAL INSPECTIONS OF THE FACILITY FOR DAMAGE. STRUCTURAL INSPECTION SHALL BE PERFORMED ON THE TIMBER WALL, ORIFICE/ WEIR(S), OUTLET DEVICE AND STONE APRONS. IF DAMAGE IS EVIDENT, FURTHER INVESTIGATION BY A PROFESSIONAL ENGINEER MAY BE REQUIRED TO ASSESS THE INTEGRITY OF THE STRUCTURE.

4. PERFORM QUARTERLY INSPECTIONS OF THE GRADED SIDE SLOPES OF THE DETENTION FACILITY FOR SIGNS OF ANIMAL/ RODENT BORROWS OR SLOPE EROSION. IMMEDIATELY PERFORM NECESSARY REPAIRS, REFILLING OR RESEEDING AS APPROPRIATE.

5. RECORD KEEPING. THE OWNER OR DESIGNATED REPRESENTATIVE SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OR INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST.

6. THE FACILITY SHALL NOT BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT/ APPROVAL OF THE COUNTY.

CONVERSION OF SEDIMENT BASINS INTO BMP FACILITIES

BMP FACILITIES WILL INITIALLY BE CONSTRUCTED AS SEDIMENT BASINS REQUIRING EXCAVATION TO PROVIDE ADEQUATE STORAGE. ONCE J.C.C. ENVIRONMENTAL DIVISION GIVES CONCURRENCE TO REMOVE THE SEDIMENT BASIN FACILITIES, EXCAVATED MATERIAL SHOULD BE REPLACED. ORIGINAL GRADES SHOULD BE RESTORED AND POSITIVE DRAINAGE SHALL BE PROVIDED TO OUTFALL ORIFICE AS NECESSARY. ANY EXCESS EARTH OR SEDIMENT SHALL BE REMOVED AND DISPOSED OF BY CONTRACTOR. ALL DISTURBED AREA SHALL BE SEEDED AND STABILIZED.

JAN 30 HOA DEV

No.	DATE	REVISION / COMMENT / NOTE	BY
5	8/16/04	RECORD DRAWING	TCS
4	10/28/02	NO REVISION THIS SHEET	VMB
3	9/20/02	REVISED PER JCC COMMENTS DATED 9/6/02	VMB
2	7/26/02	REVISED PER JCC COMMENTS DATED 6/20/02	VMB
1	5/14/02	SHEET ADDED	VMB

COMMONWEALTH OF VIRGINIA
VAN MARC BENNETT
No. 15628
10/28/02
PROFESSIONAL ENGINEER

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

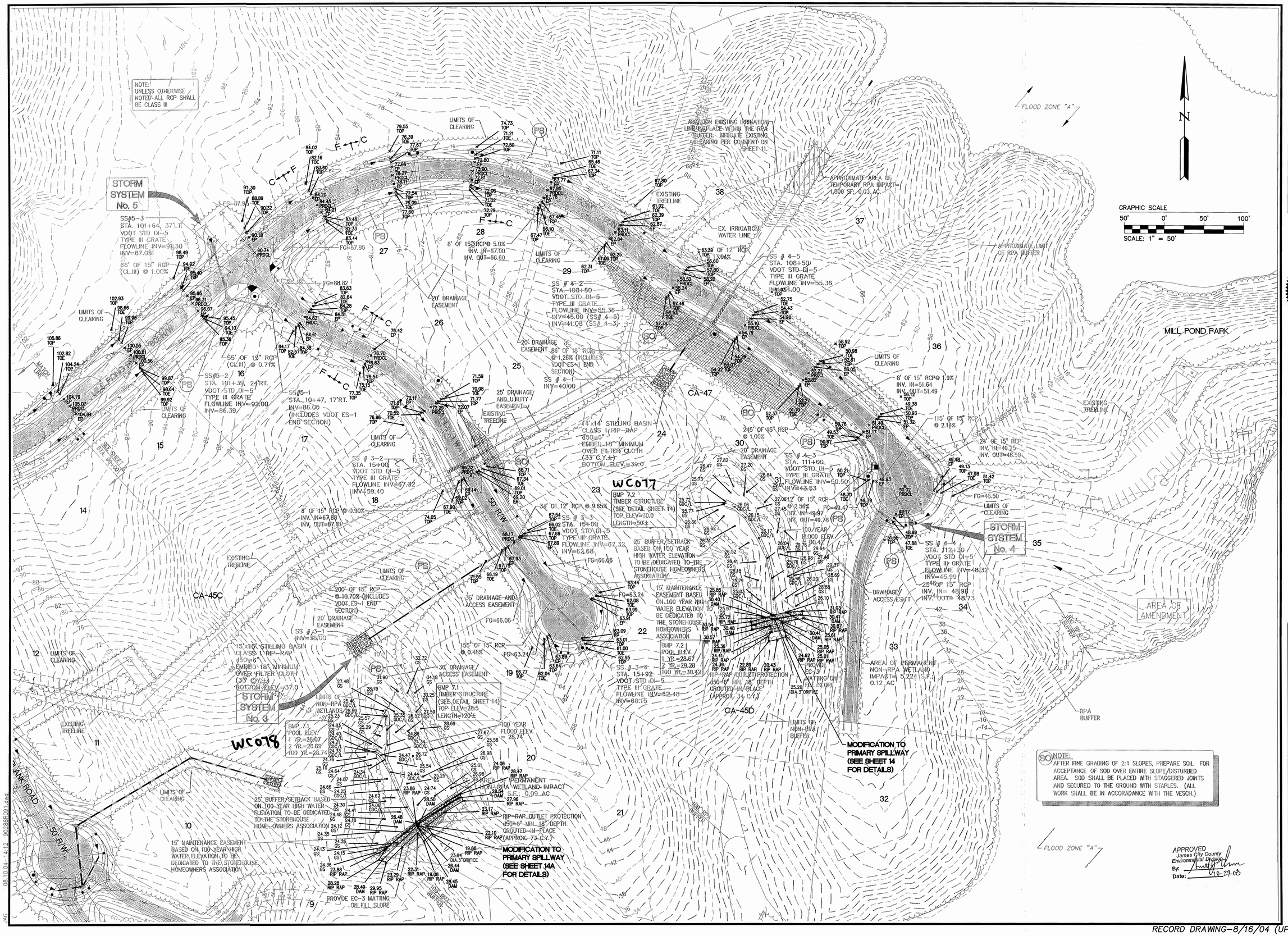
STORMWATER MANAGEMENT DETAILS
SECT.VII-A "RICHARDSON'S MILL" SECT. 1
AT STONEHOUSE FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
VMB/RDS	AWT
Scale	Date
NONE	5/3/02

Project No. 9028-8
Drawing No. 14

RECORD DRAWING-8/16/04

08.11.04-07:57 90288R14.dwg
JAG



No.	DATE	REVISION / COMMENT / NOTE	BY
7	6/20/08	BMP CONVERSION	VAB
6	10/8/07	MODIFICATION TO PRIMARY SPILLWAY	VAB
5	8/16/04	RECORD DRAWING	VMB
4	10/28/02	NO REVISION THIS SHEET	VMB
3	9/20/02	NO REVISION THIS SHEET	VMB
2	7/26/02	NO REVISION THIS SHEET	VMB
1	5/14/02	NO REVISION THIS SHEET	VMB

VIRGINIA PROFESSIONAL ENGINEER No. 26628 VAN MARC BENNETT 12/10/02

RECEIVED JUN 26 2008 ENVIRONMENTAL DIVISION

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

BMP MODIFICATION PLAN
SECTION VII-A "RICHARDSON'S MILL" SECTION I
AT STONEHOUSE FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.

STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
VMB/RDS	AWT
Scale	Date
1"=50'	10/26/01
Project No.	
9028-08	
Drawing No.	
9	

RECORD DRAWING-8/16/04 (UPDATED-6/20/08)

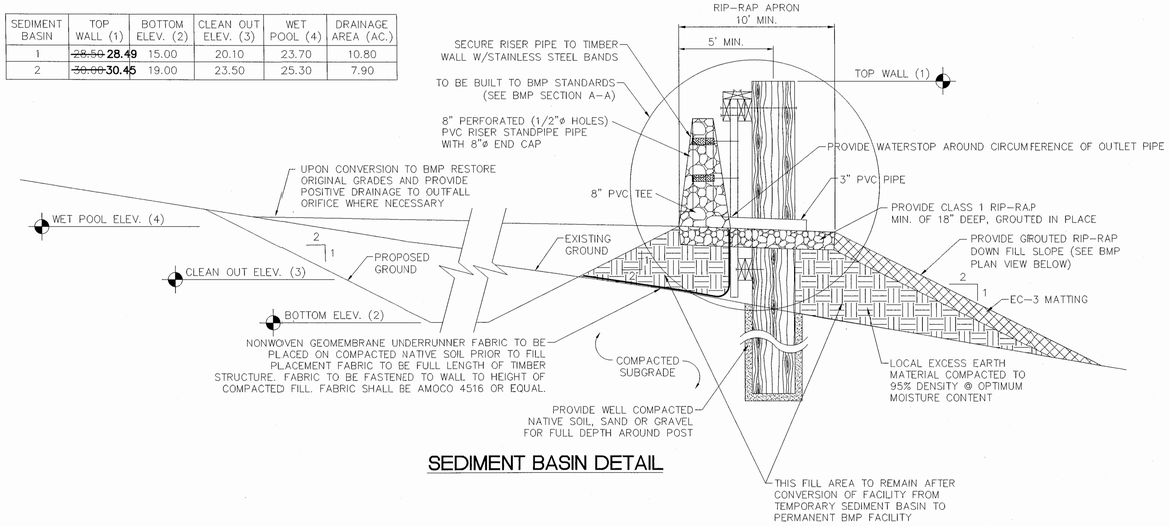
S:\Jobs\9028\08-Mill Pond ASB\dwg\Cad (asbuilts)\BMP Modifications\9028SR09.dwg, 6/25/2008 5:01:28 PM, bobby.sanders *

08.10.04-14:12 9028SR091.dwg

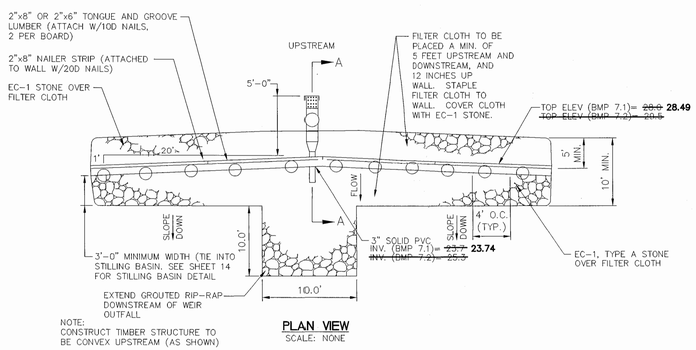
JAG

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 041

SEDIMENT BASIN	TOP WALL (1)	BOTTOM ELEV. (2)	CLEAN OUT ELEV. (3)	WET POOL (4)	DRAINAGE AREA (AC.)
1	~~28.50~~ **28.49**	15.00	20.10	23.70	10.80
2	~~30.00~~ **30.45**	19.00	23.50	25.30	7.90

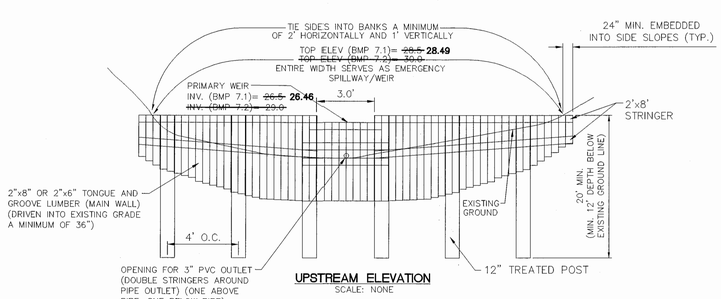


SEDIMENT BASIN DETAIL



NOTE:
CONSTRUCT TIMBER STRUCTURE TO BE CONVEX UPSTREAM (AS SHOWN)

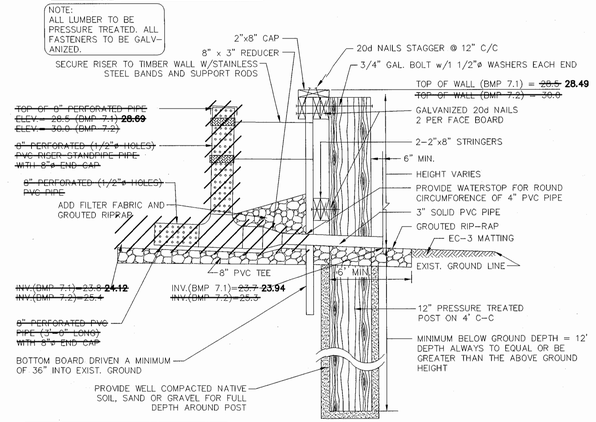
PLAN VIEW
SCALE: NONE



UPSTREAM ELEVATION
SCALE: NONE

	BMP 7.1:	~~BMP 7.2:~~
1 YEAR STORM ELEVATION	26.07	~~28.57~~
2 YEAR STORM ELEVATION	26.69	~~29.28~~
10 YEAR STORM ELEVATION	28.18	~~29.81~~
100 YEAR STORM ELEVATION	28.74	~~30.42~~

NOTE:
ALL LUMBER TO BE PRESSURE TREATED. ALL FASTENERS TO BE GALVANIZED.



NOTE:
ALL PVC PIPING USED SHOULD BE SCH. 40.

SECTION A-A
NOT TO SCALE

PRESSURE TREATED WOOD DRY DETENTION STRUCTURE WC07.1

GENERAL NOTES FOR CONSTRUCTION OF STORMWATER BASINS

1. THE CONTRACTOR SHALL PROVIDE ALL WORK AND MATERIALS NEEDED TO CONSTRUCT THE STORMWATER BASIN, STORMWATER MANAGEMENT PONDS, BEST MANAGEMENT PRACTICES, SEDIMENT BASINS AND SEDIMENT TRAPS. THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT AND MATERIALS NEEDED FOR THE COMPLETION OF GRADING AND EARTHWORK ASSOCIATED WITH THE CONSTRUCTION.

2. THE OWNER SHALL CONSULT AND PROVIDE FOR THE SERVICES OF A GEOTECHNICAL ENGINEER. THE GEOTECHNICAL ENGINEER SHALL PROVIDE TEST RESULTS ON PLACED FILL MATERIALS, IDENTIFYING SOIL CLASSIFICATION, PERMEABILITY, PLASTICITY INDEX, AND COMPACTION. ALL TESTS SHALL BE IN CONFORMANCE WITH ASTM STANDARDS. THE COST OF THE SERVICES OF THE GEOTECHNICAL ENGINEER SHALL BE THE RESPONSIBILITY OF THE OWNER. SATISFACTORY GEOTECHNICAL RESULTS ARE NEEDED PRIOR TO FINAL APPROVAL.

3. ALL INSPECTIONS REQUIRED FOR THE WORK SHALL BE PERFORMED BY A GEOTECHNICAL ENGINEER AT THE EXPENSE OF THE OWNER.

4. ON-SITE EXCAVATED MATERIAL, IF DETERMINED SUITABLE FOR USE AS FILL MATERIAL BY A GEOTECHNICAL ENGINEER, MAY BE USED FOR CONSTRUCTION. SHOULD ADDITIONAL MATERIAL BE REQUIRED, THE CONTRACTOR SHALL IDENTIFY THE NEED FOR MATERIAL TO THE OWNER, AS ADDITIONAL BORROW MATERIAL MAY BE AVAILABLE ON THE STONEHOUSE PROPERTY. ALL EXCAVATED MATERIAL DETERMINED BY THE GEOTECHNICAL ENGINEER TO BE UNSUITABLE SHALL BE DISPOSED OF PROPERLY AT THE CONTRACTOR'S EXPENSE. ALL EXCAVATED MATERIAL NOT REQUIRED FOR BACKFILLING SHALL EITHER BE DEPOSITED ON SITE AND SPREAD BY THE CONTRACTOR, OR SHALL BE DEPOSITED IN AN AREA ON THE STONEHOUSE PROPERTY AS DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE PROPER STABILIZATION, AND EROSION AND SEDIMENT CONTROL MEASURES NEEDED TO CONTROL AS PER THE VESCH THIRD EDITION.

5. RECORD DRAWINGS (AS-BUILTS) OF THE STORMWATER MANAGEMENT FACILITY PROPOSED ON THESE DRAWINGS MUST BE SUPPLIED TO THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION WITHIN 30 DAYS OF COMPLETION OF THE SWM/BMP FACILITY. A CONSTRUCTION CERTIFICATE OF THE SWM/BMP SHALL BE SUPPLIED WITH THE RECORD DRAWINGS. RECORD DRAWINGS AND SWM/BMP CERTIFICATION SHALL BE SUBMITTED, REVIEWED AND APPROVED BY THE STAFF OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION PRIOR TO THE RELEASE OF POSTED BONDS AND/OR SURETIES.

STORMWATER MANAGEMENT/ BMP FACILITY MAINTENANCE PLAN FOR BMP 7.1 AND 7.2

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT IN TO THE FACILITY, SPILLWAY(S) AND DOWNSTREAM WATERWAYS. FOLLOWING INSTALLATION OF THE FACILITY AND ESTABLISHMENT OF VEGETATION IN DISTURBED AREAS, INSPECTIONS FOR SEDIMENT BUILDUPS WILL BE PERFORMED AT LEAST QUARTERLY. IT IS ANTICIPATED THAT UNDER NORMAL CONDITIONS, SEDIMENT REMOVAL FROM THE FACILITY WILL BE REQUIRED ONCE EVERY 10 YEARS. IF OTHER CONSTRUCTION OR RELATED ACTIVITIES ARE PERFORMED ON UPSLOPE PARCELS, ADEQUATE PROTECTION SHOULD BE PROVIDED AND INSPECTIONS PERFORMED AT LEAST ONCE WEEKLY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE SWM STRUCTURE AFTER EACH SIGNIFICANT RAINFALL EVENT OR THE FOLLOWING WORKING DAY IF A WEEKEND OR HOLIDAY OCCURS. A SIGNIFICANT RAINFALL FOR THIS STRUCTURE IS DEFINED AS ONE (1) INCH OR MORE OF GAUGED RAINFALL WITHIN A 24 HOUR PERIOD. ONCE PER YEAR, A REPRESENTATIVE OF THE COUNTY MAY JOINTLY INSPECT THE STRUCTURE. APPROPRIATE ACTION, PERFORMED AT THE COST OF THE OWNER, WILL BE TAKEN TO ENSURE APPROPRIATE MAINTENANCE. WHERE STRUCTURES ARE TO BE MAINTAINED JOINTLY, ALLOCATION OF MAINTENANCE COSTS WILL BE IN ACCORDANCE WITH THE TERMS ESTABLISHED IN MAINTENANCE AGREEMENTS. KEYS TO LOCKED ACCESS POINTS SHALL BE MADE AVAILABLE TO COUNTY INSPECTION PERSONNEL UPON REQUEST.

INSPECTION AND MAINTENANCE OF THE FACILITY WILL CONSIST OF THE FOLLOWING ADDITIONAL MEASURES:

1. THE INSPECTION FOR SEDIMENT BUILDUP WILL BE PERFORMED BY VISUAL INSPECTION AND A PHYSICAL DETERMINATION OF SEDIMENT DEPTH WITHIN THE STORAGE AREA. IF THE DEPTH OF SEDIMENT REACHES THE DEPTH OF 1.0 ft. ABOVE THE BOTTOM OF THE LOW FLOW ORIFICE IN THE TIMBER WALL, REMOVAL IS REQUIRED USING A RUBBER-WHEELED BACKHOE. AT THIS TIME, THE STILLING BASINS LOCATED AT THE OUTFALLS OF THE STORM SEWER PIPE SYSTEMS SHALL ALSO BE INSPECTED. IF THE DEPTH OF SEDIMENT WITHIN THE STILLING BASINS REACHES A DEPTH OF 18" ABOVE THE BOTTOM OF THE BASIN OR 6" ABOVE THE INVERT OF THE OUTFALL PIPE, REMOVAL OF THE MATERIAL IS REQUIRED. AT THE SAME TIME, OR AT LEAST ONCE PER YEAR, CLEAN THE OUTLET PIPES WITHIN THE TIMBER WALL DETENTION BASINS OF ACCUMULATED SEDIMENTS. DISPOSE OF SEDIMENTS REMOVED FROM THE FACILITY AT AN ACCEPTABLE DISPOSAL AREA.

2. PERFORM QUARTERLY INSPECTIONS OF THE TIMBER STRUCTURE AND SPILLWAY DEVICES FOR THE OBSERVANCE OF COLLECTED DEBRIS. IMMEDIATELY REMOVE ANY DEBRIS TO MAINTAIN THE INTEGRITY OF THE STRUCTURE AND PROVIDE AN ATTRACTIVE APPEARANCE.

3. PERFORM YEARLY STRUCTURAL INSPECTIONS OF THE FACILITY FOR DAMAGE. STRUCTURAL INSPECTION SHALL BE PERFORMED ON THE TIMBER WALL, ORIFICE/WEIR(S), OUTLET DEVICE AND STONE APRONS. IF DAMAGE IS EVIDENT, FURTHER INVESTIGATION BY A PROFESSIONAL ENGINEER MAY BE REQUIRED TO ASSESS THE INTEGRITY OF THE STRUCTURE.

4. PERFORM QUARTERLY INSPECTIONS OF THE GRADED SIDE SLOPES OF THE DETENTION FACILITY FOR SIGNS OF ANIMAL/ RODENT BORROWS OR SLOPE EROSION. IMMEDIATELY PERFORM NECESSARY REPAIRS, REFILLING OR RESEEDING AS APPROPRIATE.

5. RECORD KEEPING. THE OWNER OR DESIGNATED REPRESENTATIVE SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OR INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST.

6. THE FACILITY SHALL NOT BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT/ APPROVAL OF THE COUNTY.

CONVERSION OF SEDIMENT BASINS INTO BMP FACILITIES

BMP FACILITIES WILL INITIALLY BE CONSTRUCTED AS SEDIMENT BASINS REQUIRING EXCAVATION TO PROVIDE ADEQUATE STORAGE. ONCE J.C.C. ENVIRONMENTAL DIVISION GIVES CONCURRENCE TO REMOVE THE SEDIMENT BASIN FACILITIES, EXCAVATED MATERIAL SHOULD BE REPLACED. ORIGINAL GRADES SHOULD BE RESTORED AND POSITIVE DRAINAGE SHALL BE PROVIDED TO OUTFALL ORIFICE AS NECESSARY. ANY EXCESS EARTH OR SEDIMENT SHALL BE REMOVED AND DISPOSED OF BY CONTRACTOR. ALL DISTURBED AREA SHALL BE SEEDED AND STABILIZED.

No.	DATE	REVISION / COMMENT / NOTE	BY
7	6/20/08	BMP CONVERSION	VAB
6	10/8/07	MODIFICATION TO PRIMARY SPILLWAY	VAB
5	8/16/04	NO REVISION THIS SHEET	VMB
4	10/28/02	NO REVISION THIS SHEET	VMB
3	9/20/02	REVISED PER JCC COMMENTS DATED 9/6/02	VMB
2	7/26/02	REVISED PER JCC COMMENTS DATED 6/20/02	VMB
1	5/14/02	SHEET ADDED	VMB

COMMONWEALTH OF VIRGINIA
VAN MARK BENNETT
No. 26628
10/28/02
PROFESSIONAL ENGINEER

JUN 2 6 2008
PROFESSIONAL ENGINEER

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

BMP MODIFICATION PLAN
SECT.VII-A "RICHARDSON'S MILL" SECT. 1
AT STONEHOUSE FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.

STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
VMB/RDS	AWT
Scale	Date
NONE	5/3/02

Project No. 9028-8

Drawing No. 14A

S:\Jobs\9028\08-Mill Pond ASB\dwg\Cad (asbuilts)\BMP Modifications\9028RR14A.dwg, 6/25/2008 5:00:59 PM, bobby.sanders

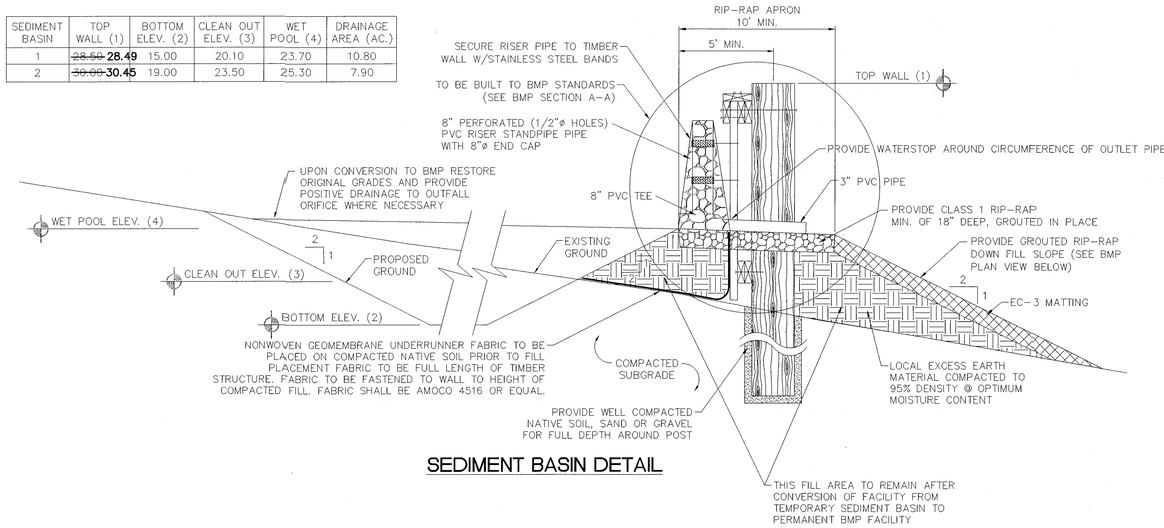
09.20.02-10:17 9028RC14.dwg

JAG

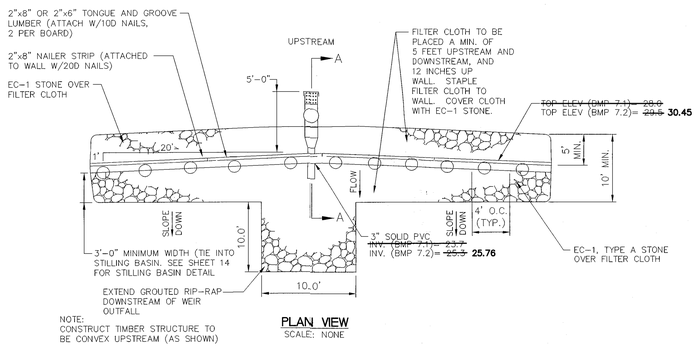
RECORD DRAWING-8/16/04 (UPDATED-6/20/08)

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 042

SEDIMENT BASIN	TOP WALL (1)	BOTTOM ELEV. (2)	CLEAN OUT ELEV. (3)	WET POOL (4)	DRAINAGE AREA (AC.)
1	~~28.50~~ **28.49**	15.00	20.10	23.70	10.80
2	~~30.00~~ **30.45**	19.00	23.50	25.30	7.90

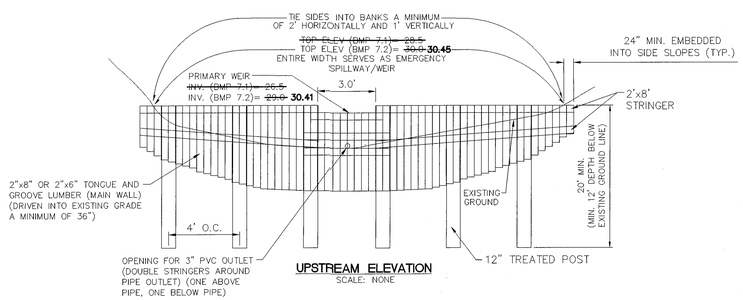


SEDIMENT BASIN DETAIL



NOTE:
CONSTRUCT TIMBER STRUCTURE TO BE CONVEX UPSTREAM (AS SHOWN)

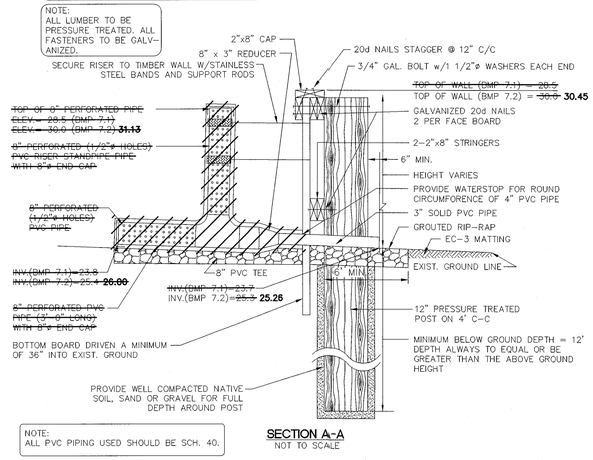
PLAN VIEW
SCALE: NONE



UPSTREAM ELEVATION
SCALE: NONE

	~~BMP 7.1~~	BMP 7.2:
1 YEAR STORM ELEVATION	~~26.07~~	28.67
2 YEAR STORM ELEVATION	~~26.59~~	29.28
10 YEAR STORM ELEVATION	~~26.18~~	29.81
100 YEAR STORM ELEVATION	~~28.74~~	30.42

NOTE:
ALL LUMBER TO BE PRESSURE TREATED. ALL FASTENERS TO BE GALVANIZED.



NOTE:
ALL PVC PIPING USED SHOULD BE SCH. 40.

SECTION A-A
NOT TO SCALE

PRESSURE TREATED WOOD DRY DETENTION STRUCTURE WC07.2

GENERAL NOTES FOR CONSTRUCTION OF STORMWATER BASINS

1. THE CONTRACTOR SHALL PROVIDE ALL WORK AND MATERIALS NEEDED TO CONSTRUCT THE STORMWATER BASIN, STORMWATER MANAGEMENT PONDS, BEST MANAGEMENT PRACTICES, SEDIMENT BASINS AND SEDIMENT TRAPS. THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT AND MATERIALS NEEDED FOR THE COMPLETION OF GRADING AND EARTHWORK ASSOCIATED WITH THE CONSTRUCTION.

2. THE OWNER SHALL CONSULT AND PROVIDE FOR THE SERVICES OF A GEOTECHNICAL ENGINEER. THE GEOTECHNICAL ENGINEER SHALL PROVIDE TEST RESULTS ON PLACED FILL MATERIALS, IDENTIFYING SOIL CLASSIFICATION, PERMEABILITY, PLASTICITY INDEX, AND COMPACTION. ALL TESTS SHALL BE IN CONFORMANCE WITH ASTM STANDARDS. THE COST OF THE SERVICES OF THE GEOTECHNICAL ENGINEER SHALL BE THE RESPONSIBILITY OF THE OWNER. SATISFACTORY GEOTECHNICAL RESULTS ARE NEEDED PRIOR TO FINAL APPROVAL.

3. ALL INSPECTIONS REQUIRED FOR THE WORK SHALL BE PERFORMED BY A GEOTECHNICAL ENGINEER AT THE EXPENSE OF THE OWNER.

4. ON-SITE EXCAVATED MATERIAL, IF DETERMINED SUITABLE FOR USE AS FILL MATERIAL BY A GEOTECHNICAL ENGINEER, MAY BE USED FOR CONSTRUCTION. SHOULD ADDITIONAL MATERIAL BE REQUIRED, THE CONTRACTOR SHALL IDENTIFY THE NEED FOR MATERIAL TO THE OWNER, AS ADDITIONAL BORROW MATERIAL MAY BE AVAILABLE ON THE STONEHOUSE PROPERTY. ALL EXCAVATED MATERIAL DETERMINED BY THE GEOTECHNICAL ENGINEER TO BE UNSUITABLE SHALL BE DISPOSED OF PROPERLY AT THE CONTRACTOR'S EXPENSE. ALL EXCAVATED MATERIAL NOT REQUIRED FOR BACKFILLING SHALL EITHER BE DEPOSITED ON SITE AND SPREAD BY THE CONTRACTOR, OR SHALL BE DEPOSITED IN AN AREA ON THE STONEHOUSE PROPERTY AS DIRECTED BY THE OWNER. THE CONTRACTOR SHALL PROVIDE PROPER STABILIZATION, AND EROSION AND SEDIMENT CONTROL MEASURES NEEDED TO CONTROL AS PER THE VESCH THIRD EDITION.

5. RECORD DRAWINGS (AS-BUILTS) OF THE STORMWATER MANAGEMENT FACILITY PROPOSED ON THESE DRAWINGS MUST BE SUPPLIED TO THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION WITHIN 30 DAYS OF COMPLETION OF THE SWM/BMP FACILITY. A CONSTRUCTION CERTIFICATE OF THE SWM/BMP SHALL BE SUPPLIED WITH THE RECORD DRAWINGS. RECORD DRAWINGS AND SWM/BMP CERTIFICATION SHALL BE SUBMITTED, REVIEWED AND APPROVED BY THE STAFF OF THE JAMES CITY COUNTY ENVIRONMENTAL DIVISION PRIOR TO THE RELEASE OF POSTED BONDS AND/OR SURETIES.

STORMWATER MANAGEMENT/ BMP FACILITY MAINTENANCE PLAN FOR BMP 7.1 AND 7.2

PROPER MAINTENANCE OF THIS FACILITY IS ENCOURAGED TO PREVENT THE INTRODUCTION OF DEBRIS AND SEDIMENT IN TO THE FACILITY, SPILLWAY(S) AND DOWNSTREAM WATERWAYS. FOLLOWING INSTALLATION OF THE FACILITY AND ESTABLISHMENT OF VEGETATION IN DISTURBED AREAS, INSPECTIONS FOR SEDIMENT BUILDUPS WILL BE PERFORMED AT LEAST QUARTERLY. IT IS ANTICIPATED THAT UNDER NORMAL CONDITIONS, SEDIMENT REMOVAL FROM THE FACILITY WILL BE REQUIRED ONCE EVERY 10 YEARS. IF OTHER CONSTRUCTION OR RELATED ACTIVITIES ARE PERFORMED ON UPSLOPE PARCELS, ADEQUATE PROTECTION SHOULD BE PROVIDED AND INSPECTIONS PERFORMED AT LEAST ONCE WEEKLY.

A DESIGNATED REPRESENTATIVE OF THE OWNER WILL INSPECT THE SWM STRUCTURE AFTER EACH SIGNIFICANT RAINFALL EVENT OR THE FOLLOWING WORKING DAY IF A WEEKEND OR HOLIDAY OCCURS. A SIGNIFICANT RAINFALL FOR THIS STRUCTURE IS DEFINED AS ONE (1) INCH OR MORE OF GAUGED RAINFALL WITHIN A 24 HOUR PERIOD. ONCE PER YEAR, A REPRESENTATIVE OF THE COUNTY MAY JOINTLY INSPECT THE STRUCTURE. APPROPRIATE ACTION, TO BE PERFORMED AT THE COST OF THE OWNER, WILL BE TAKEN TO ENSURE APPROPRIATE MAINTENANCE. WHERE STRUCTURES ARE TO BE MAINTAINED JOINTLY, ALLOCATION OF MAINTENANCE COSTS WILL BE IN ACCORDANCE WITH THE TERMS ESTABLISHED IN MAINTENANCE AGREEMENTS. KEYS TO LOCKED ACCESS POINTS SHALL BE MADE AVAILABLE TO COUNTY INSPECTION PERSONNEL UPON REQUEST.

INSPECTION AND MAINTENANCE OF THE FACILITY WILL CONSIST OF THE FOLLOWING ADDITIONAL MEASURES:

1. THE INSPECTION FOR SEDIMENT BUILDUP WILL BE PERFORMED BY VISUAL INSPECTION AND A PHYSICAL DETERMINATION OF SEDIMENT DEPTH WITHIN THE STORAGE AREA. IF THE DEPTH OF SEDIMENT REACHES THE DEPTH OF 1.0 ft. ABOVE THE BOTTOM OF THE LOW FLOW ORIFICE IN THE TIMBER WALL, REMOVAL IS REQUIRED USING A RUBBER-WHEELED BACKHOE. AT THIS TIME, THE STILLING BASINS LOCATED AT THE OUTFALLS OF THE STORM SEWER PIPE SYSTEMS SHALL ALSO BE INSPECTED. IF THE DEPTH OF SEDIMENT WITHIN THE STILLING BASINS REACHES A DEPTH OF 18" ABOVE THE BOTTOM OF THE BASIN OR 6" ABOVE THE INVERT OF THE OUTFALL PIPE, REMOVAL OF THE MATERIAL IS REQUIRED. AT THE SAME TIME, OR AT LEAST ONCE PER YEAR, CLEAN THE OUTLET PIPES WITHIN THE TIMBER WALL DETENTION BASINS OF ACCUMULATED SEDIMENTS. DISPOSE OF SEDIMENTS REMOVED FROM THE FACILITY AT AN ACCEPTABLE DISPOSAL AREA.

2. PERFORM QUARTERLY INSPECTIONS OF THE TIMBER STRUCTURE AND SPILLWAY DEVICES FOR THE OBSERVANCE OF COLLECTED DEBRIS. IMMEDIATELY REMOVE ANY DEBRIS TO MAINTAIN THE INTEGRITY OF THE STRUCTURE AND PROVIDE AN ATTRACTIVE APPEARANCE.

3. PERFORM YEARLY STRUCTURAL INSPECTIONS OF THE FACILITY FOR DAMAGE. STRUCTURAL INSPECTION SHALL BE PERFORMED ON THE TIMBER WALL, ORIFICE/ WEIR(S), OUTLET DEVICE AND STONE APRONS. IF DAMAGE IS EVIDENT, FURTHER INVESTIGATION BY A PROFESSIONAL ENGINEER MAY BE REQUIRED TO ASSESS THE INTEGRITY OF THE STRUCTURE.

4. PERFORM QUARTERLY INSPECTIONS OF THE GRADED SIDE SLOPES OF THE DETENTION FACILITY FOR SIGNS OF ANIMAL/ RODENT BORROWS OR SLOPE EROSION. IMMEDIATELY PERFORM NECESSARY REPAIRS, REFILLING OR RESEEDING AS APPROPRIATE.

5. RECORD KEEPING. THE OWNER OR DESIGNATED REPRESENTATIVE SHALL KEEP REASONABLE, ACCURATE WRITTEN RECORDS OR INSPECTIONS PERFORMED FOR THE STRUCTURE. RECORDS SHALL DOCUMENT OR REPAIRS PERFORMED. COPIES SHALL BE PROVIDED TO THE COUNTY UPON REQUEST.

6. THE FACILITY SHALL NOT BE MODIFIED IN ANY WAY WITHOUT PRIOR CONSENT/ APPROVAL OF THE COUNTY.

CONVERSION OF SEDIMENT BASINS INTO BMP FACILITIES

BMP FACILITIES WILL INITIALLY BE CONSTRUCTED AS SEDIMENT BASINS REQUIRING EXCAVATION TO PROVIDE ADEQUATE STORAGE. ONCE J.C.C. ENVIRONMENTAL DIVISION GIVES CONCURRENCE TO REMOVE THE SEDIMENT BASIN FACILITIES, EXCAVATED MATERIAL SHOULD BE REPLACED. ORIGINAL GRADES SHOULD BE RESTORED AND POSITIVE DRAINAGE SHALL BE PROVIDED TO OUTFALL ORIFICE AS NECESSARY. ANY EXCESS EARTH OR SEDIMENT SHALL BE REMOVED AND DISPOSED OF BY CONTRACTOR. ALL DISTURBED AREA SHALL BE SEEDED AND STABILIZED.

No.	DATE	REVISION / COMMENT / NOTE	BY
7	6/20/08	BMP CONVERSION	VAB
6	10/8/07	MODIFICATION TO PRIMARY SPILLWAY	VAB
5	8/16/04	RECORD DRAWING	TICS
4	10/28/02	NO REVISION THIS SHEET	VMB
3	9/20/02	REVISED PER JCC COMMENTS DATED 9/6/02	VMB
2	7/26/02	REVISED PER JCC COMMENTS DATED 5/20/02	VMB
1	5/14/02	SHEET ADDED	VMB

COMMONWEALTH OF VIRGINIA
VAN M. BENNETT
No. 26628
10/28/02
PROFESSIONAL ENGINEER

RECEIVED
JUN 26 2008
ENVIRONMENTAL DIVISION

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

BMP MODIFICATION PLAN
SECT.VII-A "RICHARDSON'S MILL" SECT. 1
AT STONEHOUSE FOR
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
STONEHOUSE DISTRICT — JAMES CITY COUNTY — VIRGINIA

Designed	Drawn
VMB/RDS	AWT
Scale	Date
NONE	5/3/02

Project No. 9028-8

Drawing No. 14

RECORD DRAWING-8/16/04 (UPDATED-6/20/08)

S:\Jobs\9028\08-Mill Pond ASBuilts\dwg\Cad (asbuilts)\BMP Modifications\90288R14.dwg, 6/25/2008 5:00:10 PM, bobby.sanders

08.11.04-07:57 90288R14.dwg

JAG

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 043

AES CONSULTING ENGINEERS
Engineering, Surveying, and Planning
5248 Olde Towne Road, Suite 1
WILLIAMSBURG, VIRGINIA 23188

Phone: (757) 253-0040
Fax: (757) 220-8994

LETTER OF TRANSMITTAL

RECEIVED
JUN 13 2006
ENVIRONMENTAL DIVISION

ATTN: **Scott Thomas**

CO.: James City County

Address: Environmental

cc:

DATE	JOB NO.
06/12/06	9028-08 & 9028-13

FROM: Victoria Bains

RE
Stonehouse Richardson's Mill
Section 1 & 2

WE ARE SENDING YOU THE FOLLOWING ITEMS: ☒ Attached ☐ Under separate cover via

☐ Original(s) ☐ Print(s) ☐ Plan(s) ☐ Specification(s) ☐ Change Order

☐ Copy of letter(s) ☐ Other:

COPIES	DATE	No. of Pages	DESCRIPTION
1	08/16/04	2	BMP Record Drawings # 7.1 & #7.2
1	08/16/04	4	BMP Record Drawing Certification #7.1
1	08/16/04	4	BMP Record Drawing Certification #7.2
1	08/16/04	1	BMP Record Drawings # 7.3 & #7.4
1	08/16/04	4	BMP Record Drawing Certification #7.3
1	08/16/04	4	BMP Record Drawing Certification #7.4

THESE ARE TRANSMITTED as checked below:

☒ For your approval ☐ For your signature ☒ For review and comment

☐ For your use ☐ As you requested ☐ As requested by:

☐ Other:

REMARKS:

If enclosures are not as noted, kindly notify us at once.

8' OF 15" RCP @ 0.90%
INV. IN=67.88
INV. OUT=67.81

34' OF 12" RCP @ 9.65%

SS # 3-3
STA. 15+00
VDOT STD DI-5
TYPE III GRATE
FLOWLINE INV=67.32
INV=62.68

TIMBER STRUCTURE
(SEE DETAIL SHEET 14)
TOP ELEV=30.0
LENGTH=50'±

@ 2.56%
INV. IN=49.97
INV. OUT=49.78

100 YEAR
FLOOD ELEV.
= 30.42'

EXISTING
TREELINE

LIMITS OF
CLEARING

CA-45C

200' OF 15" RCP
@ 10.70% (INCLUDES
VDOT ES-1 END
SECTION)

20' DRAINAGE
EASEMENT

SS # 3-1
INV=38.00

15'x15' STILLING BASIN
CLASS 1 RIP-RAP
d50=6"
EMBED 18" MINIMUM
OVER FILTER CLOTH
(33 C.Y.±)
BOTTOM ELEV.=37.0

STORM
SYSTEM
No. 3

LIMITS OF
NON-RPA
WETLANDS

BMP 7.1
POOL ELEV.
1 YR.=26.07
2 YR.=26.69
100 YR.=28.74

35' DRAINAGE AND
ACCESS EASEMENT

FG=66.06

155' OF 15" RCP
@ 0.48%

FG=63.24

30' DRAINAGE/
ACCESS EASEMENT

BMP 7.1
TIMBER STRUCTURE
(SEE DETAIL SHEET 14)
TOP ELEV=28.5
LENGTH=120'±

100 YEAR
FLOOD ELEV.
= 28.74'

FG=66.06

FG=63.24

25' BUFFER/SETBACK
BASED ON 100 YEAR
HIGH WATER ELEVATION
TO BE DEDICATED TO THE
STONEHOUSE HOMEOWNERS
ASSOCIATION

15' MAINTENANCE
EASEMENT BASED
ON 100 YEAR HIGH
WATER ELEVATION TO
BE DEDICATED TO
THE STONEHOUSE
HOMEOWNERS
ASSOCIATION

BMP 7.2
POOL ELEV.
1 YR.=28.67
2 YR.=29.28
100 YR.=30.42

SS # 3-4
STA. 15+92
VDOT STD DI-5
TYPE III GRATE
FLOWLINE INV=62.48
INV=60.15

RIP-RAP OUTLET PROTECTION
d50=6" MIN. 18" DEPTH
GROUTED-IN-PLACE
(APPROX. 34 C.Y.)

PROVIDE
EC-3
MATTING ON
FILL SLOPE

CA-45D

LIMITS OF
NON-RPA
BUFFER

AREA OF PERMANENT
NON-RPA WETLAND IMPACT
= 4,115 S.F.; 0.09 AC

25' BUFFER/SETBACK BASED
ON 100 YEAR HIGH WATER
ELEVATION TO BE DEDICATED
TO THE STONEHOUSE
HOME-OWNERS ASSOCIATION

RIP-RAP OUTLET PROTECTION
d50=6" MIN. 18" DEPTH
GROUTED-IN-PLACE
(APPROX. 73 C.Y.)

5' MAINTENANCE EASEMENT
ASED ON 100 YEAR HIGH
ATER ELEVATION TO BE
EDICATED TO THE STONEHOUSE
OMEOWNERS ASSOCIATION

PROVIDE EC-3 MATTING
ON FILL SLOPE

100' RPA
BUFFER

100' RPA
BUFFER

19 20 21 22 10 9

W0276_STONEHOUSE_SEC_7A_RICHARDSON_MILL_01.DWG

YARDING WAY

60' R/W

50' R/W

16

17

18

15

26

10

9

LIMITS OF CLEARING

LIMITS OF CLEARING

EXISTING TREELINE

BMP 7.1
POOL ELEV.
1 YR.=26.07
2 YR.=26.69
100 YR.=28.74

CA-45C

AREA OF PERMANENT NON-RPA WETLAND IMPACT = 4,115 S.F.; 0.09 AC

BMP 7.1
TIMBER STRUCTURE
(SEE DETAIL SHEET 14)
TOP ELEV=28.5
LENGTH=120'±

LIMITS OF NON-RPA WETLANDS

STORM SYSTEM No. 2

SS # 2-2
VDOT STD MH
RIM=42.0
INV=39.5

78' OF 15" RCP
@ 14.10%

SS # 2-1
INV=28.5

PS

1.49
SS#2-5
INV.IN= 71.00

20' DRAINAGE EASEMENT

165' OF 15" RCP
@ 13.94%

42' OF 15" RCP
@ 12.38%

160' OF 15" RCP
@ 1.56%

10'x10' STILLING BASIN
CLASS 1 RIP-RAP
EMBED 18" MINIMUM
OVER FILTER CLOTH
(14.4 CY±)
BOTTOM ELEV.=28.5

PROVIDE EC-3 MATTING ON FILL SLOPE

FUTURE LOT ACCESS

RIP-RAP OUTLET PROTECTION
d50=6" MIN. 18" DEPTH
GROUTED-IN-PLACE
(APPROX. 73 C.Y.)

CONTRACTOR TO PROVIDE GRADED ACCESS TO LOT 9 (NOT TO EXCEED 25%)

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 046

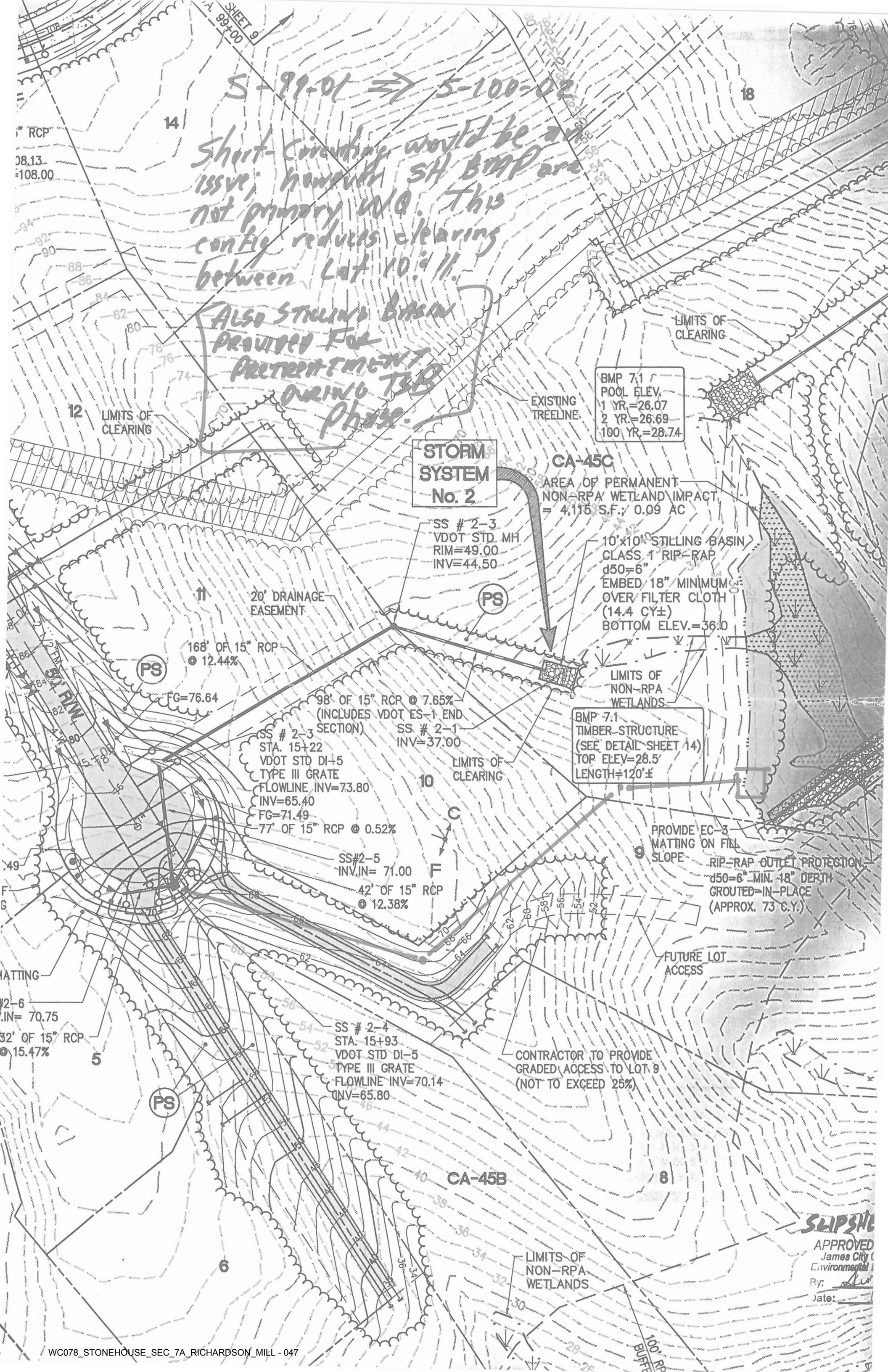
No.	DATE	REVISION / COMMENT / NOTE
1	12/9/02	REVISED PER JCC COMMENTS DATED 12/05/

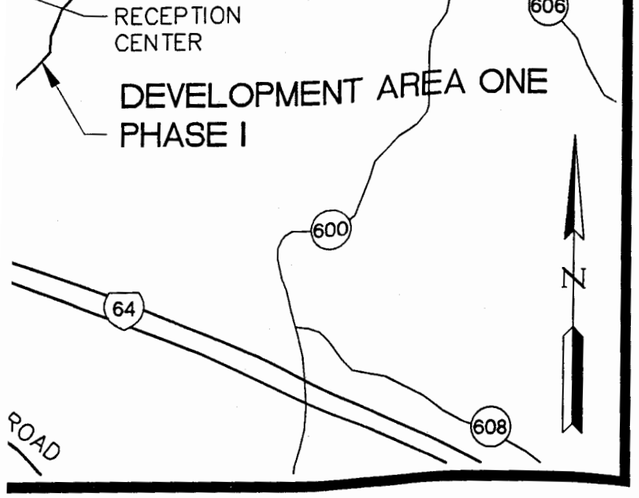
COMMONWEALTH OF VIRGINIA
VAN MARC LENNETT
No. 36628
PROFESSIONAL ENGINEER
12/10/02

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994

CONSULTING ENGINEERS

DING PLAN
'S MILL' SECTION I
E FOR
T COMPANY, L.L.C.
CITY COUNTY VIRGINIA


SHEET 9
99+00
S-99-01 ⇒ S-100-02
Short-circuiting would be an issue; however SH BMP are not primary WQ. This config reduces clearing between Lot 10 & 11.
ALSO STILLING BASIN PROVIDED FOR PRETREATMENT DURING TSB Phase.
14
18
12
11
10
9
8
6
5
LIMITS OF CLEARING
EXISTING TREELINE
BMP 7.1
POOL ELEV.
1 YR.=26.07
2 YR.=26.69
100 YR.=28.74
STORM SYSTEM No. 2
CA-45C
AREA OF PERMANENT NON-RPA WETLAND IMPACT = 4,115 S.F.; 0.09 AC
SS # 2-3
VDOT STD. MH
RIM=49.00
INV=44.50
10'x10' STILLING BASIN
CLASS 1 RIP-RAP
d50=6"
EMBED 18" MINIMUM OVER FILTER CLOTH
(14.4 CY±)
BOTTOM ELEV.=36.0
20' DRAINAGE EASEMENT
PS
168' OF 15" RCP @ 12.44%
FG=76.64
98' OF 15" RCP @ 7.65% (INCLUDES VDOT ES-1 END SECTION)
SS # 2-1
INV=37.00
LIMITS OF NON-RPA WETLANDS
BMP 7.1
TIMBER STRUCTURE
(SEE DETAIL SHEET 14)
TOP ELEV=28.5
LENGTH=120'±
SS # 2-3
STA. 15+22
VDOT STD DI-5
TYPE III GRATE
FLOWLINE INV=73.80
INV=65.40
FG=71.49
77' OF 15" RCP @ 0.52%
C
F
SS#2-5
INV.IN= 71.00
42' OF 15" RCP @ 12.38%
PROVIDE EC-3 MATTING ON FILL SLOPE
RIP-RAP OUTLET PROTECTION d50=6" MIN. 18" DEPTH GROUTED-IN-PLACE (APPROX. 73 C.Y.)
FUTURE LOT ACCESS
MATTING
SS#2-6
INV.IN= 70.75
32' OF 15" RCP @ 15.47%
SS # 2-4
STA. 15+93
VDOT STD DI-5
TYPE III GRATE
FLOWLINE INV=70.14
INV=65.80
CONTRACTOR TO PROVIDE GRADED ACCESS TO LOT 9 (NOT TO EXCEED 25%)
CA-45B
LIMITS OF NON-RPA WETLANDS
100' RPA BUFFER
APPROVED
James City
Environmental
By:
Date:



SCALE 1"=2000')

9028-08

JAMES H. BENNETT, P.E.
STONEHOUSE DEVELOPMENT COMPANY, L.L.C.
9701 MILL POND RUN
TOANO, VIRGINIA. 23168
TELEPHONE: 757-234-5000

SITE DATA:

TAX MAP PARCEL No.	(6-4) (1-1)
ZONING:	PUD-R
PROJECT AREA:	45.63 ACRES / 1,987,673 SF
DISTURBED AREA:	~~10.37 ACRES / 451,708 SF~~ **10.41 ACRES / 453,427 SF**
WETLAND DISTURBED AREA:	9,339 SF / 0.21 ACRES OF NON-RPA WETLANDS ARE DISTURBED AS PART OF THIS PROJECT
NUMBER OF LOTS:	38
FLOOD HAZARD MAP:	FEMA PANEL NUMBER 510201 0010 B NOTE: SITE IS LOCATED IN ZONE 'X' (AREAS DETERMINED TO BE OUTSIDE THE 500 YEAR FLOOD PLAIN)

NOTES:

1. ALL LOTS WITHIN RICHARDSON'S MILL, SECTION 1 SUBDIVISION SHALL REQUIRE A GRINDER PUMP FOR SANITARY SEWER SERVICE. OWNERS OF LOTS WHICH REQUIRE A GRINDER PUMP FOR SANITARY SEWER SERVICE ARE REQUIRED TO KEEP A CURRENT GRINDER PUMP MAINTENANCE CONTRACT WITH AN APPROPRIATE SERVICE ORGANIZATION.
2. ALL PROPOSED UTILITIES SHOWN ARE TO BE PLACED UNDERGROUND AS PER THE CURRENT JAMES CITY COUNTY SUBDIVISION ORDINANCE SECTION 19-33.
3. THE CONTRACTOR SHALL CONTACT "MISS UTILITY" A MINIMUM OF 48 HOURS PRIOR TO COMMENCING ANY EXCAVATION ON THE SITE. CALL 1-800-552-7001.
4. ALL EXISTING WELLS ARE TO BE ABANDONED IN ACCORDANCE WITH THE HEALTH DEPARTMENT STATE WELL REGULATIONS AND THE JAMES CITY COUNTY CODE.
5. THE VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT) WILL NOT BE RESPONSIBLE FOR MAINTENANCE OF THE PEDESTRIAN PATH WHETHER OR NOT THE PATH OCCURS WITHIN THE PROPOSED RIGHT-OF-WAY.
6. ALL DRAINAGE EASEMENTS AND STORM WATER ATTENUATION BASINS ARE TO BE DEDICATED TO STONEHOUSE COMMUNITY HOMEOWNERS ASSOCIATION.
7. THE VIRGINIA DEPARTMENT OF TRANSPORTATION IS NOT RESPONSIBLE FOR, NOR SHALL BE HELD LIABLE, FOR MAINTENANCE OF THE EXISTING STORM WATER / BMP FACILITY AS SHOWN ON THESE PLANS.
8. ALL RESIDENTIAL SUBDIVISION SIGNS SHALL BE IN ACCORDANCE WITH ARTICLE II, DIVISION 3 OF THE JAMES CITY COUNTY ZONING ORDINANCE.
9. NEW MONUMENTS WILL BE INSTALLED PER SECTIONS 19-34 THROUGH 19-36 OF THE JAMES CITY COUNTY SUBDIVISION ORDINANCE.
10. ALL NEW STREET SIGNS SHALL BE INSTALLED PER SECTION 19-55 OF THE JAMES CITY COUNTY SUBDIVISION ORDINANCE. ALL VDOT TRAFFIC AND REGULATOR SIGNS SHALL BE INSTALLED IN ACCORDANCE WITH HTCVD, LATEST EDITION.
11. THE CONTRACTOR SHALL AT ALL TIMES POSSESS AND MAINTAIN A CURRENT COPY OF THE JAMES CITY SERVICE AUTHORITY STANDARDS AND SPECIFICATIONS AT THE SITE AND READILY AVAILABLE FOR IMMEDIATE REFERENCE.
12. WETLANDS AND LAND WITHIN RESOURCE PROTECTION AREAS SHALL REMAIN IN A NATURAL UNDISTURBED STATE EXCEPT FOR THOSE ACTIVITIES PERMITTED BY SECTION 23-9(c)(1) OF THE JAMES CITY COUNTY CODE.
13. DISTURBANCE TO TOPOGRAPHY WITH SLOPES EQUAL TO OR GREATER THAN 25% IS PROHIBITED UNLESS A WAIVER HAS BEEN OBTAINED FROM JAMES CITY COUNTY. TOPOGRAPHY SHOWN ON THESE PLANS ARE REASONABLY ACCURATE FOR LAND FORM, HOWEVER THIS TOPOGRAPHY MAY NOT ACCURATELY LOCATE OR SHOW STEEPLY SLOPED GROUND PLANES PRIOR TO ANY LOT DISTURBANCE. THE HOMEOWNER SHALL IDENTIFY AREAS OF 25%, OR GREATER SLOPES AND SHALL MAKE ALL REASONABLE EFFORT TO ENSURE THAT MINIMUM DISTURBANCE TO THESE SLOPES OCCUR.
14. TEMPORARY SOIL STOCKPILE AND VEHICLE STAGING SHALL OCCUR OFF-SITE AND WILL BE LOCATED AT THE CORNER OF MILL POND RUN AND FIELDSTONE PARKWAY.
15. SECURITY LIGHT, WHERE NOTED, REFERS TO STREET LIGHTS INSTALLED FOR SECURITY AND NIGHT TIME ILLUMINATION OF THE ADJACENT STREET. THESE LIGHTS, POLES AND LUMINARS WILL NOT BE MAINTAINED OR REPLACED BY VDOT.
16. ONLY JCSA PERSONNEL ARE AUTHORIZED TO OPERATE VALVES ON EXISTING WATER MAIN.

de Towne Road, Suite 1
sburg, Virginia 23188
757) 253-0040
: (757) 220-8994

No.	DATE	REVISION / COMMENT / NOTE
1	12/9/02	REVISED PER JCC COMMENTS DATED 12/5

James City County, Virginia
Environmental Division
Stormwater Management Program

Stormwater Management Design Plan
Staff "Quick" Review

Plan No. S - 99 - 01 Date/Time: 11/28/01 2:30pm
Project Name: Stonehorse Mill Pond Sec 1
Rough Location: 1.8 mile NE of I-64 EXIT 227
ADC Map: Sheet 1 Grid: K - 3 ☒ First Review 11-28-01
Flood Map / Zone: 510201- 00 10B Zone: A & X ☐ Review
Description: Zone A along Richardson Mill Pond & Bird Swamp.

Drainage Area: ☐ Onsite ☐ Offsite

Submitted:

17 sheets

Y	N		
☐	☒	Demolition Plan (if applicable)	Sheets:
☒	☐	Site, Geometric or Layout Plan	Sheets: 2, 4-7
☒	☐	Grading Plan	Sheets: 8, 9, 10, 11
☒	☐	Storm Drainage Plan	Sheets: 8, 9, 10, 11
☒	☐	E&SC Plan	Sheets: 8, 9, 10, 11
☐	☒	Profiles (Storm)	Sheets:
☒	☐	Environmental Inventory	Sheets: 3
☒	☐	Note & Detail Sheets	Sheets: 13-17
☒	☒	Drainage Map(s)	Report insert 10/26/01
☒	☐	Soils Map/Narrative	
☒	☐	E&SC/SWM Design Plan Checklist (Required).	
☒	☐	E&SC/Stormwater Management / Drainage Narratives.	
☒	☐	E&SC/Stormwater Management Design Report with Calculations (Attachment).	
☐	☒	Geotechnical Report (Attachment).	
☒	☐	Waivers, Variances, or Exceptions (Attachments in Writing).	
		☐ VESCH ☒ CBP Ord (RPA, Steep Slope Policy) ☐ JCC BMP Manual	
☐	☐	Other (List):	

JCC GIS Database: Zoning: PUD - R Tax Parcel/GPIN: (6-4)(1-1)
Receiving Water: UT OF WARE CREEK Site Acreage: 45.63 acres / s.f.

Other Approvals (SUP, etc.):

Site Plan Information: Owner: BJ STONEHOUSE Development Co LLC.
Zoning: PUD - R Description: Res Planned Unit Dev.
Site Area: 45.63 acres / s.f
Disturbed Area: 8.45 acres / s.f. (18.52%)
☒ Disturbance > 5 acres, VPDES Notice of Intent required.
Impervious Cover: ? 5.32 ± acres / s.f. (11.3 %)
☒ Less than or equal to 60 percent. Meets CBPO requirements.
☐ More than 60 percent. Does Not Meet CBPO requirements.
Open / Green Space: acres / s.f. (. %)

Revised 3.18AC. + 2.14AC = 5.32

Site Development Plan:
☒ Residential, Lots, etc. ☐ Commercial (B / O / R) ☐ Govern./Institutional ☐ Industrial
☒ Roadways or Entrances ☐ Parking or Loading ☒ Water ☒ Sanitary Sewer
☐ Landscaping ☒ SWM/BMP facilities 2 ☒ Manmade Drainage ☒ Parks, Amenities
☒ Pump/Lift Station GRINDER ☐ Dams (regulated) ☐ Other,
Description: 38 LOTS; 0.63AC AVG.; 0.83 LOTS/AC DENSITY:
2 timber crib wall BMP's (7.1 & 7.2)

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 049

Soils Information: Site: 11C, 14B, 15F, 17, 25B, ~~45B~~ 34 Hydric: ☒ Yes ☐ No (17
Soil Survey Sheet DA: HSG: B/C
BMP: 7.1 (15F: 17); 7.2 (15F) Hydric: ☐ Yes ☐ No
Description of Soils at BMP:

BMP Control: ☐ None ☒ Onsite ☐ Offsite ☐ Previously Approved ☐ Manufactured BMP SCPV RQD. WQ NOT RQD.
BMP Types: 1- Name: BMP 7.1 (JCC BMP Type F - 1), Points 4
2- Name: BMP 7.2 (JCC BMP Type F - 1), Points 4
3- Name: (JCC BMP Type -), Points

Onsite Drainage: ☒ Reinforced Concrete Pipe ☐ Corrugated Metal Pipe ☐ Aluminum Type Pipe
☐ Corrugated Polyethylene Pipe ☐ PVC Type Pipe ☒ Open Channel ~~Type~~
☒ Storm Drain ☐ Culverts Type:
☒ Inlets ☐ Other (Specify):

1. VDOT Standards & Specifications Referenced for work **within** R/W: ☒ Yes ☐ No
2. VDOT Standards & Specifications Referenced for work **outside** R/W: ☒ Yes ☐ No

Site Limitations: ☒ RPA ☒ RMA ☒ Steep Slopes ☒ Delineated Wetlands
☒ Hydric Soils ☒ Critical Soils ☒ Vegetated ☐ Buffers:
☒ Defined Natural Drainage Features onsite ☐ Downstream Storm/Culv.
☐ Downstream Channel Erosion ☒ Floodplain ☐ Problem Drainage Area
☐ Stormwater Hotspot ☐ Other,
☐ Site Activities may warrant a General VPDES Permit for Discharge of Stormwater Associated with Industrial Activities (ie. process water, batch plants, etc.).

Site Stormwater Management / BMP Control (Add sheets if necessary for Multiple Onsite Facilities):

☒ Yes ☐ No	# 7.1 Timber Crib Wall					
Predev (Present)	DA = 9.02 ac.	C/CN = 68	Tc = 47	min / hrs.		
2-year	5	cfs				
10-year	18.5	cfs				
100-year	34.6	cfs				
PostDev w/o Detention (Inflow)	DA = 11.79 ac.	C/CN = 77	Tc = 15	min / hrs.		
1-year	13.4					
2-year	17.6	cfs				
10-year	* 46.6	cfs				
100-year	77.8	cfs				
PostDev with Detention (Routed)	DA = 11.79 ac.	C/CN = 77	Tc = 15	min / hrs.		
2-year	1.0	cfs	at El.	24.84		
10-year	* 49.1	cfs	at El.	25.25		
100-year (DHW)	77.2	cfs	at El.	25.35		

1-YR 0.9 CFS @ 24.04

Downstream Tailwater Assumption for Pond Routing: 18.50 < Pipe INV Out (negative depth)
Routed Peak Discharges (Outflows) from BMP meet Predevelopment Allowables: ☒ Yes ☐ No 2-YR.
Appears to Meet VESCH / E&SC Ordinance / CBP Ordinance Requirements: ☒ Yes ☐ No

* 10-YEAR OUTFLOW FROM BMP 7.1 IS > than 10-YEAR PRESTORM INFLOW.

✓ 1-YR CONTROL

Soils Information: Site: _____ Hydric: ❒ Yes ❒ No
Soil Survey Sheet DA: _____ HSG: _____
_____ BMP: _____ Hydric: ❒ Yes ❒ No
Description of Soils at BMP: _____

BMP Control: ❒ None ❒ Onsite ❒ Offsite ❒ Previously Approved ❒ Manufactured BMP
BMP Types: 1- Name: _____ (JCC BMP Type _____ - _____), Points _____
2- Name: _____ (JCC BMP Type _____ - _____), Points _____
3- Name: _____ (JCC BMP Type _____ - _____), Points _____
Onsite Drainage: ❒ Reinforced Concrete Pipe ❒ Corrugated Metal Pipe ❒ Aluminum Type Pipe
❒ Corrugated Polyethylene Pipe ❒ PVC Type Pipe ❒ Open Channel Type
❒ Storm Drain ❒ Culverts Type: _____
❒ Inlets ❒ Other (Specify): _____

1. VDOT Standards & Specifications Referenced for work **within** R/W: ❒ Yes ❒ No
2. VDOT Standards & Specifications Referenced for work **outside** R/W: ❒ Yes ❒ No

Site Limitations: ❒ RPA ❒ RMA ❒ Steep Slopes ❒ Delineated Wetlands
❒ Hydric Soils ❒ Critical Soils ❒ Vegetated ❒ Buffers: _____
❒ Defined Natural Drainage Features onsite ❒ Downstream Storm/Culv.
❒ Downstream Channel Erosion ❒ Floodplain ❒ Problem Drainage Area
❒ Stormwater Hotspot ❒ Other, _____
❒ Site Activities may warrant a General VPDES Permit for Discharge of Stormwater Associated with Industrial Activities (ie. process water, batch plants, etc.).

Site Stormwater Management / BMP Control (Add sheets if necessary for Multiple Onsite Facilities):

☑ Yes ❒ No	# 7.2 Timber Crib Wall					
Predev (Present)	DA = 9.34 ac.	C/CN = 70	Tc = 50 min / hrs.			
2-year	4.3	cfs				
10-year	14.6	cfs				
100-year	26.7	cfs				
PostDev w/o Detention (Inflow)	DA = 7.93 ac.	C/CN = 80	Tc = 19 min / hrs.			
1-year	9.9					
2-year	12.7	cfs				
10-year	31.5	cfs				
100-year	51.1	cfs				
PostDev with Detention (Routed)	DA = 7.93 ac.	C/CN = 80	Tc = 19. min / hrs.			
2-year	6.4	cfs	at El.	28.09		
10-year	31.1	cfs	at El.	28.36		
100-year (DHW)	50.5	cfs	at El.	28.51		

1-YEAR @ 1.1 CFS @ EL 27.98

Downstream Tailwater Assumption for Pond Routing: 21.0 @ PIPE INV OUT (no depth)
Routed Peak Discharges (Outflows) from BMP meet Predevelopment Allowables: ☑ Yes ❒ No 2-YEAR
Appears to Meet VESCH / E&SC Ordinance / CBP Ordinance Requirements: ❒ Yes ❒ No

1-YEAR CONTROL

Pond / BMP Design Data (Add Sheet If Necessary for Multiple Onsite Facilities):

☐ Check if None ☒ Provided: BMP # 7.1 Type: Timber Crib Wall

Y N * See Below for Pertinent WQv /Stream CPv Design Information.

☒ ☐ Top of Facility (Dam Crest) El. 25.0 TOP WALL

☒ ☐ Design High Water (100-year) El. 25.4

☐ ☒ Emergency Spillway (ES) Crest El. 25.0 BW: 120' SS: _____

☐ ☒ FreeBoard 0 1 ft. or > with Emerg. Spillway.

☐ Acceptable ☐ Not Acceptable. _____ 2 ft. or > w/o Emerg. Spillway.

☒ ☐ Principal Spillway (Riser) Crest El. 25.0 Size/Type: 8" PERF PVC

☐ ☒ Principal Spillway Crest 1 ft. below Crest of Emergency Spillway. ☐ Yes ☐ No ☐ N/A

☒ ☐ Stage-Storage Curve or Data

☒ ☐ Outlet Rating Curve or Table (Composite Structure)

☒ ☐ Extended Detention for WQ Provided (Min. 24 hours) ☒ Yes ☐ No ☐ N/A

☒ ☐ 1-year, 24 hour detention criteria for Stream Channel Protection. ☒ Yes ☐ No ☐ N/A

☒ ☐ 1-year design storm El. 26.2 or Volume 39,009 CF.

☒ ☐ Normal/Permanent Pool El. NA ☐ N/A

☒ ☐ Orifice/Weir #1 (Highest El.) El. 25.0 Type: 8" PERF PVC

☒ ☐ Orifice/Weir #2 El. 19.2 Type: 8" ARV DRAIN

☒ ☐ Orifice/Weir #3 El. 19.0 Type: 4" LOW FLOW ORIF.

☐ ☐ Orifice/Weir #4 El. _____ Type: _____

☐ ☐ Orifice/Weir #5 (Lowest El.) El. _____ Type: _____

☒ ☐ Low Flow Orifice (ExDet, CPv) El. 19.0 Type: 4" ORIF

☐ ☒ Pond Drain w/ Valve (24 hr.) El. 19.0 Type: _____

☒ ☐ Pond Bottom (Positive Drain) El. _____ Riser Height: _____

☐ ☒ Steps or Access Provided (for over 4 ft. depth) ☐ N/A

☐ ☒ Riser Base Bottom El. _____ Type: _____

☐ ☒ Core Trench ☐ N/A

☐ ☒ Anti-Seep Collars or other Acceptable Seepage Control Method. ☐ N/A

☐ ☒ Principal Spillway Anti-Vortex/Trash Rack Device Type: _____

☐ ☒ Low Flow Orifice Trash Rack. Type: _____

☐ ☐ Outlet Barrel: Type/Class: PVC Size: 4"

Inv. U/S: 19.0 Inv D/S: ?

Slope: FLAT Length: ? (ft.)

☐ ☒ Flared End Section/Wingwalls. Matches Outlet Barrel material type, over 48 inch with fence.

☒ ☐ Outlet Protection.

☒ Standard Riprap Outlet Protection (OP) Type: EC-1 Type A

☐ Special Dissipator Structure (SDS) Type: _____

☐ ☒ BMP Cleanout Elevation El. _____ or Depth _____

☐ ☐ Adequate Channel Downstream of BMP: ☒ 1-year, 24-hour; or ☐ MS # 19 criteria.

Sketch or Notes, If Necessary:

* WQv / Stream CPv Design Summary	
Imperv. Area	3.18 AC.
WQTV (Per JCC Man)	1.0 in/imp. AC.
WQ Vol. Required	11555 CF.
WQ Vol. Provided	11555 CF
1-yr SCPv Required	39,009 CF.
1-yr SCPv Provided	39,009 C.F.
Ext Det Orifice Size	3" WQ / 4" SCPv

Sediment Trap & Basins

☐ Temporary Sediment Trap # 1 No. DA = _____ < 3 acres

☐ Temporary Sediment Trap # 2 _____ DA = _____ < 3 acres

☐ Temporary Sediment Basin # 1 _____ DA = _____ ☐ BMP # ____ convert.

☐ Temporary Sediment Basin # 2 _____ DA = _____ ☐ BMP # ____ convert.

E&SC Plan Comments: NOT AN E&S Control.

Pond / BMP Design Data (Add Sheet If Necessary for Multiple Onsite Facilities): Timber Crib Wall

☐ Check if None ☐ Provided: BMP # 7.2 Type: Timber Crib Wall

Y N * See Below for Pertinent WQv /Stream CPv Design Information.

Y	N				
☑	☐	Top of Facility (Dam Crest)	El. 28.0		
☑	☐	Design High Water (100-year)	El. 28.5		
☑	☐	Emergency Spillway (ES) Crest	El. 28.0	BW: ____	SS: ____
☑	☐	FreeBoard	0	1 ft. or > with Emerg. Spillway.	
		☐ Acceptable ☐ Not Acceptable.		2 ft. or > w/o Emerg. Spillway.	
☑	☐	Principal Spillway (Riser) Crest	El. 28.0	Size/Type: 8" Perf PVC	
☐	☑	Principal Spillway Crest 1 ft. below Crest of Emergency Spillway.		☐ Yes ☐ No ☐ N/A	
☑	☐	Stage-Storage Curve or Data			
☑	☐	Outlet Rating Curve or Table (Composite Structure)			
☑	☐	Extended Detention for WQ Provided (Min. 24 hours)		☑ Yes ☐ No ☐ N/A	
☑	☐	1-year, 24 hour detention criteria for Stream Channel Protection.		☑ Yes ☐ No ☐ N/A	
☑	☐	1-year design storm	El. 29.7	or Volume 31,724 CF	
☐	☑	Normal/Permanent Pool	El. NA	☐ N/A	
☑	☐	Orifice/Weir #1 (Highest El.)	El. 28.0	Type: 8" Perf PVC Riser	
☑	☐	Orifice/Weir #2	El. 21.2	Type: 8" Perf PVC DRAIN	
☑	☐	Orifice/Weir #3	El. 21.0	Type: 4" ORIF	
☐	☐	Orifice/Weir #4	El.	Type:	
☐	☐	Orifice/Weir #5 (Lowest El.)	El.	Type:	
☑	☐	Low Flow Orifice (ExDet, CPv)	El. 21.0	Type: 4" ORIF	
☐	☑	Pond Drain w/ Valve (24 hr.)	El.	Type:	
☑	☐	Pond Bottom (Positive Drain)	El. 19.0	Riser Height:	
☐	☑	Steps or Access Provided (for over 4 ft. depth)		☐ N/A	
☐	☑	Riser Base	Bottom El.	Type:	
☐	☑	Core Trench	☐ N/A		
☐	☑	Anti-Seep Collars or other Acceptable Seepage Control Method.		☐ N/A	
☐	☑	Principal Spillway Anti-Vortex/Trash Rack Device		Type: EC-1 Stone	
☐	☐	Low Flow Orifice Trash Rack.		Type:	
☑	☐	Outlet Barrel:	Type/Class: PVC	Size: 4"	
			Inv. U/S: 21.0	Inv D/S: ?	
			Slope: FLAT	Length: ____ (ft.)	
☐	☑	Flared End Section/Wingwalls. Matches Outlet Barrel material type, over 48 inch with fence.			
☑	☐	Outlet Protection.			
		☑ Standard Riprap Outlet Protection (OP)		Type: EC-1 TYPE A L=?	
		☐ Special Dissipator Structure (SDS)		Type:	
☐	☑	BMP Cleanout Elevation		El. ____ or Depth ____	
☐	☐	Adequate Channel Downstream of BMP:		☑ 1-year, 24-hour; or ☐ MS # 19 criteria.	

Sketch or Notes, If Necessary:

* WQv / Stream CPv Design Summary	
Imperv. Area	2.14
WQTV (Per JCC Man)	1" Per Imp AC.
WQ Vol. Required	7772 CF
WQ Vol. Provided	7772 CF
1-yr SCPv Required	31,724 CF
1-yr SCPv Provided	31,724 CF
Ext Det Orifice Size	4"

Sediment Trap & Basins

☐ Temporary Sediment Trap # 1 ____ DA = ____ < 3 acres

☐ Temporary Sediment Trap # 2 ____ DA = ____ < 3 acres

☐ Temporary Sediment Basin # 1 ____ DA = ____ ☐ BMP # ____ convert.

☐ Temporary Sediment Basin # 2 ____ DA = ____ ☐ BMP # ____ convert.

E&SC Plan Comments: NOT for ESC purposes.

Plan Review Steps & Components:

Y	N	
☒	☐	First "Look-Thru". Quick look through plan for familiarity and completeness.
☒	☐	Existing Utilities - Miss Utility (1-800-552-7001) or other methods.
☒	☐	Responsible Land-Disturber Certification; Disturbed Area Estimate.
☐	☒	Worksheet for BMP Point System. 10 point (New Dev) or Pollutant Load method (Redevelopment). N/A WQ NOT REQ.
☒	☐	FEMA Special Flood Hazard Areas. Check location relative to property site and/or development area.
☒	☐	Check JCC Tax Parcel Maps for RPA / RMA locations and Tax Parcel number.
☒	☐	Stormwater hotspot, general layout and/or BMP separation distances (if any) are satisfactory.
☒	☐	Environmental Inventory - Chesapeake Bay Ordinance requirements satisfactory.
☒	☐	Highlight/check impacts to any Environmental Sensitive Areas (wetlands, RPA, floodplain, steep slopes, etc.).
☐	☒	Offsite borrow, waste areas and onsite stockpiles areas addressed.
☒	☐	Review existing topography to determine adequacy of perimeter E&SC plan (Phase I).
☒	☐	Current version of Standard JCC Erosion & Sediment Control Notes on plan.
☒	☐	Virginia E&SC Regulations. Minimum Standards # 1 thru # 19 appear satisfied.
☒	☐	Check for Offsite Work; Grading Plan conflicts such as excessive cut-fill slopes, deep excavations, etc.
☒	☐	Review adequacy of onsite E&SC plan (Phase II).
☒	☐	Review layout to check for conflicts (utilities, buildings, parking, buffers, etc.).
☒	☐	Storm Drainage - culverts, inlets, channels, storm drains. (pipe data, cover, conflicts, specs or reference to VDOT).
☒	☐	Proper Outlet Protection or Energy Dissipator information, details and computations.
☒	☐	Review Sequence of Construction (for E&SC and SWM/BMP installation).
☒	☐	Review E&SC Narrative (preferred to be on plan); SWM Narrative (Report).
☒	☐	Review for any Lot-to-Lot or adjacent property uncontrolled drainage problems.
☒	☐	Review plan based on Chapter 19 Subdivision ordinance as it relates to SWM/BMP control.
☒	☐	Review plan based on Chapter 24 Zoning as it relates to SWM/BMP control.
☒	☐	Review plan based on Chapter 23 Chesapeake Bay ordinance requirements.
☐	☒	Review plan based on JCC E&SC/SWM Design Plan Checklist.
☒	☐	Review plan based on Virginia Erosion and Sediment Control Handbook (VESCH).
☒	☐	Review E&SC Plan Design Report and computations (Attached report).
☒	☐	Review plan based on JCC BMP manual for BMP type selected for project.
☐	☒	Review plan based on Virginia Stormwater Management Handbook (VSMH) for BMP type.
☒	☐	Review SWM Design Report and computations (Attached Report).
☒	☐	Review plan based on JCC Stormwater Conveyance System Design/Construction Guidelines.
☒	☐	Review plan based on General Knowledge and Experience for Design/Construction.
☐	☒	Review plan based on other BMP design/construction references. List:
☐	☒	Review BMP for Buffer/Setback Requirements (Min 25 ft. from DHW) and Access.
☐	☒	Review BMP Benching (aquatic, safety) & Pondscape Plan (deep pool, shallow water, shoreline fringes, etc.).
☐	☒	Review Maintenance Plan for SWM / BMP facility. Detailed and specific guidance for long-term maintenance.
☒	☐	Well defined, adequate channels downstream of uncontrolled or SWM/BMP areas. (MS # 19 or 1-year criteria).
☐	☒	Adequate conversion plan for TSB to use as permanent BMP. N/A
☐	☒	Geotechnical. Information per Appendix E (infiltration) or to substantiate use of other BMPs (wet pond, etc.).
☒	☐	Provisions on plan requiring Record Drawing and Construction Certification of SWM facilities.
☒	☐	Drainage, Maintenance and Open Space Easements (if provided) appear satisfactory.
☒	☐	Wetland Permit required prior to issuance of a Land-Disturbance Permit or Final Approval.
☒	☐	Inclusion of H&H and SWM / BMP data into any JCC databases.
☐	☐	Other: _____

Prepared Environmental Division comments for the following categories based on above review areas:

☐ ☐	***General Comments:***	☐ ☐	***Erosion & Sediment Control Plan:***
☐ ☐	***Floodplain:***	☐ ☐	***Chesapeake Bay Preservation:***
☐ ☐	***Stormwater Management / Drainage:***	☐ ☐	***Other:***

Additional Notes & Comments: Typical ESC / SWM / Drainage

(Note: THIS FORM FOR COUNTY USE ONLY.)

☒ 1st Rev ☐ 2nd Rev ☐ 3rd Rev

Signature	Date 12-3-01
Signature	Date
Signature	Date

STORMWATER MANAGEMENT AND BMP NARRATIVE

RICHARDSON'S MILL, SECTION 1
October 22, 2001 (**Revised May 10, 2002**)
AES Project Number 9028-08

Project Description

This narrative is provided to augment the stormwater management components of the plans for the Richardson's Mill, Section 1 subdivision of the Stonehouse Project. This project site is zoned PUD-R, and is part of parcel (6-4) (1-1) on James City County Tax Maps. The total project area is 45.6 acres.

The Best Management Practices (BMPs) scheduled for this site provide runoff quantity and stream channel protection only. Through a combination of natural open space, constructed BMPs and the existing Richardson's Millpond lake, the project is able to meet the performance standards outlined for the protection of the Chesapeake Bay.

Site work for this project is to consist of construction of secondary roadways (with roadside ditches), storm sewers, water system, sanitary sewer systems, and drainage improvements to support a single-family residential development. Runoff from the proposed development is discharged three primary ways: Accumulated with storm sewers to runoff control facilities (in this case timber walls); accumulated with storm sewers to adequate channels; and un-concentrated overland runoff. All runoff from this site subsequently discharges to Richardson's Mill Pond, an existing multi-acre lake.

Project Location

The Mill Pond Subdivision is located in the northern parts of James City County, in the Stonehouse District. Section 1 of Richardson's Mill is located on the southern side of an existing gravel wood road running from the current terminus of Mill Pond Run to Mill Pond Park, a small recreation area on a peninsula of land formed by Richardson's Millpond.

Environmentally Sensitive Areas

Environmentally sensitive areas are designated on the Environmental Inventory Plan of the plan set. Hydric soils, approximate wetland areas, RPA areas, RPA Buffer areas, steep slopes, and Special Flood Hazard areas are shown on this plan.

Soils

Soils are mapped with reference to the Soil Survey of James City and York Counties and the City of Williamsburg, as issued by the Soil Conservation Service. Soils in the area of the project consist of:

11C – Craven – Uchee Complex, 6 to 10% slopes, Hydrologic Group – C

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 055

These soils are moderately well drained or well drained soils, generally located on side slopes of narrow ridge tops. The surface layer is typically a dark grayish brown, fine sandy loam about 4 inches thick. The subsurface is pale olive fine sandy loam 5 inches thick. The subsoil, extending to a depth of 42 inches, is yellowish brown clay or yellowish brown sandy clay mottled with gray clay. Generally below 42 inches, the substratum consists of a brownish yellow fine sandy loam. Permeability for this soil is low to moderate; shrink-swell potential is moderate; and erosion hazard is severe.

14B – Emporia, 2 to 6% slopes, Hydrologic Group – C

These soils are well drained, generally gently sloping. The surface layer is typically a dark grayish brown, fine sandy loam about 4 inches thick. The subsurface is pale brown loam 9 inches thick. The subsoil, extending to a depth of 58 inches, is yellowish loam. Generally below 58 inches, the substratum varies between gray, brown and red firm sandy clay loam. Permeability for this soil is moderate; shrink-swell potential is moderate; and erosion hazard is moderate.

15F – Emporia Complex, 25 to 50% slopes, Hydrologic Group – C

These soils are well drained, and steeply sloped. The surface layer is typically a dark grayish brown, fine sandy loam about 3 inches thick. The subsurface is pale brown loam 3 inches thick. The subsoil, extending to a depth of 45 inches, is yellowish brown loam. Generally below 45 inches, the substratum varies between gray, brown and red firm sandy clay loam. Permeability for this soil is moderate; shrink-swell potential is moderate; and erosion hazard is severe.

17 – Johnson complex, 0 to 2% slopes, Hydrologic Group – D

These soils are very poorly drained soils, and flatly sloped. The surface layer is typically a black silt loam about 8 inches thick. The subsoil is black silty clay loam 26 inches thick. The substratum is a black sandy clay loam and gray fine sandy loam to a depth of about 60 inches. Permeability for this soil is moderate; shrink-swell potential is low; and erosion hazard is low.

25B – Norfolk, 2 to 6% slopes, Hydrologic Group – B

These soils are well drained, and nearly level. The surface layer is typically a grayish brown, fine sandy loam about 10 inches thick. The subsurface is yellowish brown fine sandy loam 7 inches thick. The subsoil, extending to a depth of 72 inches, is yellowish brown fine sandy clay loam. Permeability for this soil is moderate; shrink-swell potential is low; and erosion hazard is moderate.

34B – Uchee, 2 to 6% slopes, Hydrologic Group – A

These soils are well drained, and gently sloped. The surface layer is typically a dark grayish brown, loamy fine sand about 5 inches thick. The subsurface is dark grayish brown loamy fine sand about 5 inches thick. A subsurface, extending to a depth of 19 inches, is yellowish brown fine sand. Generally below 19 inches, the substratum varies between gray, brown and red stratified sandy clay loam. Permeability for this soil is moderate; shrink-swell potential is moderate; and erosion hazard is slight.

Description of Site Drainage (Existing and Post-Development)

Current land use in the proposed project area is a natural forest, with very little impervious cover. With a rolling topography and some steeply sloped areas, the existing site conditions promote stormwater runoff to four primary existing natural channels. Ultimately, runoff from the site collects at Richardson's Mill Pond.

With proposed residential deveopment planned for the project area, impervious cover will increase up to approximately 25%. Roadway runoff is collected by roadside ditches, and is directed to adequate channels and/or BMPs through the use of storm sewers. BMPs (two timber walls in this project) collect and detain runoff generated by larger portions of the project. These BMPs are designed to provide stream channel protection for the receiving channel. Runoff from remaining project areas of Richardson's Mill, Section 1, flow in un-concentrated form overland, ultimately collecting at Richardson's Millpond.

The timber wall BMPs designed with this site are located in selected natural ravines of the project site. These BMPs will impacts non-RPA wetlands and the permitting for those impacts is being handled by Williamsburg Environmental Group.

Hydrology and Hydraulics

The landowner, through an aerial topographic consultant, recently generated topographic information used in the engineering calculations. This topographic information was generated in early 2001. Due to dense vegetation, AES staff was required to field verify some areas of the project topography for design purposes.

Hydrology and hydraulic modeling was performed using computer spreadsheets generated in-house, and computer modeling for hydrology by Hydraflow. SCS methodology was used in all runoff calculations. 1-year, 2-year, 10-year, and 100-year storm events where evaluated.

Storm sewer system modeling was performed by another module of the Hydraflow software. 10-year storm events were evaluated.

Precipitation data for James City County was obtained from Technical Paper No. 40 of the U.S. Department of Commerce. The values of SCS Type II rainfall distributions used are as follows:

Design Storm Frequency (in years)	Rainfall, in inches (for 24-hr. period)
1	2.8
2	3.5
5	4.7
10	5.8
100	8.0

ok.

Hydrologic Modeling Results

Evaluating predevelopment conditions provided information on allowable release rates of the BMP facilities for the 2-year storm. Results of the modeling is provided in the table below of each BMP facility (or point of concern). Calculations are also provided.

PREDEV

BMP #7.1 (timber wall, predevelopment drainage area of 9.02 acres) ✓

INPUT SAME AS BEFORE

Storm Freq.	Pre-dev. Curve Number	Tc (min.)	WAS	Pre-dev. Peak Runoff (in cfs)
1	68	47		3.3
2	68	47	50	6.5
10	68	47	15.5	19.8
100	68	47		34.6

BMP #7.2 (timber wall, predevelopment drainage area of 9.34 acres) ✓

INPUT SAME

Storm Freq.	Pre-dev. Curve Number	Tc (min.)		Pre-dev. Peak Runoff (in cfs)
1	70	50		2.9
2	70	50	4.3	5.4
10	70	50	14.6	8.4
100	70	50	26.7	26.0

POSTDEV

BMP #7.1 (timber wall, post development drainage area of 10.79 acres)

WAS 11.79AC.

Storm Freq.	Pre-dev. Curve Number	Tc (min.)	WAS	Pre-dev. Peak Runoff (in cfs)
1	77	15		12.2
2	77	15	17.6	19.2
10	77	15	46.6	45.0
100	77	15	77.9	71.2

BMP #7.2 (timber wall, post development drainage area of 7.93 acres) same

INPUT same

Storm Freq.	Pre-dev. Curve Number	Tc (min.)	Pre-dev. Peak Runoff (in cfs)
1	80	19	9.3
2	80	19	12.7 14.2
10	80	19	31.5 19.7
100	80	19	51.1 48.7

Modeling of Proposed Detention

To meet design constraints of providing stream channel protection and attenuation of runoff to pre-development rates, a timber wall BMP facility was design for both BMP 7.1 and BMP 7.2. After conversion as a temporary sediment basin, these permanenat facilities provided attenuation for the 2-year storm and channel protection using a dewatering / low flow orifice. Larger storm events are metered somewhat with both the low flow orifice and the weir created by the top of the structure.

Estimations to identify the required size of the dewatering orifice (to meet channel protection requirements) are provided in attached spreadsheets. These estimates identified 3- and 4 –inch orifice sizes. These orifice sizes do not attenuate the runoff for the 24-hour required time period. Orifices for both BMP facilities were design, however, with 3-inch orifices, as these are the minimum suggest size orifice identified for use in BMP measures.

Results of the computed modeling are as follows:

BMP #7.1 (timber wall)

Storm Freq.	Peak Release Rate (in cfs)	BMP Water Surface Elevation
1	0.4	26.07
2	0.8	27.00
10	42.3	27.25
100	70.2	27.36

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 059

BMP #7.2 (timber wall)

Storm Freq.	Peak Release Rate (in cfs)	BMP Water Surface Elevation
1	0.7	28.27
2	4.2	28.77
10	17.6	28.95
100	46.9	29.20

Conclusions for Modeling Results

From the modeling results, the proposed timber structures provide stream channel protection, and some additional stormwater management benefits. Noting the sandy nature of the soils on site, some water quality benefits will be realized, although they are not quantified here. Following is a table identifying the performance of the proposed BMPs.

BMP #7.1 (timber wall)

Storm Freq.	Pre-Dev. Runoff (in cfs)	Post-Dev. Runoff (in cfs)	Peak Release Rate (in cfs)	BMP Water Surface Elevation
1	3.3	12.2	0.4 ✓	26.07
2	6.5	19.2	0.8 ✓	27.00
10	19.8	45.0	42.3	27.25
100	34.6	71.1	70.2	27.36

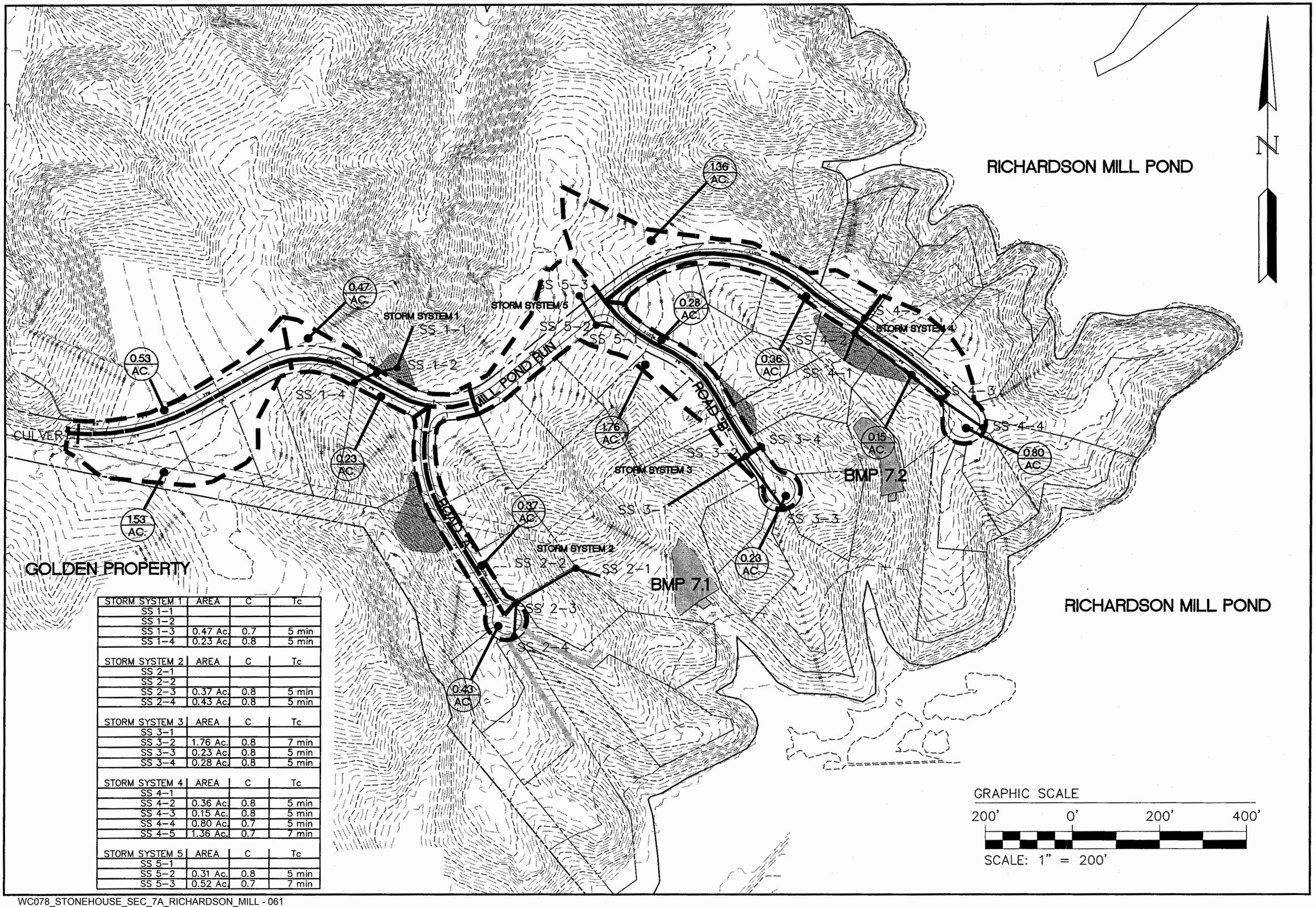
TSB Pool 23.7

BMP #7.2 (timber wall)

Storm Freq.	Pre-Dev. Runoff (in cfs)	Post-Dev. Runoff (in cfs)	Peak Release Rate (in cfs)	BMP Water Surface Elevation
1	2.9	9.3	0.7 ✓	28.27
2	5.4	14.2	4.2 ✓	28.77
10	8.4	19.7	17.6	28.95
100	26.0	48.7	46.9	29.20

TSB Pool 25.3

SIGNIFICANT INCREASE IN 10-YEAR DISCHARGE.



STORM SYSTEM 1	AREA	C	Tc
SS 1-1			
SS 1-2			
SS 1-3	0.47 Ac.	0.7	5 min
SS 1-4	0.23 Ac.	0.8	5 min

STORM SYSTEM 2	AREA	C	Tc
SS 2-1			
SS 2-2			
SS 2-3	0.37 Ac.	0.8	5 min
SS 2-4	0.43 Ac.	0.8	5 min

STORM SYSTEM 3	AREA	C	Tc
SS 3-1			
SS 3-2	1.76 Ac.	0.8	7 min
SS 3-3	0.23 Ac.	0.8	5 min
SS 3-4	0.28 Ac.	0.8	5 min

STORM SYSTEM 4	AREA	C	Tc
SS 4-1			
SS 4-2	0.36 Ac.	0.8	5 min
SS 4-3	0.15 Ac.	0.8	5 min
SS 4-4	0.80 Ac.	0.7	5 min
SS 4-5	1.36 Ac.	0.7	7 min

STORM SYSTEM 5	AREA	C	Tc
SS 5-1			
SS 5-2	0.31 Ac.	0.8	5 min
SS 5-3	0.52 Ac.	0.7	7 min

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

SECTION VII-A "RICHARDSON'S MILL SECTION 1
DRAINAGE AREAS

Designed	Drawn
AES	AES
Scale	Date
1"=200'	10/19/01
Project No.	
9028-08	
Drawing No.	
1	

RICHARDSON MILL POND

N

PRE-DEVELOPMENT

POST-DEVELOPMENT

MILL POND RUN

ROAD B

PRE-DEVELOPMENT

POST-DEVELOPMENT

POST-DEVELOPMENT

BMP 7.2

ROAD A

BMP 7.1

GOLDEN PROPERTY

RICHARDSON MILL POND

PRE-DEVELOPMENT

DRAINAGE TO BMP's

BMP 7.1	AREA	CN	Tc
PRE	9.0 Ac.	68	47 min
POST	10.8 Ac.	77	15 min
BMP 7.2	AREA	CN	Tc
PRE	9.3 Ac.	70	50 min
POST	7.9 Ac.	80	19 min
** SEE BMP CALCULATIONS PROVIDED			

GRAPHIC SCALE

200' 0' 200' 400'

SCALE: 1" = 200'

5248 Olde Towne Road, Suite 1
Williamsburg, Virginia 23188
(757) 253-0040
Fax (757) 220-8994
CONSULTING ENGINEERS

SECTION VII-A "RICHARDSON'S MILL SECTION 1

BMP DRAINAGE AREAS

Designed	Drawn
AES	AES
Scale	Date
1"=200'	10/19/01
Project No.	
9028-08	
Drawing No.	
2	

CALCULATION FOR SCS HYDROGRAPH GENERATION AND CHANNEL PROTECTION
FOR BMP / SWM 7.1
RICHARDSON'S MILL, SECTION 1 (SUBDIVISION AT STONEHOUSE)
AES Project No.: 9028-08
May 10, 2002

I. PRE-DEVELOPMENT CONDITIONS TO POINT OF CONCERN

A. Pre-Development Drainage Area to Point of Concern = 9.02 Acres

B. Pre-development Land Use, Soil Classification and Calculation of Composite Curve Number

	Soil Type	Soil Hydrologic Group	Pre-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Adjusted (CN)
1)	15-F Emporia Complex	C	Wooded (Good)	5.09	70	356
2)	11-C Craven Uchee	C	Wooded (Good)	2.18	70	153
3)	14-B Emporia Fine Sandy Loam	C	Wooded (Good)	0.00	70	0
4)	25-B Norfolk	B	Wooded (Good)	1.25	55	69
5)	17 - Johnson	D	Wooded (Fair)	0.50	79	40
6)						
7)						
	Totals =			9.02		617
	Composite CN =					68

C. Pre-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)

Surface description (table 5-7)	wooded (light underbrush)
Manning's roughness coefficient., n (table 5-7)	0.4
Length of overland flow, L	280 Feet
2-year 24-hour rainfall, P2	3.6 inches
Average slope of overland flow , s	0.029 feet per foot
Travel time, Tt = (0.007*(n*L)^0.8)/(P2^0.5*s^0.4)	0.66 hours

2) Shallow concentrated flow (maximum 300 feet)

Surface description, paved or unpaved	unpaved, wooded
Length of shallow concentrated flow, L	205 Feet
Average slope of shallow concentrated flow, s	0.165 feet per foot
Average velocity, v	0.8 feet per second
Travel time, Tt = L/(3600*v)	0.08 hours

3) Channel or Pipe Flow

Length of channel flow, L	390 Feet
Average velocity of channel flow, v	2.5 feet per second
Travel time, Tt = L/(3600*v)	0.04 hours
Total Time of Concentration =	0.78 hours
or	47 minutes

II. POST-DEVELOPMENT CONDITIONS TO POINT OF CONCERN (for total site)

A. Post-Development Drainage Area to Point of Concern = 10.79 Acres

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

	Soil Type	Soil Hydrologic Group	Post-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Adjusted (CN)
1)	15-F Emporia Complex	C	Open Space/Wooded	2.65	70	186
2)	15-F Emporia Complex	C	Residential - 1/2 acre lots	2.73	80	218
3)	11-C Craven Uchee	C	Open Space/Wooded	0.40	70	28
4)	11-C Craven Uchee	C	Residential - 1/2 acre lots	2.14	80	171
5)	14-B Emporia Fine Sandy Loam	C	Open Space/Wooded	0.00	70	0
6)	14-B Emporia Fine Sandy Loam	C	Residential - 1/2 acre lots	0.12	80	10
7)	25-B Norfolk	B	Open Space/Wooded	0.00	55	0
8)	25-B Norfolk	B	Residential - 1/2 acre lots	1.54	70	108
9)	17 - Johnson	D	Wooded (Fair)	0.36	79	28
10)	17 - Johnson	D	Residential - 1/2 acre lots	0.15	85	13
11)	Street and Roads		Street and Roads	0.70	98	69
	Total Adjusted CN =			10.79		830
	Composite CN =					77

C. Post-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)

Surface description (table 5-7)	residential / woods	
Manning's roughness coefficient., n (table 5-7)	0.3	
Length of overland flow, L	160	Feet
25-year 24-hour rainfall, P25	6.5	inches
Average slope of overland flow , s	0.125	feet per foot
Travel time, Tt = (0.007*(n*L)^0.8)/(P2^0.5*s^0.4)	0.14	hours

2) Shallow concentrated flow (maximum 300 feet)

Surface description, paved or unpaved	unpaved	
Length of shallow concentrated flow, L	205	Feet
Average slope of shallow concentrated flow, s	0.165	feet per foot
Average velocity, v	0.8	feet per second
Travel time, Tt = L/(3600*v)	0.07	hours

3) Channel or Pipe Flow

Length of channel flow, L	390	Feet
Average velocity of channel flow, v	2.5	feet per second
Travel time, Tt = L/(3600*v)	0.04	hours
Total Time of Concentration =	0.25	hours
or	15	minutes

III. PROPOSED ESTIMATED POND(S) VOLUME ABOVE LOWER STAGE or NORMAL POOL BY ELEVATION

Elevation	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Inc. Volume (cu. yd.)	Sum Volume (cu. ft.)	Sum Volume (cu. yd.)
19.0		0	0			
20.0	1.0	1212	606	22	606	22
22.0	2.0	3925	5137	190	5743	213
24.0	2.0	7559	11484	425	17227	638
26.0	2.0	11812	19371	717	36598	1355
28.0	2.0	16222	28034	1038	64632	2394
30.0	2.0	21128	37350	1383	101982	3777
32.0	2.0	27647	48775	1806	150757	5584

IV. DETERMINING RELEASE RATE OF 1-YEAR, 24-HOUR DETAINED FOR 24 HOURS FOR STREAM CHANNEL PROTECTION

Volume of 1-Year, 24-Hour Storm (based upon Hydrographs) =	35,700 cubic feet	
Elevation of water surface associated with 1-Year, 24-Hour Storm Vol. =	26.2	(Actual WSEL of routed 1-year storm is EL 24.09)
Elevation of Release Inlet for Channel Protection =	21.5	
Average Head, in feet, on Release Inlet =	2.4	

Average Release Rate Calculation

$$\frac{35{,}700 \text{ cubic feet}}{(24 \text{ hours} \times 60 \text{ minutes/hour} \times 60 \text{ seconds/ minute})} = 0.4 \text{ cfs}$$

Calculation of Size of Release Inlet

Diameter of Release Inlet = 2 * (Q / ((64.32 * (h / 2)) ^ (1/2) * 0.6 * 3.14))) ^ (1/2)
where, Q equals Average Release Rate, in cfs
h equals Average Head, in feet

Diameter of Release Inlet = 0.30 feet, or 4 inches (3" Orifice Used in Modeling)

**Note: 3" orifice was determined to be most adequate for the detaining the 1 year storm for a period of 24 hours.

Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 1 - TIMBER WALL 7.1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	20.00	1,212	0	0
2.00	22.00	3,925	5,137	5,137
4.00	24.00	7,559	11,484	16,621
6.00	26.00	11,812	19,371	35,992
8.00	28.00	16,222	28,034	64,026
10.00	30.00	21,128	37,350	101,376

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 3.0	0.0	0.0	0.0
Span in	= 3.0	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 23.70	0.00	0.00	0.00
Length ft	= 2.0	0.0	0.0	0.0
Slope %	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 120.00	0.00	0.00	0.00
Crest El. ft	= 27.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	0.00	0.00
Weir Type	= Broad	Rect	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	20.00	0.00	---	---	---	0.00	---	---	---	---	0.00
2.00	5,137	22.00	0.00	---	---	---	0.00	---	---	---	---	0.00
4.00	16,621	24.00	0.07	---	---	---	0.00	---	---	---	---	0.07
6.00	35,992	26.00	0.35	---	---	---	0.00	---	---	---	---	0.35
8.00	64,026	28.00	0.48	---	---	---	312.00	---	---	---	---	312.48
10.00	101,376	30.00	0.59	---	---	---	1621.20	---	---	---	---	1621.79

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	3.29	2	734	17,234	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	12.24	2	724	35,700	----	------	------	POST-DEV. RUNOFF
5	Reservoir	0.35	2	1074	33,358	3	26.07	36,913	ROUTED
7	Reservoir	0.62	2	870	35,016	3	26.04	37,960	SED. BASIN ROUTED

Proj. file: 90280871.gpw | Return Period: 1 yr | Run date: 05-13-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	6.48	2	732	29,510	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	19.20	2	722	54,629	----	------	------	POST-DEV. RUNOFF
5	Reservoir	0.77	2	912	47,337	3	27.00	50,044	ROUTED
7	Reservoir	0.74	2	922	53,726	3	26.98	51,177	SED. BASIN ROUTED

Proj. file: 90280871.gpw	Return Period: 2 yr	Run date: 05-13-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	19.81	2	732	80,817	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	45.01	2	722	126,215	----	------	------	POST-DEV. RUNOFF
5	Reservoir	42.28	2	726	118,203	3	27.25	53,578	ROUTED
7	Reservoir	45.01	2	724	125,104	3	27.26	55,149	SED. BASIN ROUTED

Proj. file: 90280871.gpw | Return Period: 10 yr | Run date: 05-13-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	34.61	2	730	138,675	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	71.16	2	722	201,420	----	------	------	POST-DEV. RUNOFF
5	Reservoir	70.22	2	724	193,382	3	27.36	55,113	ROUTED
7	Reservoir	70.22	2	724	200,255	3	27.36	56,533	SED. BASIN ROUTED

OHW

Proj. file: 90280871.gpw	Return Period: 100 yr	Run date: 05-13-2002

Hydrograph Plot

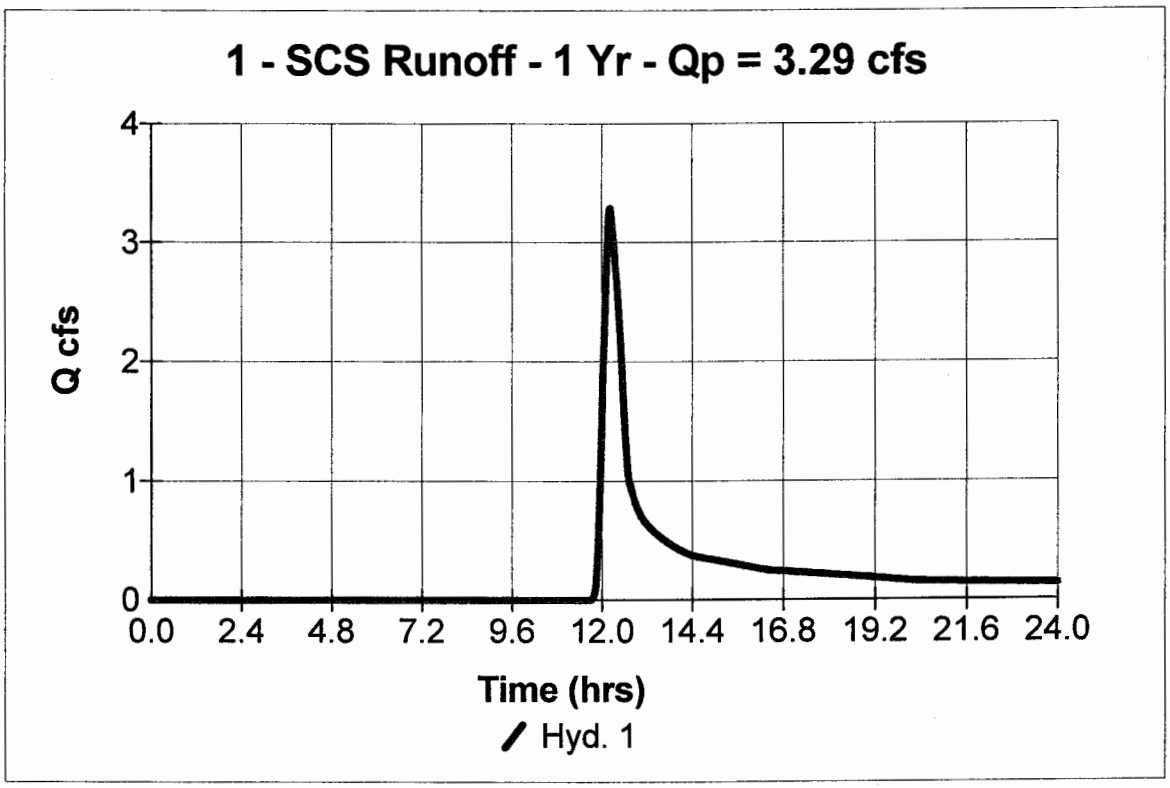
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 3.29 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 17,234 cuft



Hydrograph Plot

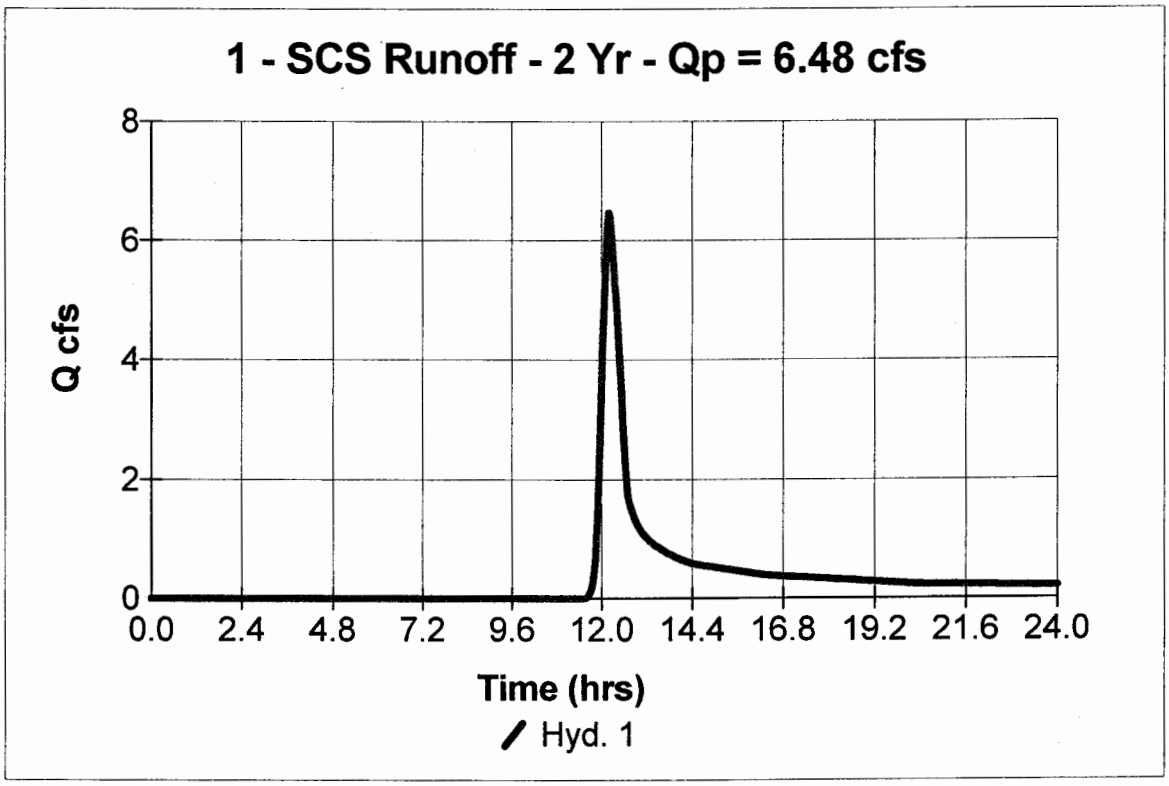
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 6.48 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 29,510 cuft



Hydrograph Plot

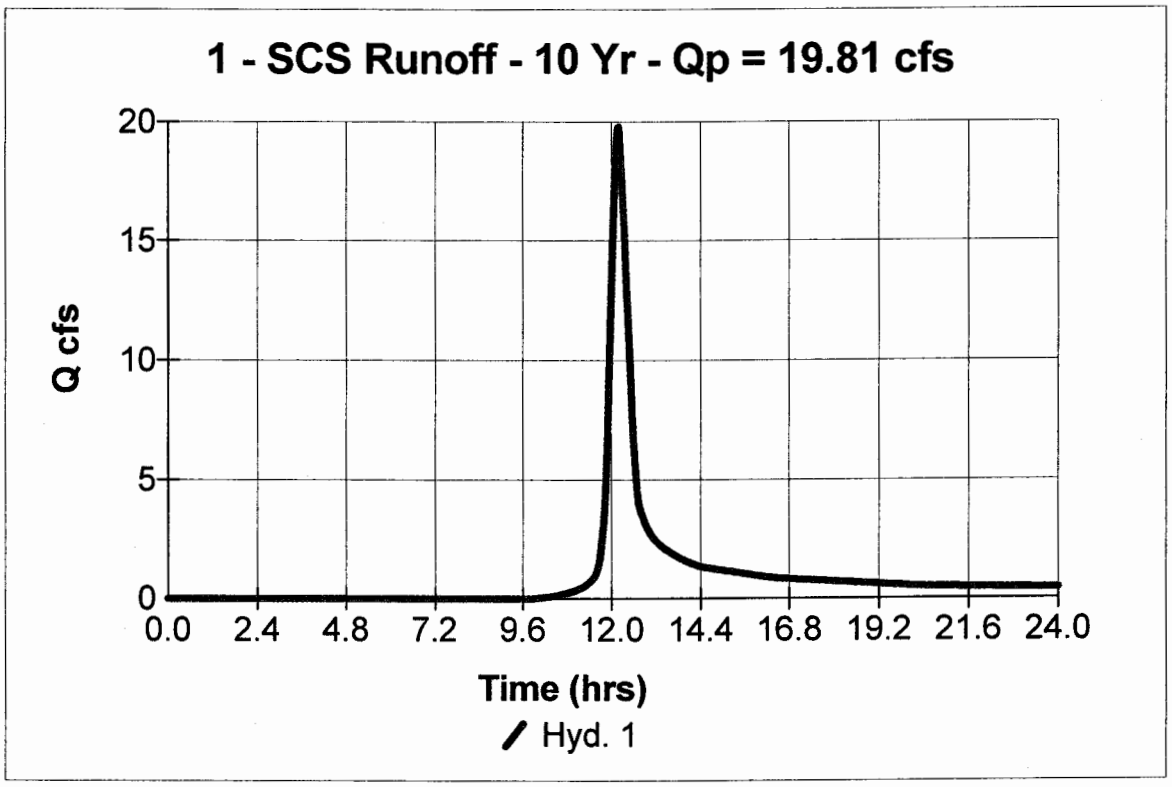
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 19.81 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 5.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 80,817 cuft



Hydrograph Plot

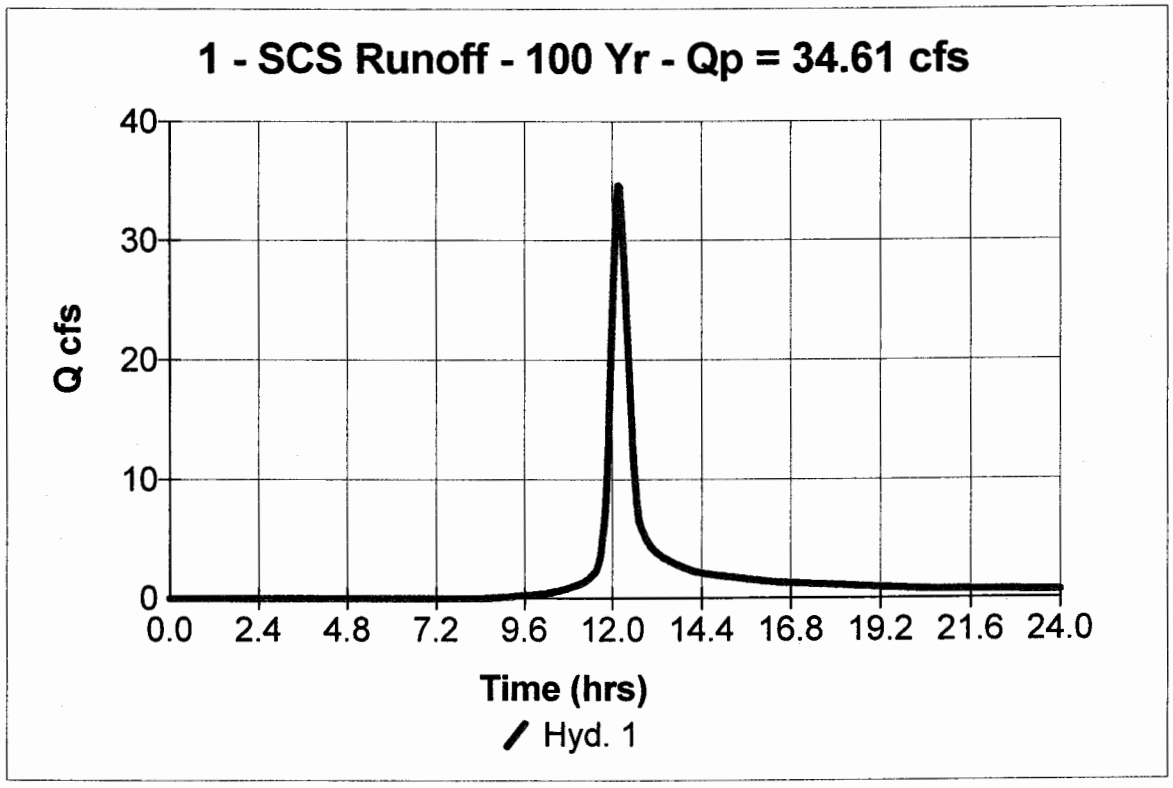
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 34.61 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 138,675 cuft



Hydrograph Plot

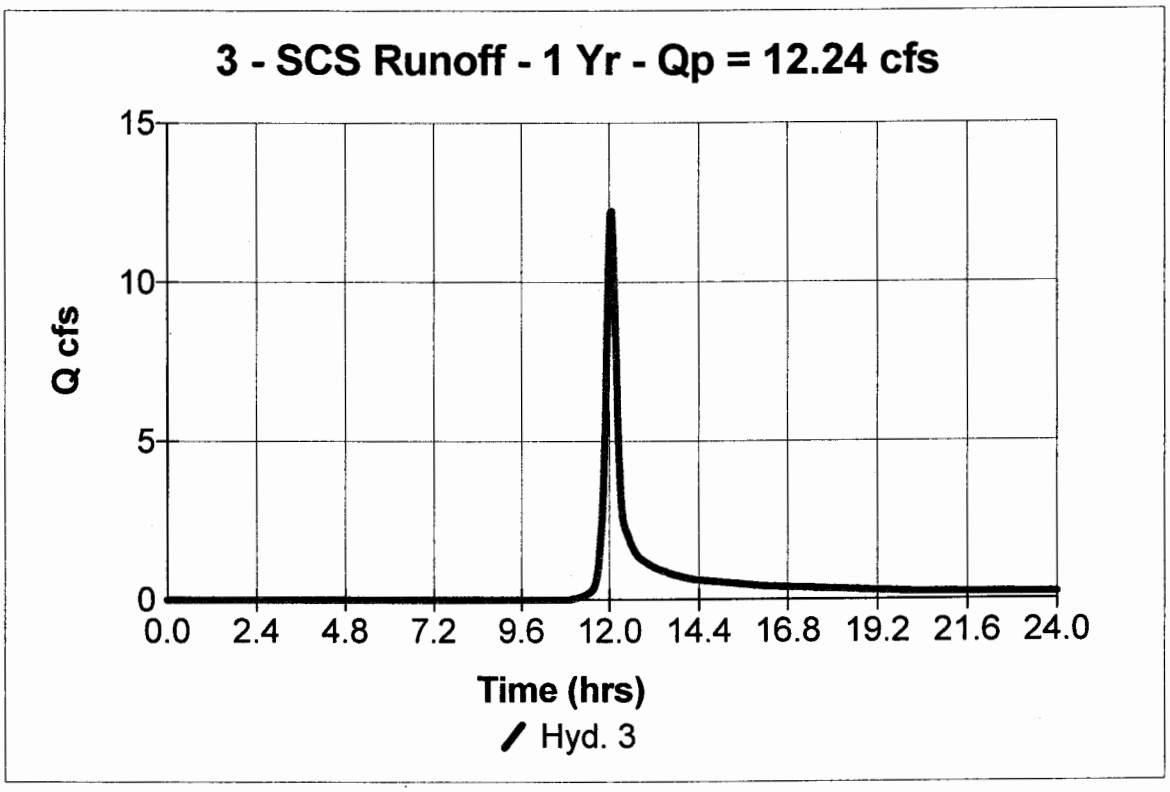
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 12.24 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 35,700 cuft



Hydrograph Plot

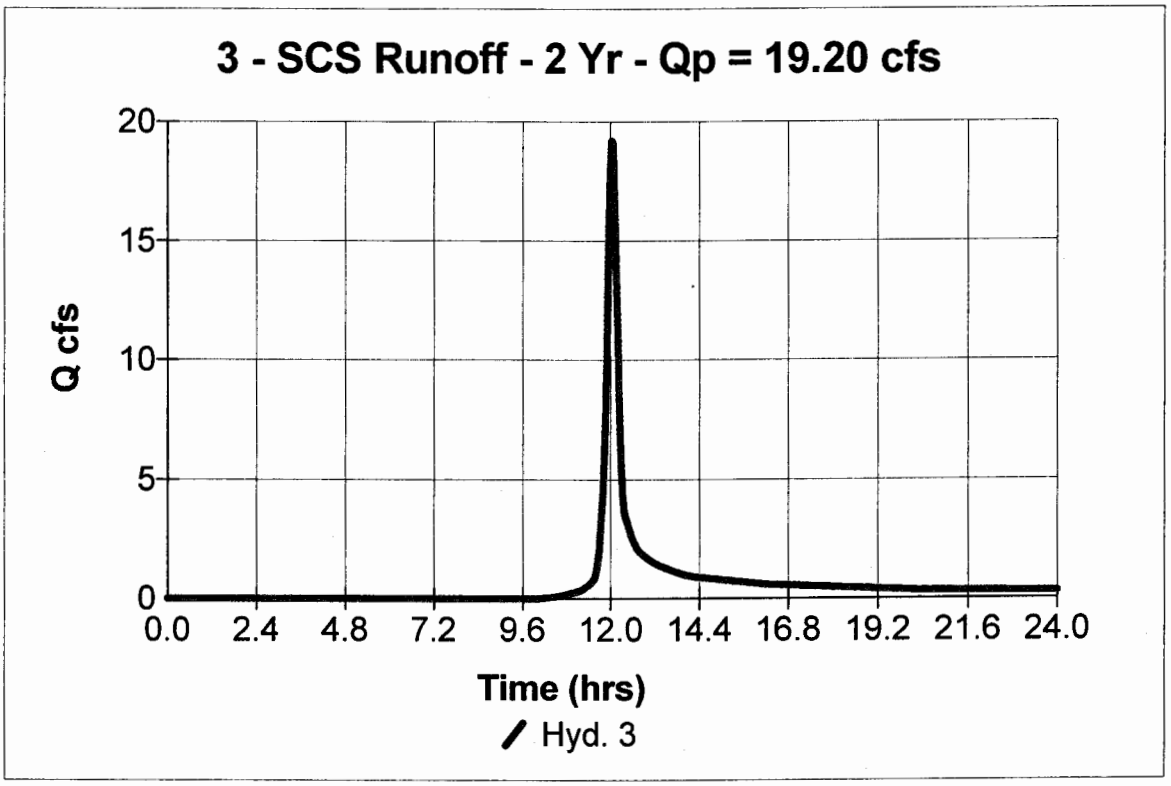
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 19.20 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 54,629 cuft



Hydrograph Plot

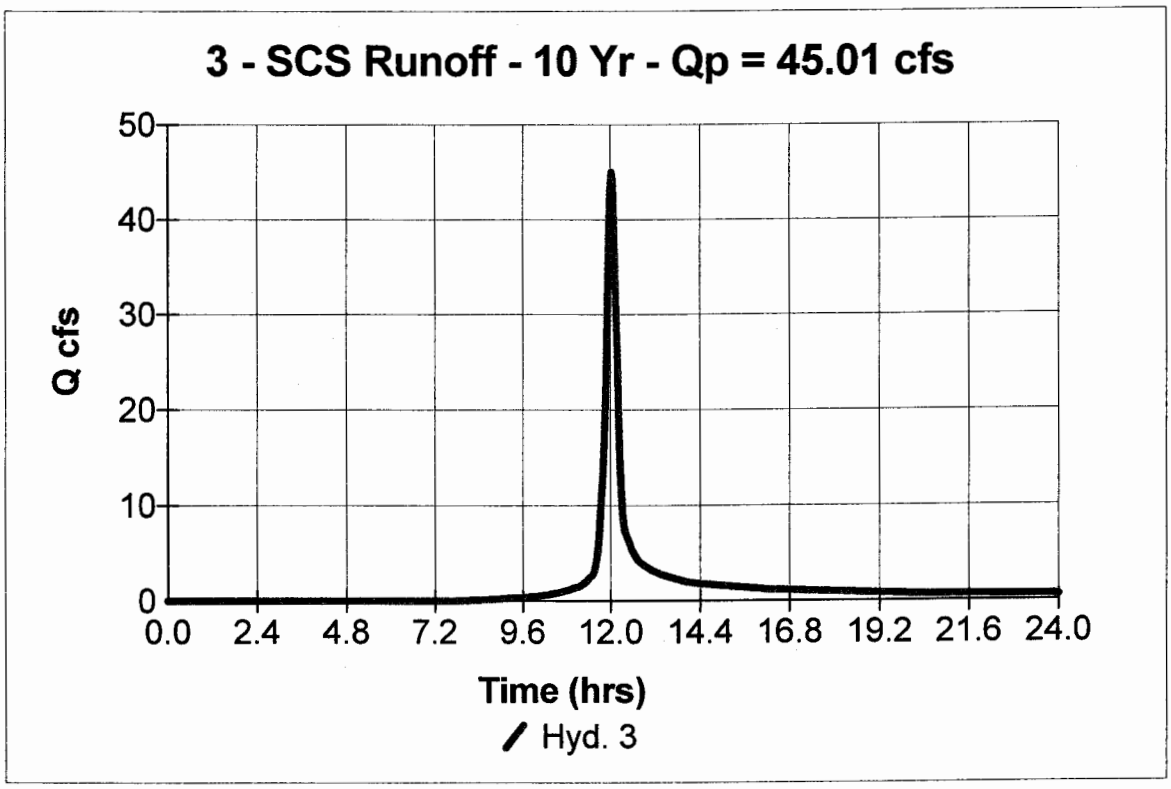
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 45.01 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 5.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 126,215 cuft



Hydrograph Plot

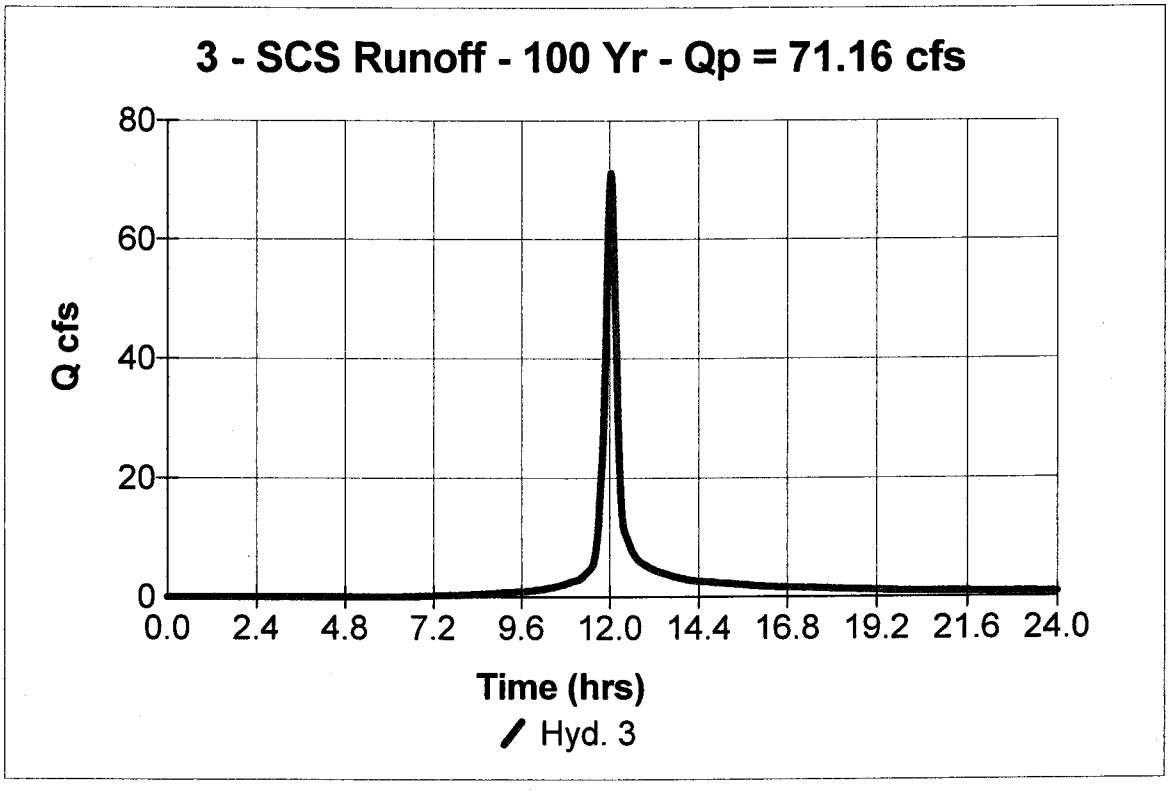
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 71.16 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 201,420 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

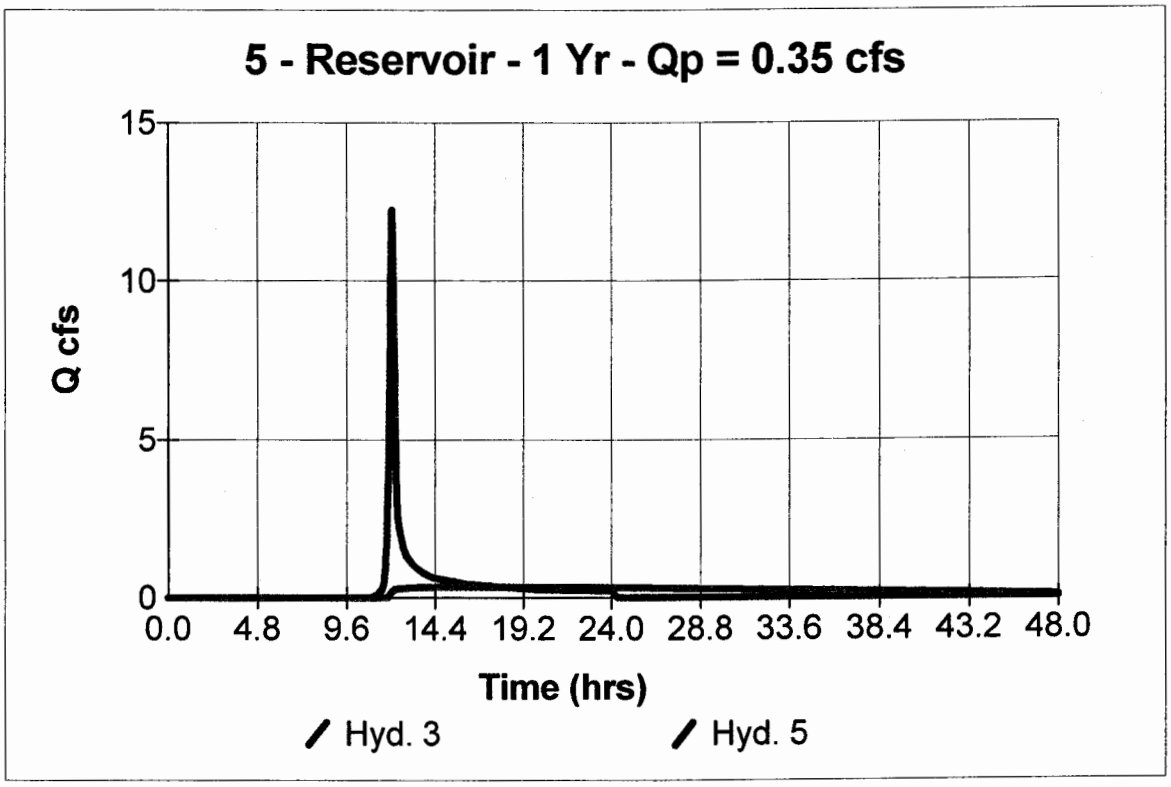
Hyd. No. 5

ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 0.35 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 26.07 ft	Max. Storage	= 36,913 cuft

Storage Indication method used.

Hydrograph Volume = 33,358 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

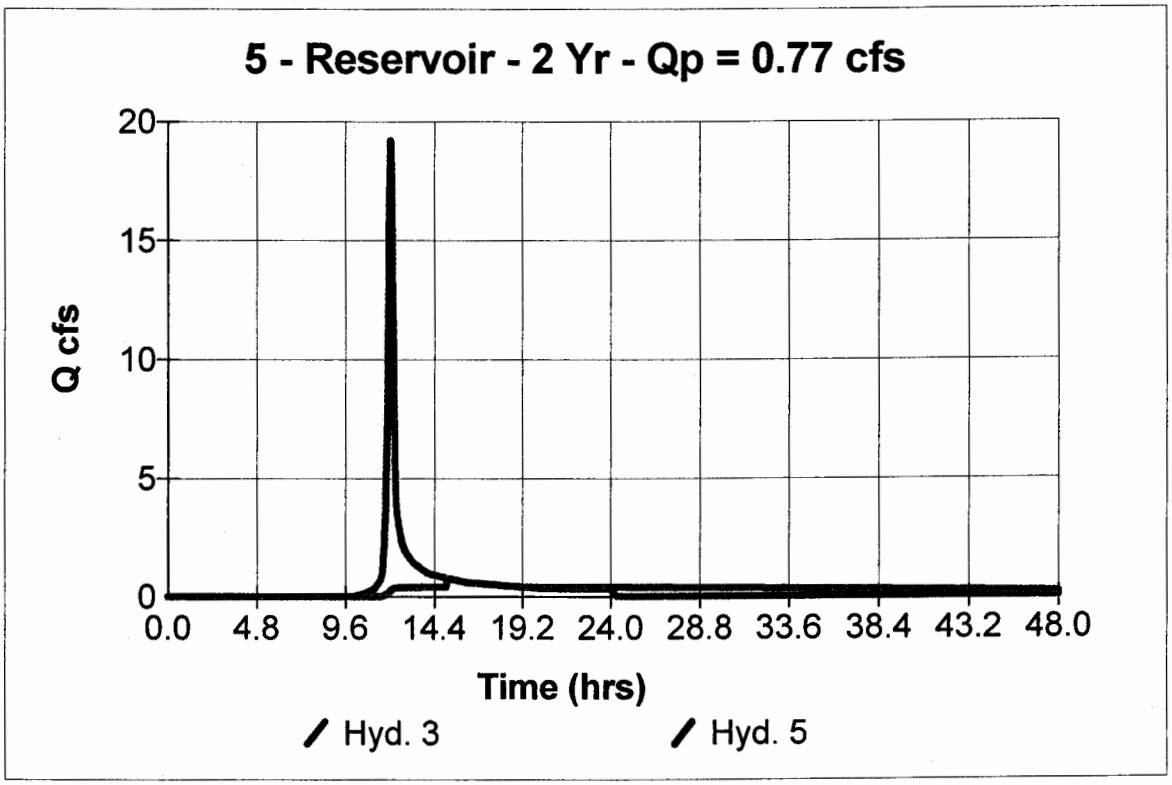
Hyd. No. 5

ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 0.77 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 27.00 ft	Max. Storage	= 50,044 cuft

Storage Indication method used.

Hydrograph Volume = 47,337 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

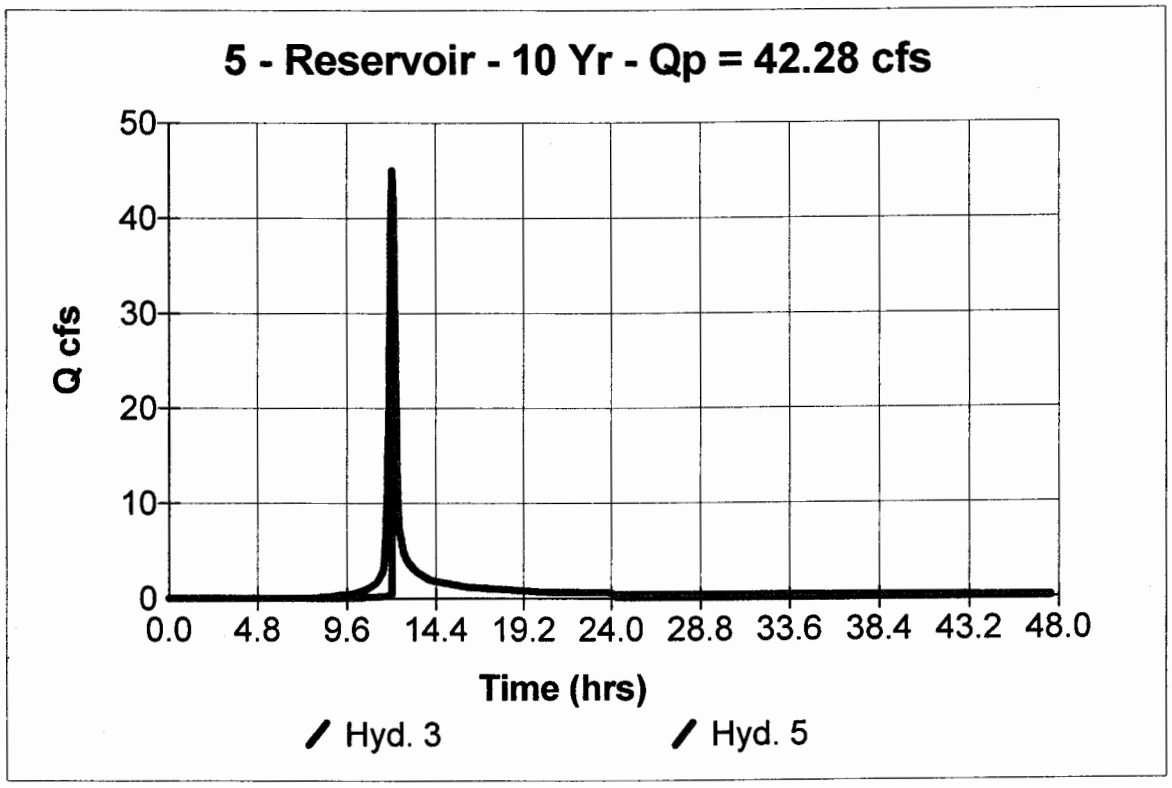
Hyd. No. 5

ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 42.28 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 27.25 ft	Max. Storage	= 53,578 cuft

Storage Indication method used.

Hydrograph Volume = 118,203 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

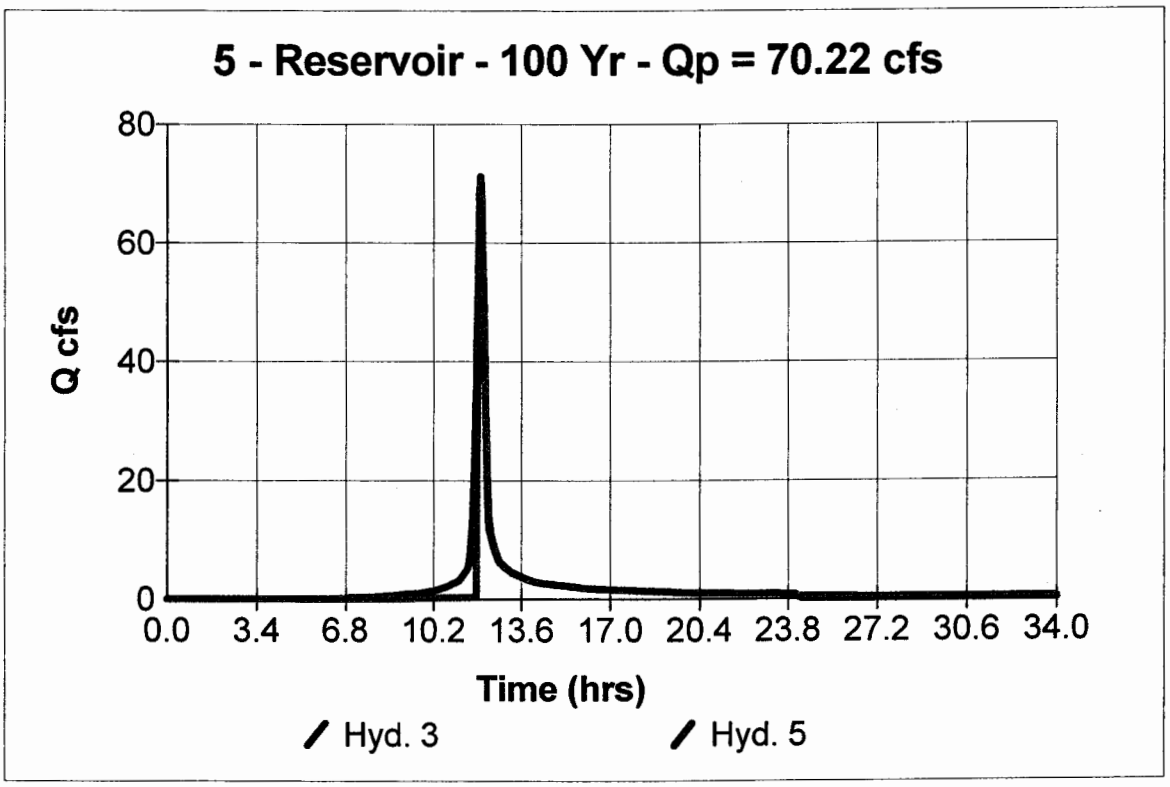
Hyd. No. 5

ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 70.22 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 27.36 ft	Max. Storage	= 55,113 cuft

Storage Indication method used.

Hydrograph Volume = 193,382 cuft



Mill Pond Section 1 @ Stonehouse
BMP Timber Structure Wall Calculations
AES Job No. 9028-8

3/6/02
ABS

Given:

butt Diameter =	12	inches =	1 ft
Spacing =	4	ft	
hw =	8	ft	
hs =	6	ft	
γw =	62.4	pcf	

Assumptions:

γsoil =	120	pcf ✓
esoil =	50	%
γsat =	131	pcf
Ka =	0.31	(Rankine Active Coefficient)

Average Soil at Site (medium clay/compact sandy loam):

p =	200 PSF	* From Table 4.8 in Timber
S =	2500 PSF	Construction Manual

Loads:

Assume total soil pressure acts horizontally on pole

Load due to Saturated Soil =	382.788	lb / LF
Load due to Water =	1996.8	lb / LF
Total Moment about toe, Mo =	6090.376	lb-ft / LF
Equivalent Load at top =	761.297	lb / LF
Load at each pole =	3045.188	lbs

Calculate Pole Depth:

Calculations based on procedure outlined in Timber Construction Manual Section 4 on Pole-Type Framing.

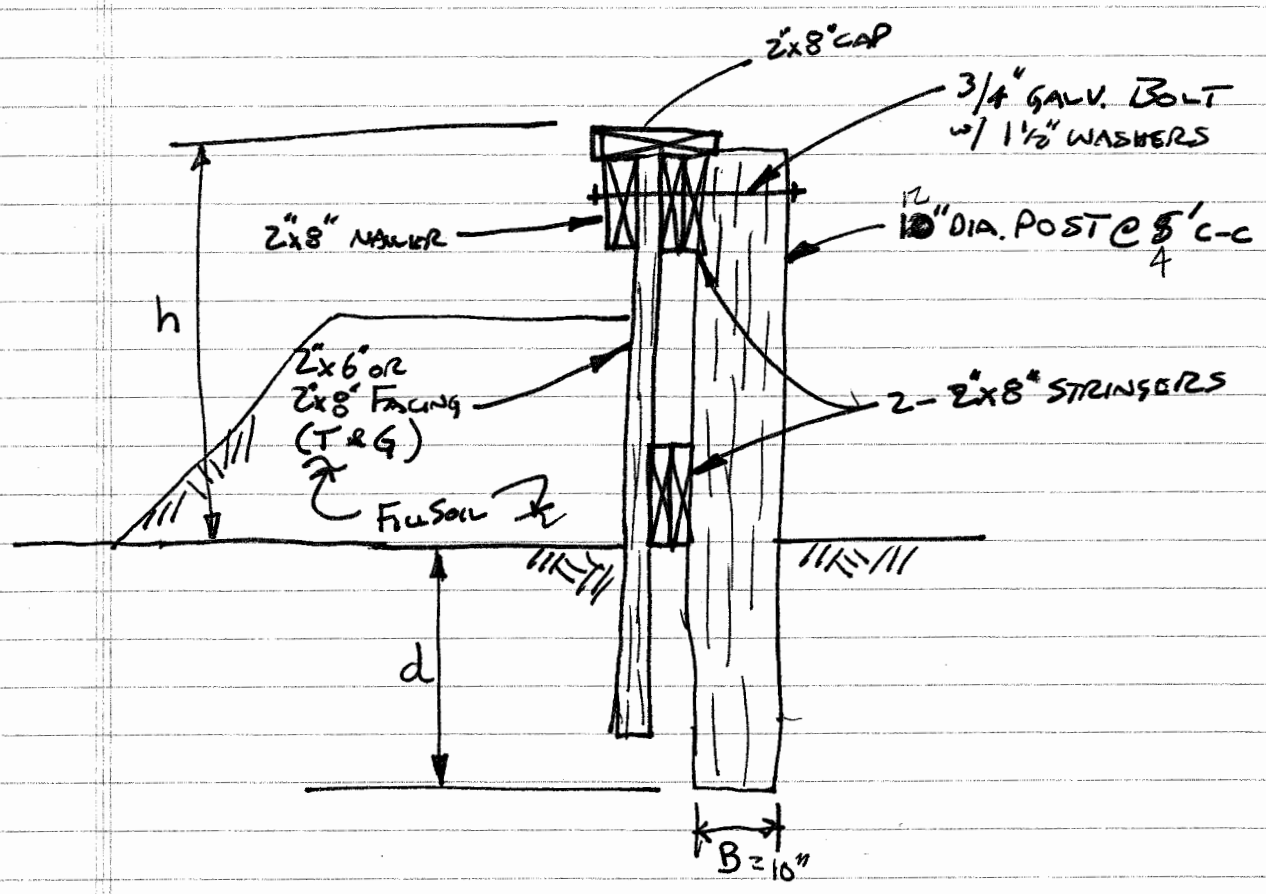
Assume initial pole depth is same as height (pole is twice length of height)

iteration	d	S1	A	d
1	8.00	533.33	13.36	12.69
2	12.69	846.26	8.42	9.55
3	9.55	636.49	11.20	11.36
4	11.36	757.07	9.41	10.21
5	10.21	680.60	10.47	10.90
6	10.90	726.33	9.81	10.47
7	10.47	697.96	10.21	10.73
8	10.73	715.18	9.96	10.57
9	10.57	704.59	10.11	10.67
10	10.67	711.05	10.02	10.61
11	10.61	707.09	10.08	10.64
12	10.64	709.51	10.04	10.62
13	10.62	708.03	10.06	10.63
14	10.63	708.93	10.05	10.63
15	10.63	708.38	10.06	10.63

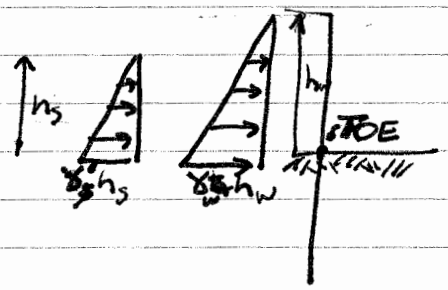
USE 19.0 FT MINIMUM LENGTH POLE

disembelment

PLAN SHOW 12' MIN. INC



LOADS:



$h_w = 8'$
$h_s = 6'$
$\gamma_w = 62.4\ lb/FT^3$

ASSUME $\gamma_s = 120\ lb/FT^3$ (CLAY SOIL) $\therefore \gamma' = 131 - 62.4$
$\gamma_{SAT} = 131\ lb/FT^3$

MOMENT ABOUT TOE, $M_o = \left(\frac{\gamma_s h_s^2}{2}\right)\left(\frac{h_s}{3}\right) + \left(\frac{\gamma_w h_w^2}{2}\right)\left(\frac{h_w}{3}\right)$

$$M_o = \frac{\overset{(131-62.4)}{\cancel{(120)}}(6)^2}{2}\left(\frac{6}{3}\right) + \frac{(62.4)(8)^2}{2}\left(\frac{8}{3}\right)$$

$$= \overset{2470}{\cancel{4320}}\ lb\text{-}FT + 5325\ lb\text{-}FT$$

$$= \overset{7794}{\cancel{7645}}\ lb\text{-}FT/LF \text{ @ } 5' \text{ SPACING} = \overset{38{,}972}{\cancel{48{,}225}}\ lb/FT$$

~~FOR DESIGN LOAD @ TOP~~ $\cancel{P = \frac{M_o}{h} = \frac{9645}{8} = 1206\ lbs}$ $P = \overset{4872}{\cancel{6028}}$ lb @ TOP

$M = 152{,}800 - 203{,}700 = -50{,}900$ in.-lb

Section modulus required $= S = \dfrac{M}{F_b}$

$$S = \frac{50{,}900}{2{,}740} = 18.6 \text{ in.}^3$$

A section which meets these requirements and is in accordance with industry standard depths and widths measures $3\frac{1}{8} \times 9$, $A = 28.1$ in.^{2}, $S = 42.2$ in.^{3}.

2. Check for combined stresses.

$$\frac{P}{A} = \frac{57{,}600}{28.1} = 2{,}050 \text{ psi}$$

$$\frac{M}{S} = \frac{50{,}900}{42.2} = 1{,}210 \text{ psi}$$

Since $P/A > M/S$, use

$$\frac{P}{AF_c'} + \frac{M}{SF_b} \leq 1$$

$$F_c' = 1.15\frac{(0.3)(2{,}000{,}000)}{[(13.3)(12)/9]^2} = 2{,}190 \text{ psi}$$

$F_c = 2{,}300$ psi $> 2{,}190$ psi

$\therefore$ Use $F_c' = 2{,}190$ psi

$$\frac{57{,}600}{(28.1)(2{,}190)} + \frac{50{,}900}{(42.2)(2{,}740)} = 0.936 + 0.440 = 1.376 > 1 \qquad \text{N.G.}$$

Try a $3\frac{1}{8} \times 12$, $A = 37.5$ in.^{2}, $S = 75.0$ in.^{3}.

$$F_c' = 1.15\frac{(0.3)(2{,}000{,}000)}{[(13.3)(12)/12]^2} = 3{,}900 \text{ psi}$$

$\therefore$ Use $F_c' = 2{,}300$ psi

$$\frac{57{,}600}{(37.5)(2{,}300)} + \frac{50{,}900}{(75.0)(2{,}740)} = 0.668 + 0.248 = 0.916 < 1 \qquad \text{O.K.}$$

3. Check for radial stress. Moment is tending to decrease the radius, therefore, radial stress is compressive and allowable radial stress $= F_{c\perp} = 470$ psi.

$$f_{rc} = \frac{3M}{2RA} = \frac{(3)(50{,}900)}{(2)(80)(12)(37.5)} = 2.12 \text{ psi} < 470 \qquad \text{O.K.}$$

4. The bottom chord is designed for direct tension only, since there are no ceiling loads. The center panel is critical.

$$\text{Required } A = \frac{P}{F_t} = \frac{54{,}400}{2{,}760} = 19.7 \text{ in.}^2$$

A $3\frac{1}{8} \times 7\frac{1}{2}$ section would be adequate to meet this requirement. However, the section size reduced by the projected area of the fastenings at that section must meet net section requirements (see page **5-13**).

If ceiling loads are present, bending is induced in the member, and the bottom chord must be designed for combined loading.

The complete design of a truss includes other factors noted in the general design procedure beginning on page **4-88**.

POLE-TYPE FRAMING

Pole-type frame structures employ preservatively treated timber poles or sawn timber posts set in the ground as main structural members. Usually, the hole in which the pole or post is set furnishes both vertical and horizontal support for the pole in supporting the structure. Setting the pole in the ground tends to prevent rotation of the bottom of the pole and thereby provides some or all of the required bracing. Preservative treatment of poles should be in accordance with the *American Wood-Preservers' Association Standards* C1 and C4.

General Considerations

General considerations, which are applicable to all pole-type frame structures include the following.

1. A bracing system can be provided at the top of a pole in order to reduce bending moments at the base of the pole and to distribute loads. The design of buildings supported by poles without bracing requires good knowledge of soil conditions in order to eliminate excessive deflection or sidesway.

2. Bearing values under butt ends of poles should be checked. It is common practice to backfill holes around the pole with well-tamped native soil, sand, or gravel. Backfilling with concrete or soil-cement can develop a more effective pole diameter; consequently, it can be used as a means of reducing required depth of embedment. Concrete backfill also increases the area of the pole for skin friction and thus increases the bearing capacity. Skin friction is also effective where uplift due to wind may act on a pole through its connections to the roof framing.

3. In order to increase bearing capacity under pole butts, concrete footings may be used. If they are used, they should be designed to withstand the punching shear of the pole and bending moment due to the pole load. Thickness of concrete footings should never be less than 12 in. and may need to be greater, depending on the loads. Concrete footings should be considered even in firm soils such as dry hard clay, coarse firm sand, or

The intended use of the structure largely determines such general features as height, overall length and width, spacing of poles, height at eaves, type of roof framing, and the kind of flooring to be used, as well as any special features such as wide bays, unsymmetrical layouts, or the possible suspension of particular loads from the roof framing. These general design features having been determined, the following procedure may be used.

Design procedure.

1. Determine loads. The principal load on a pole-type frame is generally the horizontal wind load; therefore, the wind load value required by the governing building code or, in the absence of a governing code, as determined from Section 3 of this *Manual*, should be used. In addition to dead load and other loads, roofs will transmit vertical components of wind load to poles. When wind loads are involved, allowable unit stress values may be increased one-third for the duration of loading.

2. Determine soil values. If soil tests are not available, visual inspection and a careful estimate of the bearing value of samples of the soil should be made. Building codes contain allowable design values for direct bearing assigned to various soil classifications.

Normally, building codes do not give established allowable passive soil pressure values, in which case the values may be determined by using Rankine's formula

$$p = \frac{1+\sin\phi}{1-\sin\phi} wd$$

where p = allowable passive soil pressure, psf per ft of depth
ϕ = angle of internal friction of soil, degrees
w = weight of soil, pcf
d = depth below grade, ft

Allowable soil pressure values for various classes of soil are also given in Table 4.8. For most soils suitable for foundations, a value of $p = 250$ psf is conservative.

3. Estimate the size of pole required. The American National Standards Institute (ANSI) has established certain pole classes. Table 4.9 tabulates the size requirements corresponding to ANSI Classes H-6 through 10 for Douglas fir and for Southern pine poles.

Poles of a given class and length are selected to have approximately the same load carrying capacity regardless of species. The minimum circumferences specified at 6 ft from the butt in Table 4.9 are based on the maximum fiber stress in bending that will occur at the groundline due to a given horizontal load applied 2 ft from the top of the pole. The horizontal loads used in the calculations for separating the 15 classes given in Table 4.9 are:

Class	Horizontal Load, lb
H-6	11,400
H-5	10,000
H-4	8,700
H-3	7,500
H-2	6,400
H-1	5,400
1	4,500
2	3,700
3	3,000
4	2,400
5	1,900
6	1,500
7	1,200
9	740

TABLE 4.8

ALLOWABLE LATERAL PASSIVE SOIL PRESSURE

Class of Material	Allowable Values per Foot of Depth Below Natural Grade, p, psf	Maximum Allowable S Values, psf
Good Compact, well-graded sand and gravel Hard clay Well-graded fine and coarse sand (All drained, so water will not stand)	400	8,000
Average Compact fine sand Medium clay Compact sandy loam Loose sand and gravel (All drained, so water will not stand)	200	2,500
Poor Soft clay Clay loam Poorly compacted sand Clays containing large amounts of silt (Water stands during wet season)	100	1,500

Isolated poles, such as flagpoles or signs, may be designed using lateral bearing values equal to twice these tabulated values.

TABLE 4.9

DIMENSIONS OF DOUGLAS FIR (BOTH[b] TYPES) AND SOUTHERN PINE POLES[a]

Class		H-6	H-5	H-4	H-3	H-2	H-1	1	2	3	4	5	6	7	9	10
Minimum Circumference at Top, in.		39	37	35	33	31	29	27	25	23	21	19	17	15	15	12
Length of Pole, ft	Groundline Distance from Butt[c], ft	Minimum Circumference at 6 ft from Butt, in.														
20	4.0							31.0	29.0	27.0	25.0	23.0	21.0	19.5	17.5	14.0
25	5.0							33.5	31.5	29.5	27.5	25.5	23.0	21.5	19.5	15.0
30	5.5							36.5	34.0	32.0	29.5	27.5	25.0	23.5	20.5	
35	6.0					43.5	41.5	39.0	36.5	34.0	31.5	29.0	27.0	25.0		
40	6.0			51.0	48.5	46.0	43.5	41.0	38.5	36.0	33.5	31.0	28.5			
45	6.5	58.5	56.0	53.5	51.0	48.5	45.5	43.0	40.5	37.5	35.0	32.5	30.0			
50	7.0	61.0	58.5	55.5	53.0	50.5	47.5	45.0	42.0	39.0	36.5	34.0				
55	7.5	63.5	60.5	58.0	55.0	52.0	49.5	46.5	43.5	40.5	38.0					
60	8.0	65.5	62.5	59.5	57.0	54.0	51.0	48.0	45.0	42.0	39.0					
65	8.5	67.5	64.5	61.5	58.5	55.5	52.5	49.5	46.5	43.5	40.5					
70	9.0	69.0	66.5	63.5	60.5	57.0	54.0	51.0	48.0	45.0	41.5					
75	9.5	71.0	68.0	65.0	62.0	59.0	55.5	52.5	49.0	46.0						
80	10.0	72.5	69.5	66.5	63.5	60.0	57.0	54.0	50.5	47.0						
85	10.5	74.5	71.5	68.0	65.0	61.5	58.5	55.0	51.5	48.0						
90	11.0	76.0	73.0	69.5	66.5	63.0	59.5	56.0	53.0	49.0						
95	11.0	77.5	74.5	71.0	67.5	64.5	61.0	57.0	54.0							
100	11.0	79.0	76.0	72.5	69.0	65.5	62.0	58.5	55.0							
105	12.0	80.5	77.0	74.0	70.5	67.0	63.0	59.5	56.0							
110	12.0	82.0	78.5	75.0	71.5	68.0	64.5	60.5	57.0							
115	12.0	83.5	80.0	76.5	72.5	69.0	65.5	61.5	58.0							
120	12.0	85.0	81.0	77.5	74.0	70.0	66.5	62.5	59.0							
125	12.0	86.0	82.5	78.5	75.0	71.0	67.5	63.5	59.5							

[a] Source: *American National Standard Specifications and Dimensions for Wood Poles*, 05.1-1972, copyright 1972 by American National Standards Institute, Inc.

[b] Includes Douglas fir, interior North and Douglas fir, coastal.

[c] The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars and straightness, etc.

Safe concentric column loads for various unsupported lengths of poles of Douglas fir or Southern pine are given in Table 4.10. If Tables 4.9 and 4.10 are used, the load to be supported by the poles is known and an estimate of the size of pole required can be made.

TABLE 4.10

SAFE CONCENTRIC COLUMN LOADS ON DOUGLAS FIR AND SOUTHERN PINE POLES

Unsupported Pole Length (above Groundline),	Safe Concentric Column Load, lb			
	Minimum Top Diameter			
	8 in.	7 in.	6 in.	5 in.
	ANSI Pole Class			
ft	2	3	5	6
0	68,500	52,500	38,500	26,000
10	68,500	51,000	28,500	14,000
12	61,500	36,500	20,500	10,000
14	46,000	27,500	15,500	8,000
16	36,000	22,000	12,500	6,500
18	29,500	17,500	10,000	5,000
20	24,500	15,000	8,500	4,500
25	16,500	10,000	6,000	
30	12,500	7,500		
35	10,000	6,000		

Circumferences at points other than those tabulated in Table 4.9 may be determined assuming an average taper of 0.25 in. circumference per foot of length of pole for Douglas fir and Southern pine.

4. Determine required embedment of pole. The following formula may be used in determining required embedment depth where no constraint (such as a rigid floor or surface pavement) is provided at the ground surface. Note that this procedure requires the assumption of an initial embedment depth.

$$d = \frac{A}{2}\left(\sqrt{1+\frac{4.36h}{A}}\right) \qquad \text{(see Figure 4.24)}$$

where d = depth of embedment, ft

$A = 2.34P/S_1B$

P = applied horizontal force on pole, lb

$S_1 = pd/3$ (see Table 4.8 for p)

h = height above groundline at which force P is applied, ft

B = butt diameter of pole, in. [illegible]

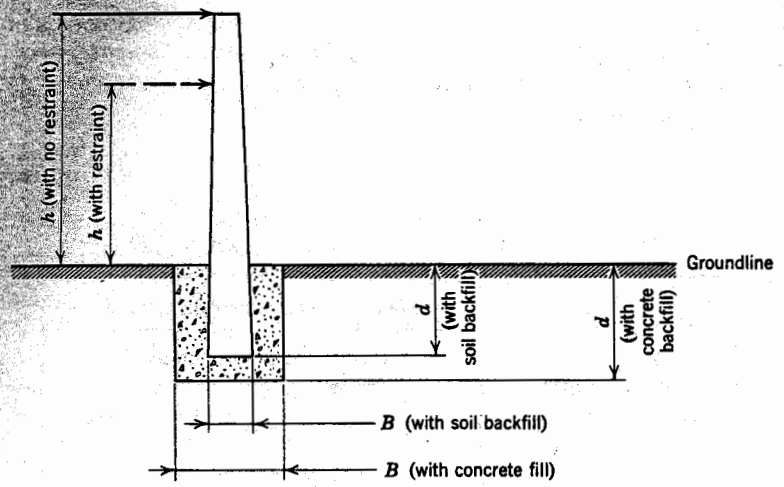


Figure 4.24. DEPTH OF EMBEDMENT.

If the post is restrained at the groundline such as by a rigid concrete floor, the following formula is used

$$d = \sqrt{\frac{4.25Ph}{S_3B}}$$

where $S_3 = pd$ (see Table 4.8 for p; note that S_3 values may not exceed the maximum values specified in Table 4.8)

and other terms are as previously defined.

For poles having some degree of fixity or restraint at the eave line, such as provided by knee braces, the point at which the applied horizontal force, P, acts is at the point of inflection of the pole. For round, tapered poles, the point of inflection is assumed to be at two-thirds the distance from the groundline to the point of restraint. For poles with no restraint, the height to the top of the pole is used as the value for h.

It may be desirable to repeat the procedure for determining embedment with the first determination of embedment as the basis for recalculating the parameter S_3.

5. Check pole bending stress. The actual bending stress in the pole at the point of maximum bending moment may be determined by the formula

$$f_b = \frac{32\pi^2 M}{C^3} = \frac{32M}{\pi D^3}$$

where f_b = actual bending stress, psi
C = pole circumference at point of maximum moment, in.
D = pole diameter at point of maximum moment, in.
M = maximum moment, in.-lb, which, for a round, tapered pole, is assumed to occur at one-fourth the depth of embedment below groundline; it may be determined if P and h, as previously

The actual bending stress cannot exceed the allowable bending stresses as tabulated in Table 4.11. These allowable bending stresses may be increased one-third for wind duration of loading.

TABLE 4.11

STRESS VALUES FOR TREATED[a] ANSI POLE SPECIES
(Normal Duration of Loading)

Species	Modulus of Rupture,[b] Extreme Fiber in Bending, psi	Extreme Fiber in Bending,[c] F_b, psi	Modulus of Elasticity,[c] E, psi	Compression Parallel to Grain[c] F_c, psi
Cedar, Northern white	4,000	1,540	600,000	740
Cedar, Western red	6,000	1,850	900,000	1,030
Douglas fir	8,000	2,700	1,500,000	1,360
Hemlock, Western	7,400	2,380	1,300,000	1,250
Larch, Western	8,400	2,940	1,500,000	1,500
Pine, jack	6,600	2,100	1,100,000	1,100
Pine, lodgepole	6,600	1,820	1,100,000	980
Pine, ponderosa	6,000	1,710	1,000,000	920
Pine, red or Norway	6,600	2,100	1,300,000	1,020
Pine, Southern	8,000	2,740	1,500,000	1,360

[a]Air-dried prior to treatment.
[b]Based on *American National Standard Specifications and Dimensions for Wood Poles*, ANSI 05.1-1972.
[c]Based on ASTM D 2899-70T, *Tentative Method for Establishing Design Stresses for Round Timber Piles.*

Above the pole's point of inflection, the bending moment reaches a maximum at the bottom of the roof bracing. The bending stress at this point should also be checked to make sure that it does not exceed the allowable bending stress.

6. Check the pole compression stress. The vertical loads on one pole include, in addition to applied live loads and/or snow loads and dead load of the supported structure, the vertical component of wind load and one-third the weight of the pole.

The allowable unit stress for a round column may be determined by the formula

$$F_c' = \frac{3.6E}{(l/r)^2} = \frac{0.225E}{(l/D)^2}$$

where F_c' = allowable unit stress in compression parallel to grain adjusted for l/d ratio, psi
E = modulus of elasticity of pole species, psi (see Table 4.11)
l = unsupported length of pole, in.
r = least radius of gyration of pole at one-third the length from

D = diameter of the pole, in., taken as the sum of the minimum diameter and one-third the difference between the minimum and maximum diameters, but in no case shall it be assumed as more than $1\frac{1}{2}$ times the minimum diameter.

The ratio l/D should not exceed 44 for round columns. The unsupported length of long poles may be reduced by providing bracing in both directions at approximately the inflection point of the pole. The actual compression parallel to grain stress at the top, or small end, of the pole should be checked, and it should not exceed the allowable unit stress for a short column. Actual compressive stress, f_c, may be determined by the formula

$$f_c = \frac{P}{A}$$

where P = total vertical load on the pole, lb
A = cross-sectional area at the top of the pole, in.^{2}

7. Determine footing requirements. The pole footing requirements can be determined if the kind of soil, the vertical load on the pole, and the size of pole required are known. Soil bearing load, in pounds per square foot, can be determined by the formula

$$\text{Soil bearing load} = 144\frac{P}{A}$$

where P = total vertical load on pole, lb
A = area of butt of pole, in.^{2}

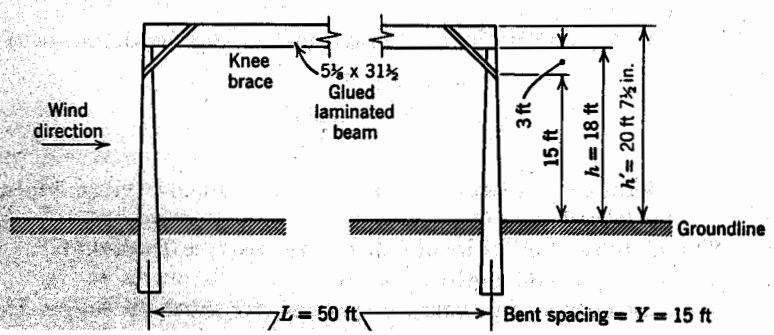
If this load exceeds the allowable bearing capacity, S_B, for the type of soil in question, a concrete footing is required.

The required area, A_c, in square feet, of a concrete footing may be determined by the formula

$$A_c = \frac{P}{S_B}$$

Concrete footings should be designed in accordance with the recommendations of the American Concrete Institute.

Example. Design the poles for the illustrated typical bent of a pole-type building to meet the stated conditions:



Loads:
DL = 10 psf
SL = 20 psf
WL = 15 psf

Pole stresses:
$F_b = (2{,}700)(1.33) = 3{,}590$ psi
$E = 1{,}500{,}000$ psi

1. Determine loads.

$$\text{Vertical load on one pole} = V = \frac{YL(\text{DL}+\text{SL})}{2}$$

$$V = \frac{(15)(50)(10+20)}{2} = 11{,}250 \text{ lb}$$

$$\text{Wind load at top of pole} = P = \frac{Yh'}{2}(\text{WL}) = \frac{(15)(20.625)}{2}(15) = 2{,}320 \text{ lb}$$

2. Soil values.

Soil is compact, well-graded sand (good soil)
Allowable passive pressure = p = 400 psf (from Table 4.8)
Allowable bearing capacity = S_B = 8,000 psf
Concrete fill not required

3. Estimate size of pole required.

From Table 4.10, for an unsupported pole length of 15 ft carrying a 11,250 lb load, select an ANSI Class 5 pole.
Assuming a 12 ft depth of embedment, from Table 4.9 a 30 ft Class 5 pole has a minimum top circumference of 19 in. and a minimum circumference 6 ft from the butt of 27.5 in.

4. Determine required embedment.

Distance from groundline to point of inflection = $h = \frac{2}{3}$ unsupported pole length = $\frac{2}{3}(15) = 10$ ft

$$\text{Diameter 6 ft from butt} = \frac{27.5}{\pi} = 8.75 \text{ in.}$$

$$\text{Butt diameter} = B = \frac{27.5+(6)(0.25)}{\pi} = 9.23 \text{ in.} = 0.769 \text{ ft}$$

$$\text{Soil stress} = S_1 = \frac{pd}{3} = \frac{(400)(12.0)}{3} = 1{,}600 \text{ psf}$$

$$A = \frac{2.34P}{S_1B} = \frac{(2.34)(2{,}320)}{(1{,}600)(0.769)} = 4.41$$

Depth of embedment = d

$$d = \frac{A}{2}\left(1+\sqrt{1+\frac{4.36h}{A}}\right)$$

$$d = \frac{4.41}{2}\left(1+\sqrt{1+\frac{(4.36)(10.0)}{4.41}}\right) = 9.48 \text{ ft}$$

Use a 30 ft pole; actual $d = 12$ ft, circumference 6 ft from butt = 27.5 in. (for Class 5 pole)

5. Check bending stress.

Maximum moment $= M = 12P\left(h+\frac{d}{4}\right)$

$M = (12)(2{,}320)\left(10.0+\frac{12}{4}\right) = 362{,}000$ in.-lb

Circumference at $\frac{1}{4}$ depth of embedment

$\frac{3d}{4} = \frac{(3)(12)}{4} = 9.0$ ft (distance from butt)

$C = 27.5-(9-6)(0.25) = 26.75$ in.

$f_b = \frac{32\pi^2 M}{C^3} = \frac{32\pi^2(362{,}000)}{(26.75)^3} = 5{,}970 \text{ psi} > 3{,}590$ N.G.

Try a Class 2 pole—circumference 6 ft from butt = 34.0 in.
Circumference at $\frac{1}{4}$ depth of embedment

$C = 34.0-(9-6)(0.25) = 33.25$ in.

$f_b = \frac{32\pi^2(362{,}000)}{(33.25)^3} = 3{,}090 \text{ psi} < 3{,}590$ O.K.

Use a Class 2 pole
Upper maximum moment occurs at the knee brace-to-column connection, or 5 ft above the point of inflection.
Upper maximum $M = 12P(5) = (12)(2{,}320)(5)$
$M = 139{,}200$ in.-lb
Circumference at knee brace connection $= C$
Top circumference for Class 2 pole = 25 in.
Knee brace connection occurs 3 ft below top

$C = 25+(3)(0.25) = 25.75$ in.

$f_b = \frac{32\pi^2 M}{C^3} = \frac{32\pi^2(139{,}200)}{(25.75)^3} = 2{,}570 \text{ psi} < 3{,}590$ O.K.

6. Check compression stress.

Weight of 30 ft Class 2 pole $= W = 725$ lb (approx.)

Axial load $= P = V+\frac{W}{3} = 11{,}250+\frac{725}{3}$

$P = 11{,}490$ lb

Diameter at $\frac{1}{3}$ pole length $\left(\frac{30}{3} = 10 \text{ ft}\right)$ from top $= D$

Diameter at top $= \frac{25}{}$

$l/D = \frac{(15)(12)}{8.75} = 20.6 < 44$ O.K.

$F_c' = \frac{0.225E}{(l/D)^2} = \frac{(0.225)(1{,}500{,}000)}{(20.6)^2} = 795$ psi

$f_c = \frac{P}{A} = \frac{11{,}490}{(25)^2/4\pi} = 231 \text{ psi} < 795$ O.K.

7. Determine footing requirements.

Area of pole butt $= A = \frac{[34.0+(6)(0.25)]^2}{4\pi}$

$A = 100$ in.^{2}

Soil bearing load $= 144\frac{P}{A} = 144\left(\frac{11{,}490}{100}\right) = 16{,}550$ psf $>$ 8,000; therefore, a footing is required
Required area of concrete footing $= A_c$

$A_c = \frac{P}{S_B} = \frac{11{,}490}{8{,}000} = 1.436$ ft^2

TIMBER PILES

Recommendations for the use of timber piles in foundations may be found in *Pressure Treated Timber Foundation Piles for Permanent Structures*, of the American Wood Preservers Institute. The American Society for Testing and Materials publication, *Standard Specifications for Round Timber Piles*, ASTM D25–70, classifies round timber piles according to the manner in which their load carrying capacity is developed. There are two classes:

1. *Friction Piles.* Friction piles are specified when pile capacity is determined by the friction developed in contact with the surrounding soil, along with the compressive strength of the timber piles used.
2. *End-Bearing Piles.* End-bearing piles are specified when pile capacity is determined primarily by the end-bearing capacity of the soil at the pile tip, along with the compressive strength of the timber piles used.

Table 4.12 lists size requirements for piles in accordance with ASTM Specification D25-70.

FALSEWORK AND CENTERING

Framing employing either glued laminated or sawn material is often economically used as falsework to support formwork for large poured-in-place concrete structures or as centering for placing precast concrete, stone, and steel structures which are assembled in place.

Falsework is the temporary structure erected to support work in the

TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Project STONEHOUSE RICHARDSON'S MILL SECT. 2

Basin # 1 Location BETWEEN PLANK + YARDING

Total area draining to basin: 10.79 acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 10.8 acres = 723 cu. yds.

2. Available basin volume = 725 cu. yds. at elevation 23.7. (From storage - elevation curve)

3. Excavate 700 cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x 10.8 acres = 356 cu. yds.

5. Elevation corresponding to cleanout level = 20.1.

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = 2.6 ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 10.8 acres = 723 cu. yds.

8. Total available basin volume at crest of riser* = 1900 cu. yds. at elevation 27. (From Storage - Elevation Curve)

* Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = 4 in.

10. ~~Diameter of flexible tubing = _____ in. (diameter of dewatering orifice plus 2 inches).~~
PERFORATED RISER = 8in

Preliminary Design Elevations

11. Crest of Riser = 27.0

Top of Dam = 27.0

Design High Water = 27.3 (25yr)

Upstream Toe of Dam = 15

Basin Shape

12. Length of Flow / Effective Width — L / We = _____

If > 2, baffles are not required X

If < 2, baffles are required _____

Runoff

13. Q_2 = 0.7 cfs (From Chapter 5)

14. Q_{25} = 51.5 cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = 0.7 cfs. (riser and barrel)

~~Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = _____ cfs. (riser and barrel)~~

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 093

16. With emergency spillway:

Assumed available head (h) = 3.3 ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

Without emergency spillway:

Assumed available head (h) = _____ ft. (Using Q_{25})

h = Design High Water Elevation - Crest of Riser Elevation

17. Riser diameter (D_r) = _____ in. Actual head (h) = _____ ft.

(From Plate 3.14-8.)

Note: Avoid orifice flow conditions.

18. Barrel length (l) = _____ ft.

Head (H) on barrel through embankment = _____ ft.

(From Plate 3.14-7).

19. Barrel diameter = _____ in.

(From Plate 3.14-B [concrete pipe] or Plate 3.14-A [corrugated pipe]).

20. Trash rack and anti-vortex device

Diameter = _____ inches.

Height = _____ inches.

(From Table 3.14-D).

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = 50.8 cfs.

22. Bottom width (b) = _____ ft.; the slope of the exit channel (s) = _____ ft./foot; and the minimum length of the exit channel (x) = _____ ft.
(From Table 3.14-C).

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 094

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = ____ ft.

Slope of upstream face of embankment (Z) = _____:1.

Slope of principal spillway barrel (S_b) = _____%

Length of barrel in saturated zone (L_s) = _____ ft.

24. Number of collars required = _____ dimensions = _____

(from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 27.0

Design High Water = 27.3

Emergency Spillway Crest = 27.0

Principal Spillway Crest = 23.7

Dewatering Orifice Invert = 23.7

Cleanout Elevation = 20.1

Elevation of Upstream Toe of Dam
or Excavated Bottom of "Wet Storage
Area" (if excavation was performed) = _____

WC078_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 095

Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 3 - SED BASIN 7.1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	15.00	416	0	0
1.00	16.00	720	568	568
2.00	17.00	1,095	908	1,476
3.00	18.00	1,511	1,303	2,779
4.00	19.00	1,962	1,737	4,515
5.00	20.00	2,450	2,206	6,721
6.00	21.00	2,965	2,708	9,429
7.00	22.00	3,518	3,242	12,670
8.00	23.00	4,104	3,811	16,481
9.00	24.00	4,725	4,415	20,896
11.00	26.00	11,810	16,535	37,431
13.00	28.00	16,225	28,035	65,466

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 4.0	0.0	0.0	0.0
Span in	= 4.0	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 23.70	0.00	0.00	0.00
Length ft	= 2.0	0.0	0.0	0.0
Slope %	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 120.00	0.00	0.00	0.00
Crest El. ft	= 27.00	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	0.00	0.00
Weir Type	= Broad	Rect	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	15.00	0.00	---	---	---	0.00	---	---	---	---	0.00
1.00	568	16.00	0.00	---	---	---	0.00	---	---	---	---	0.00
2.00	1,476	17.00	0.00	---	---	---	0.00	---	---	---	---	0.00
3.00	2,779	18.00	0.00	---	---	---	0.00	---	---	---	---	0.00
4.00	4,515	19.00	0.00	---	---	---	0.00	---	---	---	---	0.00
5.00	6,721	20.00	0.00	---	---	---	0.00	---	---	---	---	0.00
6.00	9,429	21.00	0.00	---	---	---	0.00	---	---	---	---	0.00
7.00	12,670	22.00	0.00	---	---	---	0.00	---	---	---	---	0.00
8.00	16,481	23.00	0.00	---	---	---	0.00	---	---	---	---	0.00
9.00	20,896	24.00	0.05	---	---	---	0.00	---	---	---	---	0.05
11.00	37,431	26.00	0.61	---	---	---	0.00	---	---	---	---	0.61
13.00	65,466	28.00	0.85	---	---	---	312.00	---	---	---	---	312.85

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

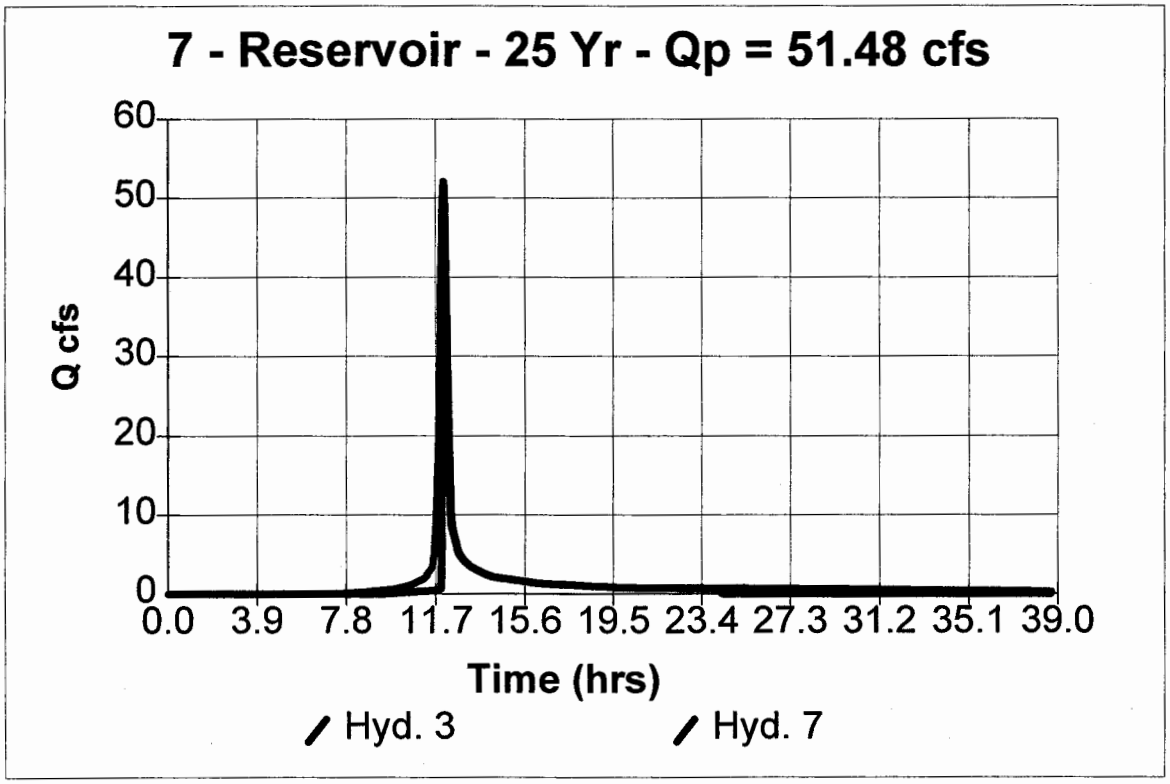
Hyd. No. 7

SED. BASIN ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 51.48 cfs
Storm frequency	= 25 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= SED BASIN 7.1
Max. Elevation	= 27.29 ft	Max. Storage	= 55,504 cuft

Storage Indication method used.

Hydrograph Volume = 145,141 cuft



CALCULATION FOR SCS HYDROGRAPH GENERATION AND CHANNEL PROTECTION
FOR BMP / SWM 7.2
RICHARDSON'S MILL, SECTION 1 (SUBDIVISION AT STONEHOUSE)
AES Project No.: 9028-08
May 10, 2002

I. PRE-DEVELOPMENT CONDITIONS TO POINT OF CONCERN

A. Pre-Development Drainage Area to Point of Concern = 9.34 Acres

B. Pre-development Land Use, Soil Classification and Calculation of Composite Curve Number

	Soil Type	Soil Hydrologic Group	Pre-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Adjusted (CN)
1)	15-F Emporia Complex	C	Wooded (Good)	3.09	70	216
2)	11-C Craven Uchee	C	Wooded (Good)	5.70	70	399
3)	14-B Emporia Fine Sandy Loam	C	Wooded (Good)	0.31	70	22
4)	25-B Norfolk	B	Wooded (Good)	0.24	55	13
5)	17 - Johnson	D	Wooded (Fair)	0.00	79	0
6)						
7)						
	Totals =			9.34		650
	Composite CN =					70

C. Pre-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)

Surface description (table 5-7)	wooded (light underbrush)
Manning's roughness coefficient., n (table 5-7)	0.4
Length of overland flow, L	280 Feet
2-year 24-hour rainfall, P2	3.6 inches
Average slope of overland flow , s	0.029 feet per foot
Travel time, Tt = (0.007*(n*L)^0.8)/(P2^0.5*s^0.4)	0.66 hours

2) Shallow concentrated flow (maximum 300 feet)

Surface description, paved or unpaved	unpaved, wooded
Length of shallow concentrated flow, L	300 Feet
Average slope of shallow concentrated flow, s	0.088 feet per foot
Average velocity, v	0.8 feet per second
Travel time, Tt = L/(3600*v)	0.11 hours

3) Channel or Pipe Flow

Length of channel flow, L	515 Feet
Average velocity of channel flow, v	2.5 feet per second
Travel time, Tt = L/(3600*v)	0.06 hours

Total Time of Concentration = 0.83 hours or 50 minutes

II. POST-DEVELOPMENT CONDITIONS TO POINT OF CONCERN (for total site)

A. Post-Development Drainage Area to Point of Concern = 7.93 Acres

B. Post-development Land Use, Soil Classification and Calculation of Composite Curve Number

	Soil Type	Soil Hydrologic Group	Post-Development Land Use	Area of Land Use (in Acres)	Curve Number for Land Use (CN)	Adjusted (CN)
1)	15-F Emporia Complex	C	Open Space/Wooded	0.80	70	56
2)	15-F Emporia Complex	C	Residential - 1/2 acre lots	1.9	80	152
3)	11-C Craven Uchee	C	Open Space/Wooded	0.00	70	0
4)	11-C Craven Uchee	C	Residential - 1/2 acre lots	4.44	80	355
5)	14-B Emporia Fine Sandy Loam	C	Open Space/Wooded	0.00	70	0
6)	14-B Emporia Fine Sandy Loam	C	Residential - 1/2 acre lots	0.13	80	10
7)	25-B Norfolk	B	Open Space/Wooded	0.00	55	0
8)	25-B Norfolk	B	Residential - 1/2 acre lots	0.00	70	0
9)	17 - Johnson	D	Wooded (Fair)	0.00	79	0
10)	17 - Johnson	D	Residential - 1/2 acre lots	0.00	85	0
11)	Street and Roads		Street and Roads	0.66	98	65
	Total Adjusted CN =			7.93		638
	Composite CN =					80

C. Post-Development Time of Concentration Calculations

1) Overland Flow (maximum 300 feet)

Surface description (table 5-7)	residential / woods	
Manning's roughness coefficient., n (table 5-7)	0.3	
Length of overland flow, L	230	Feet
25-year 24-hour rainfall, P25	6.5	inches
Average slope of overland flow , s	0.1	feet per foot
Travel time, Tt = (0.007*(n*L)^0.8)/(P2^0.5*s^0.4)	0.20	hours

2) Shallow concentrated flow (maximum 300 feet)

Surface description, paved or unpaved	unpaved	
Length of shallow concentrated flow, L	150	Feet
Average slope of shallow concentrated flow, s	0.088	feet per foot
Average velocity, v	0.8	feet per second
Travel time, Tt = L/(3600*v)	0.05	hours

3) Channel or Pipe Flow

Length of channel flow, L	475	Feet
Average velocity of channel flow, v	2.5	feet per second
Travel time, Tt = L/(3600*v)	0.05	hours

Total Time of Concentration =	0.31	hours	
or	19	minutes	

III. PROPOSED ESTIMATED POND(S) VOLUME ABOVE LOWER STAGE or NORMAL POOL BY ELEVATION

Elevation	Depth	Area (sq. ft.)	Incremental Volume (cu. ft.)	Inc. Volume (cu. yd.)	Sum Volume (cu. ft.)	Sum Volume (cu. yd.)
21.0		0	0			
22.0	1.0	35	18	1	18	1
24.0	2.0	829	864	32	882	33
26.0	2.0	3183	4012	149	4894	181
28.0	2.0	7322	10505	389	15399	570
30.0	2.0	11554	18876	699	34275	1269
32.0	2.0	15961	27515	1019	61790	2289
34.0	2.0	20612	36573	1355	98363	3643

IV. DETERMINING RELEASE RATE OF 1-YEAR, 24-HOUR DETAINED FOR 24 HOURS FOR STREAM CHANNEL PROTECTION

Volume of 1-Year, 24-Hour Storm (based upon Hydrograph #1) = 31,724 cubic feet

Elevation of water surface associated with 1-Year, 24-Hour Storm Vol. = 29.7 (Actual WSEL of routed 1-year storm is EL 27.98)

Elevation of Release Inlet for Channel Protection = 25.3

Average Head, in feet, on Release Inlet = 2.2

Average Release Rate Calculation

$$\frac{31{,}724 \text{ cubic feet}}{(24 \text{ hours} \times 60 \text{ minutes/hour} \times 60 \text{ seconds/ minute})} = 0.4 \text{ cfs}$$

Calculation of Size of Release Inlet

Diameter of Release Inlet = 2 * (Q / ((64.32 * (h / 2)) ^ (1/2) * 0.6 * 3.14))) ^ (1/2)
where, Q equals Average Release Rate, in cfs
h equals Average Head, in feet

Diameter of Release Inlet = 0.30 feet, or 4 inches (3" use in Computer Routing)

**Note: 3" orifice was determined to be most adequate for the detaining the 1 year storm for a period of 24 hours.

Reservoir Report

Reservoir No. 1 - TIMBER WALL 7.2

Hydraflow Hydrographs by Intelisolve

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	21.00	00	0	0
1.00	22.00	35	18	18
3.00	24.00	829	864	882
5.00	26.00	3,183	4,012	4,894
7.00	28.00	7,322	10,505	15,399
9.00	30.00	11,554	18,876	34,275
11.00	32.00	15,961	27,515	61,790

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 3.0	0.0	0.0	0.0
Span in	= 3.0	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 25.30	0.00	0.00	0.00
Length ft	= 2.0	0.0	0.0	0.0
Slope %	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 50.00	0.00	0.00	0.00
Crest El. ft	= 28.70	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	0.00	0.00
Weir Type	= Broad	Rect	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	21.00	0.00	---	---	---	0.00	---	---	---	---	0.00
1.00	18	22.00	0.00	---	---	---	0.00	---	---	---	---	0.00
3.00	882	24.00	0.00	---	---	---	0.00	---	---	---	---	0.00
5.00	4,894	26.00	0.18	---	---	---	0.00	---	---	---	---	0.18
7.00	15,399	28.00	0.38	---	---	---	0.00	---	---	---	---	0.38
9.00	34,275	30.00	0.51	---	---	---	192.69	---	---	---	---	193.19
11.00	61,790	32.00	0.61	---	---	---	779.32	---	---	---	---	779.92

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	2.90	6	744	20,033	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	9.30	6	720	29,742	----	------	------	POST-DEV. RUNOFF
5	Reservoir	0.70	6	810	29,742	3	28.27	17,990	BMP ROUTED
7	Reservoir	0.39	6	936	29,251	3	28.13	31,561	SED BASIN ROUTED

Proj. file: 90280872.gpw | Return Period: 1 yr | Run date: 05-10-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	5.37	6	744	33,324	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	14.17	6	720	44,160	----	------	------	POST-DEV. RUNOFF
5	Reservoir	4.18	6	738	44,160	3	28.77	22,632	BMP ROUTED
7	Reservoir	1.99	6	756	43,669	3	28.68	36,639	SED BASIN ROUTED

Proj. file: 90280872.gpw	Return Period: 2 yr	Run date: 05-10-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	8.39	6	744	49,557	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	19.69	6	720	60,720	----	------	------	POST-DEV. RUNOFF
5	Reservoir	17.62	6	732	60,720	3	28.95	24,342	BMP ROUTED
7	Reservoir	13.67	6	732	60,229	3	28.91	38,792	SED BASIN ROUTED

Proj. file: 90280872.gpw	Return Period: 10 yr	Run date: 05-10-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	25.98	6	744	146,155	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	48.65	6	720	150,536	----	------	------	POST-DEV. RUNOFF
5	Reservoir	46.91	6	726	150,536	3	29.20	26,732	BMP ROUTED
7	Reservoir	46.68	6	726	150,045	3	29.20	41,569	SED BASIN ROUTED

DHW

Proj. file: 90280872.gpw | Return Period: 100 yr | Run date: 05-10-2002

Hydrograph Plot

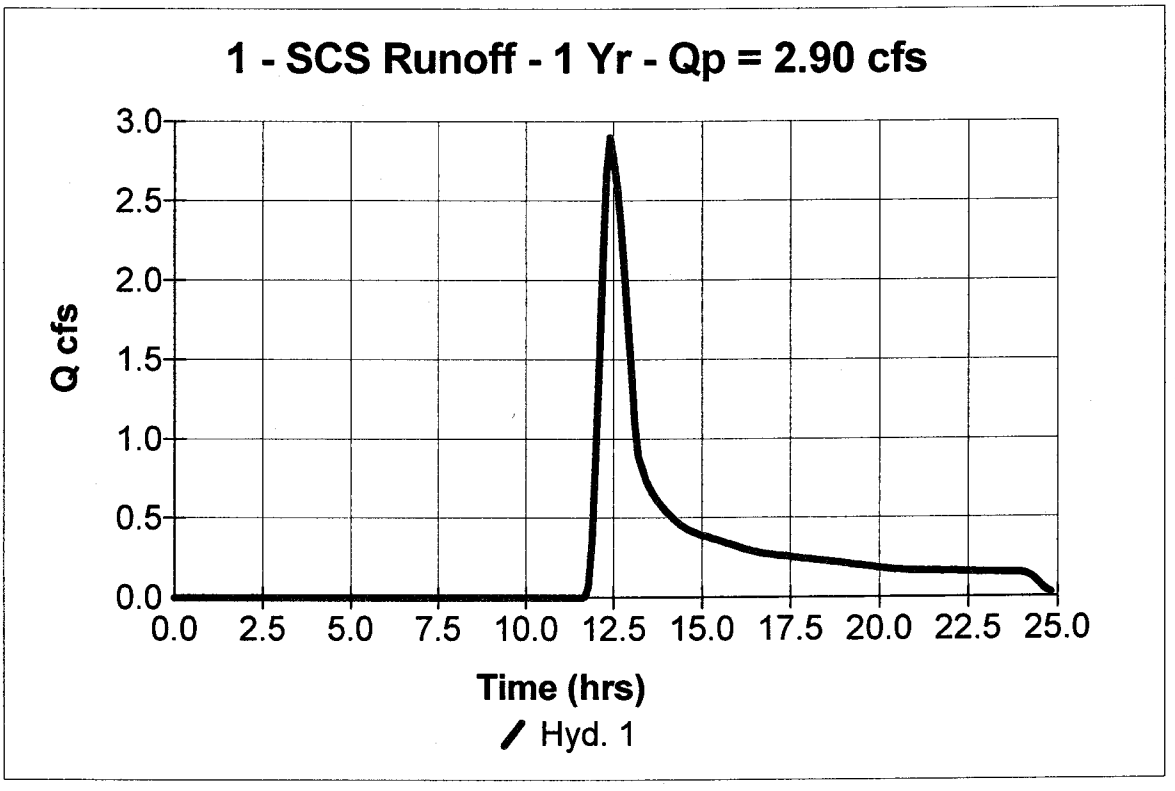
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 2.90 cfs
Storm frequency	= 1 yrs	Time interval	= 6 min
Drainage area	= 9.34 ac	Curve number	= 70
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 50 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 20,033 cuft



Hydrograph Plot

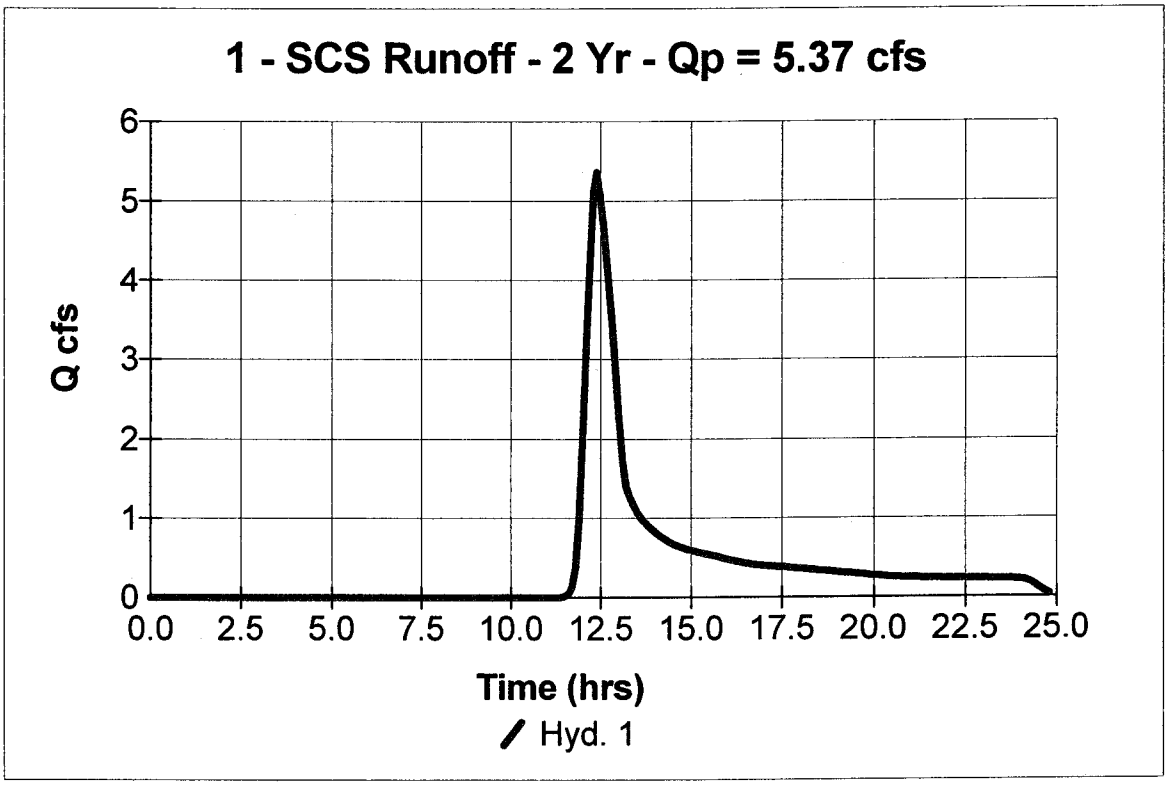
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 5.37 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 9.34 ac	Curve number	= 70
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 50 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 33,324 cuft



Hydrograph Plot

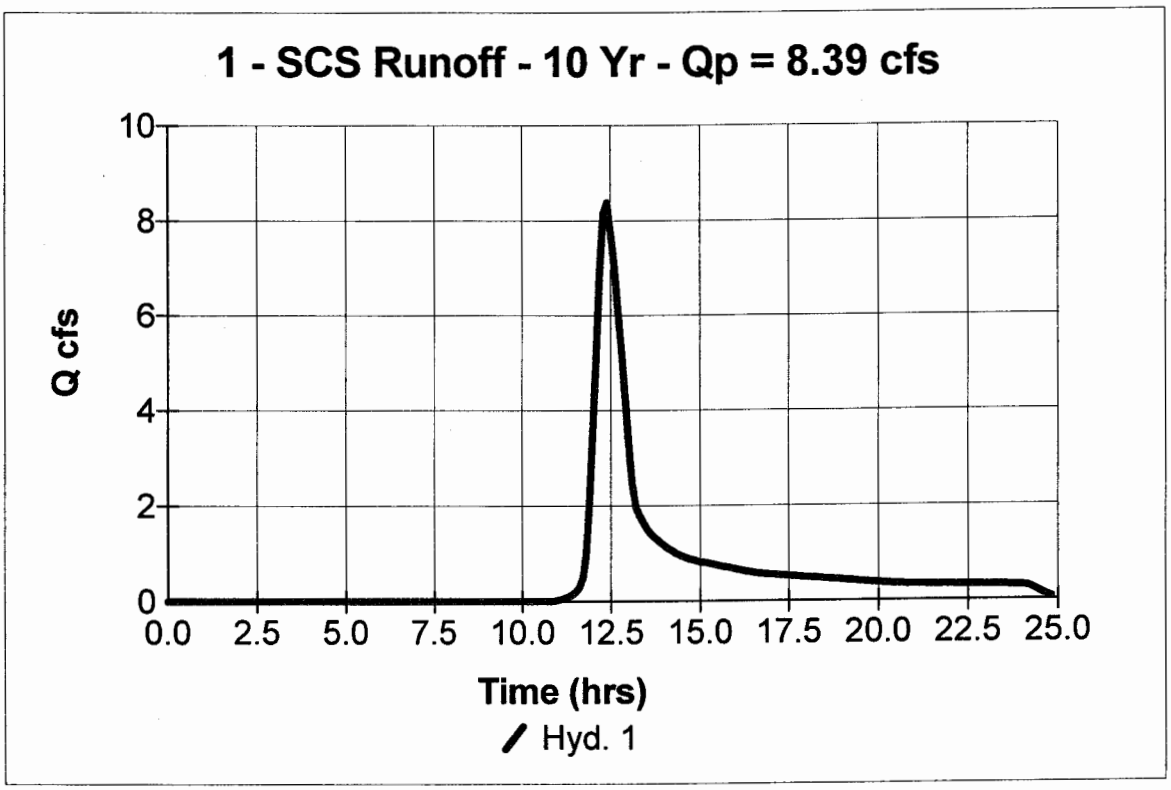
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 8.39 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 9.34 ac	Curve number	= 70
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 50 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 49,557 cuft



Hydrograph Plot

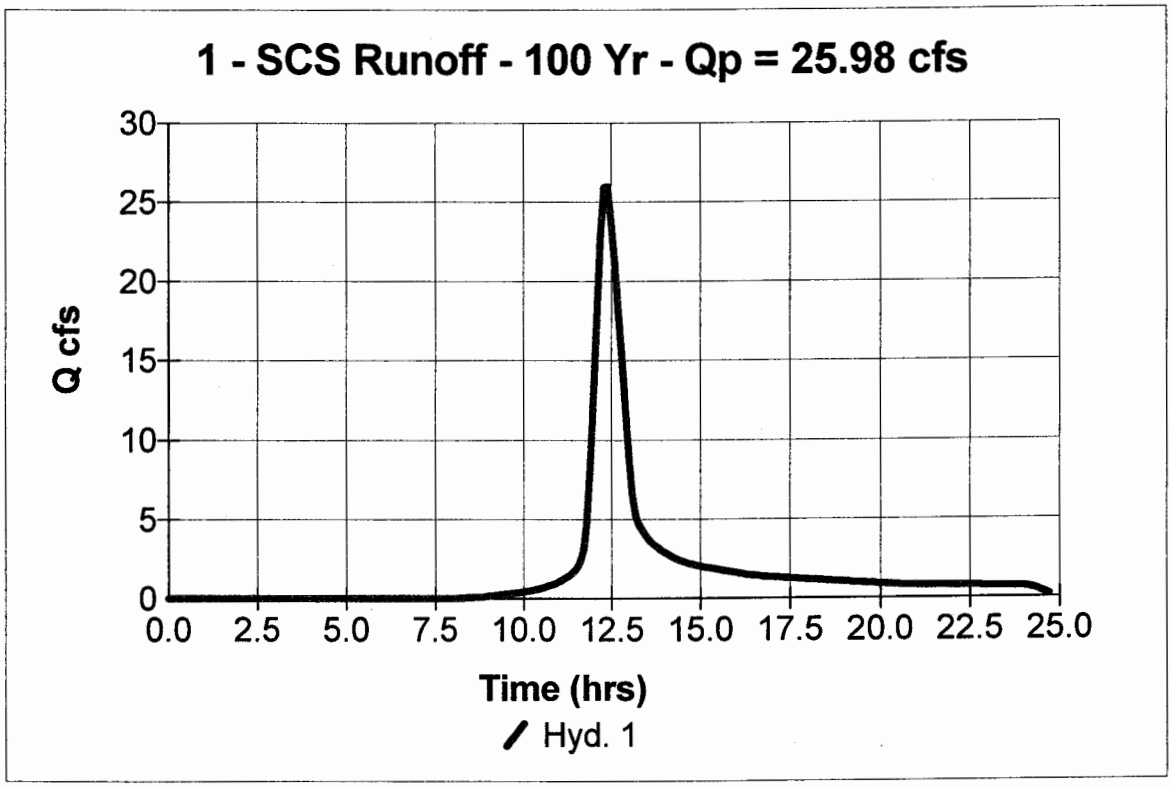
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 25.98 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 9.34 ac	Curve number	= 70
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 50 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 146,155 cuft



Hydrograph Plot

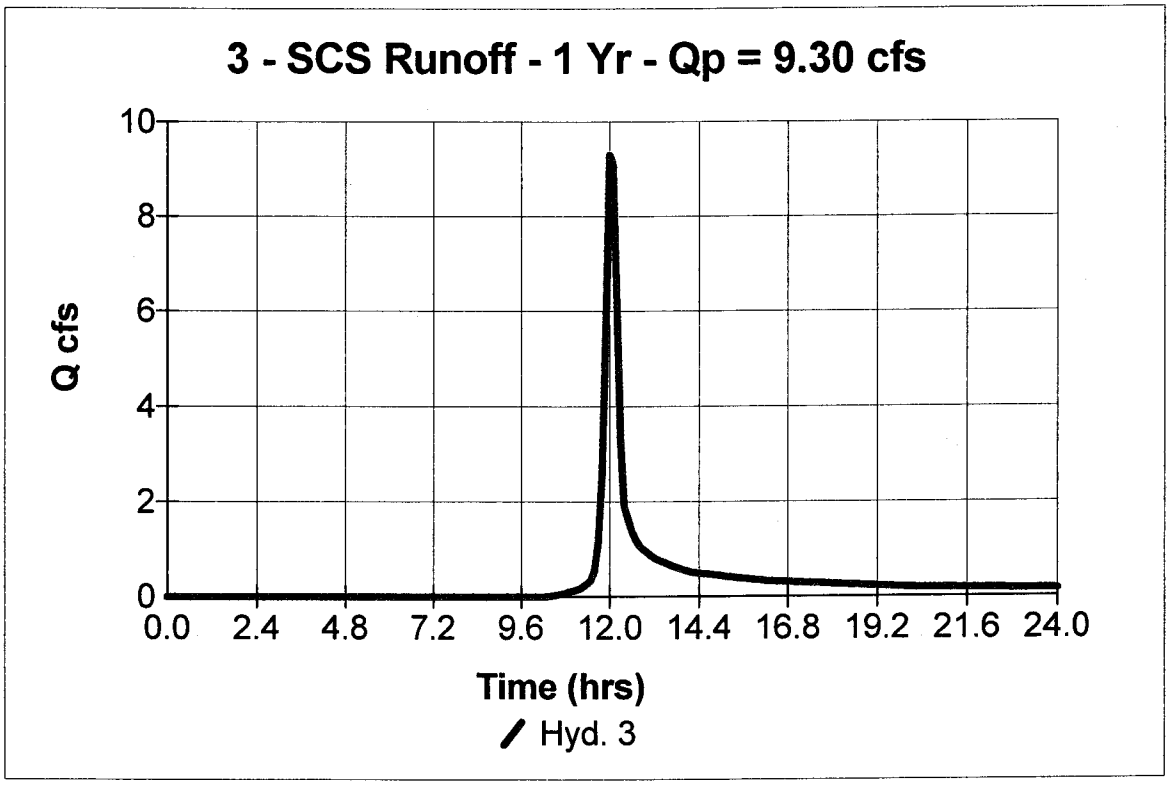
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 9.30 cfs
Storm frequency	= 1 yrs	Time interval	= 6 min
Drainage area	= 7.93 ac	Curve number	= 80
Basin Slope	= 10.0 %	Hydraulic length	= 855 ft
Tc method	= USER	Time of conc. (Tc)	= 19 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 29,742 cuft



Hydrograph Plot

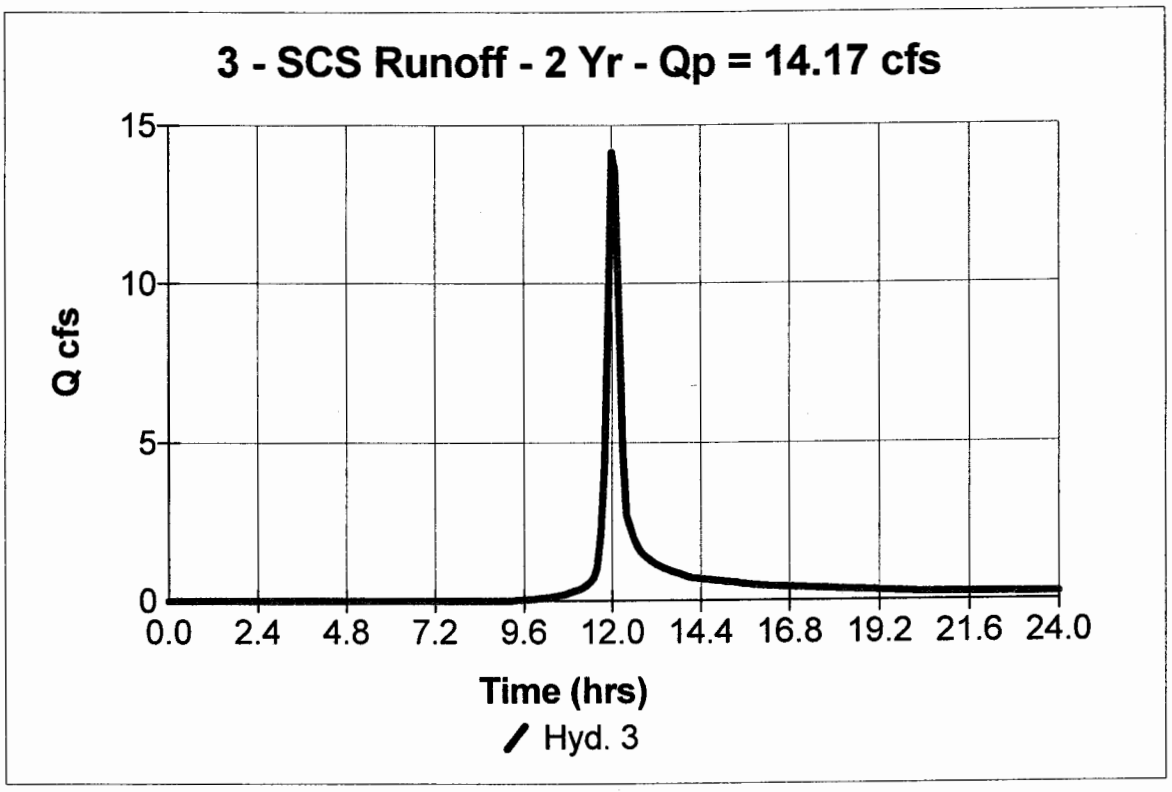
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 14.17 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Drainage area	= 7.93 ac	Curve number	= 80
Basin Slope	= 10.0 %	Hydraulic length	= 855 ft
Tc method	= USER	Time of conc. (Tc)	= 19 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 44,160 cuft



Hydrograph Plot

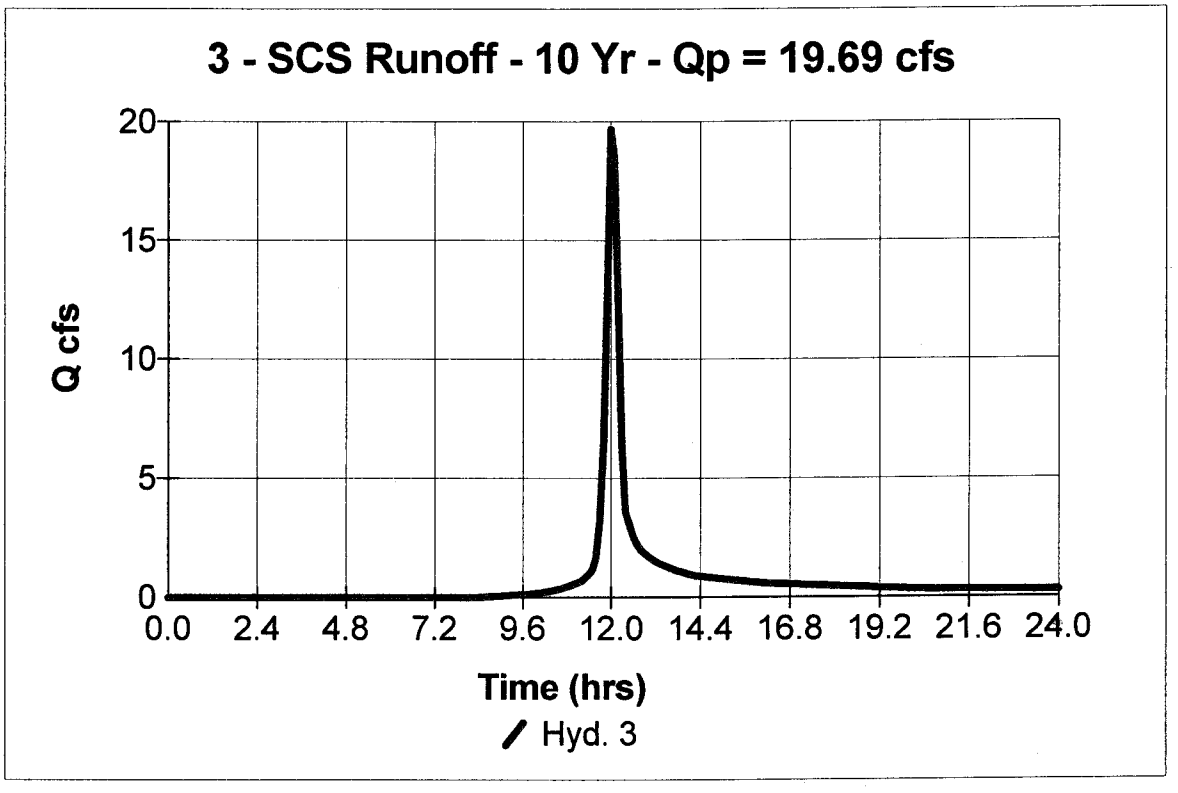
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 19.69 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Drainage area	= 7.93 ac	Curve number	= 80
Basin Slope	= 10.0 %	Hydraulic length	= 855 ft
Tc method	= USER	Time of conc. (Tc)	= 19 min
Total precip.	= 4.25 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 60,720 cuft



Hydrograph Plot

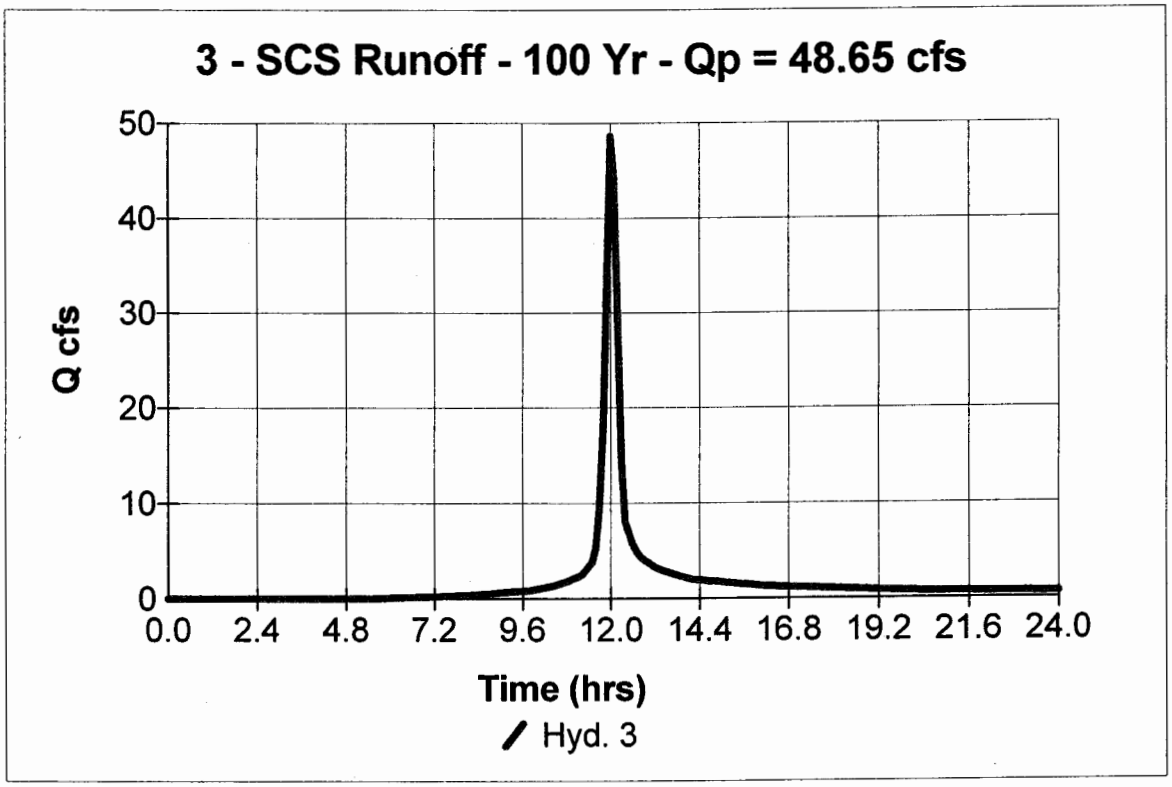
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 48.65 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Drainage area	= 7.93 ac	Curve number	= 80
Basin Slope	= 10.0 %	Hydraulic length	= 855 ft
Tc method	= USER	Time of conc. (Tc)	= 19 min
Total precip.	= 7.95 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 150,536 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

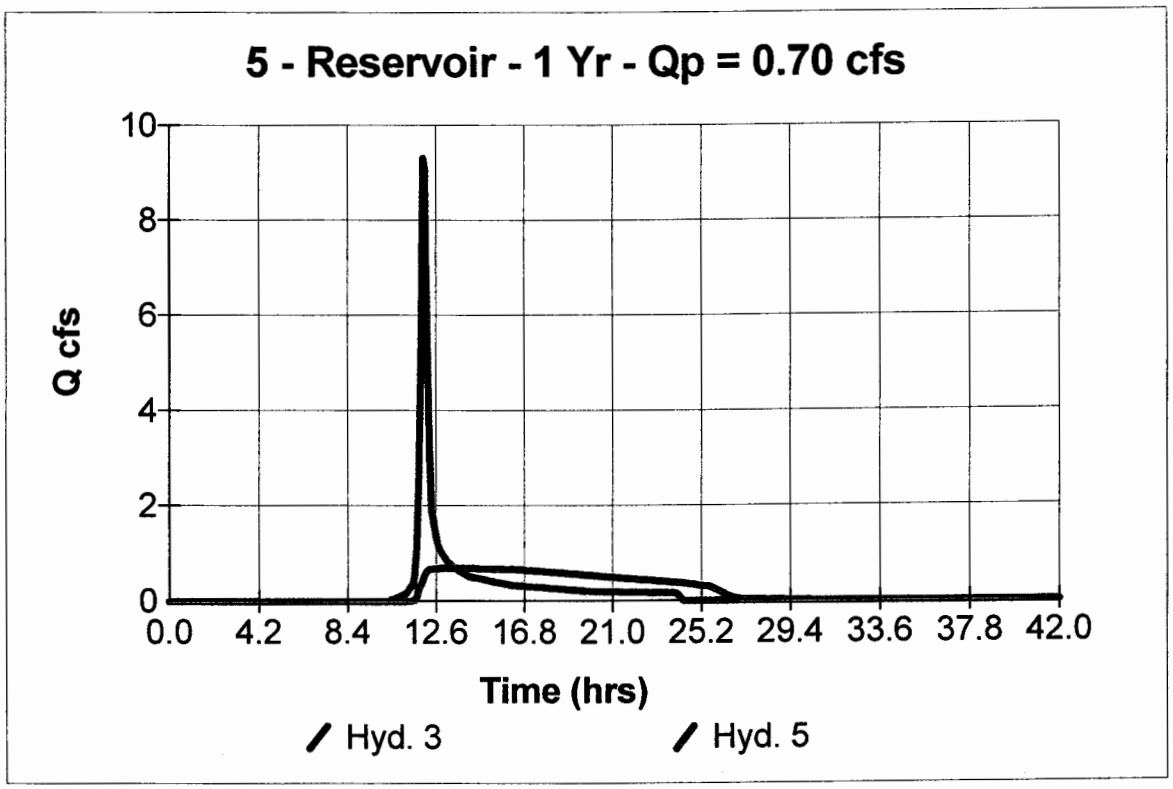
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 0.70 cfs
Storm frequency	= 1 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.2
Max. Elevation	= 28.27 ft	Max. Storage	= 17,990 cuft

Storage Indication method used.

Hydrograph Volume = 29,742 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

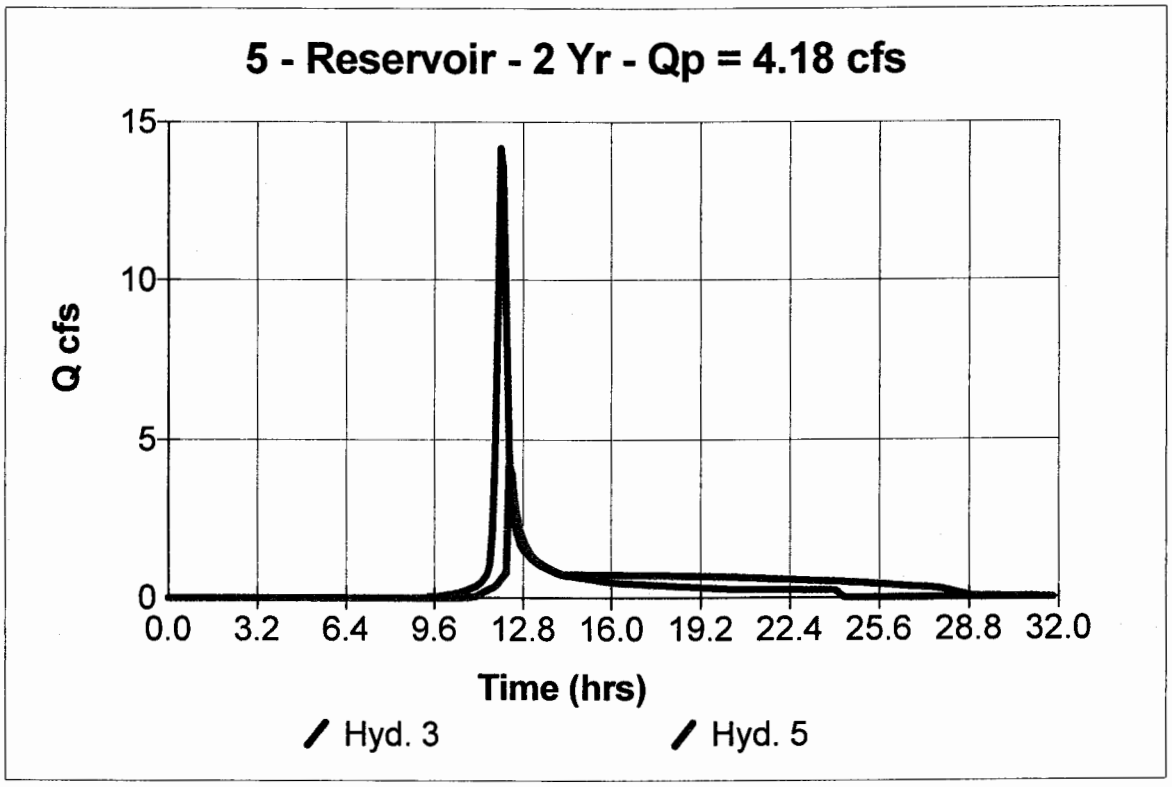
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 4.18 cfs
Storm frequency	= 2 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.2
Max. Elevation	= 28.77 ft	Max. Storage	= 22,632 cuft

Storage Indication method used.

Hydrograph Volume = 44,160 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

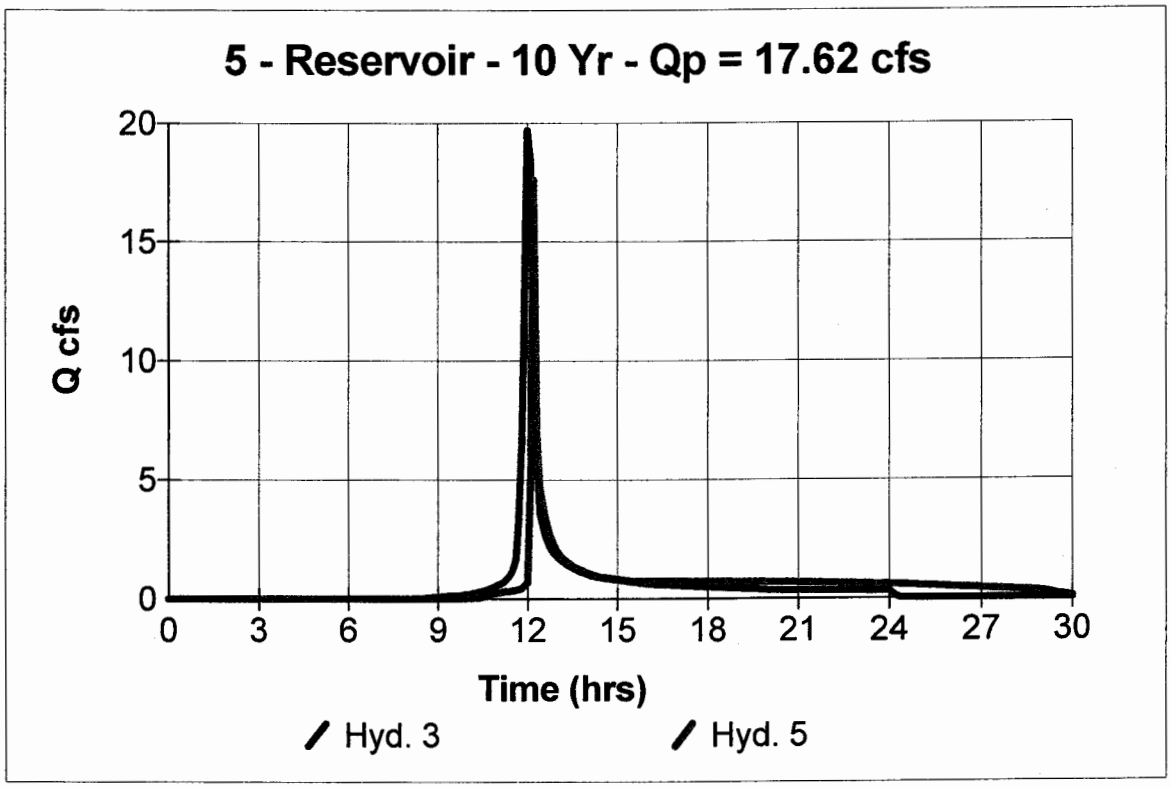
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 17.62 cfs
Storm frequency	= 10 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.2
Max. Elevation	= 28.95 ft	Max. Storage	= 24,342 cuft

Storage Indication method used.

Hydrograph Volume = 60,720 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

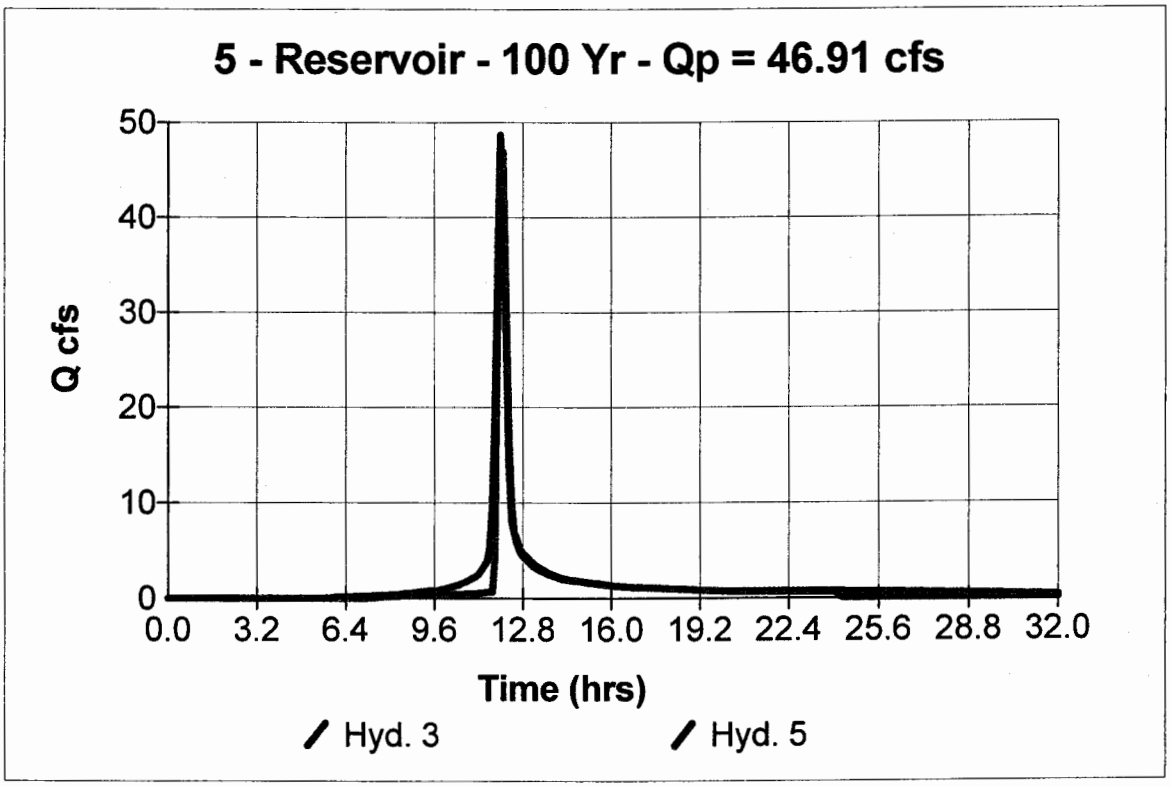
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 46.91 cfs
Storm frequency	= 100 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.2
Max. Elevation	= 29.20 ft	Max. Storage	= 26,732 cuft

Storage Indication method used.

Hydrograph Volume = 150,536 cuft



TEMPORARY SEDIMENT BASIN DESIGN DATA SHEET

(with or without an emergency spillway)

Project STONEHOUSE RICHARDSON'S MILL SECT. 1

Basin # 2 Location BETWEEN YARDING + MILL POND

Total area draining to basin: 7.93 acres.

Basin Volume Design

Wet Storage:

1. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 7.9 acres = 529 cu. yds.

2. Available basin volume = 535 cu. yds. at elevation 25.3. (From storage - elevation curve)

3. Excavate 500 cu. yds. to obtain required volume*.

   * Elevation corresponding to required volume = invert of the dewatering orifice.

4. Available volume before cleanout required.

   33 cu. yds. x 7.9 acres = 261 cu. yds.

5. Elevation corresponding to cleanout level = 23.5.

   (From Storage - Elevation Curve)

6. Distance from invert of the dewatering orifice to cleanout level = 1.8 ft. (Min. = 1.0 ft.)

Dry Storage:

7. Minimum required volume = 67 cu. yds. x Total Drainage Area (acres).

   67 cu. yds. x 7.9 acres = 529 cu. yds.

8. Total available basin volume at crest of riser* = 1365 cu. yds. at elevation 28.7. (From Storage - Elevation Curve)

* Minimum = 134 cu. yds./acre of total drainage area.

9. Diameter of dewatering orifice = 3 in.

10. ~~Diameter of flexible tubing = _____ in. (diameter of dewatering orifice plus 2 inches).~~
PERFORATED RISER = 8 in

Preliminary Design Elevations

11. Crest of Riser = 28.7

Top of Dam = 28.7

Design High Water = 29.1 (25 yr)

Upstream Toe of Dam = 19

Basin Shape

12. Length of Flow / Effective Width — L / We = _____

If > 2, baffles are not required X

If < 2, baffles are required _____

Runoff

13. Q_2 = 2.0 cfs (From Chapter 5)

14. Q_{25} = 35.9 cfs (From Chapter 5)

Principal Spillway Design

15. With emergency spillway, required spillway capacity $Q_p = Q_2$ = 2.0 cfs. (riser and barrel)

~~Without emergency spillway, required spillway capacity $Q_p = Q_{25}$ = _____ cfs. (riser and barrel)~~

16. With emergency spillway:

Assumed available head (h) = 3.4 ft. (Using Q_2)

h = Crest of Emergency Spillway Elevation - Crest of Riser Elevation

~~Without emergency spillway:~~

~~Assumed available head (h) = _____ ft. (Using Q_{25})~~

~~h = Design High Water Elevation - Crest of Riser Elevation~~

17. ~~Riser diameter (D_r) = _____ in. Actual head (h) = _____ ft.~~

~~(From Plate 3.14-8.)~~

~~Note: Avoid orifice flow conditions.~~

18. ~~Barrel length (l) = _____ ft.~~

~~Head (H) on barrel through embankment = _____ ft.~~

~~(From Plate 3.14-7).~~

~~19. Barrel diameter = _____ in.~~

~~(From Plate 3.14-B [concrete pipe] or Plate 3.14-A [corrugated pipe]).~~

~~20. Trash rack and anti-vortex device~~

~~Diameter = _____ inches.~~

~~Height = _____ inches.~~

~~(From Table 3.14-D).~~

Emergency Spillway Design

21. Required spillway capacity $Q_e = Q_{25} - Q_p$ = 33.9 cfs.

~~22. Bottom width (b) = _____ ft.; the slope of the exit channel (s) = _____ ft./foot; and the minimum length of the exit channel (x) = _____ ft.~~

~~(From Table 3.14-C).~~

Anti-Seep Collar Design

23. Depth of water at principal spillway crest (Y) = ____ ft.

Slope of upstream face of embankment (Z) = _____:1.

Slope of principal spillway barrel (S_b) = _____%

Length of barrel in saturated zone (L_s) = _____ ft.

24. Number of collars required = _____ dimensions = _____

(from Plate 3.14-12).

Final Design Elevations

25. Top of Dam = 28.7

Design High Water = 29.1

Emergency Spillway Crest = 28.7

Principal Spillway Crest = 25.3

Dewatering Orifice Invert = 25.3

Cleanout Elevation = 23.5

Elevation of Upstream Toe of Dam or Excavated Bottom of "Wet Storage Area" (if excavation was performed) = 19.0

Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 2 - SED BASIN 7.2

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	19.00	56	0	0
1.00	20.00	282	169	169
2.00	21.00	1,532	907	1,076
3.00	22.00	2,227	1,880	2,956
4.00	23.00	2,953	2,590	5,546
5.00	24.00	3,709	3,331	8,877
6.00	25.00	4,495	4,102	12,979
7.00	26.00	5,312	4,904	17,882
8.00	27.00	6,160	5,736	23,618
9.00	28.00	7,202	6,681	30,299
11.00	30.00	11,554	18,756	49,055
13.00	32.00	15,961	27,515	76,570

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 3.0	0.0	0.0	0.0
Span in	= 3.0	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 25.30	0.00	0.00	0.00
Length ft	= 2.0	0.0	0.0	0.0
Slope %	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 50.00	0.00	0.00	0.00
Crest El. ft	= 28.70	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	0.00	0.00
Weir Type	= Broad	Rect	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	19.00	0.00	---	---	---	0.00	---	---	---	---	0.00
1.00	169	20.00	0.00	---	---	---	0.00	---	---	---	---	0.00
2.00	1,076	21.00	0.00	---	---	---	0.00	---	---	---	---	0.00
3.00	2,956	22.00	0.00	---	---	---	0.00	---	---	---	---	0.00
4.00	5,546	23.00	0.00	---	---	---	0.00	---	---	---	---	0.00
5.00	8,877	24.00	0.00	---	---	---	0.00	---	---	---	---	0.00
6.00	12,979	25.00	0.00	---	---	---	0.00	---	---	---	---	0.00
7.00	17,882	26.00	0.18	---	---	---	0.00	---	---	---	---	0.18
8.00	23,618	27.00	0.30	---	---	---	0.00	---	---	---	---	0.30
9.00	30,299	28.00	0.38	---	---	---	0.00	---	---	---	---	0.38
11.00	49,055	30.00	0.51	---	---	---	192.69	---	---	---	---	193.19
13.00	76,570	32.00	0.61	---	---	---	779.32	---	---	---	---	779.92

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

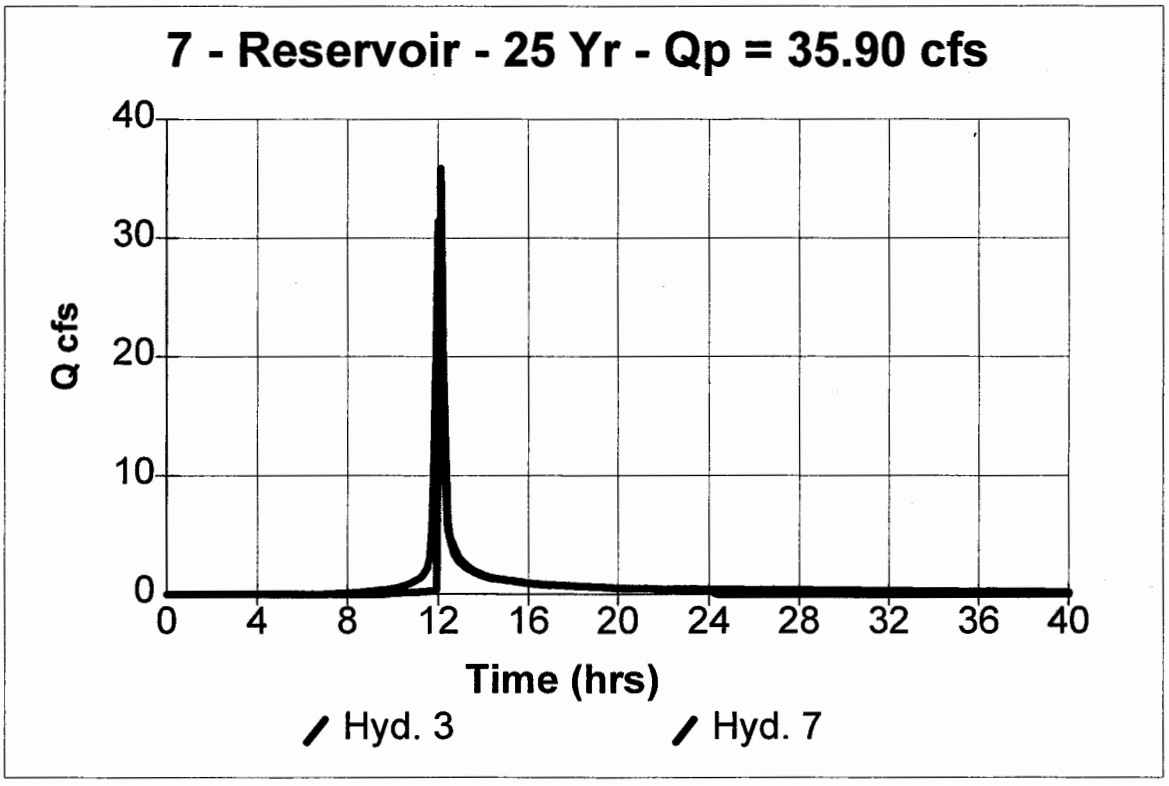
Hyd. No. 7

SED BASIN ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 35.90 cfs
Storm frequency	= 25 yrs	Time interval	= 6 min
Inflow hyd. No.	= 3	Reservoir name	= SED BASIN 7.2
Max. Elevation	= 29.11 ft	Max. Storage	= 40,751 cuft

Storage Indication method used.

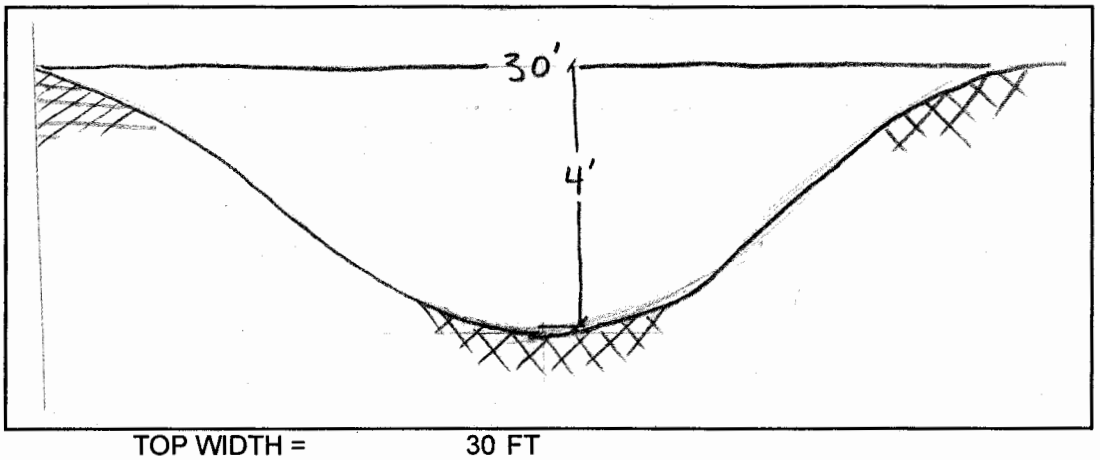
Hydrograph Volume = 95,970 cuft



Adequate Channel Analysis for Outfall of Storm System 1
Stonehouse Richardson's Mill Phase 1
10/26/2001 (Revised 12/11/01)
Project No. 9028-08

NEED NEW COMPS SYSTEM #1 INVALID

CHANNEL GEOMETRY
Parabolic Channel



TOP WIDTH =	30 FT
HEIGHT =	4 FT
SLOPE (S)	0.2 FT/FT
MANNING'S N	0.20

PLAN & ENV INV SHOW 25% SLOPES

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

VESCH DOES NOT GO HIGHER THAN 0.060

WHERE:

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0.02	(Side slopes eroded)
N3 = SIZE/SHAPE OF CHANN	0.005	(Channel shape changes slightly over length)
N4 = OBSTRUCTIONS	0.075	(flow obstructed bytrees and large amounts of underbrush)
N5 = VEGETATION	0.05	(trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)
N =	0.20	

0.15 (0.155) 0.0233 MAX! ∴ CAN BE 0.15

N VALUE IS NON REPRESENTATIVE PER VESCH V-122 + 123 PROCEDURE. RENO

SOIL TYPE

1 - 0.20
2 0.20?
3 0.13
4 0.10?

SANDY LOAM
MAX. PERMISSIBLE VELOCITY = 2.5 FT/S

UNCONTROLLED

2-YEAR STORM EVENT

TIME OF CONCENTRATION 5.7 min
RAINFALL INTENSITY = 6.9 in/hr
RUNOFF COEF. = 0.77
DRAINAGE AREA = 0.7 Ac.

PEAK FLOW RATE = 2.84 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 1.2 FT/S 1.2 < 2.5 OK

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 3.70 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Depth (FT)	Incremental Top Width (FT)	Area (SQ FT)	Wetted Perimeter (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	2.83	0.04	12.00	0.01	0.21	0.01
0.04	4.00	0.11	24.01	0.03	0.35	0.04
0.06	4.90	0.20	36.01	0.05	0.49	0.10
0.08	5.66	0.30	48.03	0.08	0.63	0.19
0.10	6.32	0.42	60.04	0.11	0.77	0.32
0.12	6.93	0.55	72.06	0.14	0.91	0.50
0.14	7.48	0.70	84.08	0.17	1.05	0.74
0.16	8.00	0.85	96.10	0.21	1.20	1.02
0.18	8.49	1.02	108.13	0.25	1.35	1.38
0.20	8.94	1.19	120.16	0.29	1.50	1.79
0.21	9.07	1.24	123.45	0.31	1.55	1.92
0.22	9.38	1.38	132.19	0.34	1.66	2.29
0.24	9.80	1.57	144.23	0.39	1.82	2.85
0.26	10.20	1.77	156.27	0.44	1.98	3.51
0.27	10.31	1.82	159.61	0.46	2.03	3.70

0.27' Depth < 4' Depth OK CAPACITY.

Hydrograph Plot

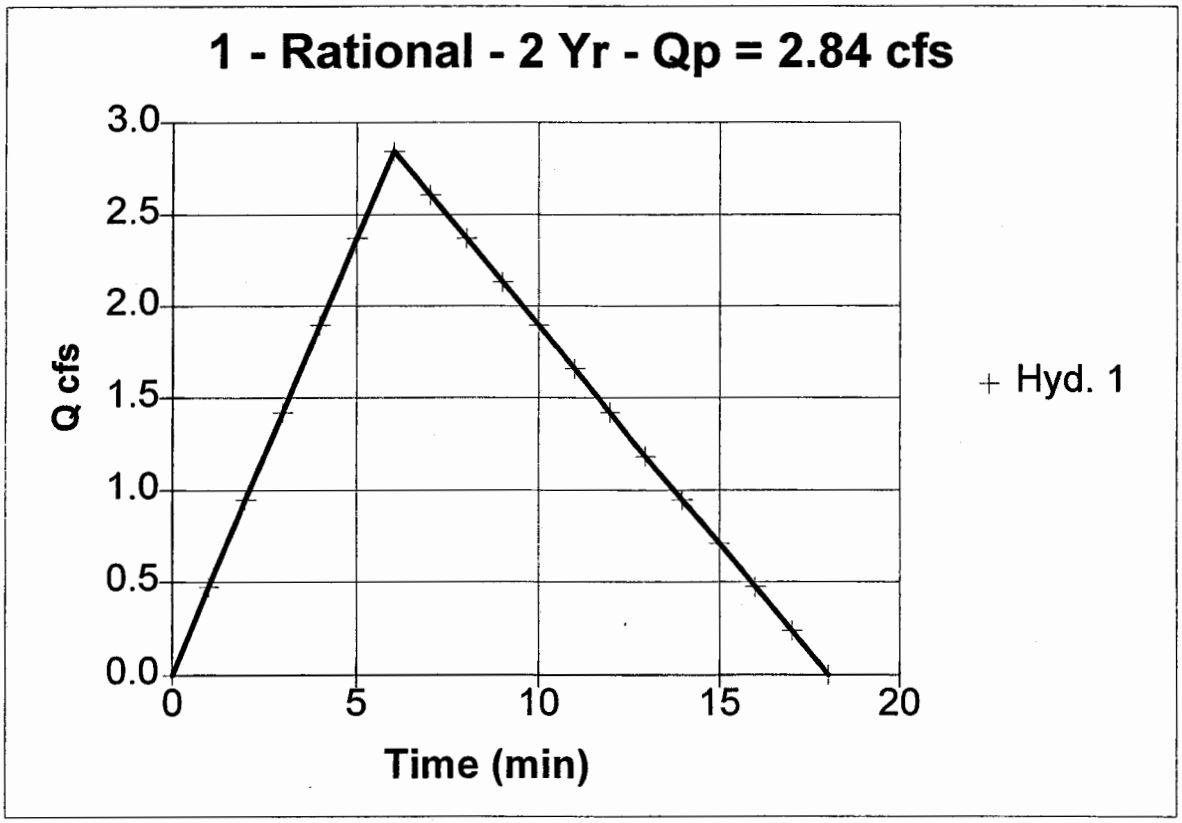
English

Hyd. No. 1

STORM SYSTEM 1

Hydrograph type	= Rational	Peak discharge	= 2.84 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.77
Intensity	= 5.27 in	Time of conc. (Tc)	= 6 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 1,535 cuft



Hydrograph Plot

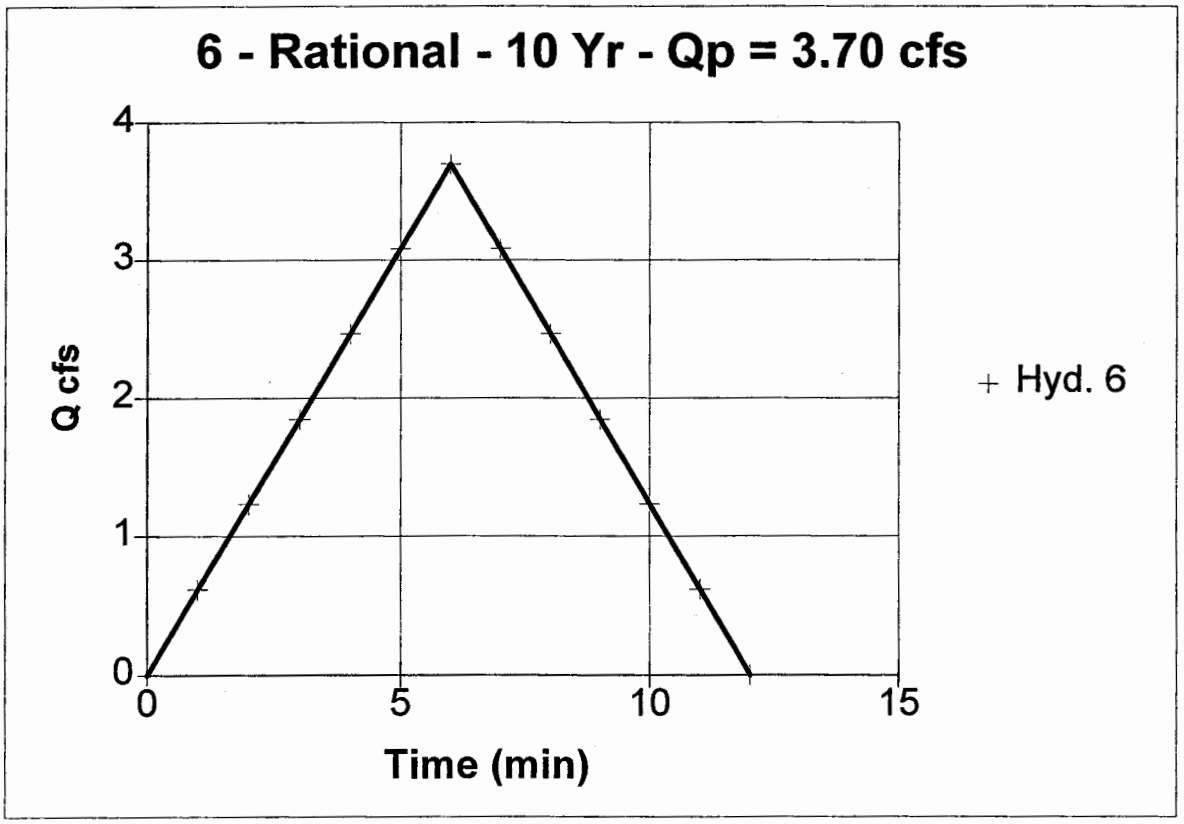
English

Hyd. No. 6

STORM SYSTEM 1

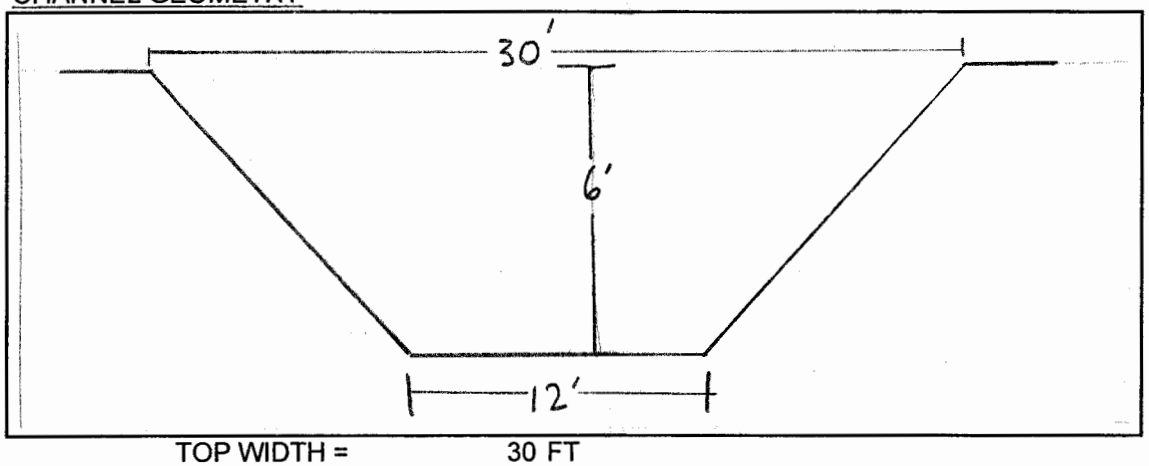
Hydrograph type	= Rational	Peak discharge	= 3.70 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.77
Intensity	= 6.86 in	Time of conc. (Tc)	= 6 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 1

Total Volume = 1,331 cuft



Adequate Channel Analysis for Outfall of Storm System 2
Stonehouse Richardson's Mill Phase 1
10/26/2001(Revised 12/11/01)
Project No. 9028-08

CHANNEL GEOMETRY



TOP WIDTH =	30 FT
BOTTOM WIDTH =	12 FT
HEIGHT =	6 FT
Z =	1.5 FT
SLOPE (S)	0.05 FT/FT ✓
MANNING'S N	0.20

CHECK 3.6% OK

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0.01	(Side slopes eroded)
N3 = SIZE/SHAPE OF CHANN	0.005	(Channel shape changes slightly over length)
N4 = OBSTRUCTIONS	0.04	(flow obstructed by large trees and underbrush)
N5 = VEGETATION	0.1	(trees and underbrush) 0.15 (0.175)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)
N =	0.20 ✓	

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = **2.5 FT /SEC**

2-YEAR STORM EVENT

TIME OF CONCENTRATION	5.7	min
RAINFALL INTENSITY =	6.9	in/hr
RUNOFF COEF. =	0.77	
DRAINAGE AREA =	0.8	Ac.

OK EROSION D/S BMP.

PEAK FLOW RATE = **9.70 CFS** (SEE HYDROGRAPH)
PEAK VELOCITY = **1.20 FT/S**

* **VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = **12.71 CFS** (SEE HYDROGRAPH)

* **10 yr storm event results in a depth within the confines of the channel**

Incremental Depth (FT)	Area (SQ FT)	WP (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	12.00	0.00	0.00	0.00
0.05	0.60	12.10	0.05	0.23	0.14
0.10	1.22	12.20	0.10	0.36	0.43
0.15	1.83	12.30	0.15	0.47	0.86
0.20	2.46	12.40	0.20	0.57	1.39
0.25	3.09	12.50	0.25	0.66	2.03
0.30	3.74	12.60	0.30	0.74	2.77
0.35	4.38	12.70	0.35	0.82	3.59
0.40	5.04	12.80	0.39	0.89	4.51
0.45	5.70	12.90	0.44	0.97	5.51
0.50	6.38	13.00	0.49	1.04	6.60
0.55	7.05	13.10	0.54	1.10	7.78
0.60	7.74	13.20	0.59	1.17	9.03
0.63	8.09	13.25	0.61	1.20	9.70
0.65	8.43	13.30	0.63	1.23	10.37
0.70	9.14	13.40	0.68	1.29	11.79
0.73	9.58	13.46	0.71	1.33	12.71
0.75	9.84	13.50	0.73	1.35	13.28
0.80	10.56	13.60	0.78	1.41	14.86
0.85	11.28	13.70	0.82	1.46	16.52

OK CAPACITY

Hydrograph Plot

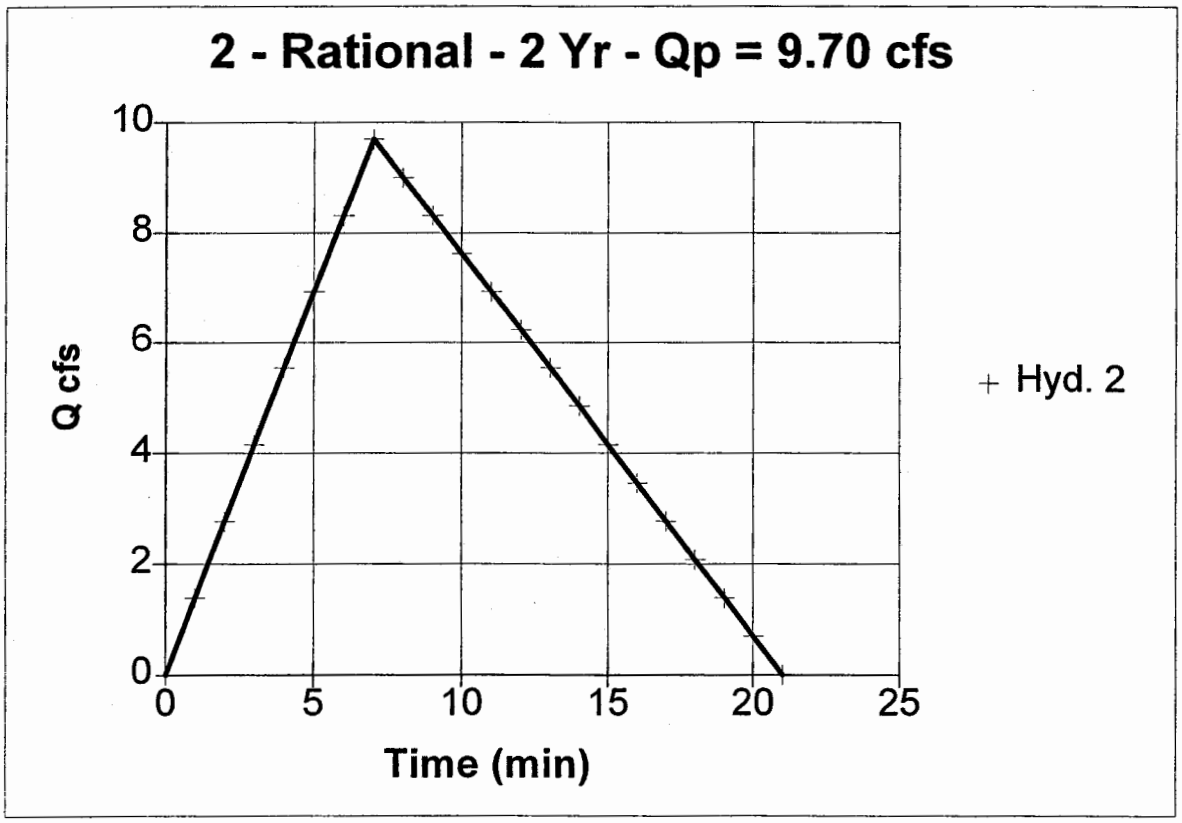
English

Hyd. No. 2

STORM SYSTEM 2

Hydrograph type	= Rational	Peak discharge	= 9.70 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.72
Intensity	= 5.05 in	Time of conc. (Tc)	= 7 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 6,112 cuft



Hydrograph Plot

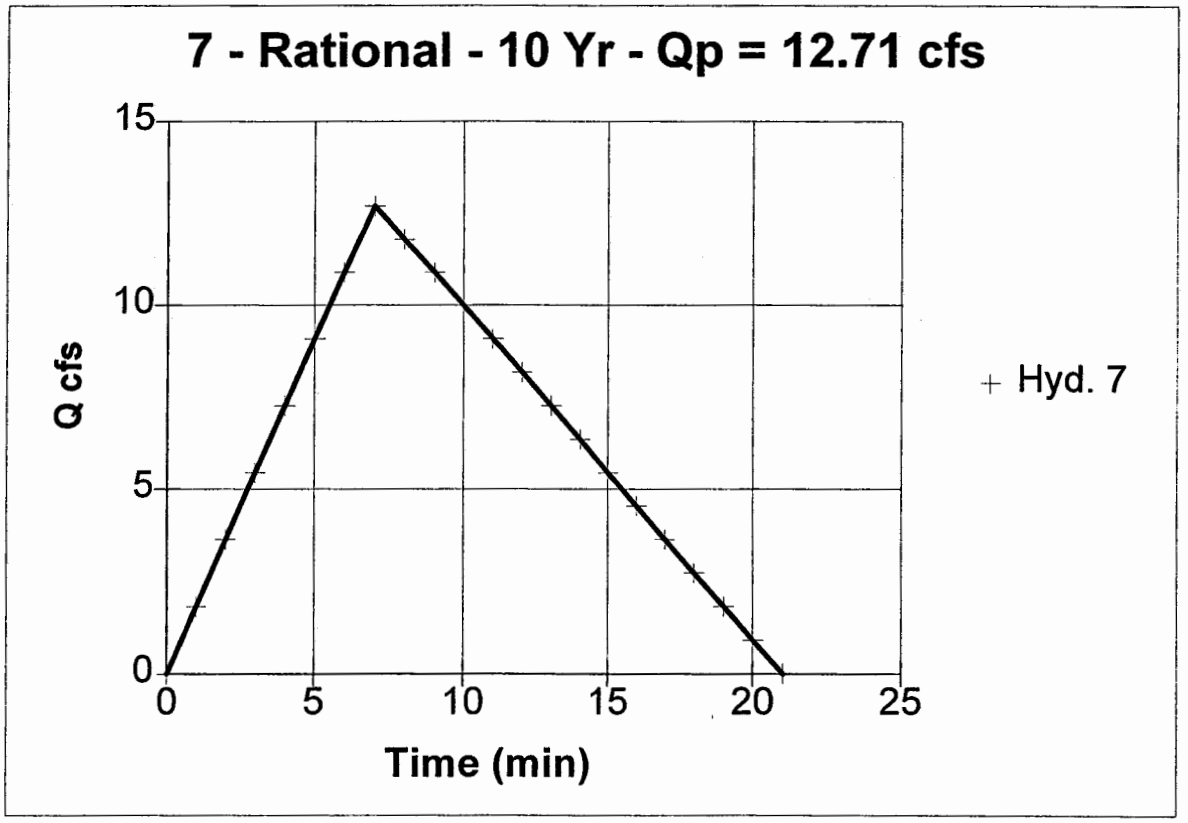
English

Hyd. No. 7

STORM SYSTEM 2

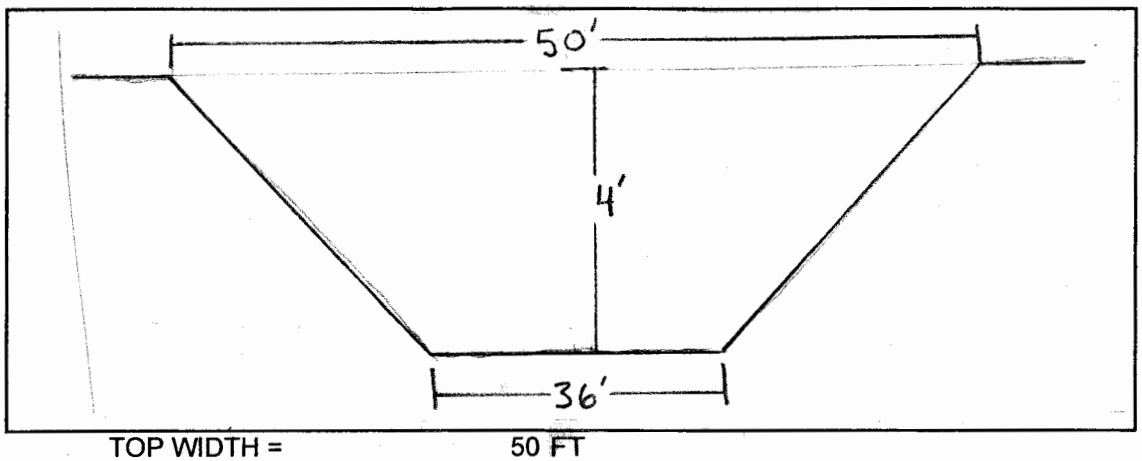
Hydrograph type	= Rational	Peak discharge	= 12.71 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.72
Intensity	= 6.61 in	Time of conc. (Tc)	= 7 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 8,007 cuft



Adequate Channel Analysis for Outfall of Storm System 3
Stonehouse Richardson's Mill Phase 1
10/26/2001 (Revised 12/11/01)
Project No. 9028-08

CHANNEL GEOMETRY
Trapezoidal Channel



TOP WIDTH =	50 FT	
BOTTOM WIDTH =	36 FT	
HEIGHT =	4 FT	
Z =	1.75 FT	check 8.89%
SLOPE (S)	0.085 FT/FT	
MANNING'S N	0.13	✓

Note: Ravine fairly flat and wide with no clearly defined flow channel.

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0.01	(Channel is slightly eroded)
N3 = SIZE/SHAPE OF CHANNEL	0.01	(Channel shape changes over length)
N4 = OBSTRUCTIONS	0.025	(flow obstructed by underbrush and trees)
N5 = VEGETATION	0.05	(some small trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)

0.13 ✓

N = 0.13

SOIL TYPE

SANDY LOAM
MAX. PERMISSIBLE VELOCITY = 2.5 FT /SEC

2-YEAR STORM EVENT

TIME OF CONCENTRATION = 7.4 min
RAINFALL INTENSITY = 6.5 in/hr
RUNOFF COEF. = 0.8
DRAINAGE AREA = 2.27 Ac.

OK EROSION D/S RMP

PEAK FLOW RATE = 9.61 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 1.19 FT/S

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 12.01 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Depth (FT)	Area (SQ FT)	Wetted Perimeter (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	36.00	0.00	0.00	0.00
0.02	0.72	36.08	0.02	0.24	0.17
0.04	1.44	36.16	0.04	0.38	0.55
0.06	2.17	36.24	0.06	0.50	1.09
0.08	2.89	36.32	0.08	0.61	1.76
0.10	3.62	36.40	0.10	0.70	2.55
0.12	4.35	36.48	0.12	0.80	3.46
0.14	5.07	36.56	0.14	0.88	4.47
0.16	5.80	36.64	0.16	0.96	5.58
0.18	6.54	36.73	0.18	1.04	6.79
0.20	7.27	36.81	0.20	1.11	8.10
0.22	8.00	36.89	0.22	1.19	9.49
0.22	8.06	36.89	0.22	1.19	9.61
0.24	8.74	36.97	0.24	1.26	10.98
0.25	9.23	37.02	0.25	1.30	12.01

OK CAPACITY 0.25< 4'

Hydrograph Plot

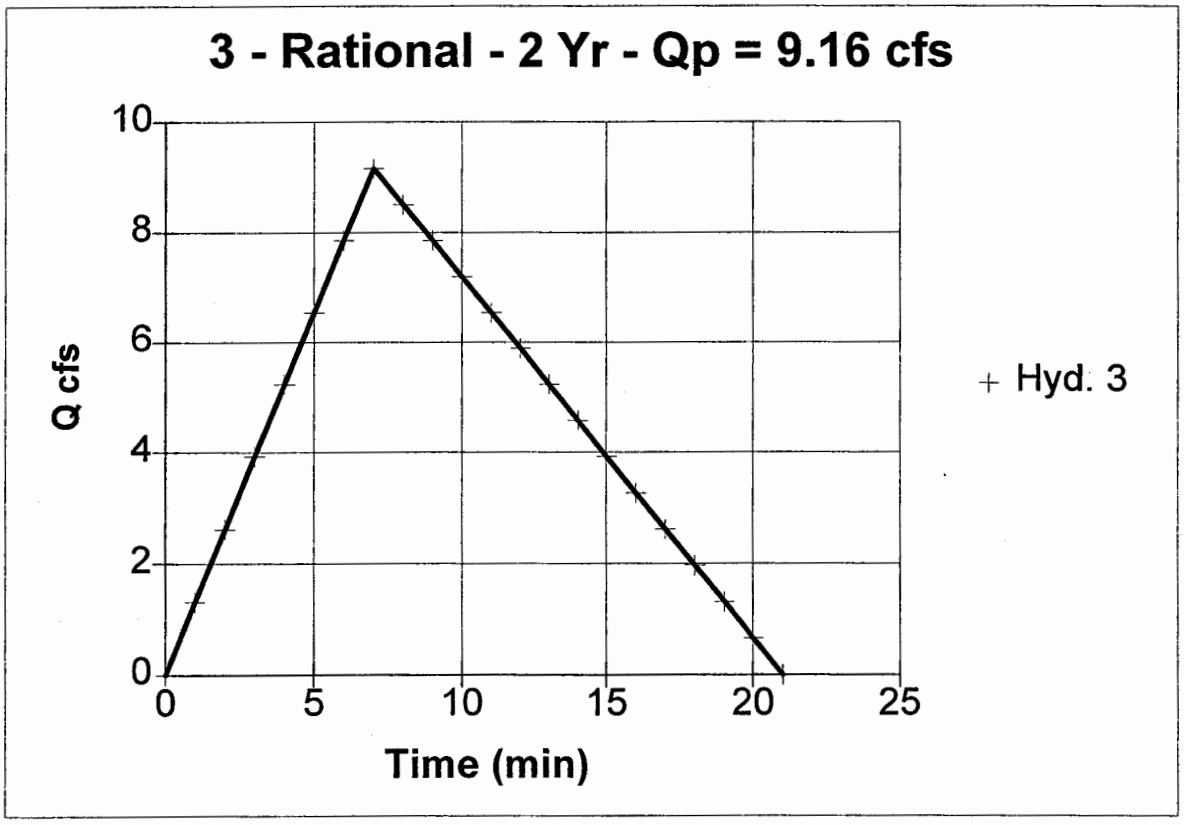
English

Hyd. No. 3

STORM SYSTEM 3

Hydrograph type	= Rational	Peak discharge	= 9.16 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 2.3 ac	Runoff coeff.	= 0.8
Intensity	= 5.05 in	Time of conc. (Tc)	= 7 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 5,774 cuft



Hydrograph Plot

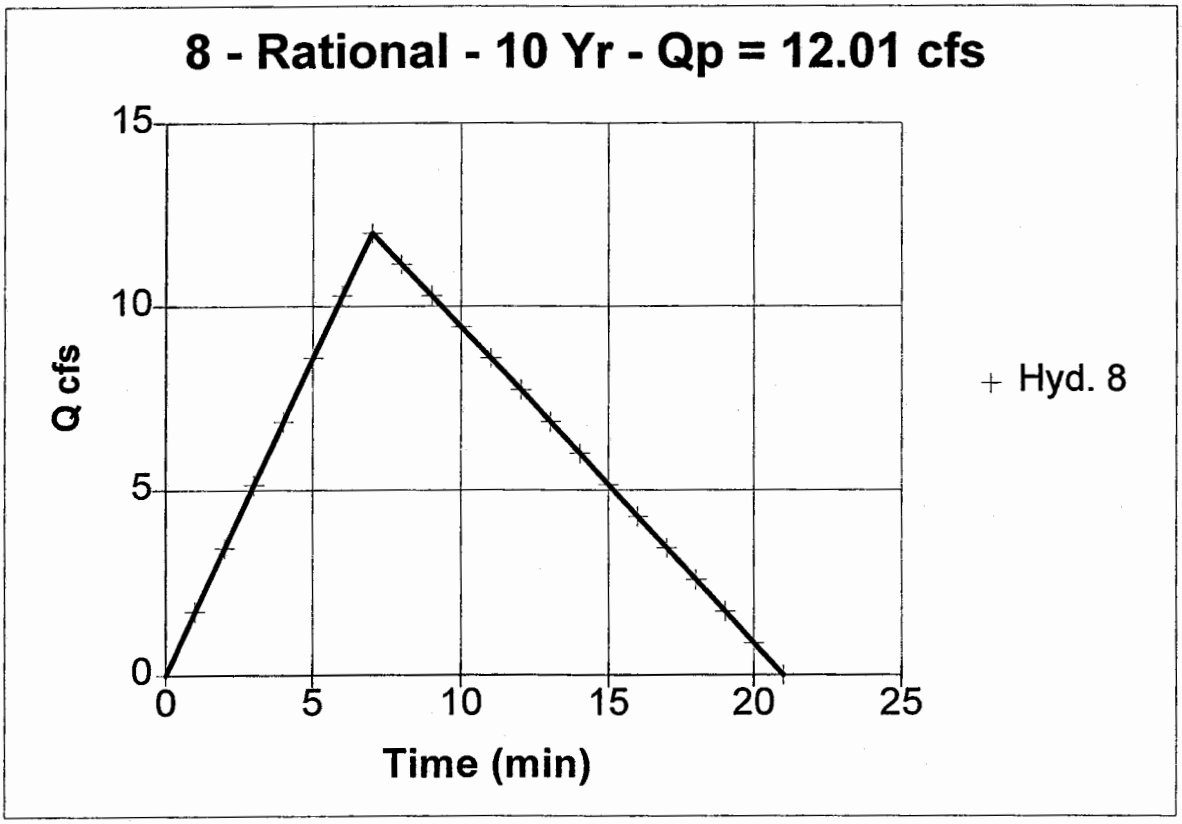
English

Hyd. No. 8

STORM SYSTEM 3

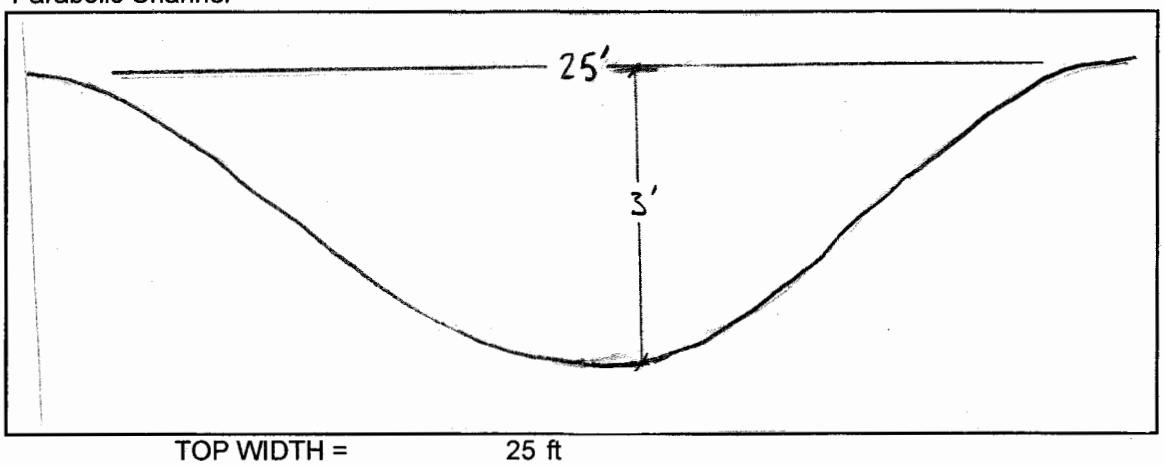
Hydrograph type	= Rational	Peak discharge	= 12.01 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 2.3 ac	Runoff coeff.	= 0.8
Intensity	= 6.61 in	Time of conc. (Tc)	= 7 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 7,564 cuft



Adequate Channel Analysis for Outfall of Storm System 4
Stonehouse Richardson's Mill Phase 1
10/26/01
Project No. 9028-08

CHANNEL GEOMETRY
Parabolic Channel



TOP WIDTH =	25	ft
HEIGHT =	3	ft
SLOPE (S)	0.06	ft/ft
MANNING'S N	0.10	

Note: Ravine fairly flat and wide with no clearly defined flow channel.

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

WHERE:

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0	(Channel in good condition)
N3 = SIZE/SHAPE OF CHANN	0	(Channel shape consistent)
N4 = OBSTRUCTIONS	0.02	(flow obstructed by underbrush and trees)
N5 = VEGETATION	0.05	(some trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)
N =	0.10	

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = 2.5 FT /SEC

2-YEAR STORM EVENT

TIME OF CONCENTRATION 6.4 min
RAINFALL INTENSITY = 6.8 in/hr
RUNOFF COEF. = 0.8
DRAINAGE AREA = 0.8 Ac.

PEAK FLOW RATE = 3.38 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 1.99 FT/S

OK EROSION D/S BMP

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 4.39 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Incremental Depth (FT)	Incremental Top Width (FT)	Area (SQ FT)	Wetted Perimeter (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	2.83	0.04	12.00	0.01	0.21	0.01
0.04	4.00	0.11	24.01	0.03	0.36	0.04
0.06	4.90	0.20	36.01	0.05	0.51	0.10
0.08	5.66	0.30	48.03	0.08	0.65	0.20
0.10	6.32	0.42	60.04	0.11	0.79	0.33
0.12	6.93	0.55	72.06	0.14	0.94	0.52
0.14	7.48	0.70	84.08	0.17	1.09	0.76
0.16	8.00	0.85	96.10	0.21	1.24	1.06
0.18	8.49	1.02	108.13	0.25	1.40	1.42
0.20	8.94	1.19	120.16	0.29	1.56	1.86
0.22	9.38	1.38	132.19	0.34	1.72	2.36
0.24	9.80	1.57	144.23	0.39	1.88	2.95
0.25	10.06	1.70	152.05	0.42	1.99	3.38
0.26	10.20	1.77	156.27	0.44	2.05	3.63
0.28	10.58	1.98	168.31	0.50	2.22	4.39

OK CAP. 0.25 < 3'

Hydrograph Plot

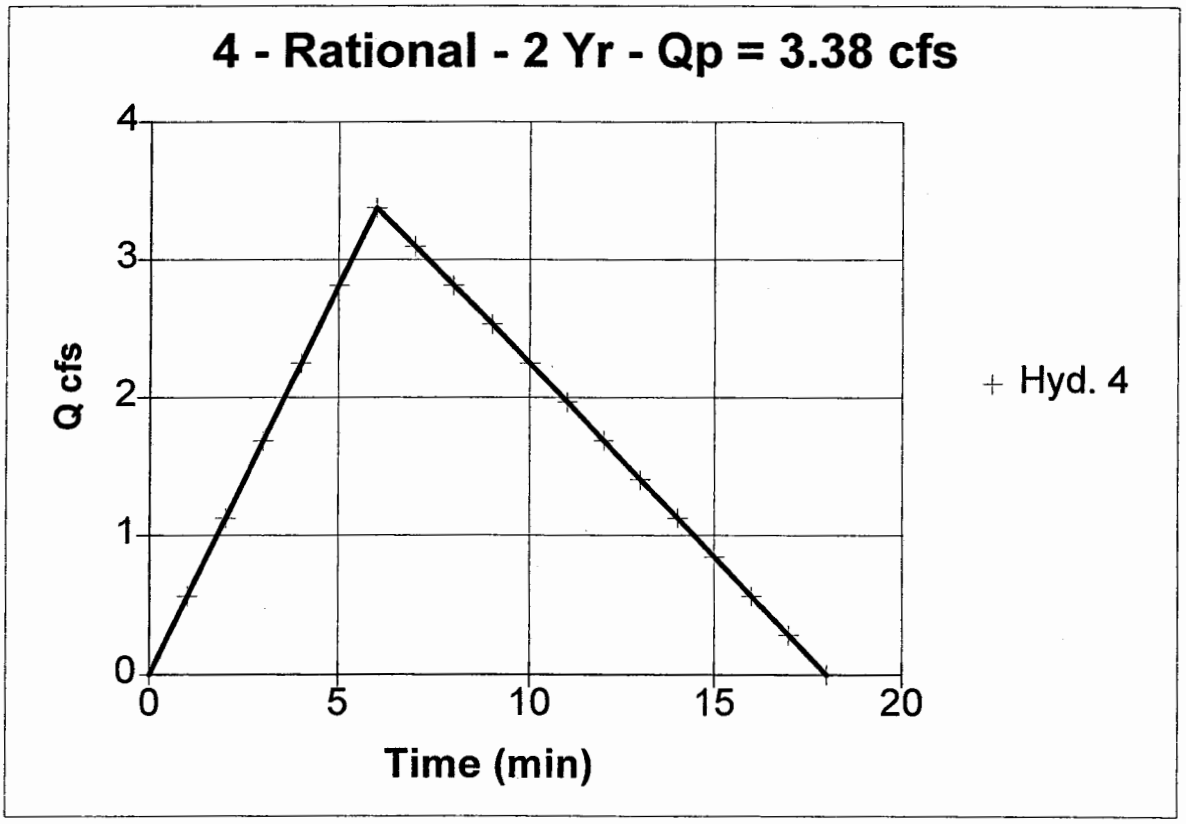
English

Hyd. No. 4

STORM SYSTEM 4

Hydrograph type	= Rational	Peak discharge	= 3.38 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.8 ac	Runoff coeff.	= 0.8
Intensity	= 5.27 in	Time of conc. (Tc)	= 6 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 1,823 cuft



Hydrograph Plot

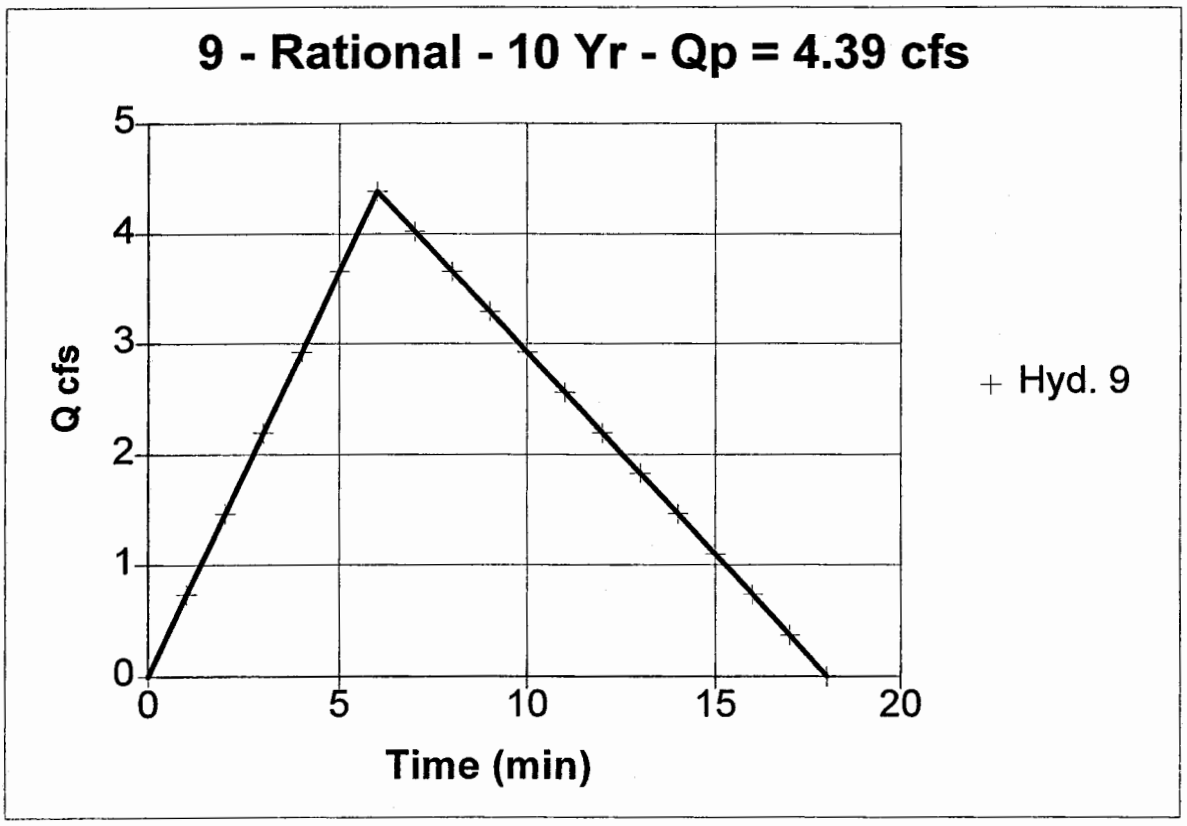
English

Hyd. No. 9

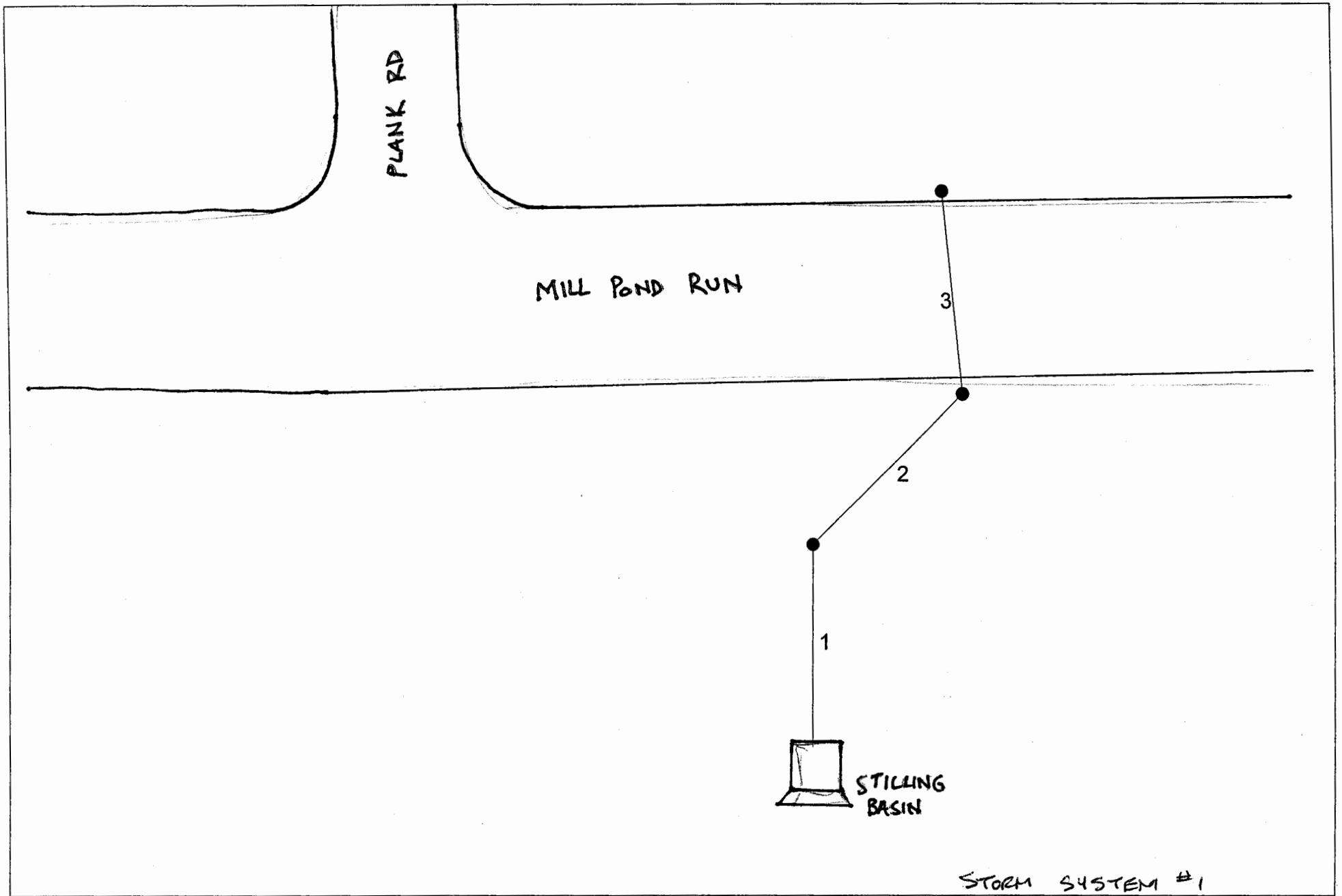
STORM SYSTEM 4

Hydrograph type	= Rational	Peak discharge	= 4.39 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.8 ac	Runoff coeff.	= 0.8
Intensity	= 6.86 in	Time of conc. (Tc)	= 6 min
I-D-F Curve	= JCChydrographs.IDF	Reced. limb factor	= 2

Total Volume = 2,370 cuft



Hydraflow Plan View - STORM SYSTEM #1



Project file: 902808_SS1.stm	IDF file: JCChydrographs.IDF	No. Lines: 3	10-22-2001

Hydraflow Storm Sewer Tabulation

STORM SYSTEM #1

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	40.0	0.00	0.70	0.00	0.00	0.54	0.0	5.7	6.9	3.73	25.01	3.86	15	15.00	92.00	86.00	92.77	87.25	103.49	88.00	SS#1 1-2
2	1	42.0	0.23	0.70	0.70	0.16	0.54	5.0	5.5	7.0	3.76	17.71	3.88	15	7.52	95.16	92.00	95.94	93.25	103.49	103.49	SS#1 2-3
3	2	60.0	0.47	0.47	0.80	0.38	0.38	5.0	5.0	7.1	2.68	14.65	3.15	15	5.15	98.25	95.16	98.91	96.41	0.00	103.49	SS#1 3-4

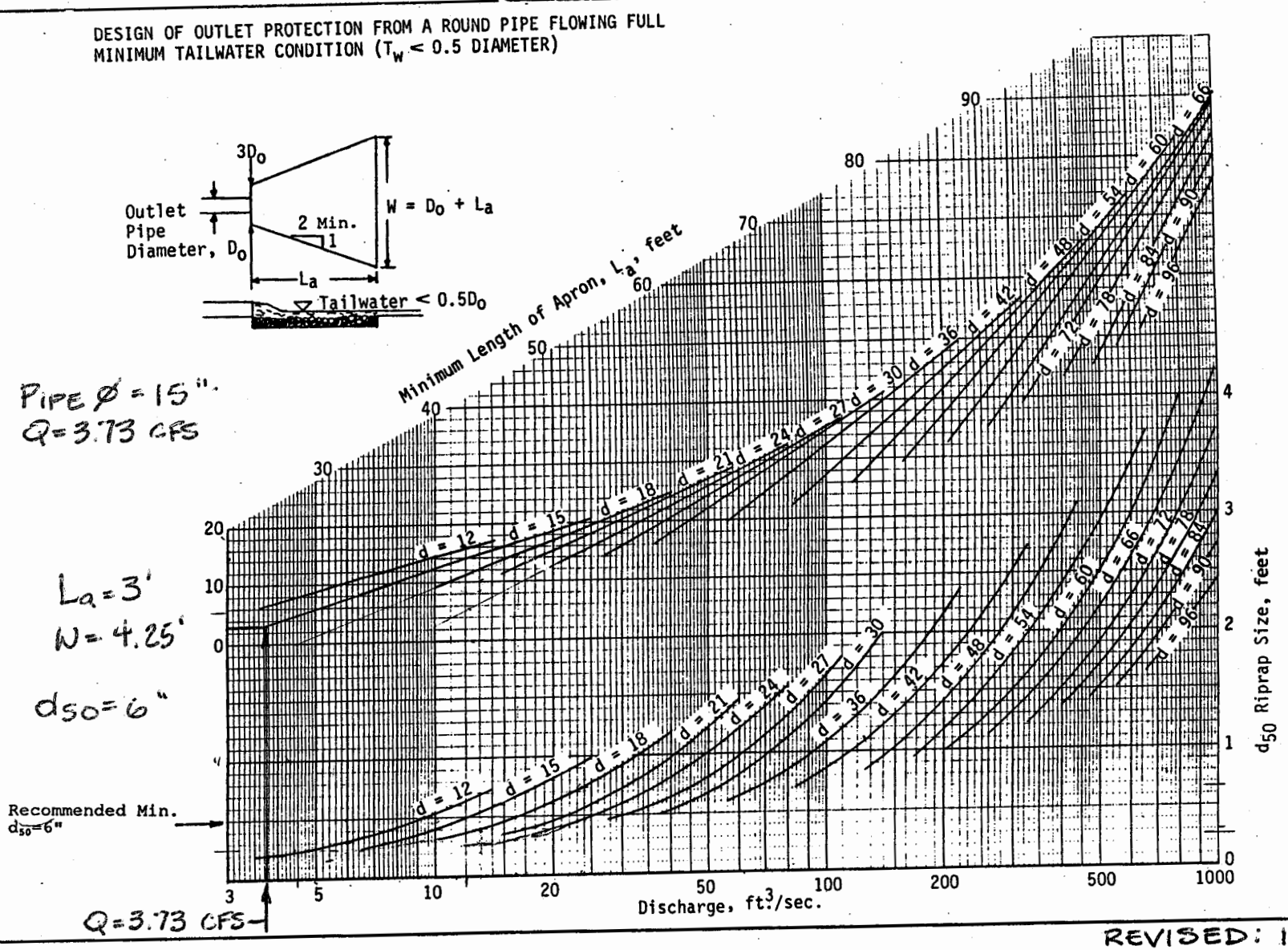
Project File: 902808_SS1.stm | IDF File: JCChydrographs.IDF | Total number of lines: 3 | Run Date: 10-24-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 87.25 (ft)

JOB # 9028-08

MILL POND PHASE 1: STORM SYSTEM 1

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_W < 0.5 DIAMETER)



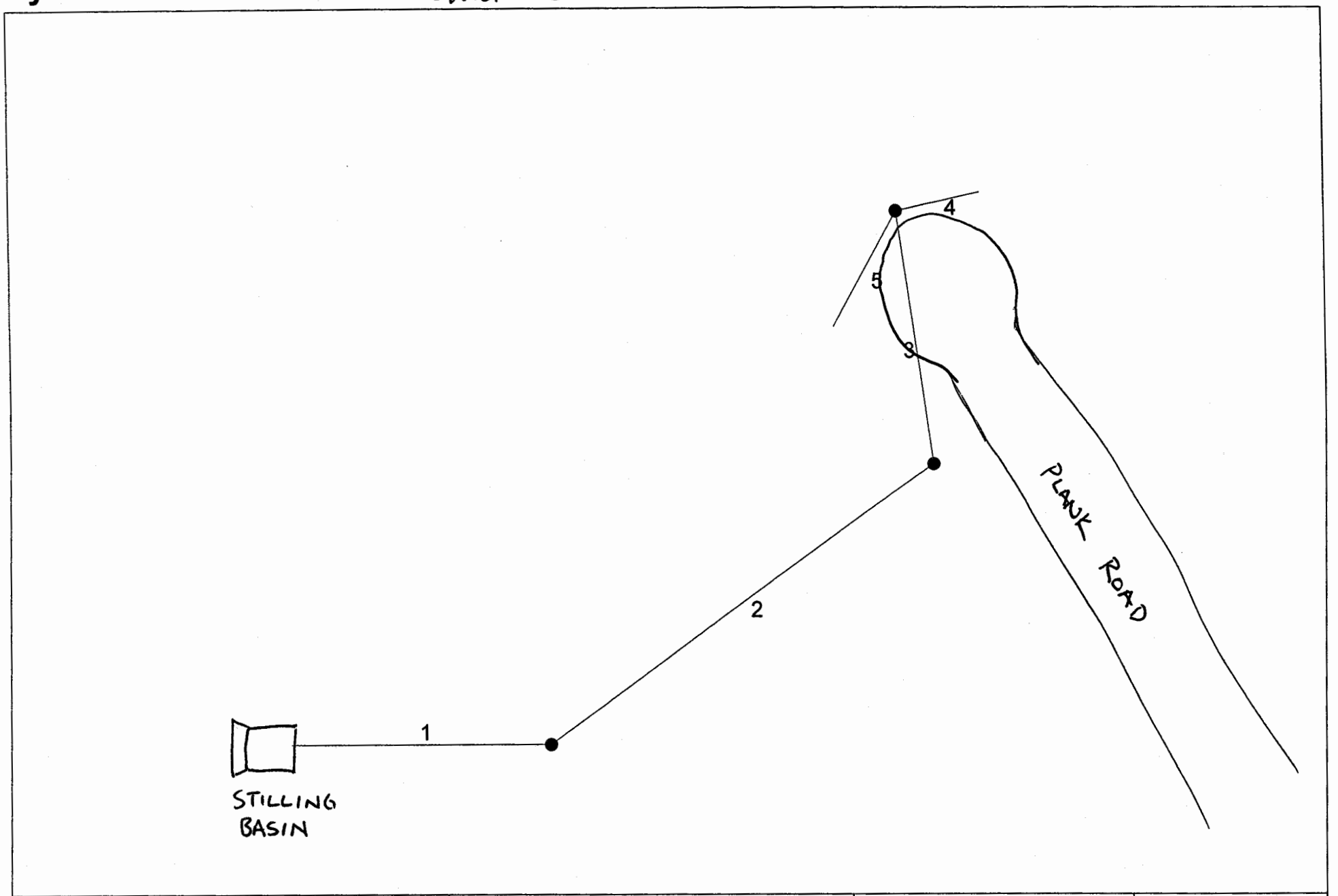
RDS.

REVISED: 12/17/01

Source: USDA-SCS

Plate 3.18-3

Hydraflow Plan View STORM SYSTEM #2



Project file: 902808_SS2REV2.stm	IDF file: JCChydrographs.IDF	No. Lines: 5	05-13-2002

Hydraflow Storm Sewer Tabulation STORM SYSTEM #2

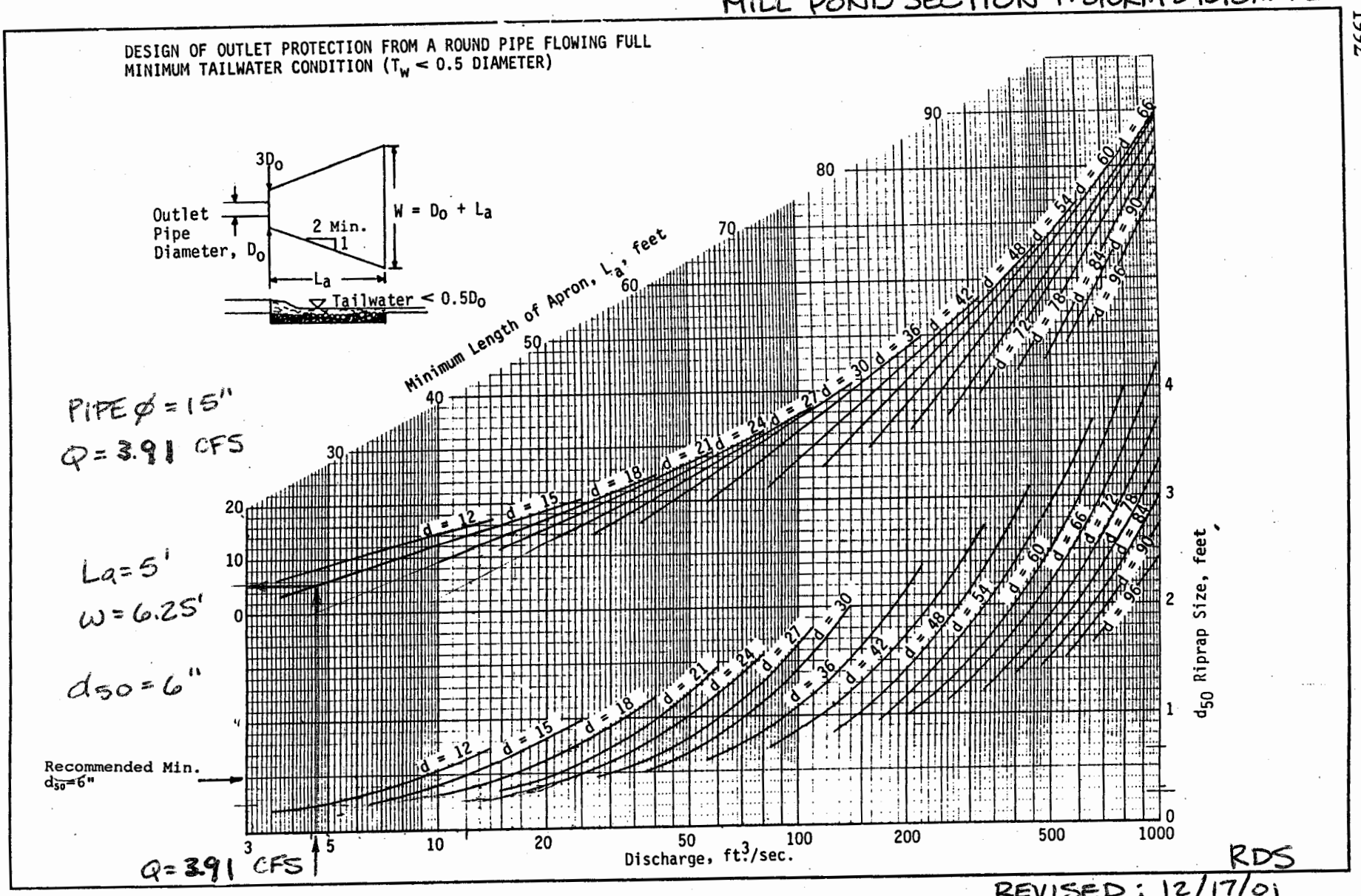
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	98.0	0.00	1.23	0.00	0.00	0.92	0.0	22.6	4.3	3.91	17.86	3.98	15	7.65	44.50	37.00	45.29	38.25	49.00	39.00	SS#2 1-2
2	1	168.0	0.37	1.23	0.80	0.30	0.92	5.0	22.1	4.3	3.96	22.78	4.01	15	12.44	65.40	44.50	66.20	45.75	73.80	49.00	SS#2 2-3
3	2	77.0	0.43	0.86	0.80	0.34	0.62	5.0	21.7	4.3	2.70	4.65	2.44	15	0.52	65.80	65.40	66.76	66.65	70.14	73.80	SS#2 3-4
4	3	32.0	0.34	0.34	0.80	0.27	0.27	5.0	5.0	7.1	1.94	25.40	2.62	15	15.47	70.75	65.80	71.31	67.05	72.00	70.14	SS#2 3-5
5	3	42.0	0.09	0.09	0.08	0.01	0.01	5.0	5.0	7.1	0.05	22.72	0.67	15	12.38	71.00	65.80	71.09	67.05	72.25	70.14	SS#2 3-6

Project File: 902808_SS2REV2.stm | IDF File: JCChydrographs.IDF | Total number of lines: 5 | Run Date: 05-13-2002

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 38.25 (ft)

JOB #9028-08

MILL POND SECTION 1: STORM SYSTEM #2

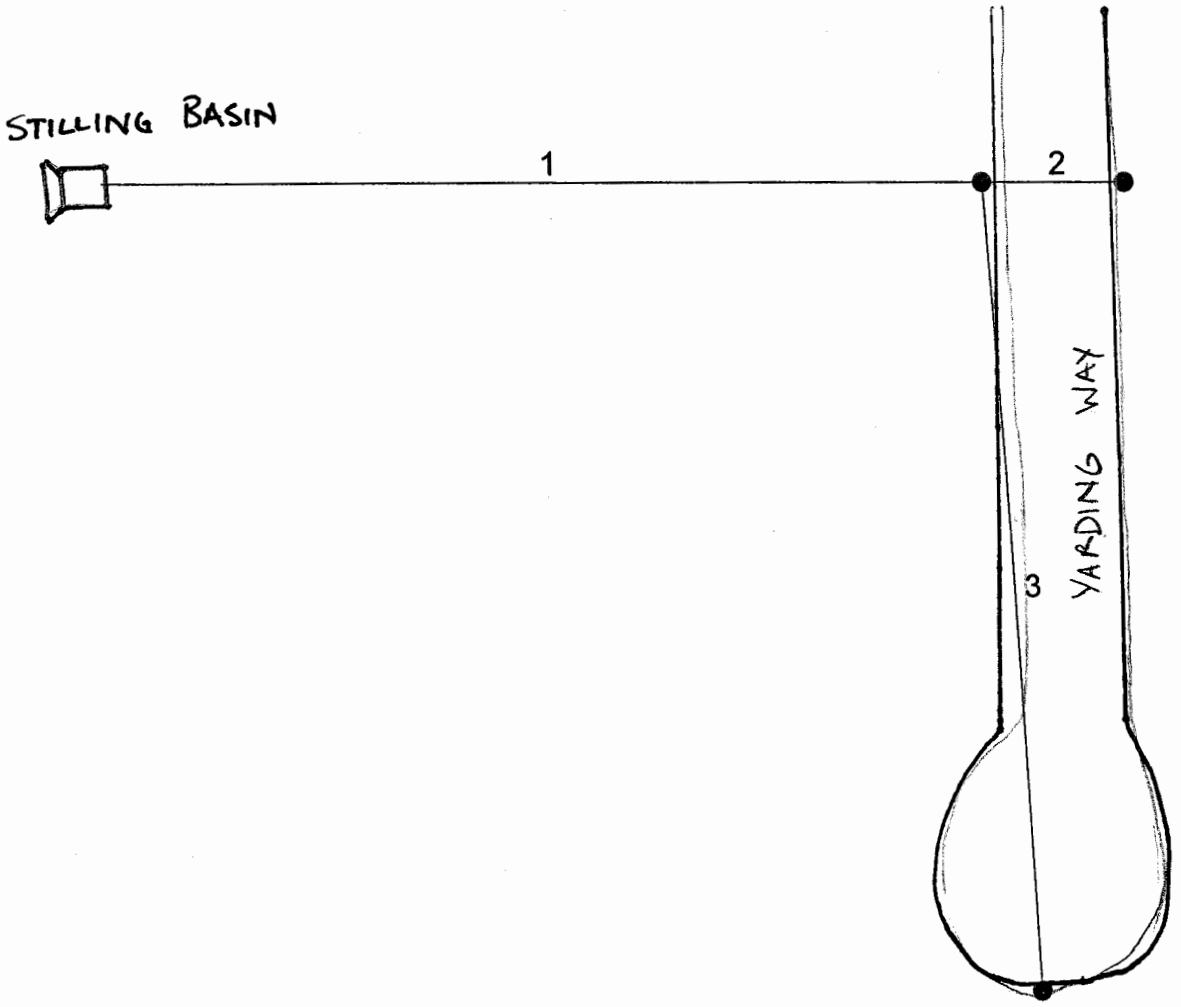


REVISED: 12/17/01

Source: USDA-SCS

Plate 3.18-3

Hydraflow Plan View - Storm System #3



Project file: 902808_SS3.stm	IDF file: JCChydrographs.IDF	No. Lines: 3	10-22-2001

Hydraflow Storm Sewer Tabulation

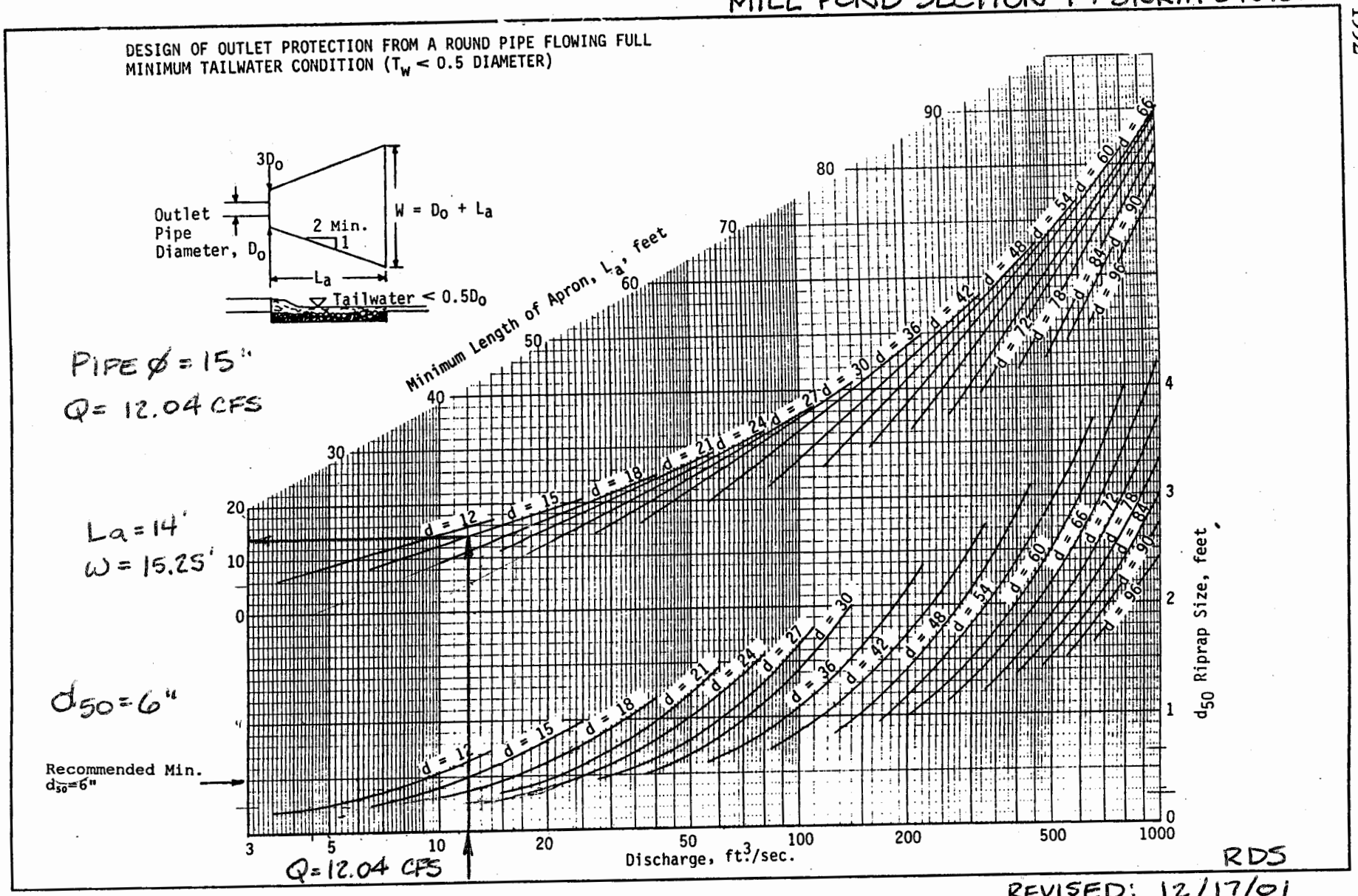
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	200.0	1.76	2.32	0.78	1.37	1.82	5.0	7.0	6.6	12.04	21.12	9.85	15	10.70	59.40	38.00	60.62	39.25	67.32	37.00	SS#3 1-2
2	1	34.0	0.28	0.28	0.80	0.22	0.22	5.0	5.0	7.1	1.60	9.14	2.88	12	6.59	65.24	63.00	65.78	64.00	67.32	67.32	SS#3 2-3
3	1	155.0	0.28	0.28	0.80	0.22	0.22	5.0	5.0	7.1	1.60	4.49	1.30	15	0.48	60.15	59.40	62.23	62.14	62.48	67.32	SS#3 4-2

Project File: 902808_SS3REV1.stm | IDF File: JCChydrographs.IDF | Total number of lines: 3 | Run Date: 12-14-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 39.25 (ft)

JOB# 9028-08

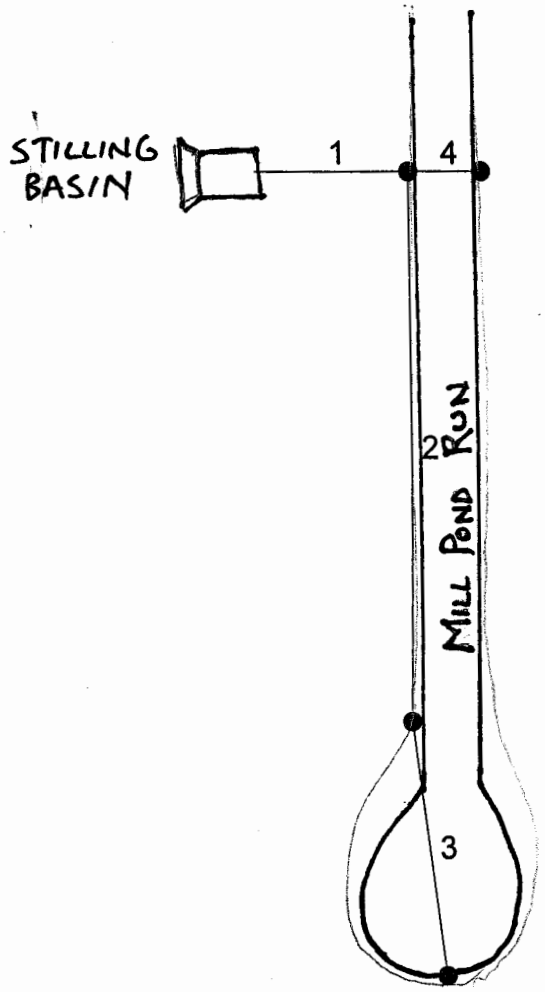
MILL POND SECTION 1 : STORM SYSTEM #3



Source: USDA-SCS

Plate 3.18-3

Hydraflow Plan View - Storm System #4



Project file: 902808_SS4.stm	IDF file: JCChydrographs.IDF	No. Lines: 4	10-22-2001

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	86.0	0.36	2.67	0.80	0.29	1.92	5.0	7.1	6.6	12.65	11.77	7.16	18	1.26	41.08	40.00	42.75	41.50	55.36	42.00	SS#4 1-2
2	1	245.0	0.15	0.95	0.80	0.12	0.68	5.0	5.6	7.0	4.74	6.46	3.87	15	1.00	43.53	41.08	44.75	43.55	50.50	55.36	SS#4 2-3
3	2	115.0	0.80	0.80	0.70	0.56	0.56	5.0	5.0	7.1	3.99	9.44	4.03	15	2.14	45.99	43.53	46.79	44.79	48.32	50.50	SS#4 3-4
4	1	46.0	1.36	1.36	0.70	0.95	0.95	7.0	7.0	6.6	6.29	12.86	8.06	12	13.04	51.00	45.00	51.96	46.00	55.36	55.36	SS#4 2-5

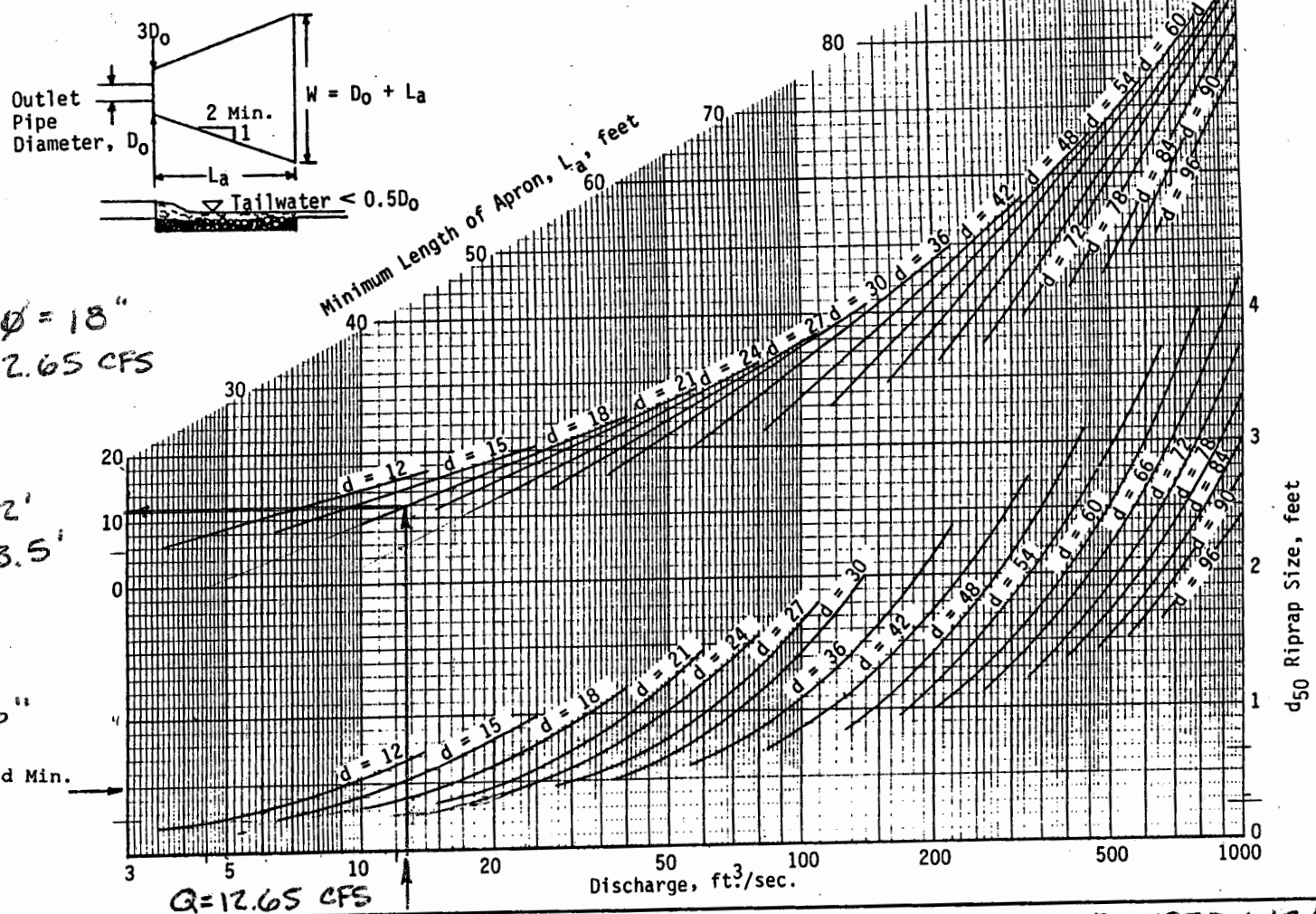
Project File: 902808_SS4.stm | IDF File: JCChydrographs.IDF | Total number of lines: 4 | Run Date: 12-17-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 41.50 (ft)

JOB No. 9028-8

MILL POND PHASE I: STORM SYSTEM #4

DESIGN OF OUTLET PROTECTION FROM A ROUND PIPE FLOWING FULL
MINIMUM TAILWATER CONDITION (T_w < 0.5 DIAMETER)



RDS

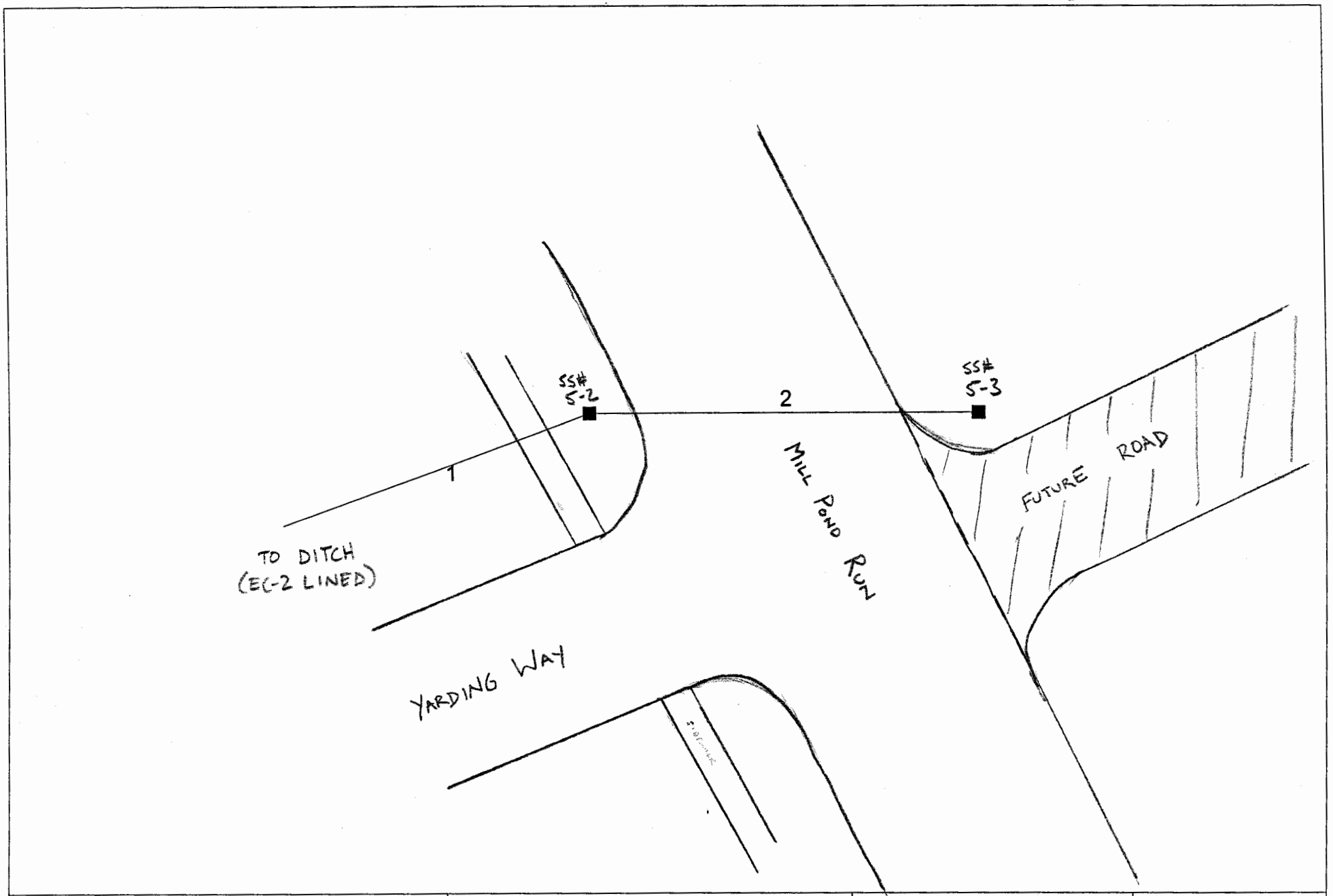
REVISED: 12/17/01

Source: USDA-SCS

Plate 3.18-3

Hydraflow Plan View

STORM SYSTEM 5



Project file: 902808_SS5.stm	IDF file: JCChydrographs.IDF	No. Lines: 2	12-19-2001

Hydraflow Storm Sewer Tabulation

STORM SYSTEM 5

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	55.0	0.31	0.83	0.80	0.25	0.62	5.0	7.6	6.5	4.00	5.44	3.50	15	0.71	86.79	86.40	87.81	87.65	92.00	88.00	SS#5 1-2
2	1	66.0	0.52	0.52	0.71	0.37	0.37	7.0	7.0	6.6	2.44	6.46	2.92	15	1.00	87.45	86.79	88.09	88.04	91.30	92.00	SS#5 2-3

Project File: 902808_SS5.stm | IDF File: JCChydrographs.IDF | Total number of lines: 2 | Run Date: 12-19-2001

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 87.65 (ft)

LANE SIDE — CUT — MED. — FILL — BY JAG — DATE 10/8/01

Mill Pond Run — 3:1 Ditch

STA.	TO STA.	FLOW	B. WS CA	B.C WS CA	B.A WS CA	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW. VEL.	Earth n=.03 VEL.	Protective Lining n=.05 On	n=.05 VEL.	n=.05 DEP.	n=.015 On	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
88+00	88+50	↑		0.8	.03	.024	.258	5	5.5	1.4		.04				2.4	5"			7	1.8	5"	GRASS TO PROPOSED SWALE
88+50	89+00	↑		0.8	.03	.024	.234	5	5.5	1.3		.04				2.4	4"			7	1.6	5"	GRASS
89+00	89+50	↑		0.8	.03	.024	.21	5	5.5	1.1		.05				2.5	4"			7	1.5	5"	GRASS
89+50	90+00	↑		0.8	.03	.024	.186	5	5.5	1.0		.04				2.2	4"			7	1.3	5"	GRASS
90+00	90+50	↑		0.8	.03	.024	.162	5	5.5	0.9		.03				1.8	4"			7	1.1	5"	GRASS
90+50	91+00	↑		0.8	.04	.032	.138	5	5.5	0.8		.025				1.6	4"			7	1.0	5"	GRASS
91+00	91+50	↑		0.8	.04	.032	.106	5	5.5	0.6		.02				1.4	4"			7	0.7	4"	GRASS
91+50	92+00	↑		0.75	.05	.037	.074	5	5.5	0.4		.01				1.0	4"			7	0.5	4"	GRASS
92+00	92+50	↑		0.75	.05	.037	—	5	5.5	0.2		.01				0.9	3"			7	0.3	3"	GRASS
HIGH	POINT																						HIGH POINT
92+50	93+00	↓		0.70	.06	.042	—	5	5.5	0.2		.01				0.9	3"			7	0.3	3"	GRASS
93+00	93+50	↓		.65	.08	.052	.094	5	5.5	0.5		.03				1.7	4"			7	0.7	4"	GRASS
93+50	94+00	↓		.65	.05	.032	.126	5	5.5	0.7		.04				2.0	4"			7	0.9	4"	GRASS

MILL POND

LANE

SIDE

CUT MED. FILL

BY JAG DATE 10/8/01

Mill Pond Run 3:1 Ditch

STA.	TO STA.	FLOW	O. WS/CA	C WS/CA	A WS/CA	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW. VEL.	Earth n=.03 VEL.	Protective n=.05 Qn	Protective n=.05 VEL.	Protective n=.05 DEP.	Lining n=.015 Qn	Lining n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
94+00	94+50	↓		0.60	.19	.114	.24	5	5.5	1.3		.03				2.1	5"			7	1.7	5"	GRASS
94+50	95+00	↓		0.75	.06	.045	.285	5	5.5	1.6		.01				1.5	6"			7	2.0	7"	GRASS
95+00	95+50	↓		0.8	.03	.024	.309	5	5.5	1.7		.01				1.5	6"			7	2.2	7"	GRASS
LOW POINT																							LOW POINT
95+50	96+00	↑		0.8	.03	.024	.096	5	5.5	0.5		.02				1.4	4"			7	0.7	4"	GRASS
96+00	96+50	↑		0.8	.03	.024	.072	5	5.5	0.4		.03				1.6	3"			7	0.5	3"	GRASS
96+50	97+00	↑		0.8	.03	.024	.048	5	5.5	0.3		.03				1.5	3"			7	0.3	3"	GRASS
97+00	97+50	↑		0.8	.03	.024	—	5	5.5	0.1		.01				0.7	2"			7	0.2	3"	GRASS
HIGH POINT																							HIGH POINT
97+50	98+00	↓		0.8	.04	.032	—	5	5.5	0.2		.01				0.9	3"			7	0.2	3"	GRASS
98+00	98+50	↓		0.8	.04	.032	.064	5	5.5	0.3		.01				1.0	3"			7	0.4	4"	GRASS
98+50	99+00	↓		0.75	.04	.03	.094	5	5.5	0.5		.03				1.6	3"			7	0.7	4"	GRASS
99+00	99+50	↓		0.7	.06	.042	.136	5	5.5	0.7		.03				1.8	4"			7	0.9	4"	GRASS
99+50	100+00	↓		0.7	.07	.049	.185	5	5.5	1.0		.03				2.0	4"			7	1.3	5"	GRASS

2-27

~~CANYE MILL POND~~ MILL POND

SIDE — CUT — MED. — FILL

BY JAG DATE 10/8/01

MILL POND RUN 3:1 Ditch

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
00+00	100+50	↓		0.7	.09	.063	.248	5	5.5	1.4		.04				2.4	5"			7	1.7	5"	GRASS (<2.5 fps)
00+50	101+00	↓		0.7	.07	.049	.297	5	5.5	1.6		.05				2.6	5"			7	2.1	5"	EC-2 LINED
01+00	101+50	↓		0.7	.11	.077	.374	5	5.5	2.1		.05				2.8	5"			7	2.6	6"	EC-2 LINED
TO	CULVERT																						TO CULVERT
01+50	102+00	↓		0.7	.08	.056	—	5	5.5	0.3		.06				1.9	3"			7	0.4	3"	GRASS
102+00	102+50	↓		0.5	.20	.10	.156	5	5.5	0.9		.06				2.4	4"			7	1.1	4"	GRASS
02+50	103+00	↓		0.5	.27	.135	.291	5	5.5	1.6		.07				2.9	5"			7	2.0	5"	EC-2 LINED
03+00	103+50	↓		0.45	.43	.193	.484	5	5.5	2.7		.06				3.0	5"			7	3.4	6"	EC-2 LINED
03+50	104+00	↓		0.7	.05	.035	.519	5	5.5	2.8		.06				3.0	5"			7	3.6	6"	EC-2 LINED
04+00	104+50	↓		0.5	.21	.105	.624	5	5.5	3.4		.05				3.1	7"			7	4.4	7"	EC-2 LINED
04+50	105+00	↓		0.8	.03	.024	.648	5	5.5	3.6		.05				3.2	7"			7	4.5	7"	EC-2 LINED
05+00	105+50	↓		0.8	.03	.024	.672	5	5.5	3.7		.05				3.2	7"			7	4.7	7"	EC-2 LINED
05+50	106+00	↓		0.8	.03	.024	.696	5	5.5	3.8		.05				3.2	7"			7	4.9	7"	EC-2 LINED

MILL POND

~~EAST MILL POND~~

L SIDE

CUT — MED. — FILL

BY JAG DATE 10/8/01

MILL POND RUN 3:1 DITCH

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC. (.96)	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
106+00	106+50	↓		0.8	.03	.024	.720	5	5.5	4.0		.07				3.5	7"			7	5.0	8"	EC-2 LINED
106+50	107+00	↓		0.8	.03	.024	.744	5	5.5	4.1		.05				3.4	8"			7	5.2	8"	EC-2 LINED
107+00	107+50	↓		0.8	.03	.024	.768	5	5.5	4.2		.05				3.4	8"			7	5.4	8"	EC-2 LINED
107+50	108+00	↓		0.8	.03	.024	.792	5	5.5	4.3		.05				3.4	8"			7	5.5	8"	EC-2 LINED
108+00	108+50	↓		0.8	.03	.024	.816	5	5.5	4.5		.04				3.3	8"			7	5.7	8"	EC-2 LINED
TO INLET																							TO INLET
108+50	109+00	↓		0.8	.03	.024	—	5	5.5	0.2		.03				1.4	3"			7	0.2	3"	GRASS
109+00	109+50	↓		0.8	.03	.024	.048	5	5.5	0.3		.02				1.3	3"			7	0.3	3"	GRASS
109+50	110+00	↓		0.8	.03	.024	.072	5	5.5	0.4		.02				1.4	3"			7	0.5	4"	GRASS
110+00	110+50	↓		0.8	.03	.024	.096	5	5.5	0.5		.015				1.3	3"			7	0.7	4"	GRASS
110+50	111+00	↓		0.8	.03	.024	.110	5	5.5	0.6		.015				1.5	4"			7	0.8	4"	GRASS
111+00	111+50	↓		0.8	.03	.024	.134	5	5.5	0.7		.015				1.5	4"			7	0.9	5"	GRASS
111+50	112+00	↓		0.85	.06	.051	.185	5	5.5	1.0		.015				1.6	5"			7	1.3	5"	GRASS
112+00	TO END			0.85	.05	.042	.227	5	5.5	1.2		.01				1.6	5"			7	1.6	6"	GRASS

MILL POND

R SIDE — CUT — MED. — FILL — BY JAG — DATE 10/8/01

MILL POND RUN — 3:1 Ditch

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
88+00	88+50	↑		0.5	.06	.03	.641	5	5.5	3.5		.04				3.3	7"			7	4.5	7"	EC-2 LINED TO CULVERT
88+50	89+00	↑		0.45	.12	.054	.611	5	5.5	3.4		.04				3.0	7"			7	4.3	7"	EC-2 LINED
89+00	89+50	↑		0.45	.16	.072	.557	5	5.5	3.1		.05				3.0	7"			7	3.9	7"	EC-2 LINED
89+50	90+00	↑		0.45	.22	.099	.485	5	5.5	2.7		.04				2.8	6"			7	3.4	7"	EC-2 LINED
90+00	90+50	↑		0.45	.20	.09	.386	5	5.5	2.1		.03				2.4	6"			7	2.7	6"	GRASS
90+50	91+00	↑		0.40	.37	.148	.296	7	5	1.5		.025				2.0	5"			6	1.8	6"	GRASS
91+00	91+50	↑		0.45	.14	.063	.148	5	5.5	0.8		.02				1.6	4"			7	1.0	5"	GRASS
91+50	92+00	↑		0.45	.11	.05	.085	5	5.5	0.5		.01				1.0	4"			7	0.6	5"	GRASS
92+00	92+50	↑		0.5	.07	.035	—	5	5.5	0.2		.01				0.9	3"			7	0.2	3"	GRASS
HIGH POINT																							HIGH POINT
92+50	93+00	↓		0.65	.05	.03	—	5	5.5	0.2		.01				0.9	3"			7	0.2	3"	GRASS
93+00	93+50	↓		0.7	.04	.028	.058	5	5.5	0.3		.03				1.4	3"			7	0.4	3"	GRASS
93+50	94+00	↓		0.8	.03	.024	.082	5	5.5	0.4		.04				1.8	3"			7	0.6	3"	GRASS

MILL POND

LANE

R SIDE

CUT MED. FILL

BY JAG DATE 10/8/01

MILL POND RUN 3:1 Ditch

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW. VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
94+00	94+50	↓		0.8	.03	.024	.106	5	5.5	0.6		.03				1.8	4"			7	0.7	4"	GRASS
94+50	95+00	↓		0.8	.03	.024	.13	5	5.5	0.7		.01				1.2	5"			7	0.9	5"	GRASS
LOW POINT																							LOW POINT
95+00	95+50	↑		0.8	.03	.024	.08	5	5.5	0.4		.01				1.0	4"			7	0.6	4"	GRASS
95+50	96+00	↑		0.8	.03	.024	.056	5	5.5	0.3		.02				1.4	3"			7	0.4	3"	GRASS
96+00	96+50	↑		0.8	.04	.032	.032	5	5.5	0.2		.03				1.4	2"			7	0.2	3"	GRASS
																							TO ROAD "A"
96+50	97+00	↑		0.8	.03	.024	.04	5	5.5	0.2		.03				1.4	2"			7	0.3	4"	GRASS
97+00	97+50	↑		0.8	.02	.016	—	5	5.5	0.1		.01				0.75	2"			7	0.1	2"	GRASS
HIGH POINT																							HIGH POINT
97+50	98+00	↓		0.8	.02	.016	—	5	5.5	0.1		.01				0.75	2"			7	0.1	2"	GRASS
98+00	98+50	↓		0.8	.03	.024	.04	5	5.5	0.2		.01				0.9	3"			7	0.3	3"	GRASS
98+50	99+00	↓		0.8	.04	.032	.072	5	5.5	0.4		.03				1.6	3"			7	0.5	3"	GRASS
99+00	99+50	↓		0.8	.04	.032	.104	5	5.5	0.6		.03				1.7	4"			7	0.7	4"	GRASS
99+50	100+00	↓		0.8	.03	.024	.128	5	5.5	0.7		.03				1.8	4"			7	0.9	4"	GRASS

___ LANE
R SIDE

CUT — MED. — FILL

BY SAG DATE 10/8/01

MILL POND RUN 3:1 Ditch

STA. TO STA.		FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
00+00	100+50	↓		0.8	.04	.032	0.16	5	5.5	0.9		.04				2.1	4"			7	1.1	4"	GRASS (<2.5 fps)
00+50	101+00	↓		0.8	.03	.028	0.19	5	5.5	1.0		.05				2.4	4"			7	1.3	4"	GRASS (<2.5 fps)
01+00	101+50	↓		0.8	.03	.028	0.22	5	5.5	1.2		.05				2.4	4"			7	1.5	5"	GRASS (<2.5 fps)
01+50	102+00	↓		0.8	.04	.032	0.25	5	5.5	1.4		.06				2.6	4"			7	1.7	5"	EC-2 LINED
02+00	102+50	↓		0.85	.01	.009	0.26	5	5.5	1.4		.06				2.6	4"			7	1.8	5"	EC-2 LINED
																							TO ROAD "B"
02+50	103+00	↓		0.8	.03	.024	—	5	5.5	0.1		.07				1.7	<2"			7	0.2	2"	GRASS (<2.5 fps)
03+00	103+50	↓		0.8	.03	.024	.048	5	5.5	0.3		.06				2.0	2"			7	0.3	3"	GRASS (<2.5 fps)
03+50	104+00	↓		0.8	.03	.024	.072	5	5.5	0.4		.06				2.1	3"			7	0.5	3"	GRASS (<2.5 fps)
04+00	104+50	↓		0.8	.03	.024	.096	5	5.5	0.5		.05				2.0	4"			7	0.7	4"	GRASS (<2.5 fps)
04+50	105+00	↓		0.8	.03	.024	.120	5	5.5	0.7		.05				2.2	4"			7	0.9	4"	GRASS (<2.5 fps)
05+00	105+50	↓		0.8	.03	.024	.144	5	5.5	0.8		.05				2.2	4"			7	1.1	4"	GRASS (<2.5 fps)
05+50	106+00	↓		0.8	.03	.024	.168	5	5.5	0.9		.05				2.4	4"			7	1.2	4"	GRASS (<2.5 fps)

MILL POND

LANE

R SIDE

CUT MED. FILL

BY JAG DATE 10/8/01

MILL POND RUN 3:1 Ditch

STA. TO STA.		FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	VEL.	DEP.	n=.015 Qn	DEP.	I_{10}	Q_{10}	DEP.	REMARKS
06+00	106+50	↓		0.8	.03	.024	.192	5	5.5	1.1		.07				2.6	4"			7	1.3	4"	EC-2 LINED
06+50	107+00	↓		0.8	.03	.024	.216	5	5.5	1.2		.05				2.5	4"			7	1.5	5"	EC-2 LINED
07+00	107+50	↓		0.8	.03	.024	.240	5	5.5	1.3		.05				2.5	5"			7	1.7	5"	EC-2 LINED
07+50	108+00	↓		0.8	.03	.024	.264	5	5.5	1.4		.05				2.6	5"			7	1.8	5"	EC-2 LINED
08+00	109+50	↓		0.8	.03	.024	.288	5	5.5	1.6		.04				2.4	5"			7	2.0	5"	GRASS (<2.5fps)
TO INLET																							TO INLET
08+50	109+00	↓		0.8	.03	.024	—	5	5.5	0.2		.03				1.4	3"			7	0.2	3"	GRASS (<2.5fps)
09+00	109+50	↓		0.8	.03	.024	.048	5	5.5	0.3		.02				1.3	4"			7	0.3	4"	GRASS
09+50	110+00	↓		0.8	.03	.024	.072	5	5.5	0.4		.02				1.4	4"			7	0.5	4"	GRASS
10+00	110+50	↓		0.8	.03	.024	.096	5	5.5	0.5		.015				1.3	4"			7	0.7	4"	GRASS
10+50	111+00	↓		0.8	.03	.024	.110	5	5.5	0.6		.015				1.5	4"			7	0.8	5"	GRASS
11+00	111+50	↓		0.8	.03	.024	.134	5	5.5	0.7		.015				1.5	4"			7	0.9	5"	GRASS
11+50	112+00	↓		0.85	.04	.034	.168	5	5.5	0.9		.015				1.5	5"			7	1.2	5"	GRASS
12+00	TO END	↓		0.85	.05	.042	.200	5	5.5	1.1		.01				1.5	5"			7	1.4	6"	GRASS

PLANK LANE

L SIDE

CUT — MED. — FILL

BY JAG DATE 10/8/01

PLANK RD 3:1 Ditch

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 VEL.	DEP.	n=.015 Qn	DEP.	I_{10}	Q_{10}	DEP.	REMARKS
0+00	10+50	↓		.8	.02	.016	.056	5	5.5	0.31		.03			1.4	3"			7	0.4	3"	ADD CARRY OVER FROM MILL POND GRASS (<2.5fps)
0+50	11+00	↓		0.8	.03	.028	.084	5	5.5	0.46		.03			1.6	3"			7	0.6	4"	GRASS (<2.5 fps)
1+00	11+50	↓		0.8	.03	.028	.112	5	5.5	0.62		.025			1.6	4"			7	0.8	4"	GRASS (< 2.5 fps)
+50	12+00	↓		0.8	.03	.028	.14	5	5.5	0.77		.035			2.0	4"			7	0.98	4"	GRASS (< 2.5fps)
12+00	12+50	↓		0.8	.03	.028	.168	5	5.5	0.92		.05			2.4	4"			7	1.2	4"	GRASS (<2.5 fps)
12+50	13+00	↓		0.8	.03	.028	.196	5	5.5	1.08		.07			2.8	4"			7	1.4	4"	EC-2 LINED
3+00	13+50	↓		0.8	.03	.028	.224	5	5.5	1.23		.09			3.1	4"			7	1.6	4"	EC-2 LINED
3+50	14+00	↓		0.8	.03	.028	.252	5	5.5	1.39		.10			3.2	4"			7	1.8	5"	EC-2 LINED
4+00	14+50	↓		0.8	.03	.028	.280	5	5.5	1.54		.10			3.4	4"			7	2.0	5"	EC-2 LINED
4+50	15+00	↓		0.8	.03	.028	.308	5	5.5	1.70		.10			3.5	5"			7	2.2	5"	EC-2 LINED
5+00	15+50	↓		0.8	.03	.028	.336	5	5.5	1.85		.09			3.5	5"			7	2.3	5"	EC-2 LINED
5+50	to end	↓		0.85	.04	.034	.400	5	5.5	2.2		.05			2.8	5"			7	2.8	6"	EC-2 LINED TO INLET

PLANK LANE

R SIDE

CUT — MED. — FILL

PLANK RD 3:1 Ditch

BY JAG DATE 10/8/01

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
0+00	10+50	↓		0.8	.02	.016	—	5	5.5	0.09		.03				1.2	2"			7	0.1	2"	GRASS (<2.5 fps)
0+50	11+00	↓		0.8	.03	.028	.044	5	5.5	0.2		.03				1.4	2"			7	0.3	3"	GRASS (<2.5 fps)
1+00	11+50	↓		0.8	.03	.028	.072	5	5.5	0.4		.025				1.4	3"			7	0.5	3"	GRASS (<2.5 fps)
1+50	12+00	↓		0.8	.03	.028	.10	5	5.5	0.55		.035				1.8	3"			7	0.7	4"	GRASS (under 2.5 fps)
2+00	12+50	↓		0.8	.03	.028	.128	5	5.5	0.7		.05				2.2	4"			7	0.9	4"	GRASS (under 2.5 fps)
2+50	13+00	↓		0.8	.03	.028	.156	5	5.5	0.85		.07				2.5	4"			7	1.1	4"	EC-2 LINED
3+00	13+50	↓		0.8	.03	.028	.184	5	5.5	1.01		.09				3.0	4"			7	1.3	4"	EC-2 LINED
3+50	14+00	↓		0.8	.03	.028	.212	5	5.5	1.17		.10				3.2	4"			7	1.5	4"	EC-2 LINED
4+00	14+50	↓		0.8	.03	.028	.240	5	5.5	1.32		.10				3.25	4"			7	1.7	4"	EC-2 LINED
4+50	15+00	↓		0.8	.03	.028	.268	5	5.5	1.47		.10				3.5	4"			7	1.9	5"	EC-2 LINED
5+00	15+50	↓		0.8	.03	.028	.296	5	5.5	1.63		.09				3.25	4"			7	2.1	5"	EC-2 LINED
INLET																							INLET
5+50	to end	↓		0.85	.04	.034	—	5	5.5	.19		.05				1.6	2"			7	0.2	2"	GRASS

YARDING LANE

R SIDE

CUT — YARDING RD

MED. — 3:1 Ditch

FILL

BY JAG DATE 10/8/01

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
0+00	10+50	↓		0.8	.03	.024	0.28	5	5.5	1.5		.06				3.0	5"			7	2.0	5"	EC-2 LINED FROM MILL POND
0+50	11+00	↓		0.75	.05	.037	0.32	5	5.5	1.8		.09				3.5	5"			7	2.2	5"	EC-2 LINED
1+00	11+50	↓		0.7	.08	.056	0.37	5	5.5	2.0		.08				3.5	5"			7	2.6	6"	EC-2 LINED
+50	12+00	↓		0.7	.11	.077	0.45	5	5.5	2.5		.07				3.5	5"			7	3.1	6"	EC-2 LINED
+00	12+50	↓		0.6	.14	.084	0.53	5	5.5	2.9		.05				3.5	6"			7	3.7	7"	EC-2 LINED
+50	13+00	↓		0.7	.06	.042	0.58	5	5.5	3.2		.04				3.0	7"			7	4.1	7"	EC-2 LINED
+00	13+50	↓		0.7	.08	.056	0.63	5	5.5	3.5		.03				2.7	7"			7	4.4	8"	EC-2 LINED
+50	14+00	↓		0.7	.07	.049	0.68	5	5.5	3.7		.02				2.5	8"			7	4.8	8"	EC-2 LINED
+00	14+50	↓		0.7	.07	.049	0.73	5	5.5	4.0		.01				1.9	9"			7	5.1	10"	GRASS (<2.5 fps)
+50	15+00	↓		0.75	.05	.037	0.77	5	5.5	4.2		.01				2	9"			7	5.4	10"	GRASS (<2.5 fps)
TO	INLET																						TO INLET
+00	15+50	↓		0.8	.04	.032	—	5	5.5	0.2		.02								7	0.2		GRASS
+50	16+00	↓		0.8	.03	.024	.056	5	5.5	0.3		.03								7	0.4		GRASS
+00	TO INLET	↓		0.85	.04	.034	.090	5	5.5	0.5		.03								7	0.6		GRASS

YARDING
L DRIVE
L SIDE

CUT — MED. — FILL

BY JAG DATE 10/8/01

YARDING RD 3:1 Ditch

STA.	TO STA.	FLOW		C	A (Ac.)	C A INCR.	C A ACC.	Tc	I_2	Q_2	C or F	Slope Ft/Ft	ALLOW VEL	Earth n=.03 VEL.	Protective Lining n=.05 Qn	n=.05 VEL.	n=.05 DEP.	n=.015 Qn	n=.015 DEP.	I_{10}	Q_{10}	DEP.	REMARKS
10+00	10+50	↓		0.8	.05	.040	—	5	5.5	0.2		.06				1.8	2"			7	0.3	2"	GRASS (<2.5fps)
10+50	11+00	↓		0.8	.03	.024	.068	5	5.5	0.4		.09				2.2	3"			7	0.5	3"	GRASS (<2.5fps)
11+00	11+50	↓		0.8	.03	.024	.096	5	5.5	0.5		.08				2.4	3"			7	0.7	3"	GRASS (<2.5fps)
11+50	12+00	↓		0.8	.03	.024	.124	5	5.5	0.7		.07				2.5	3"			7	0.9	4"	GRASS (<2.5fps)
12+00	12+50	↓		0.8	.03	.024	.152	5	5.5	0.8		.05				2.2	3"			7	1.1	4"	GRASS (<2.5fps)
12+50	13+00	↓		0.8	.03	.024	.180	5	5.5	1.0		.04				2.2	3"			7	1.3	4"	GRASS (<2.5fps)
13+00	13+50	↓		0.8	.03	.024	.208	5	5.5	1.1		.03				2.0	4"			7	1.5	5"	GRASS (<2.5fps)
13+50	14+00	↓		0.8	.03	.024	.236	5	5.5	1.3		.02				1.8	5"			7	1.6	6"	GRASS (<2.5fps)
14+00	14+50	↓		0.8	.03	.024	.264	5	5.5	1.4		.01				1.4	6"			7	1.9	7"	GRASS (<2.5fps)
14+50	15+00	↓		0.8	.03	.024	.292	5	5.5	1.6		.01				1.5	7"			7	2.0	7"	GRASS (<2.5fps)
TO INLET																							TO INLET
15+00	15+50	↓		0.8	.03	.024	—	5	5.5	0.1		.02				1.0	2"			7	0.2	3"	GRASS (<2.5fps)
15+50	16+00	↓		0.8	.03	.024	.048	5	5.5	0.3		.03				1.4	3"			7	0.3	3"	GRASS (<2.5fps)
16+00	TO INLET	↓		0.85	.04	.034	.082	5	5.5	0.5		.03				1.6	3"			7	0.6	4"	GRASS

PROJECT: Stonehouse Mill Pond Phase 1	STATION: Mill Pond Run 88+25	CULVERT DESIGN FORM
	SHEET 1 OF 1	DESIGNER / DATE: JAG / 10/11/91
		REVIEWER / DATE: /

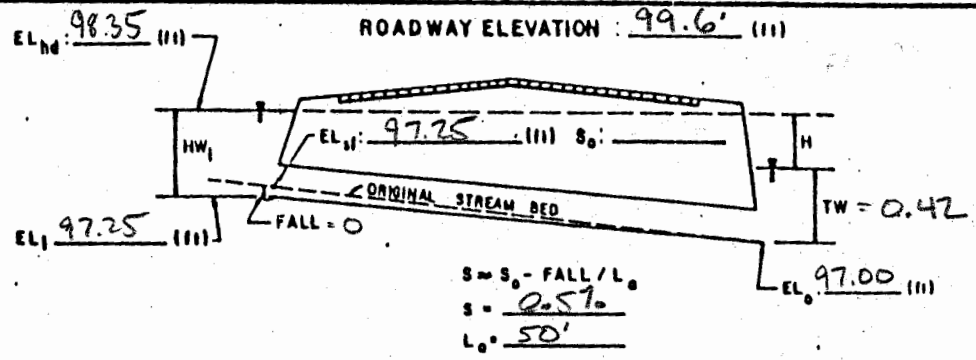
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- [x] METHOD: RATIONAL
- [x] DRAINAGE AREA: 1.53 [ ] STREAM SLOPE:
- [ ] CHANNEL SHAPE: 3:1 DITCH (PAVED) "V"
- [ ] ROUTING: [ ] OTHER.

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10yr	3.52 cfs	0.42'



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	h_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
15" RCP - Grooved + Projecting	3.52	3.52	1.1	1.1	Ø	98.3	0.42	1.25	1.25	1.25	0.2	≈0	98.2	98.3	3.1	GOOD

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW/D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) EL_{hi} = HW_i + EL_i (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_e + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho HEADWATER IN OUTLET CONTROL
- i INLET CONTROL SECTION
- o. OUTLET
- sf STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

$Q = CI_{10}A$
$C = 0.5$
$T_c = 18$ min
$I_{10} = 4.6$ in/hr

$A = 1.53$ Acres
$Q = 3.52$ cfs

CULVERT BARREL SELECTED:

SIZE: 15"
SHAPE: Circular
MATERIAL: Concrete
ENTRANCE: Grooved + Projecting

PROJECT: Stonehouse - Richardsons Mill Mill Pond Run	STATION: 97+20 SHEET 1 OF 1	CULVERT DESIGN FORM DESIGNER / DATE: JAG / 5/1/02 REVIEWER / DATE: /

HYDROLOGICAL DATA

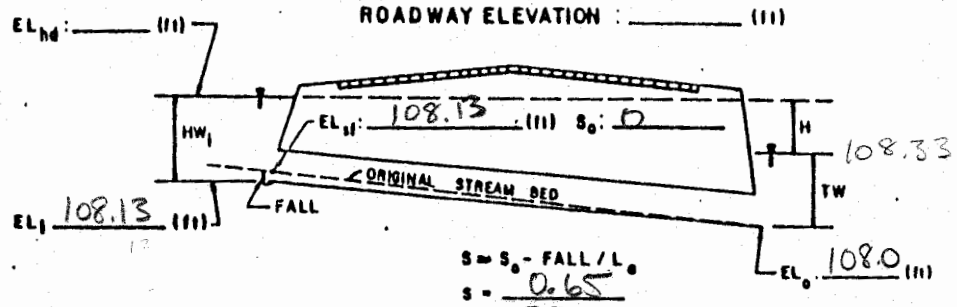
SEE ADD'L SHTS.

- ☐ METHOD: RATIONAL
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE: 1%
- ☐ CHANNEL SHAPE: 3:1 DITCH
- ☐ ROUTING: ____ ☐ OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10	0.2	4'

ROADWAY ELEVATION: ____ (ft)



$S = S_o - FALL / L_e$

$S = 0.65$

$L_e = 20$

CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_hi (4)	OUTLET CONTROL TW (5)	d_c	(d_c+D)/2	h_o (6)	h_e	H (7)	EL_ho (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
CONC. - CIR - 15" - GRV. PRJ.	0.2	0.2	.12	0.2	0	108.3	0.3	<0.5	0.7	<0.7	0.2	<0.4	<109	108.3		GOOD - LOW FLOW

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i/D = HW/D$ OR HW_i/D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{sf})$, FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) $h_o = TW$ or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_e + (29 n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- e. APPROXIMATE
- f CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho HEADWATER IN OUTLET CONTROL
- i INLET CONTROL SECTION
- o. OUTLET
- sf STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 15"

SHAPE: CIR.

MATERIAL: RCP n

ENTRANCE: GROV. + PROJ.

PROJECT: STONEHOUSE - RICHARDSON'S MILL PLANK ROAD	STATION: 14+25	CULVERT DESIGN FORM
	SHEET 1 OF 1	DESIGNER / DATE: JAG / 5/1/02
		REVIEWER / DATE: /

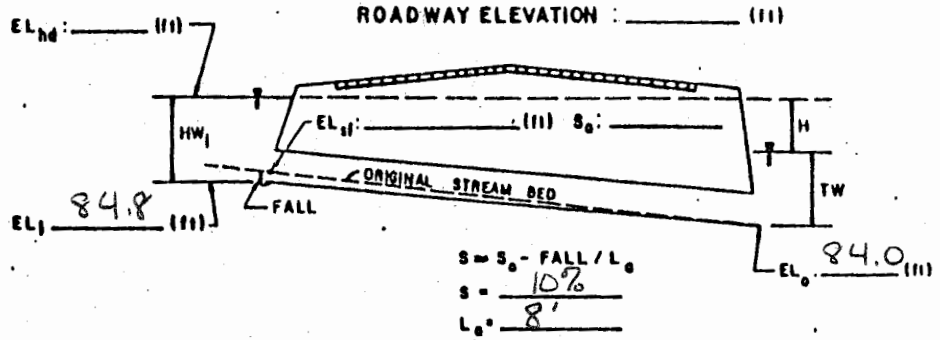
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD: RATIONAL
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE: ____
- ☐ CHANNEL SHAPE: 3:1 Ditch
- ☐ ROUTING: ____ ☐ OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10	1.7	4"



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	h_a	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
CONC - CIR - 15" - GR + PRJ	1.7	1.7	0.7	0.9	0	85.7	0.3	0.3	0.8	0.8	0.2	<0.4	85.2	85.7		GOOD

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) $HW_i/D = HW/D$ OR HW_i/D FROM DESIGN CHARTS

(3) $FALL = HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_a + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

a. APPROXIMATE
f CULVERT FACE
hd. DESIGN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho HEADWATER IN OUTLET CONTROL
i. INLET CONTROL SECTION
o. OUTLET
sf STREAMBED AT CULVERT FACE
tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 15"
SHAPE: CIR.
MATERIAL: RCP n
ENTRANCE: GROV. + PROJ.

PROJECT: STONEHOUSE - RICHARDSON'S MILL MILL POND RUN	STATION: 111+75 SHEET 1 OF 1	CULVERT DESIGN FORM DESIGNER/DATE: JAG / 5/1/02 REVIEWER/DATE: /

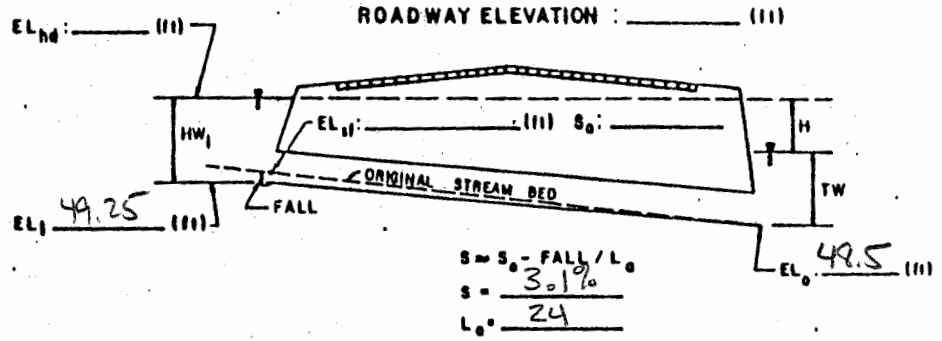
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- [x] METHOD: RATIONAL
- [ ] DRAINAGE AREA: ____ [ ] STREAM SLOPE: ____
- [ ] CHANNEL SHAPE: 3:1 Ditch
- [ ] ROUTING: ____ [ ] OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10	1.2	5"



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	h_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
CONC - CIR - 15" - GRO + PRJ	1.2	1.2	0.6	0.7	0	50.0	0.4	0.3	0.8	0.8	0.2	<0.4	49.4	50.0		GOOD

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW /D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{if})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_e + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

a. APPROXIMATE
f CULVERT FACE
hd. DESIGN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho HEADWATER IN OUTLET CONTROL
i. INLET CONTROL SECTION
o. OUTLET
if STREAMBED AT CULVERT FACE
is. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 15"
SHAPE: CIR
MATERIAL: RCP
ENTRANCE: GROV + PROJ

PROJECT: STONEHOUSE - RICHARDSON'S MILL YARDING WAY	STATION: 14+50 SHEET 1 OF 1	CULVERT DESIGN FORM DESIGNER/DATE: JAG / 5/1/02 REVIEWER/DATE: /

HYDROLOGICAL DATA

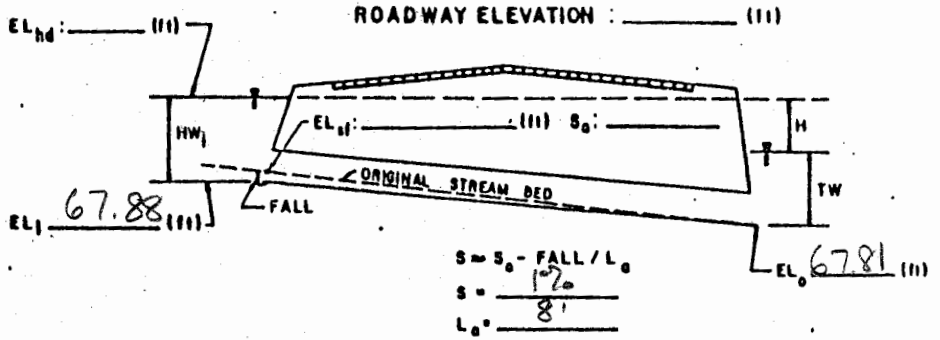
SEE ADD'L SHTS.

- [x] METHOD: RATIONAL
- [ ] DRAINAGE AREA: ____ [ ] STREAM SLOPE: ____
- [ ] CHANNEL SHAPE: 3:1 Ditch
- [ ] ROUTING: ____ [ ] OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10	5.4	10"

ROADWAY ELEVATION: ____ (ft)



$S \approx S_o - FALL / L_o$

$S = 1\%$

$L_o = 8'$

CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	h_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
CONC - CIR - 15" - GRO+PRJ	5.4	5.4	1.4	1.7	0	69.6	0.8	1.0	1.1	1.1	0.2	<0.4	69.3	69.6		GOOD

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW/D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_e + (29 n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho HEADWATER IN OUTLET CONTROL
- i INLET CONTROL SECTION
- o. OUTLET
- sf STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 15"

SHAPE: CIR

MATERIAL: RCP n ____

ENTRANCE: GROV + PROJ.

PROJECT: STONEHOUSE - RICHARDSON'S MILL
MILL POND RUN

STATION: 106+00

SHEET 1 **OF** 1

CULVERT DESIGN FORM

DESIGNER / DATE: JAG / 5/1/02

REVIEWER / DATE: ____ / ____

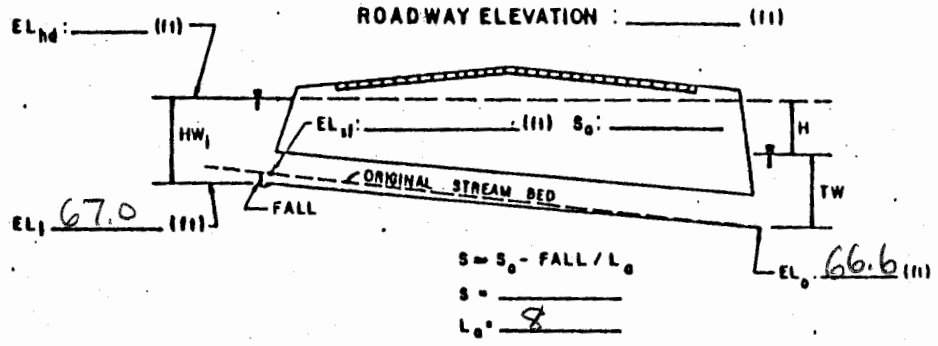
HYDROLOGICAL DATA

SEE ADD'L SHTS.

- ☐ METHOD: RATIONAL
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE: ____
- ☐ CHANNEL SHAPE: 3:1 DITCH
- ☐ ROUTING: ____ ☐ OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10	1.2	4"



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	h_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
RCP-CIR-15"-GR+PRJ	1.2	1.2	0.4	0.5	0	67.5	0.3	<0.3	0.8	0.8	0.2	<0.4	67.3	67.5		GOOD

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW/D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{if})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_e + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

a. APPROXIMATE
f CULVERT FACE
hd. DESIGN HEADWATER
hi. HEADWATER IN INLET CONTROL
ho HEADWATER IN OUTLET CONTROL
i. INLET CONTROL SECTION
o. OUTLET
if STREAMBED AT CULVERT FACE
tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 15"
SHAPE: CIR.
MATERIAL: RCP
ENTRANCE: GROV. + PROJ.

PROJECT: STONEHOUSE - RICHARDSON'S MILL
MILL POND RUN

STATION: 110+50

SHEET 1 **OF** 1

CULVERT DESIGN FORM

DESIGNER / DATE: JAG / 5/1/02

REVIEWER / DATE: ____ / ____

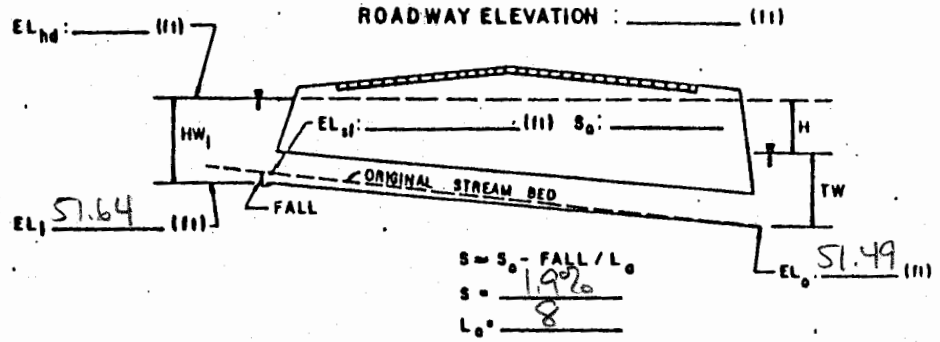
HYDROLOGICAL DATA

SEE ADD'L. SHTS.

- ☐ METHOD: RATIONAL
- ☐ DRAINAGE AREA: ____ ☐ STREAM SLOPE: ____
- ☐ CHANNEL SHAPE: 3:1 Ditch
- ☐ ROUTING: ____ ☐ OTHER: ____

DESIGN FLOWS/TAILWATER

R.I. (YEARS)	FLOW (cfs)	TW (ft)
10	0.7	4"



CULVERT DESCRIPTION: MATERIAL - SHAPE - SIZE - ENTRANCE	TOTAL FLOW Q (cfs)	FLOW PER BARREL Q/N (1)	HEADWATER CALCULATIONS: INLET CONTROL HW_i/D (2)	HW_i	FALL (3)	EL_{hi} (4)	OUTLET CONTROL TW (5)	d_c	$\frac{d_c+D}{2}$	h_o (6)	h_e	H (7)	EL_{ho} (8)	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY	COMMENTS
CONC - CIR - 15" - GROOVED	0.7	0.7	<0.4	0.5	0	52.2	0.3	<0.3	0.8	0.8	0.2	<0.4	<52.2	52.2		GOOD

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW /D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = $HW_i - (EL_{hd} - EL_{sf})$; FALL IS ZERO FOR CULVERTS ON GRADE

(4) $EL_{hi} = HW_i + EL_i$ (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL.

(6) h_o = TW or $(d_c + D/2)$ (WHICHEVER IS GREATER)

(7) $H = \left[1 + h_o + (29n^2 L)/R^{1.33}\right] V^2/2g$

(8) $EL_{ho} = EL_o + H + h_o$

SUBSCRIPT DEFINITIONS:

- a. APPROXIMATE
- f CULVERT FACE
- hd. DESIGN HEADWATER
- hi. HEADWATER IN INLET CONTROL
- ho HEADWATER IN OUTLET CONTROL
- i INLET CONTROL SECTION
- o. OUTLET
- sf STREAMBED AT CULVERT FACE
- tw. TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

SIZE: 15"

SHAPE: CIR

MATERIAL: RCP

ENTRANCE: GROV + PROJ

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	3.29	2	734	17,234	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	12.24	2	724	35,700	----	------	------	POST-DEV. RUNOFF
5	Reservoir	0.35	2	1074	33,358	3	26.07	36,913	BMP ROUTED
7	Reservoir	0.37	2	1052	34,214	3	26.28	41,296	SED. BASIN ROUTED

POST DEV
DA = 10.79 AC
CN = 77
TC = 15 MIN

PREDEV
DA = 9.03 AC.
CN = 68
TC = 30 MIN

ROUTED BMP

1-YEAR 0.35 CFS @ EL. 26.07
2-YR. 1.12 CFS @ EL 26.69
10-YR 17.55 CFS @ EL. 26.18
100-YR 05.49 CFS @ EL. 28.74 DHW

BMP ~~E~~ 7.1

S-99-01
3RD SUBMISSION

STONEHOUSE
SECTION 7A
RICHARDSON MILL
SECTION 1

Proj. file: 90280871.gpw	Return Period: 1 yr	Run date: 07-26-2002

Hydraflow Hydrographs by Intelisolve

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	6.48	2	732	29,510	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	19.20	2	722	54,629	----	------	------	POST-DEV. RUNOFF
5	Reservoir	1.12	2	828	50,379	3	26.69	45,682	BMP ROUTED
7	Reservoir	1.48	2	792	52,397	3	26.76	48,086	SED. BASIN ROUTED

Proj. file: 90280871.gpw	Return Period: 2 yr	Run date: 07-26-2002

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	19.81	2	732	80,817	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	45.01	2	722	126,215	----	------	------	POST-DEV. RUNOFF
5	Reservoir	17.55	2	734	121,098	3	28.18	67,462	BMP ROUTED
7	Reservoir	18.81	2	734	123,393	3	28.27	70,422	SED. BASIN ROUTED

Proj. file: 90280871.gpw	Return Period: 10 yr	Run date: 07-26-2002

Hydraflow Hydrographs by Intelisolve

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Maximum storage (cuft)	Hydrograph description
1	SCS Runoff	34.61	2	730	138,675	----	------	------	PRE-DEV. RUNOFF
3	SCS Runoff	71.16	2	722	201,420	----	------	------	POST-DEV. RUNOFF
5	Reservoir	65.49	2	726	196,124	3	28.74	77,842	BMP ROUTED
7	Reservoir	66.13	2	726	198,464	3	28.74	79,335	SED. BASIN ROUTED

Proj. file: 90280871.gpw	Return Period: 100 yr	Run date: 07-26-2002

Hydraflow Hydrographs by Intelisolve

Hydrograph Plot

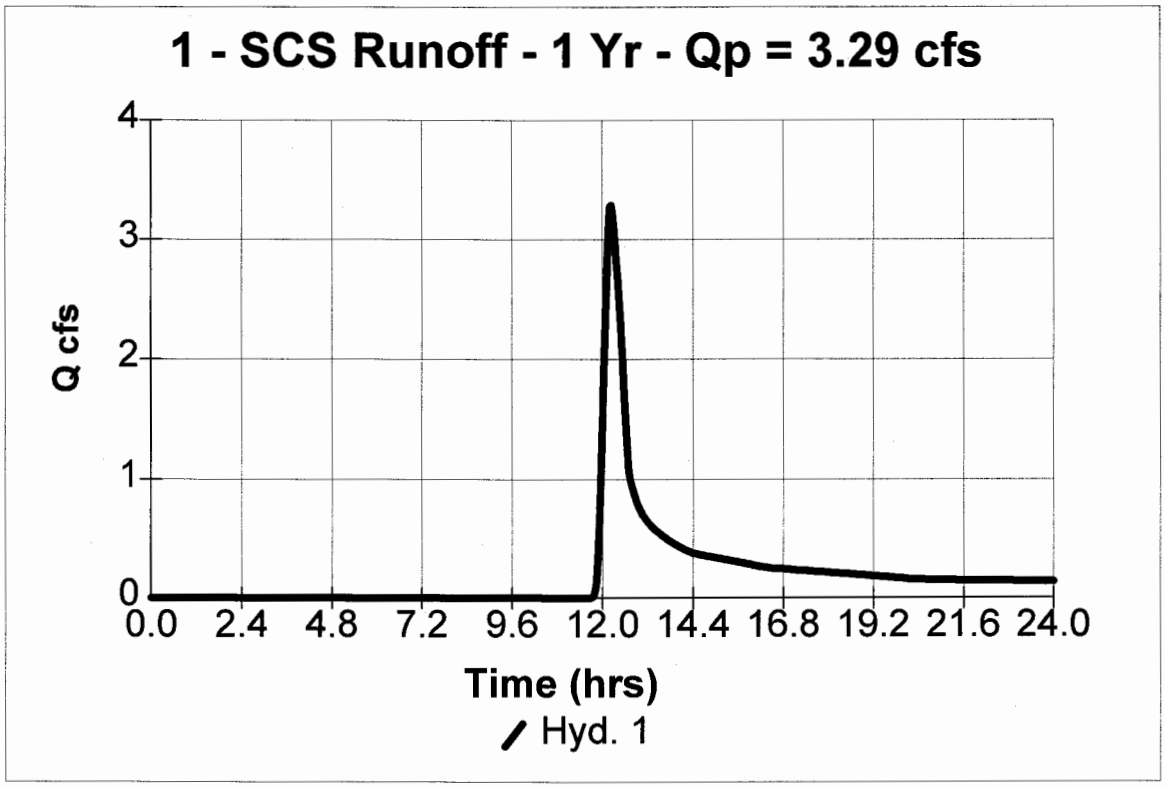
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 3.29 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 17,234 cuft



Hydrograph Plot

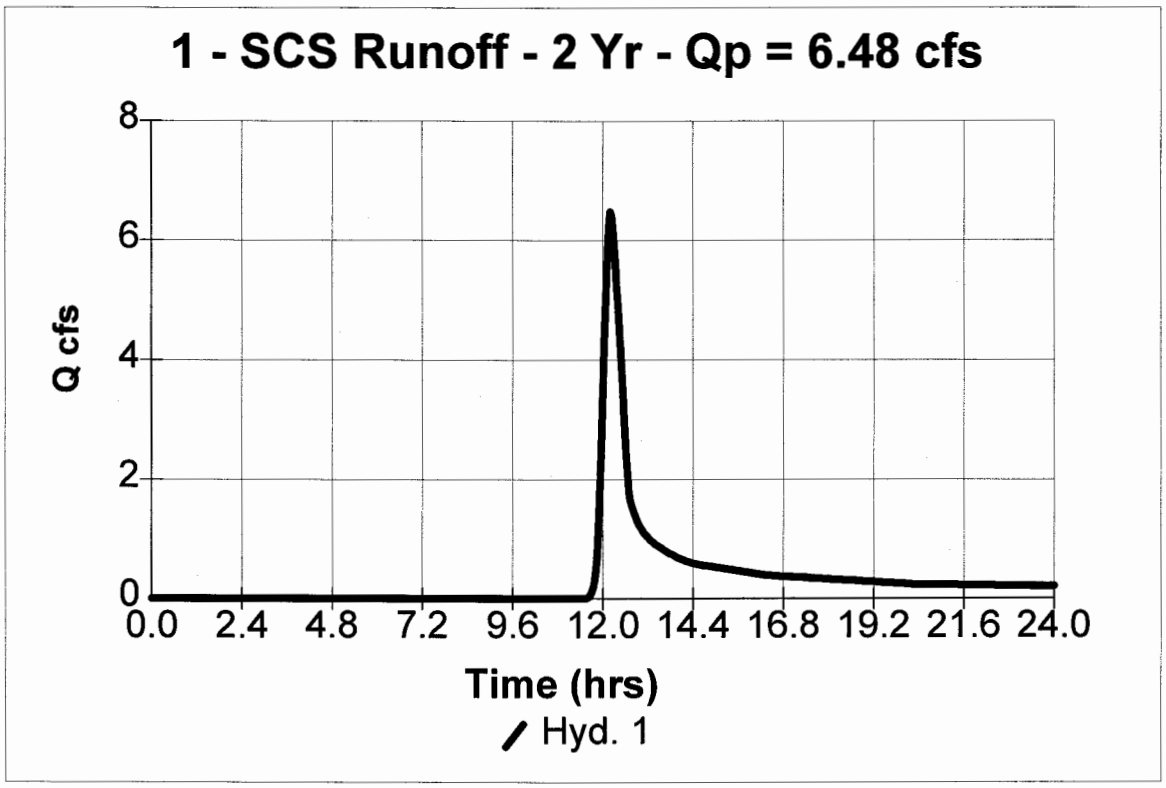
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 6.48 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 29,510 cuft



Hydrograph Plot

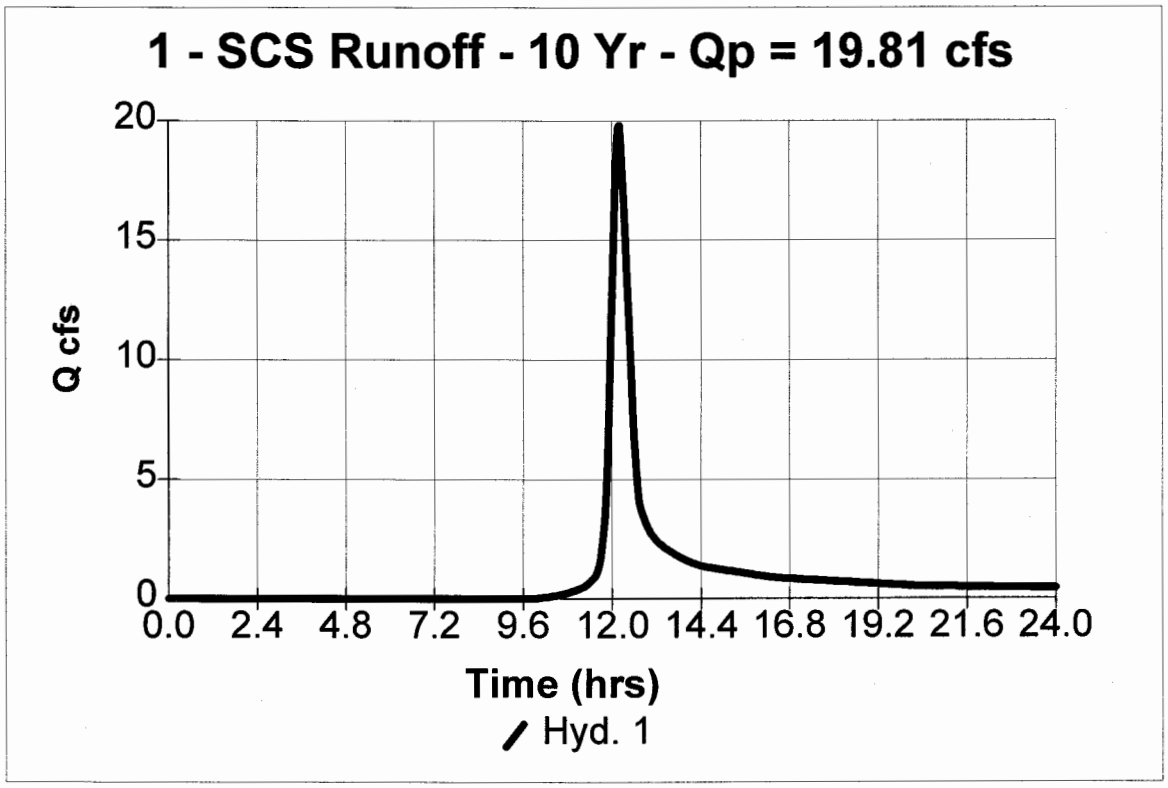
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 19.81 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 5.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 80,817 cuft



Hydrograph Plot

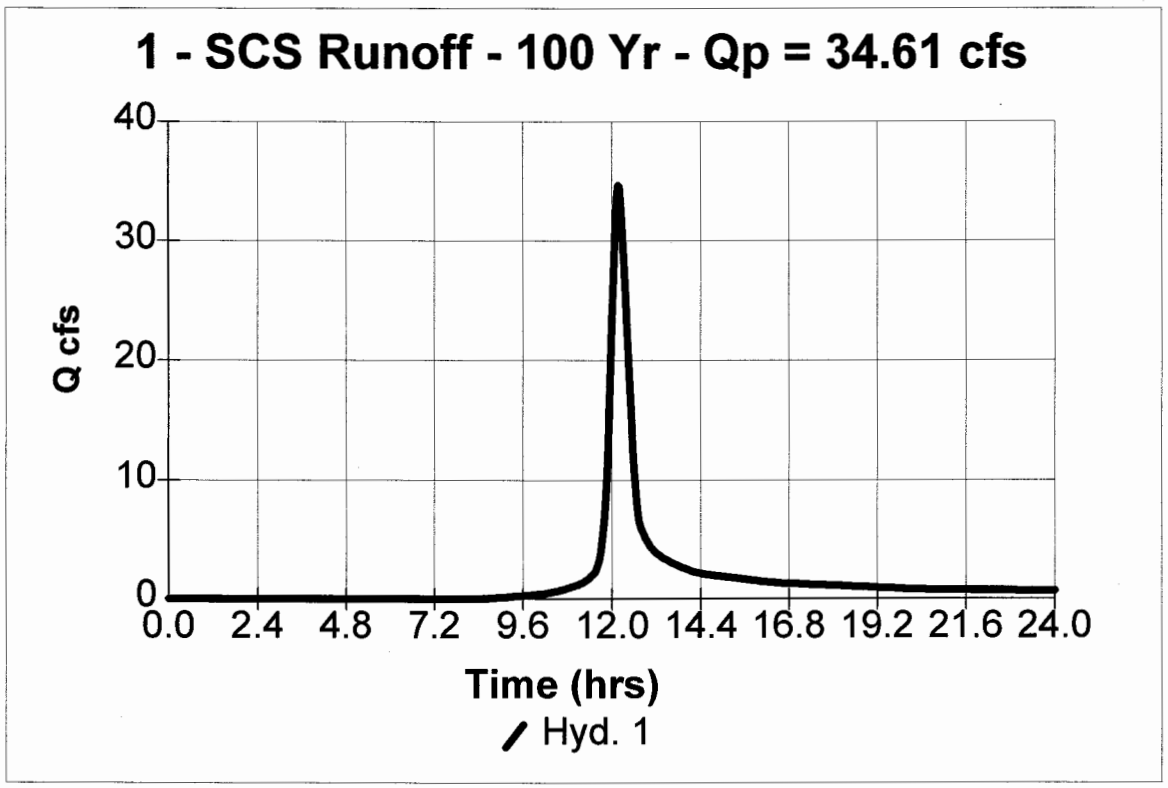
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

PRE-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 34.61 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Drainage area	= 9.02 ac	Curve number	= 68
Basin Slope	= 12.0 %	Hydraulic length	= 875 ft
Tc method	= USER	Time of conc. (Tc)	= 30 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 138,675 cuft



Hydrograph Plot

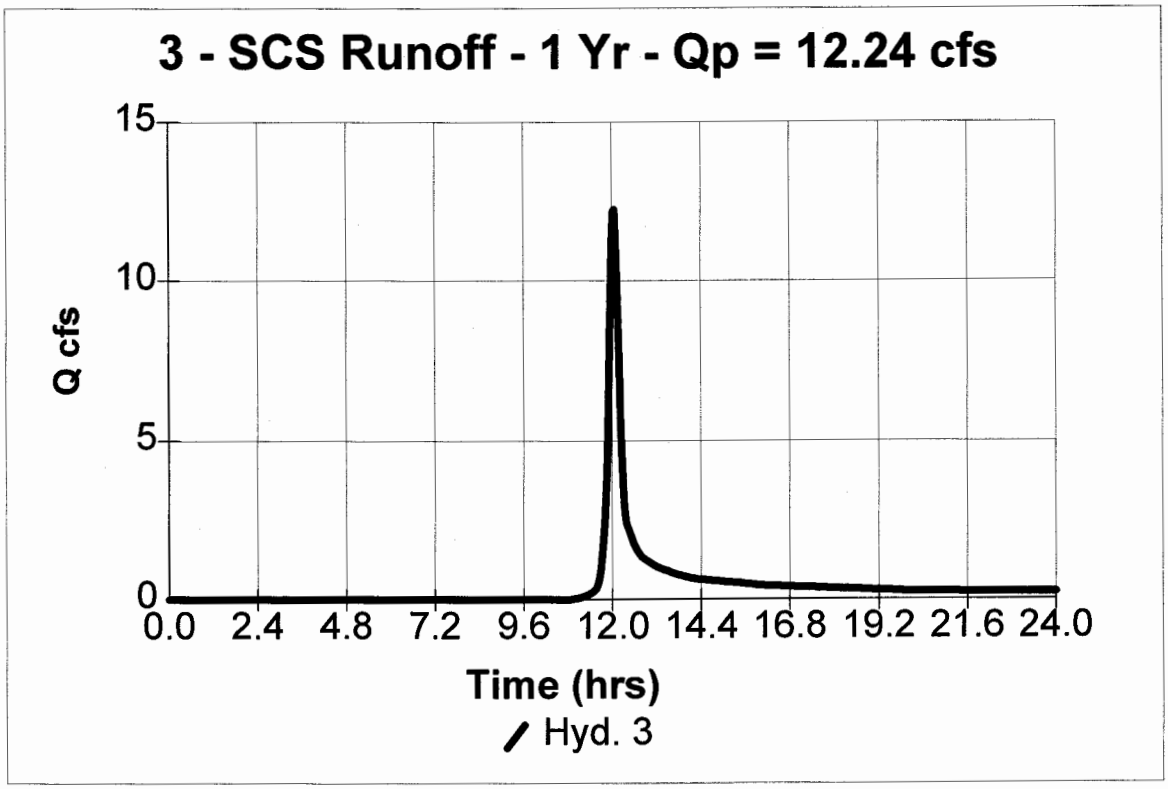
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 12.24 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 2.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 35,700 cuft



Hydrograph Plot

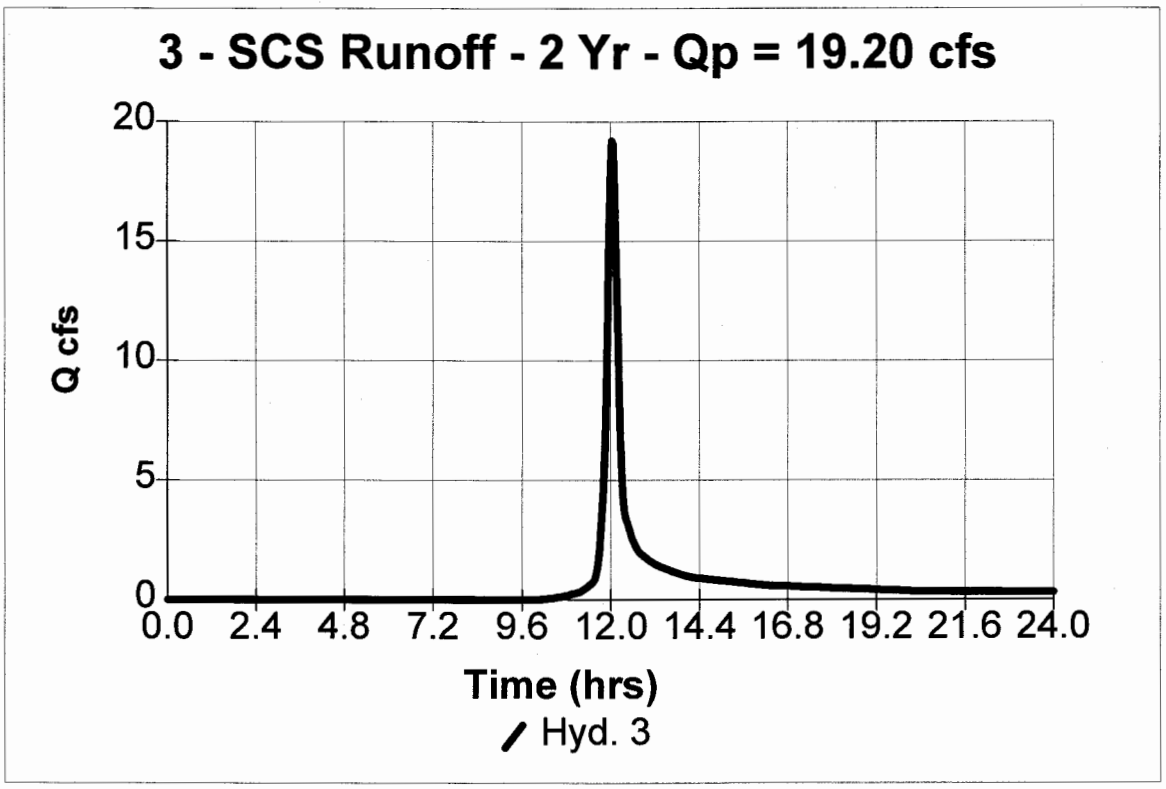
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 19.20 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 3.50 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 54,629 cuft



Hydrograph Plot

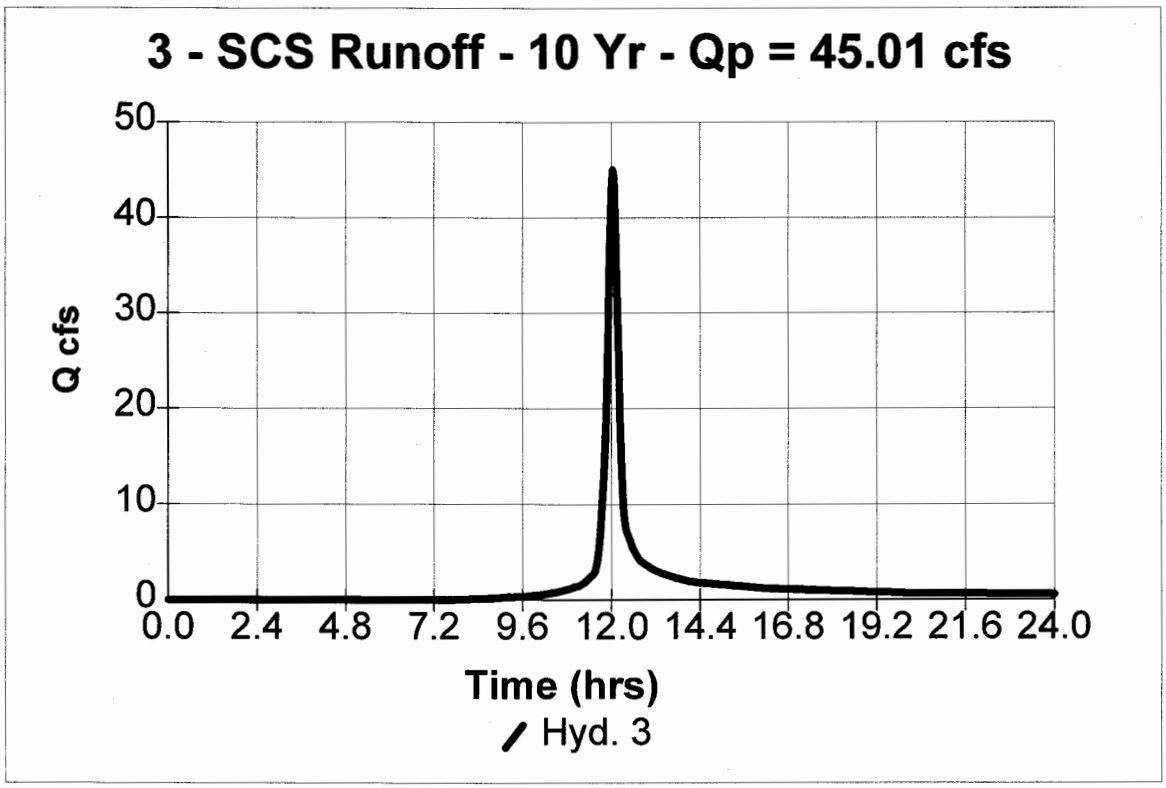
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 45.01 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 5.80 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 126,215 cuft



Hydrograph Plot

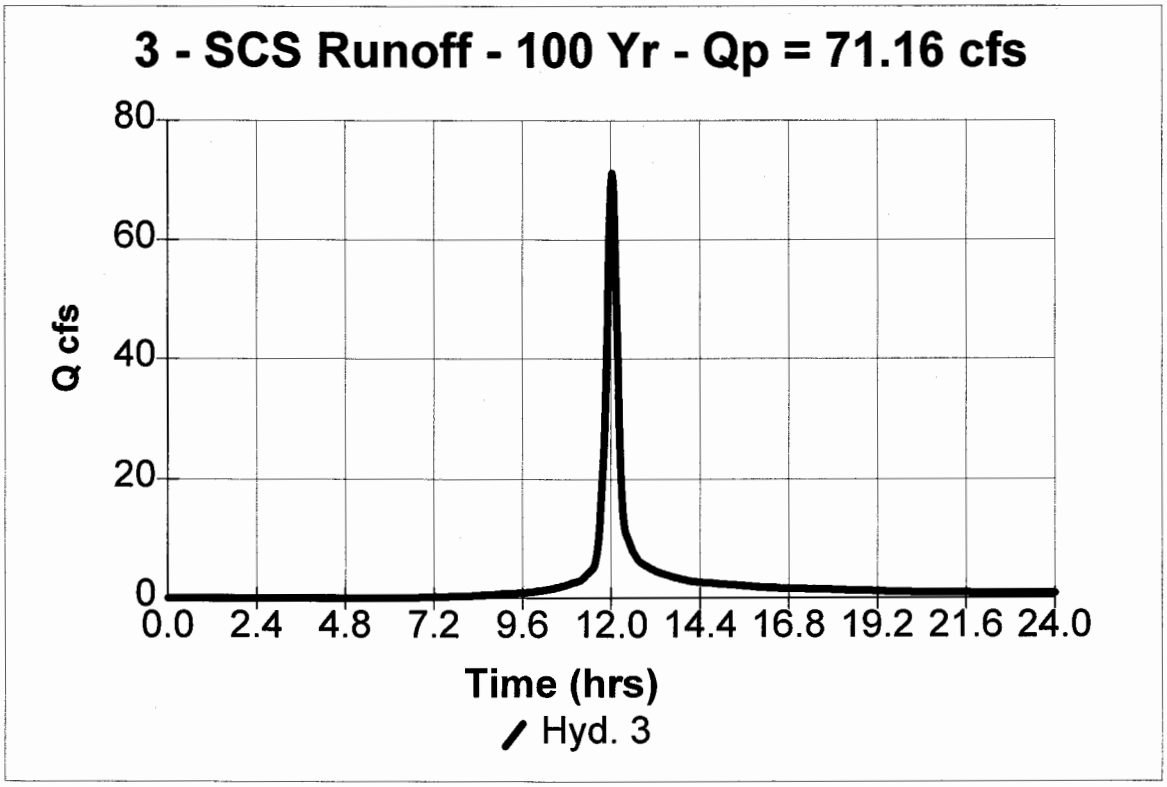
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

POST-DEV. RUNOFF

Hydrograph type	= SCS Runoff	Peak discharge	= 71.16 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Drainage area	= 10.79 ac	Curve number	= 77
Basin Slope	= 10.0 %	Hydraulic length	= 755 ft
Tc method	= USER	Time of conc. (Tc)	= 15 min
Total precip.	= 8.00 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 201,420 cuft



Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 3 - SED BASIN 7.1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	15.00	416	0	0
1.00	16.00	720	568	568
2.00	17.00	1,095	908	1,476
3.00	18.00	1,511	1,303	2,779
4.00	19.00	1,962	1,737	4,515
5.00	20.00	2,450	2,206	6,721
6.00	21.00	2,965	2,708	9,429
7.00	22.00	3,518	3,242	12,670
8.00	23.00	4,104	3,811	16,481
9.00	24.00	4,725	4,415	20,896
11.00	26.00	11,810	16,535	37,431
13.00	28.00	16,225	28,035	65,466
15.00	30.00	21,128	37,353	102,819

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 3.0	0.0	0.0	0.0
Span in	= 3.0	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 23.70	0.00	0.00	0.00
Length ft	= 2.0	0.0	0.0	0.0
Slope %	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 120.00	3.00	0.00	0.00
Crest El. ft	= 28.50	26.50	0.00	0.00
Weir Coeff.	= 2.60	2.60	0.00	0.00
Weir Type	= Broad	Broad	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	15.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
1.00	568	16.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
2.00	1,476	17.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
3.00	2,779	18.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
4.00	4,515	19.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
5.00	6,721	20.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
6.00	9,429	21.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
7.00	12,670	22.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
8.00	16,481	23.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
9.00	20,896	24.00	0.07	---	---	---	0.00	0.00	---	---	---	0.07
11.00	37,431	26.00	0.35	---	---	---	0.00	0.00	---	---	---	0.35
13.00	65,466	28.00	0.48	---	---	---	0.00	14.33	---	---	---	14.81
15.00	102,819	30.00	0.59	---	---	---	573.18	51.07	---	---	---	624.84

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

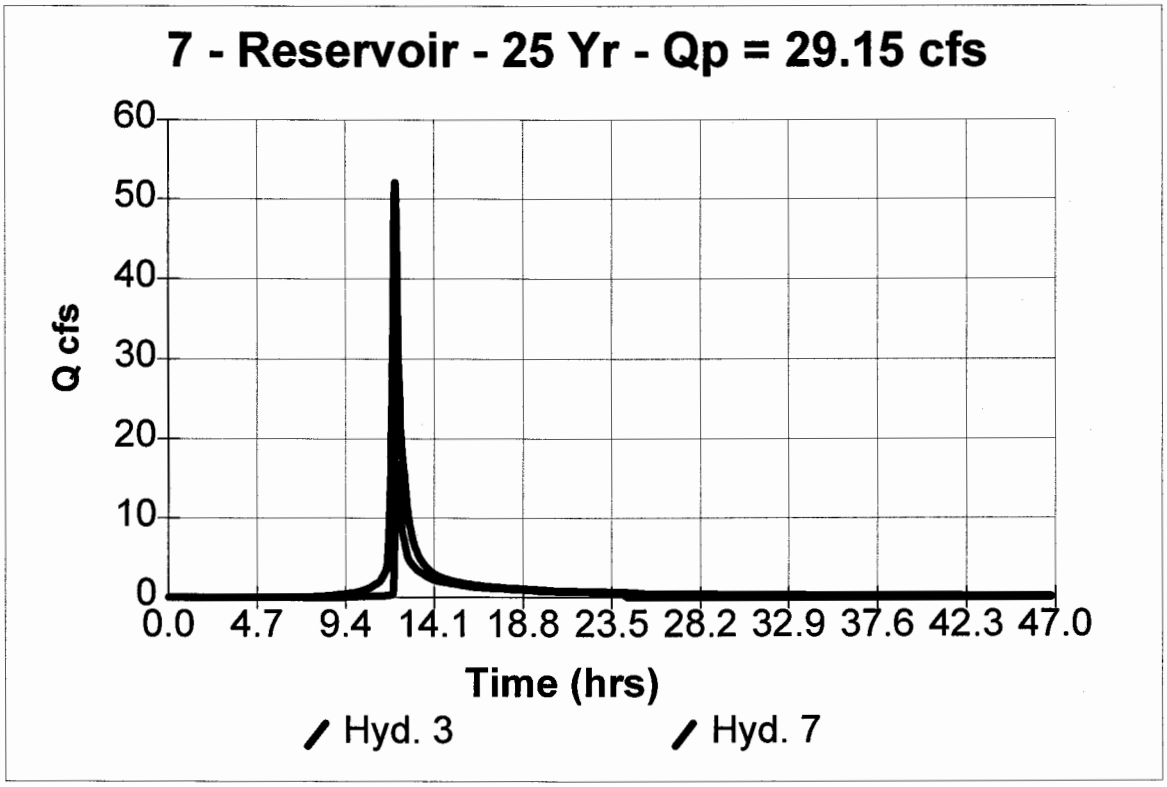
Hyd. No. 7

SED. BASIN ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 29.15 cfs
Storm frequency	= 25 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= SED BASIN 7.1
Max. Elevation	= 28.52 ft	Max. Storage	= 75,265 cuft

Storage Indication method used.

Hydrograph Volume = 143,418 cuft



Reservoir Report

Hydraflow Hydrographs by Intelisolve

Reservoir No. 1 - TIMBER WALL 7.1

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	20.00	1,212	0	0
2.00	22.00	3,925	5,137	5,137
4.00	24.00	7,559	11,484	16,621
6.00	26.00	11,812	19,371	35,992
8.00	28.00	16,222	28,034	64,026
10.00	30.00	21,128	37,350	101,376

Culvert / Orifice Structures

	[A]	[B]	[C]	[D]
Rise in	= 3.0	0.0	0.0	0.0
Span in	= 3.0	0.0	0.0	0.0
No. Barrels	= 1	0	0	0
Invert El. ft	= 23.70	0.00	0.00	0.00
Length ft	= 2.0	0.0	0.0	0.0
Slope %	= 0.50	0.00	0.00	0.00
N-Value	= .013	.013	.000	.000
Orif. Coeff.	= 0.60	0.60	0.00	0.00
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len ft	= 120.00	3.00	0.00	0.00
Crest El. ft	= 28.50	26.50	0.00	0.00
Weir Coeff.	= 2.60	2.60	3.33	0.00
Weir Type	= Broad	Broad	---	---
Multi-Stage	= No	No	No	No

Exfiltration Rate = 0.00 in/hr/sqft Tailwater Elev. = 0.00 ft

Note: All outflows have been analyzed under inlet and outlet control.

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	Clv D cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Total cfs
0.00	0	20.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
2.00	5,137	22.00	0.00	---	---	---	0.00	0.00	---	---	---	0.00
4.00	16,621	24.00	0.07	---	---	---	0.00	0.00	---	---	---	0.07
6.00	35,992	26.00	0.35	---	---	---	0.00	0.00	---	---	---	0.35
8.00	64,026	28.00	0.48	---	---	---	0.00	14.33	---	---	---	14.81
10.00	101,376	30.00	0.59	---	---	---	573.18	51.07	---	---	---	624.84

Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

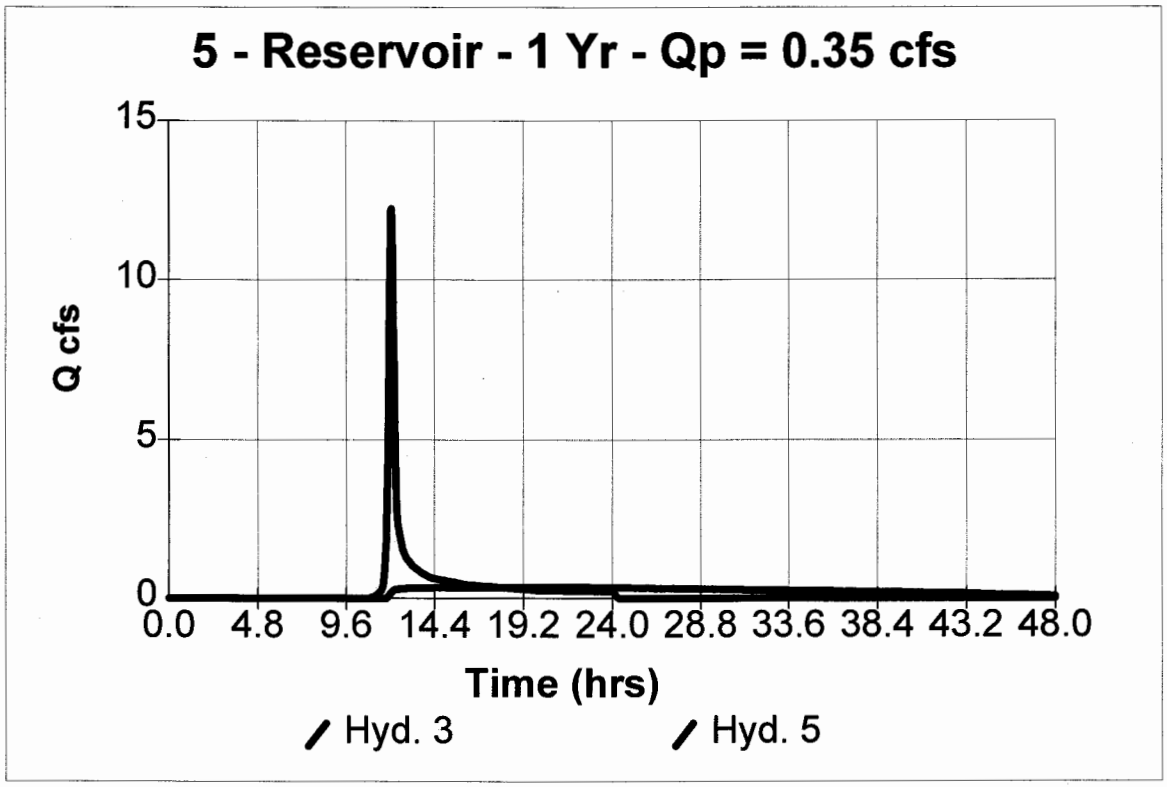
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 0.35 cfs
Storm frequency	= 1 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 26.07 ft	Max. Storage	= 36,913 cuft

Storage Indication method used.

Hydrograph Volume = 33,358 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

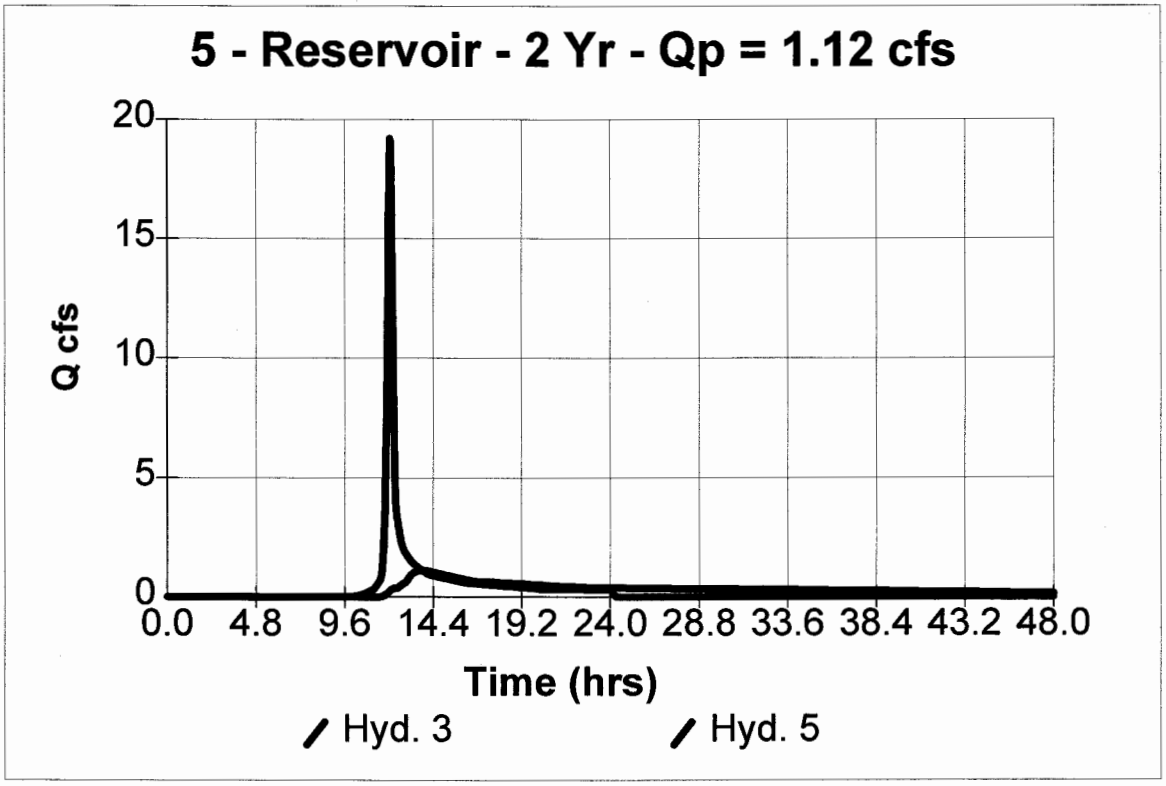
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 1.12 cfs
Storm frequency	= 2 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 26.69 ft	Max. Storage	= 45,682 cuft

Storage Indication method used.

Hydrograph Volume = 50,379 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

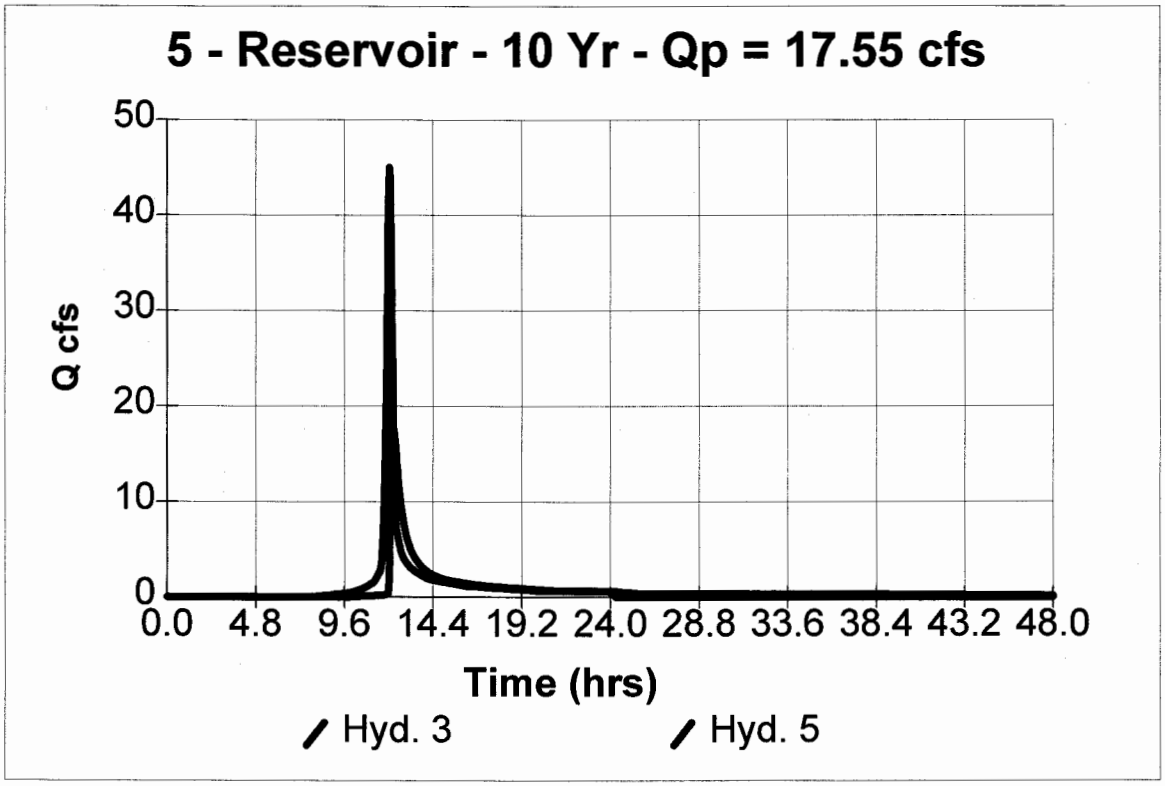
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 17.55 cfs
Storm frequency	= 10 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 28.18 ft	Max. Storage	= 67,462 cuft

Storage Indication method used.

Hydrograph Volume = 121,098 cuft



Hydrograph Plot

Hydraflow Hydrographs by Intelisolve

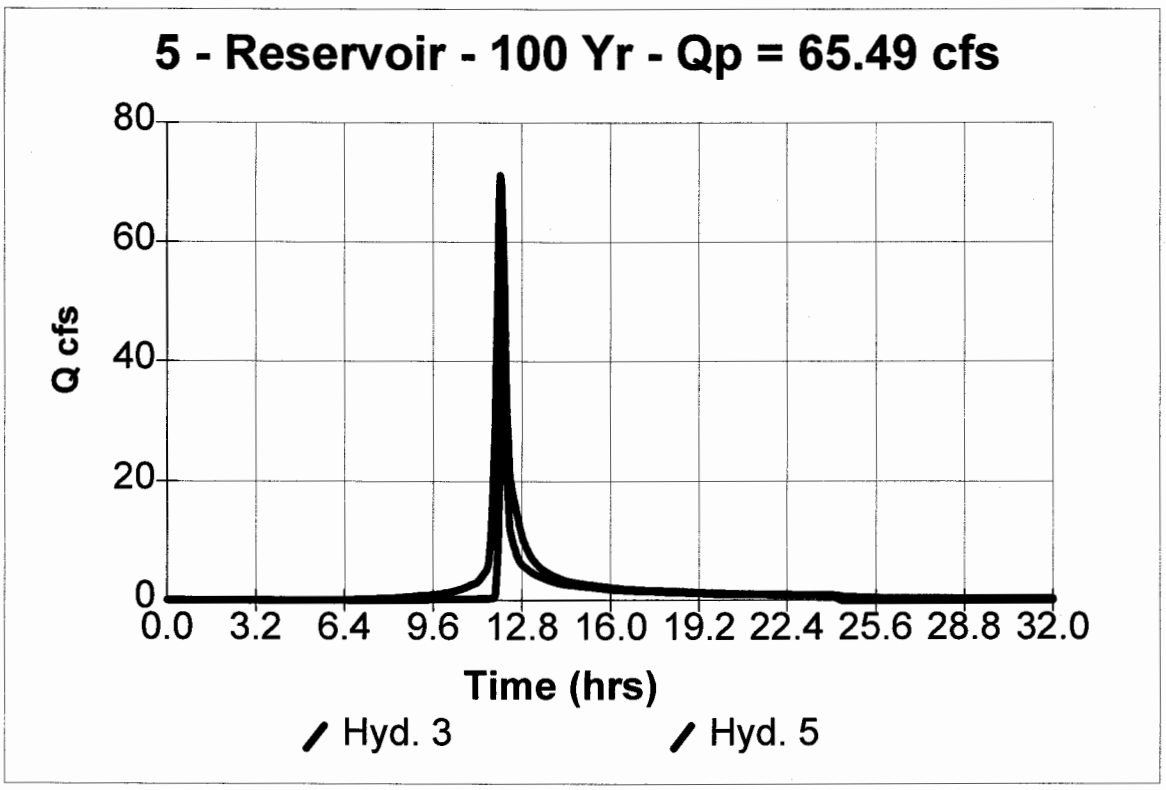
Hyd. No. 5

BMP ROUTED

Hydrograph type	= Reservoir	Peak discharge	= 65.49 cfs
Storm frequency	= 100 yrs	Time interval	= 2 min
Inflow hyd. No.	= 3	Reservoir name	= TIMBER WALL 7.1
Max. Elevation	= 28.74 ft	Max. Storage	= 77,842 cuft

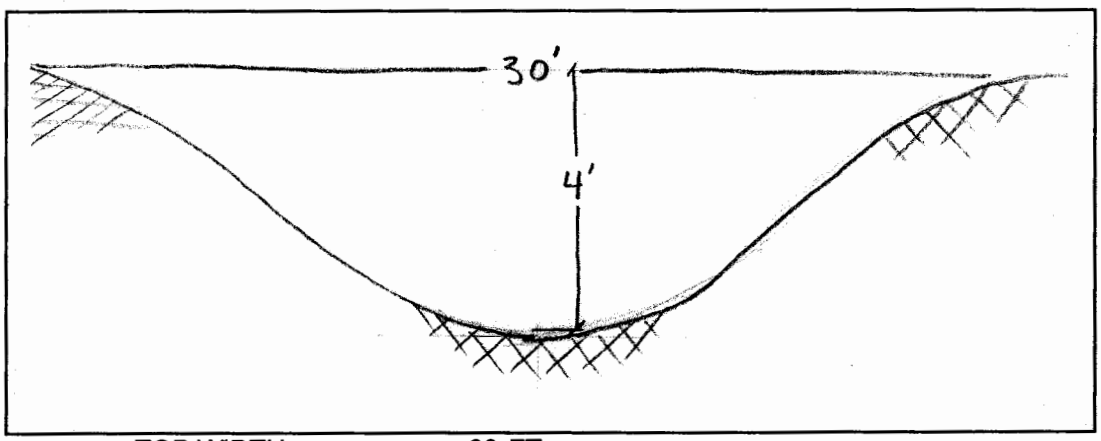
Storage Indication method used.

Hydrograph Volume = 196,123 cuft



Adequate Channel Analysis for Outfall of Storm System 1
Stonehouse Richardson's Mill Phase 1
10/26/2001 (Revised 7/30/02)
Project No. 9028-08

CHANNEL GEOMETRY
Parabolic Channel



TOP WIDTH =	30 FT
HEIGHT =	4 FT
SLOPE (S)	0.28 FT/FT
MANNING'S N	0.20

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0.02	(Side slopes eroded)
N3 = SIZE/SHAPE OF CHANN	0.005	(Channel shape changes slightly over length)
N4 = OBSTRUCTIONS	0.05	(flow obstructed by trees and large amounts of underbrush)
N5 = VEGETATION	0.075	(trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

N = 0.20

SOIL TYPE

SANDY LOAM
MAX. PERMISSIBLE VELOCITY = 2.5 FT/S

2-YEAR STORM EVENT

TIME OF CONCENTRATION 5.7 min
RAINFALL INTENSITY = 6.9 in/hr
RUNOFF COEF. = 0.77
DRAINAGE AREA = 0.7 Ac.

PEAK FLOW RATE = 2.84 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 2.01 FT/S

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 3.70 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Depth (FT)	Incremental Top Width (FT)	Area (SQ FT)	Wetted Perimeter (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	2.83	0.04	12.00	0.01	0.24	0.01
0.04	4.00	0.11	24.01	0.03	0.42	0.04
0.06	4.90	0.20	36.01	0.05	0.58	0.11
0.08	5.66	0.30	48.03	0.08	0.74	0.22
0.10	6.32	0.42	60.04	0.11	0.91	0.38
0.12	6.93	0.55	72.06	0.14	1.07	0.60
0.14	7.48	0.70	84.08	0.17	1.25	0.87
0.16	8.00	0.85	96.10	0.21	1.42	1.21
0.18	8.49	1.02	108.13	0.25	1.60	1.63
0.20	8.94	1.19	120.16	0.29	1.78	2.12
0.22	9.38	1.38	132.19	0.34	1.97	2.70
0.22	9.47	1.42	134.76	0.35	2.01	2.84
0.24	9.80	1.57	144.23	0.39	2.15	3.38
0.25	9.97	1.65	149.48	0.41	2.24	3.70

Hydrograph Plot

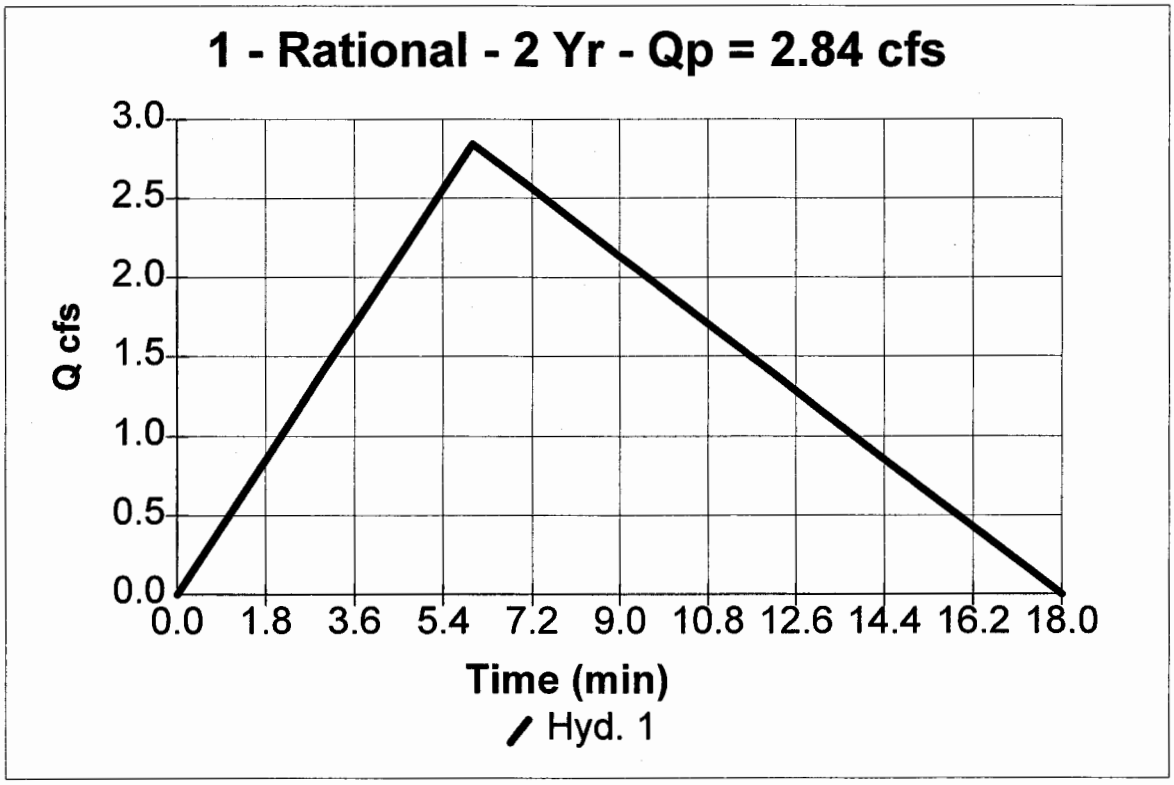
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

STORM SYSTEM 1

Hydrograph type	= Rational	Peak discharge	= 2.84 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.77
Intensity	= 5.275 in/hr	Time of conc. (Tc)	= 6 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 1,535 cuft



Hydrograph Plot

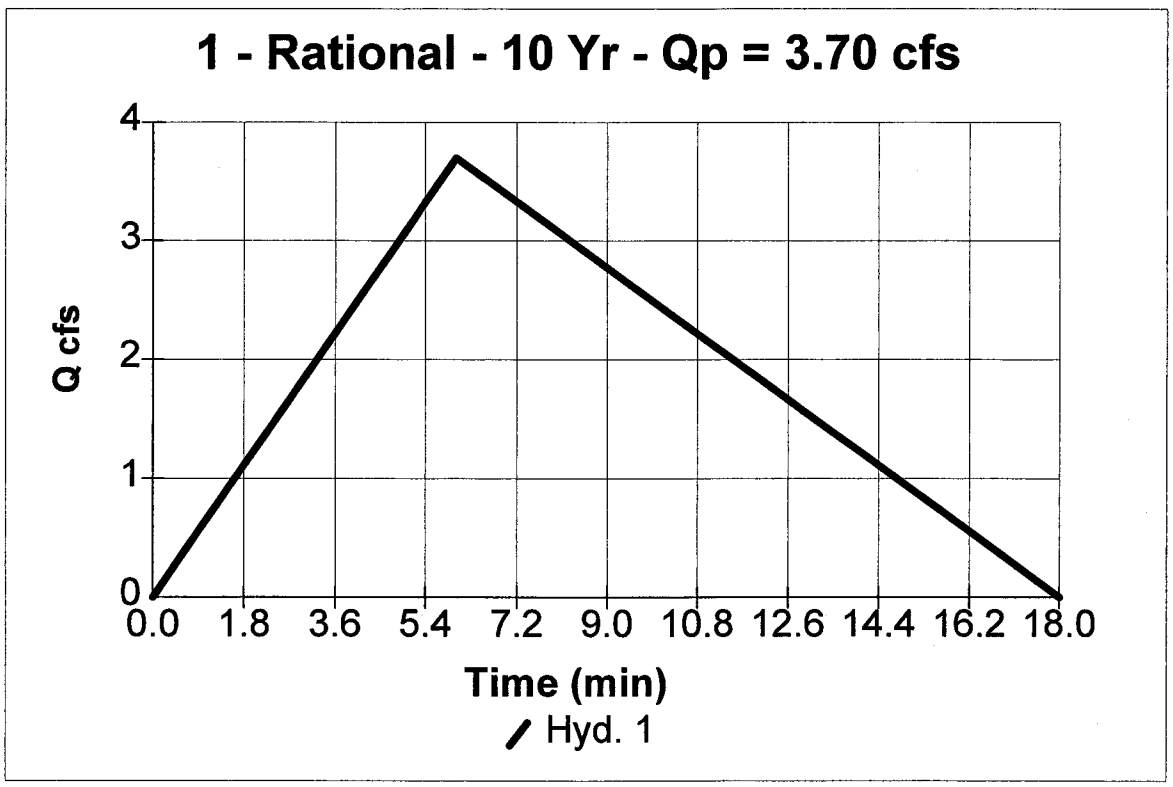
Hydraflow Hydrographs by Intelisolve

Hyd. No. 1

STORM SYSTEM 1

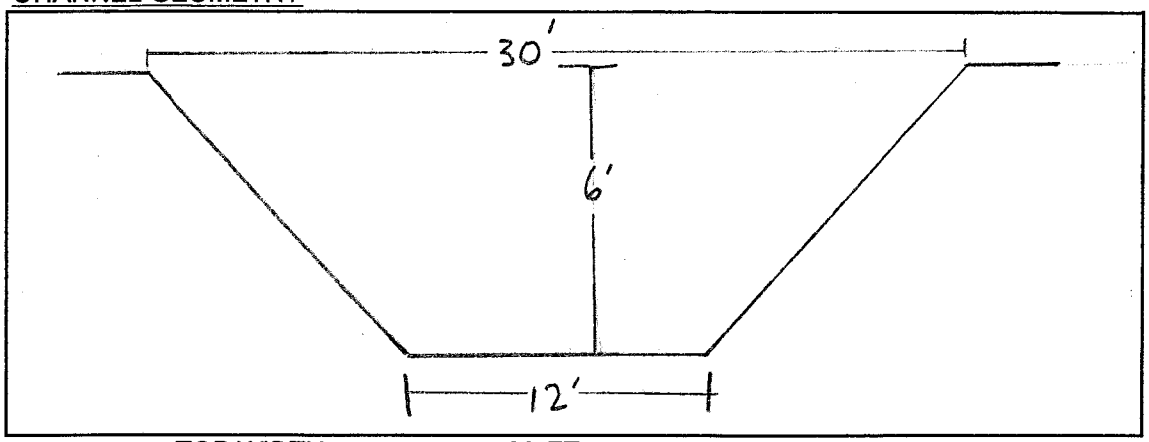
Hydrograph type	= Rational	Peak discharge	= 3.70 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.7 ac	Runoff coeff.	= 0.77
Intensity	= 6.859 in/hr	Time of conc. (Tc)	= 6 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 1,996 cuft



Adequate Channel Analysis for Outfall of Storm System 2
Stonehouse Richardson's Mill Phase 1
10/26/2001(Revised 7/30/02)
Project No. 9028-08

CHANNEL GEOMETRY



TOP WIDTH =	30 FT
BOTTOM WIDTH =	12 FT
HEIGHT =	6 FT
Z =	1.5 FT
SLOPE (S)	0.05 FT/FT
MANNING'S N	0.20

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0.01	(Side slopes eroded)
N3 = SIZE/SHAPE OF CHANN	0.005	(Channel shape changes slightly over length)
N4 = OBSTRUCTIONS	0.04	(flow obstructed by large trees and underbrush)
N5 = VEGETATION	0.1	(trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

N = 0.20

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = 2.5 FT /SEC

2-YEAR STORM EVENT

TIME OF CONCENTRATION 5.7 min
RAINFALL INTENSITY = 6.9 in/hr
RUNOFF COEF. = 0.77
DRAINAGE AREA = 0.8 Ac.

PEAK FLOW RATE = 9.70 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 1.20 FT/S

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 12.71 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Incremental Depth (FT)	Area (SQ FT)	WP (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	12.00	0.00	0.00	0.00
0.05	0.60	12.10	0.05	0.23	0.14
0.10	1.22	12.20	0.10	0.36	0.43
0.15	1.83	12.30	0.15	0.47	0.86
0.20	2.46	12.40	0.20	0.57	1.39
0.25	3.09	12.50	0.25	0.66	2.03
0.30	3.74	12.60	0.30	0.74	2.77
0.35	4.38	12.70	0.35	0.82	3.59
0.40	5.04	12.80	0.39	0.89	4.51
0.45	5.70	12.90	0.44	0.97	5.51
0.50	6.38	13.00	0.49	1.04	6.60
0.55	7.05	13.10	0.54	1.10	7.78
0.60	7.74	13.20	0.59	1.17	9.03
0.63	8.09	13.25	0.61	1.20	9.70
0.65	8.43	13.30	0.63	1.23	10.37
0.70	9.14	13.40	0.68	1.29	11.79
0.73	9.58	13.46	0.71	1.33	12.71
0.75	9.84	13.50	0.73	1.35	13.28
0.80	10.56	13.60	0.78	1.41	14.86
0.85	11.28	13.70	0.82	1.46	16.52

Hydrograph Plot

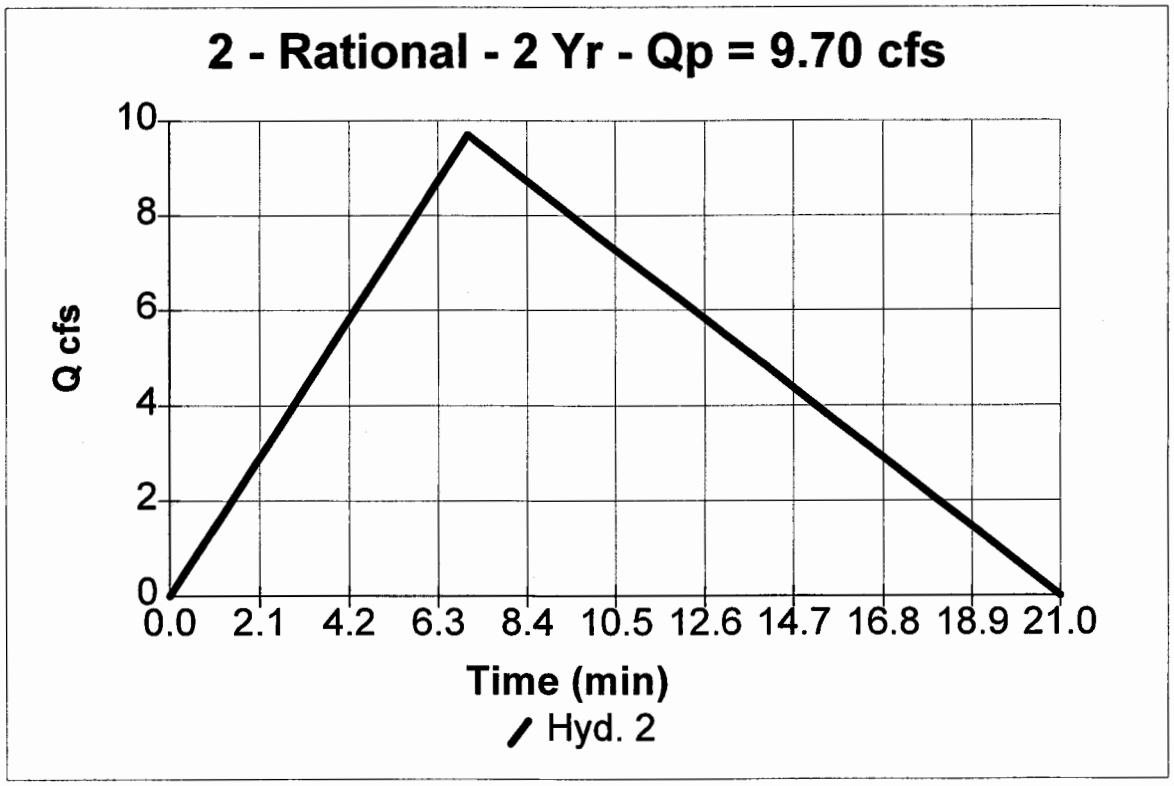
Hydraflow Hydrographs by Intelisolve

Hyd. No. 2

STORM SYSTEM 2

Hydrograph type	= Rational	Peak discharge	= 9.70 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.72
Intensity	= 5.047 in/hr	Time of conc. (Tc)	= 7 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 6,112 cuft



Hydrograph Plot

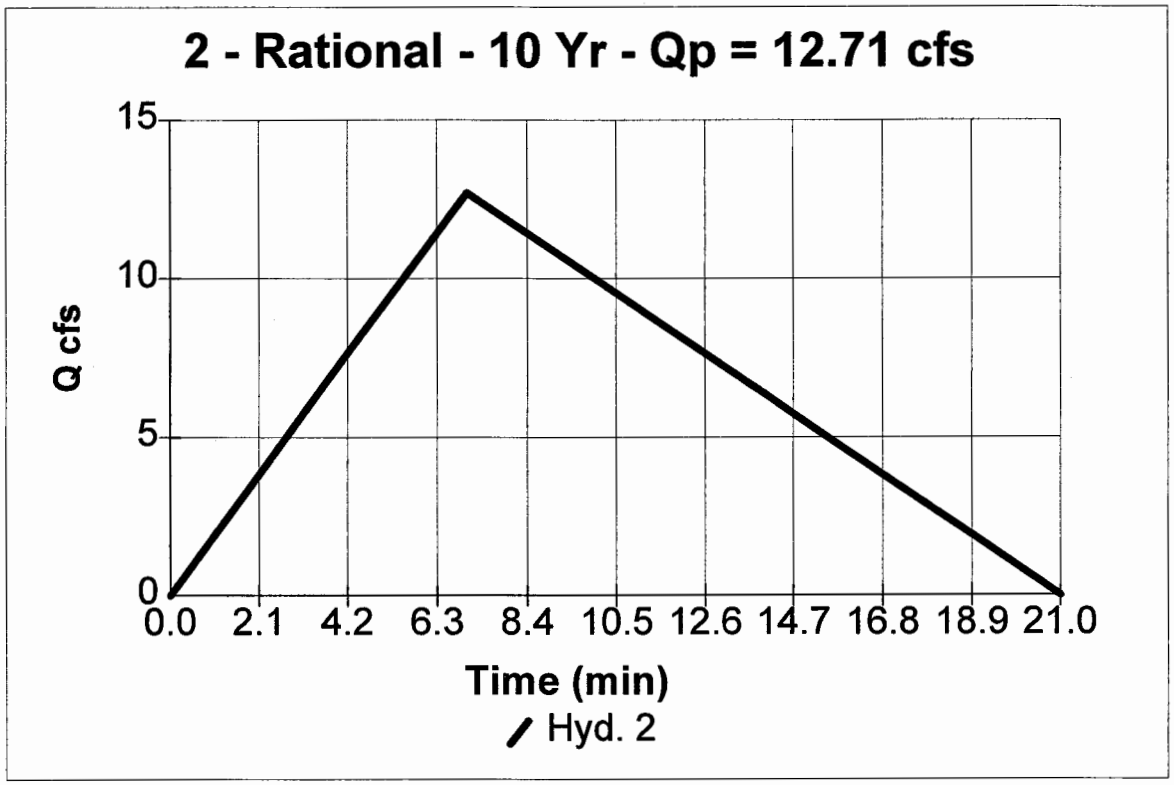
Hydraflow Hydrographs by Intelisolve

Hyd. No. 2

STORM SYSTEM 2

Hydrograph type	= Rational	Peak discharge	= 12.71 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 2.7 ac	Runoff coeff.	= 0.72
Intensity	= 6.612 in/hr	Time of conc. (Tc)	= 7 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

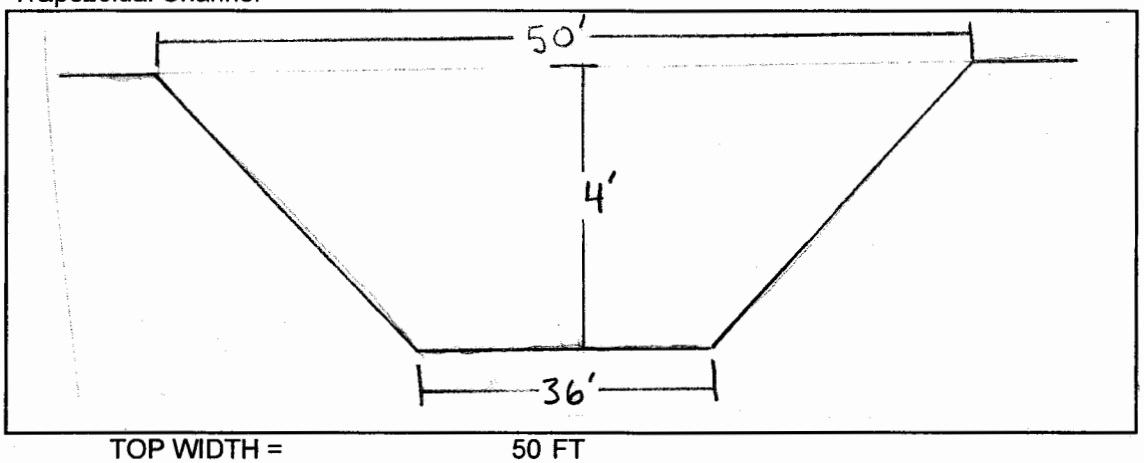
Hydrograph Volume = 8,007 cuft



Adequate Channel Analysis for Outfall of Storm System 3
Stonehouse Richardson's Mill Phase 1
10/26/2001 (Revised 7/30/02)
Project No. 9028-08

CHANNEL GEOMETRY

Trapezoidal Channel



TOP WIDTH =	50	FT
BOTTOM WIDTH =	36	FT
HEIGHT =	4	FT
Z =	1.75	FT
SLOPE (S)	0.085	FT/FT
MANNING'S N	0.13	

Note: Ravine fairly flat and wide with no clearly defined flow channel.

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0.01	(Channel is slightly eroded)
N3 = SIZE/SHAPE OF CHANNEL	0.01	(Channel shape changes over length)
N4 = OBSTRUCTIONS	0.025	(flow obstructed by underbrush and trees)
N5 = VEGETATION	0.05	(some small trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

N = 0.13

SOIL TYPE

SANDY LOAM
MAX. PERMISSIBLE VELOCITY = **2.5 FT /SEC**

2-YEAR STORM EVENT

TIME OF CONCENTRATION = 7.4 min
RAINFALL INTENSITY = 6.5 in/hr
RUNOFF COEF. = 0.8
DRAINAGE AREA = 2.27 Ac.

PEAK FLOW RATE = 9.61 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 1.19 FT/S

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 12.01 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Depth (FT)	Area (SQ FT)	Wetted Perimeter (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	36.00	0.00	0.00	0.00
0.02	0.72	36.08	0.02	0.24	0.17
0.04	1.44	36.16	0.04	0.38	0.55
0.06	2.17	36.24	0.06	0.50	1.09
0.08	2.89	36.32	0.08	0.61	1.76
0.10	3.62	36.40	0.10	0.70	2.55
0.12	4.35	36.48	0.12	0.80	3.46
0.14	5.07	36.56	0.14	0.88	4.47
0.16	5.80	36.64	0.16	0.96	5.58
0.18	6.54	36.73	0.18	1.04	6.79
0.20	7.27	36.81	0.20	1.11	8.10
0.22	8.00	36.89	0.22	1.19	9.49
0.22	8.06	36.89	0.22	1.19	9.61
0.24	8.74	36.97	0.24	1.26	10.98
0.25	9.23	37.02	0.25	1.30	12.01

Hydrograph Plot

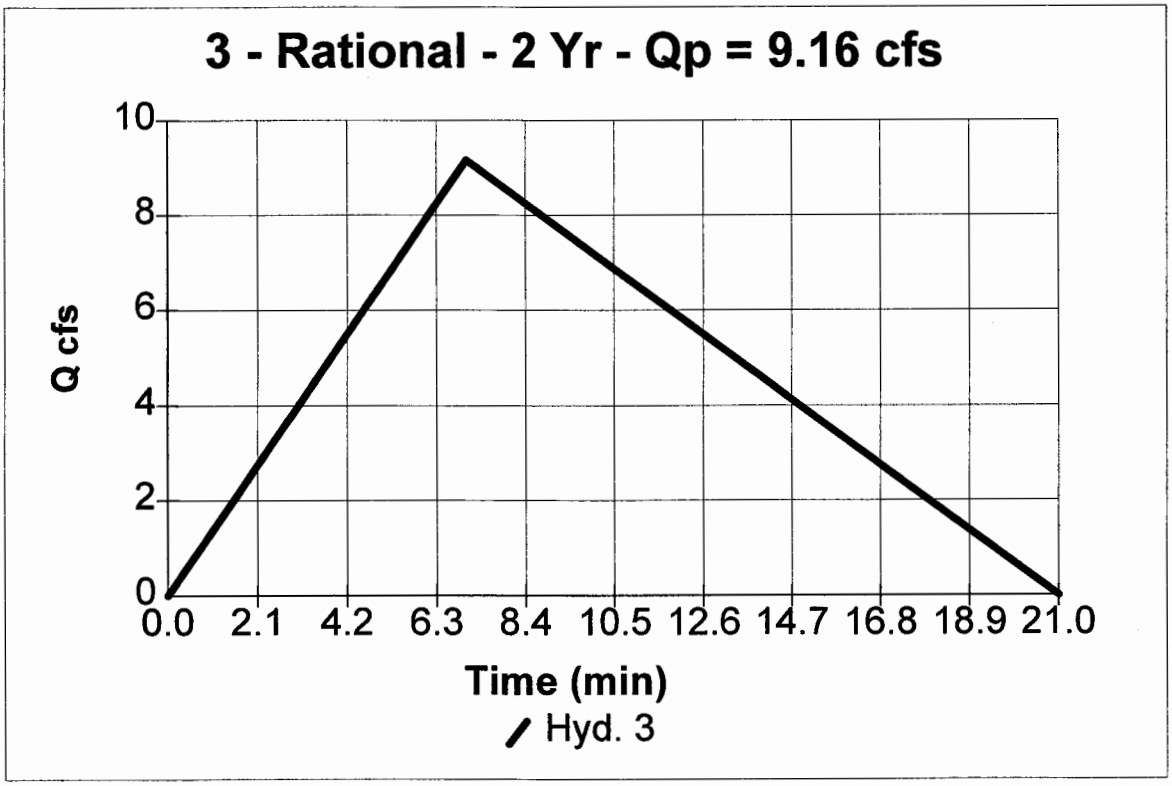
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

STORM SYSTEM 3

Hydrograph type	= Rational	Peak discharge	= 9.16 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 2.3 ac	Runoff coeff.	= 0.8
Intensity	= 5.047 in/hr	Time of conc. (Tc)	= 7 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 5,774 cuft



Hydrograph Plot

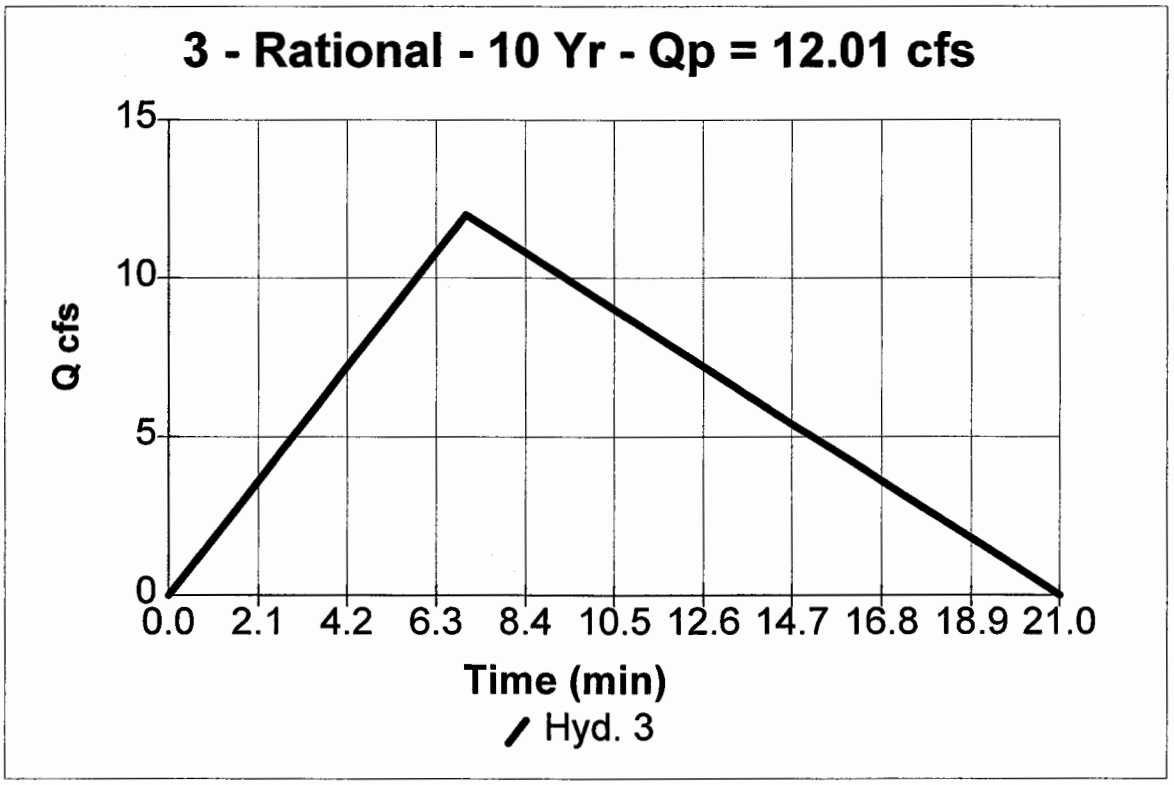
Hydraflow Hydrographs by Intelisolve

Hyd. No. 3

STORM SYSTEM 3

Hydrograph type	= Rational	Peak discharge	= 12.01 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 2.3 ac	Runoff coeff.	= 0.8
Intensity	= 6.612 in/hr	Time of conc. (Tc)	= 7 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

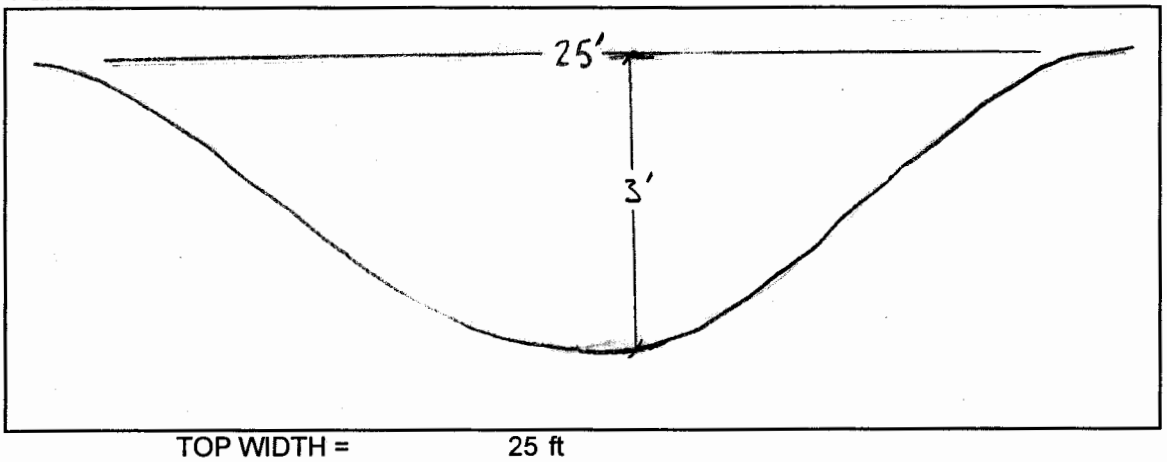
Hydrograph Volume = 7,564 cuft



Adequate Channel Analysis for Outfall of Storm System 4
Stonehouse Richardson's Mill Phase 1
10/26/2001 (Revised 7/30/02)
Project No. 9028-08

CHANNEL GEOMETRY

Parabolic Channel



TOP WIDTH =	25	ft
HEIGHT =	3	ft
SLOPE (S)	0.06	ft/ft
MANNING'S N	0.10	

Note: Ravine fairly flat and wide with no clearly defined flow channel.

CALCULATION OF CHANNEL CAPACITY AND VELOCITY

MANNING'S EQUATION

$$V = 1.49 / N * R^{2/3} * S^{1/2}$$

WHERE:

V = AVERAGE VELOCITY
N = MANNING'S ROUGHNESS COEF.
R = HYDRAULIC RADIUS = A / WP
S = SLOPE OF CHANNEL
A = AREA OF CROSS SECTION
WP = WETTED PERIMETER

MANNING'S ROUGHNESS COEF.

N1 = CHANNEL IN EARTH	0.02	(Earthen Channel)
N2 = EROSION	0	(Channel in good condition)
N3 = SIZE/SHAPE OF CHANN	0	(Channel shape consistent)
N4 = OBSTRUCTIONS	0.02	(flow obstructed by underbrush and trees)
N5 = VEGETATION	0.05	(some trees and underbrush)
N6 = MEANDER	0.15	(Flow line meanders through trees and underbrush)

N = (N1 + N2 + N3 + N4 + N5) * N6 + (N1 + N2 + N3 + N4 + N5)

N = 0.10

SOIL TYPE

SANDY LOAM

MAX. PERMISSIBLE VELOCITY = 2.5 FT /SEC

2-YEAR STORM EVENT

TIME OF CONCENTRATION 6.4 min
RAINFALL INTENSITY = 6.8 in/hr
RUNOFF COEF. = 0.8
DRAINAGE AREA = 0.8 Ac.

PEAK FLOW RATE = 3.38 CFS (SEE HYDROGRAPH)
PEAK VELOCITY = 1.99 FT/S

*** VELOCITY FOR POST DEVELOPMENT 2-YEAR STORM IS LESS THAN MAXIMUM PERMISSIBLE VELOCITY OF 2.50 ft/s THEREFORE, CHANNEL IS ADEQUATE.**

10-YEAR STORM EVENT

PEAK FLOW RATE = 4.39 CFS (SEE HYDROGRAPH)

*** 10 yr storm event results in a depth within the confines of the channel**

Incremental Depth (FT)	Incremental Top Width (FT)	Area (SQ FT)	Wetted Perimeter (FT)	Hydraulic Radius (FT)	Velocity (FT/SEC)	Flow (CFS)
0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.02	2.83	0.04	12.00	0.01	0.21	0.01
0.04	4.00	0.11	24.01	0.03	0.36	0.04
0.06	4.90	0.20	36.01	0.05	0.51	0.10
0.08	5.66	0.30	48.03	0.08	0.65	0.20
0.10	6.32	0.42	60.04	0.11	0.79	0.33
0.12	6.93	0.55	72.06	0.14	0.94	0.52
0.14	7.48	0.70	84.08	0.17	1.09	0.76
0.16	8.00	0.85	96.10	0.21	1.24	1.06
0.18	8.49	1.02	108.13	0.25	1.40	1.42
0.20	8.94	1.19	120.16	0.29	1.56	1.86
0.22	9.38	1.38	132.19	0.34	1.72	2.36
0.24	9.80	1.57	144.23	0.39	1.88	2.95
0.25	10.06	1.70	152.05	0.42	1.99	3.38
0.26	10.20	1.77	156.27	0.44	2.05	3.63
0.28	10.58	1.98	168.31	0.50	2.22	4.39

Hydrograph Plot

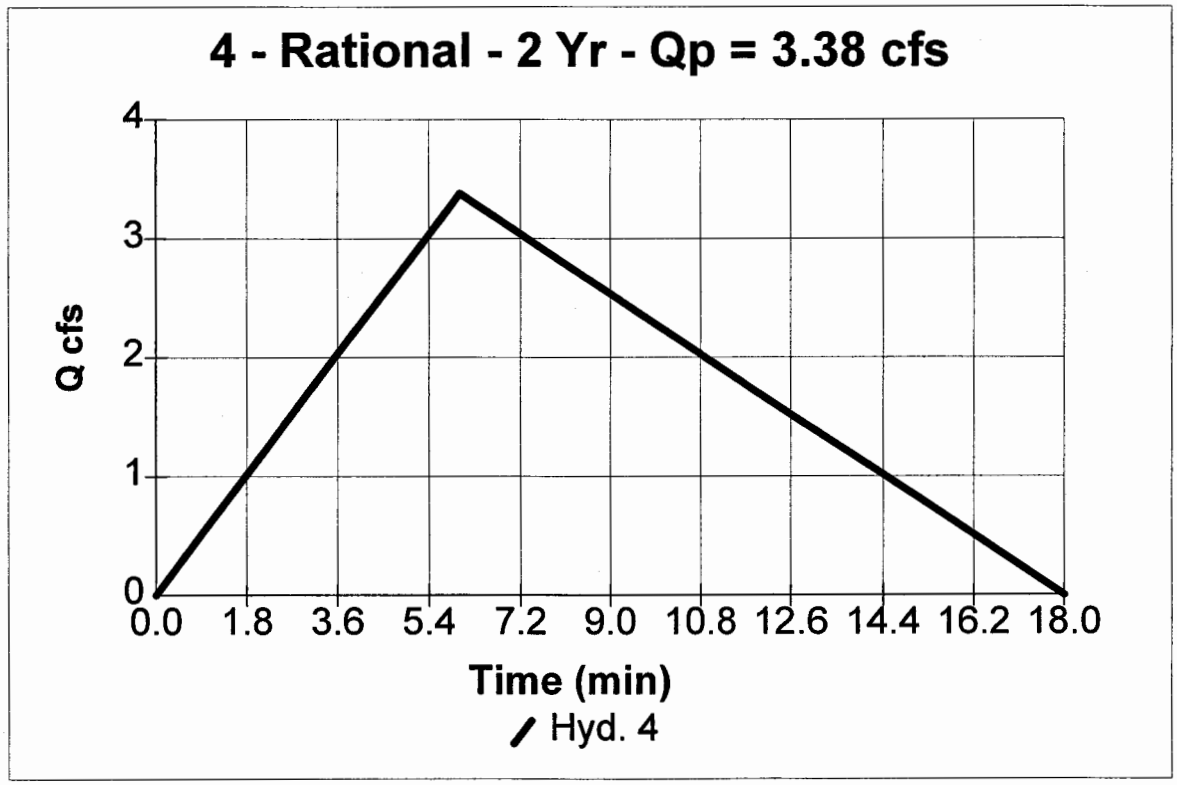
Hydraflow Hydrographs by Intelisolve

Hyd. No. 4

STORM SYSTEM 4

Hydrograph type	= Rational	Peak discharge	= 3.38 cfs
Storm frequency	= 2 yrs	Time interval	= 1 min
Drainage area	= 0.8 ac	Runoff coeff.	= 0.8
Intensity	= 5.275 in/hr	Time of conc. (Tc)	= 6 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

Hydrograph Volume = 1,823 cuft



Hydrograph Plot

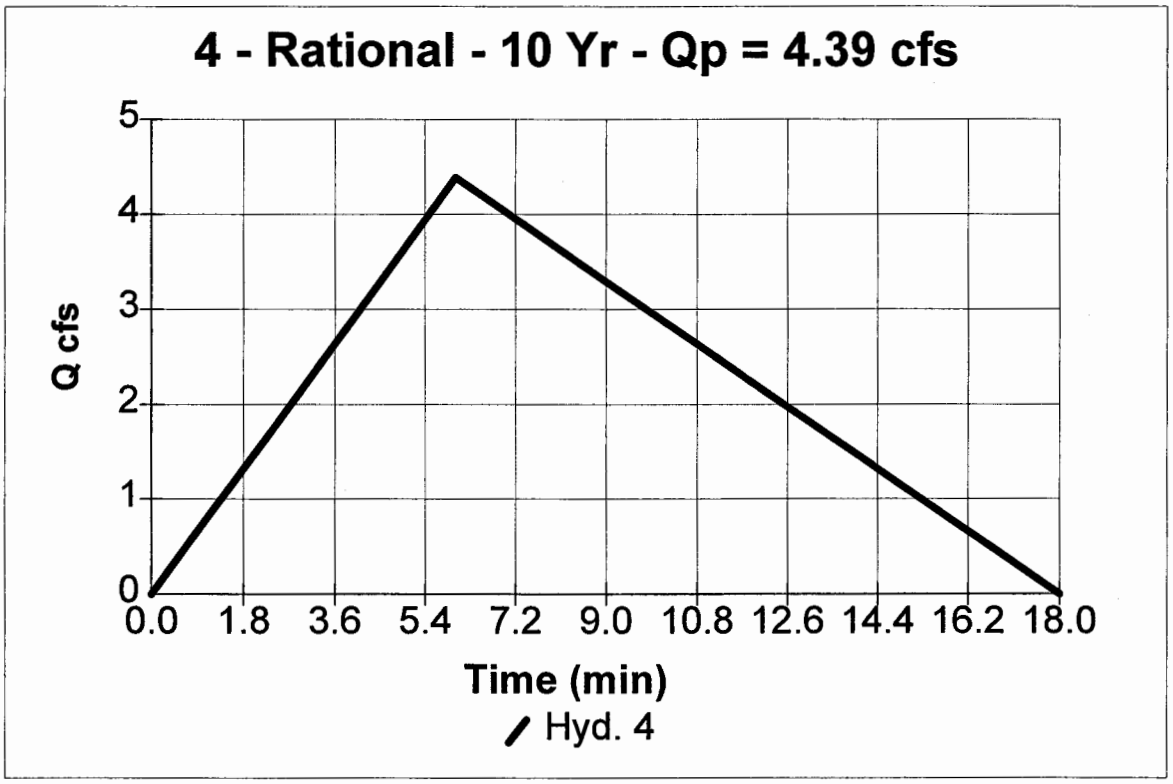
Hydraflow Hydrographs by Intelisolve

Hyd. No. 4

STORM SYSTEM 4

Hydrograph type	= Rational	Peak discharge	= 4.39 cfs
Storm frequency	= 10 yrs	Time interval	= 1 min
Drainage area	= 0.8 ac	Runoff coeff.	= 0.8
Intensity	= 6.859 in/hr	Time of conc. (Tc)	= 6 min
IDF Curve	= JCChydrographs.IDF	Asc/Rec limb fact	= 1/2

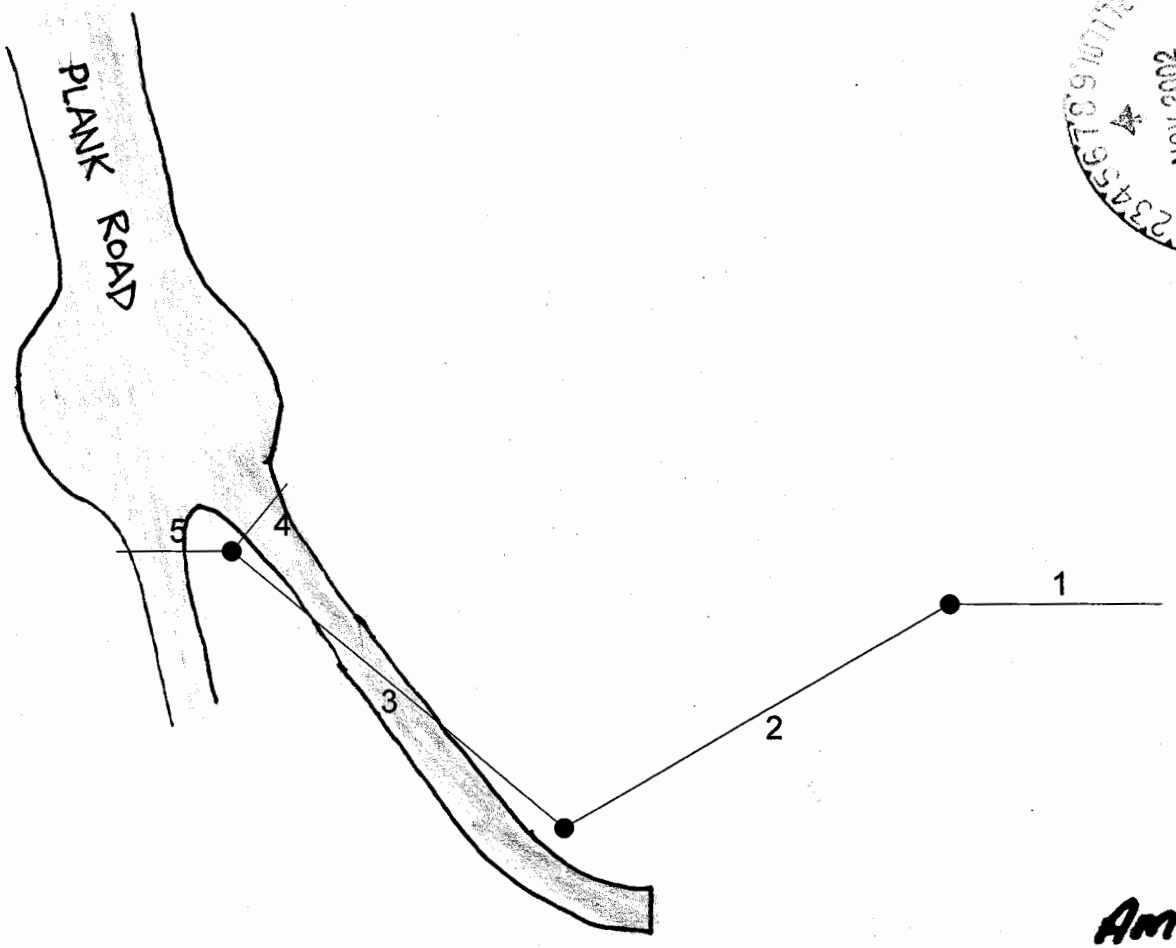
Hydrograph Volume = 2,370 cuft



Hydraflow Plan View

RICHARDSON'S MILL SECT 1
STORM SYSTEM 2

RECEIVED
NOV 2002
PLANNING DEPARTMENT



AMENDED
STORM SYSTEM 2
S-100-02.

JAG

Project file: 902808_SS2REV1.stm	IDF file: JCChydrographs.IDF	No. Lines: 5	11-01-2002

Hydraflow Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	78.0	0.10	1.43	0.45	0.04	1.07	5.0	7.6	6.5	6.94	24.25	5.97	15	14.10	39.50	28.50	40.55	29.75	42.00	32.00	SS#2-1 TO 2-2
2	1	165.0	0.10	1.33	0.45	0.04	1.03	5.0	7.1	6.6	6.77	24.11	5.86	15	13.94	62.50	39.50	63.54	40.83	66.00	42.00	SS#2-2 TO 2-3
3	2	160.0	0.80	1.23	0.80	0.64	0.98	5.0	6.7	6.7	6.58	8.07	5.73	15	1.56	65.00	62.50	66.03	64.05	70.14	66.00	SS#2-3 TO 2-4
4	3	32.0	0.34	0.34	0.80	0.27	0.27	5.0	5.0	7.1	1.94	27.37	2.62	15	17.97	70.75	65.00	71.31	66.61	72.00	70.14	SS#2-3 TO 2-5
5	3	42.0	0.09	0.09	0.80	0.07	0.07	5.0	5.0	7.1	0.51	24.41	1.42	15	14.29	71.00	65.00	71.29	66.61	72.25	70.14	SS#2-3 TO 2-6

Project File: 902808_SS2REV1.stm | IDF File: JCChydrographs.IDF | Total number of lines: 5 | Run Date: 11-05-2002

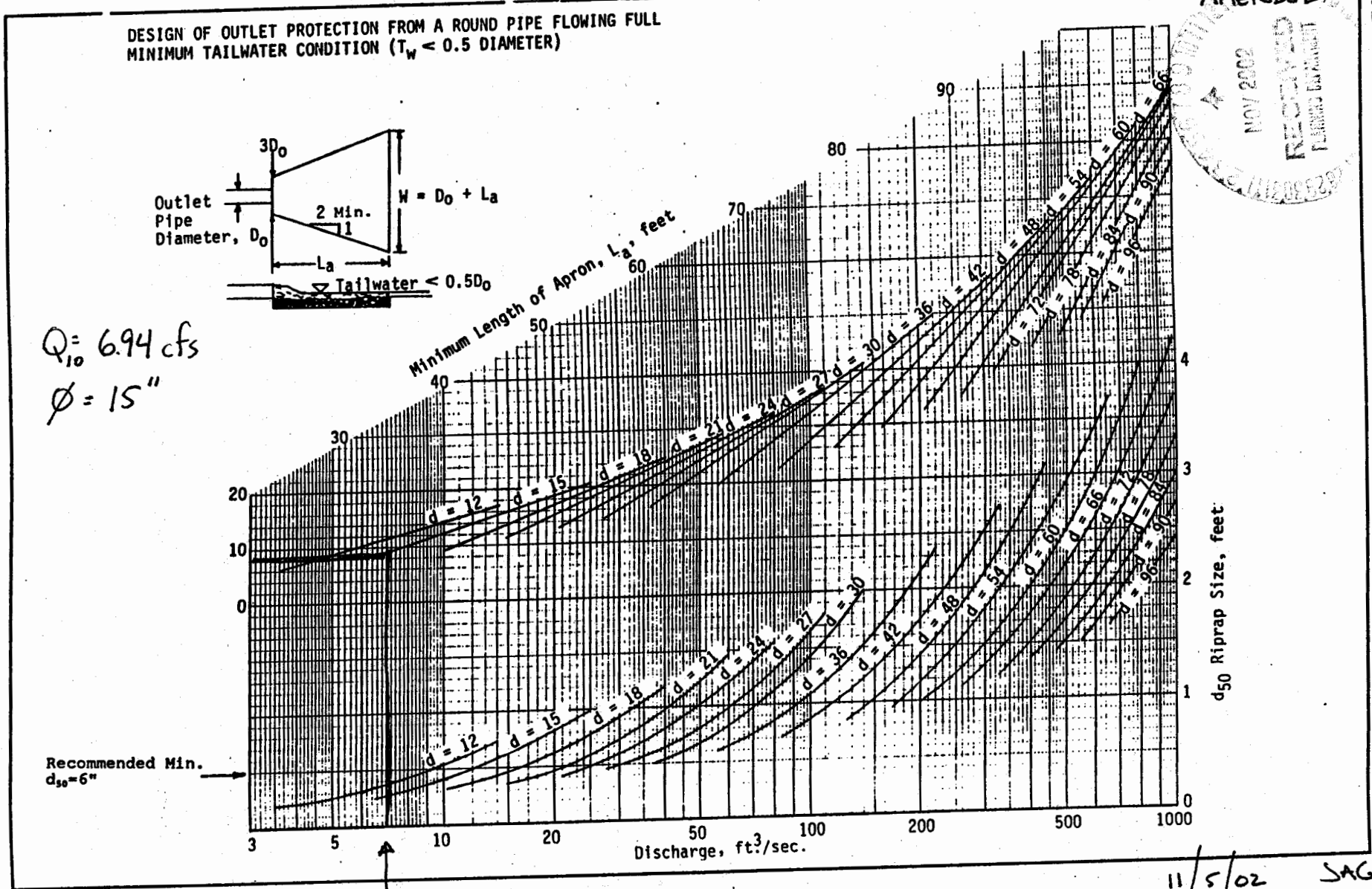
NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 29.75 (ft)

RECEIVED NOV 2002 PLANNING DEPARTMENT

STORM SYSTEM 2

Stonehouse Rich. Mill Sect 1

AMENDED



11/5/02 SAG

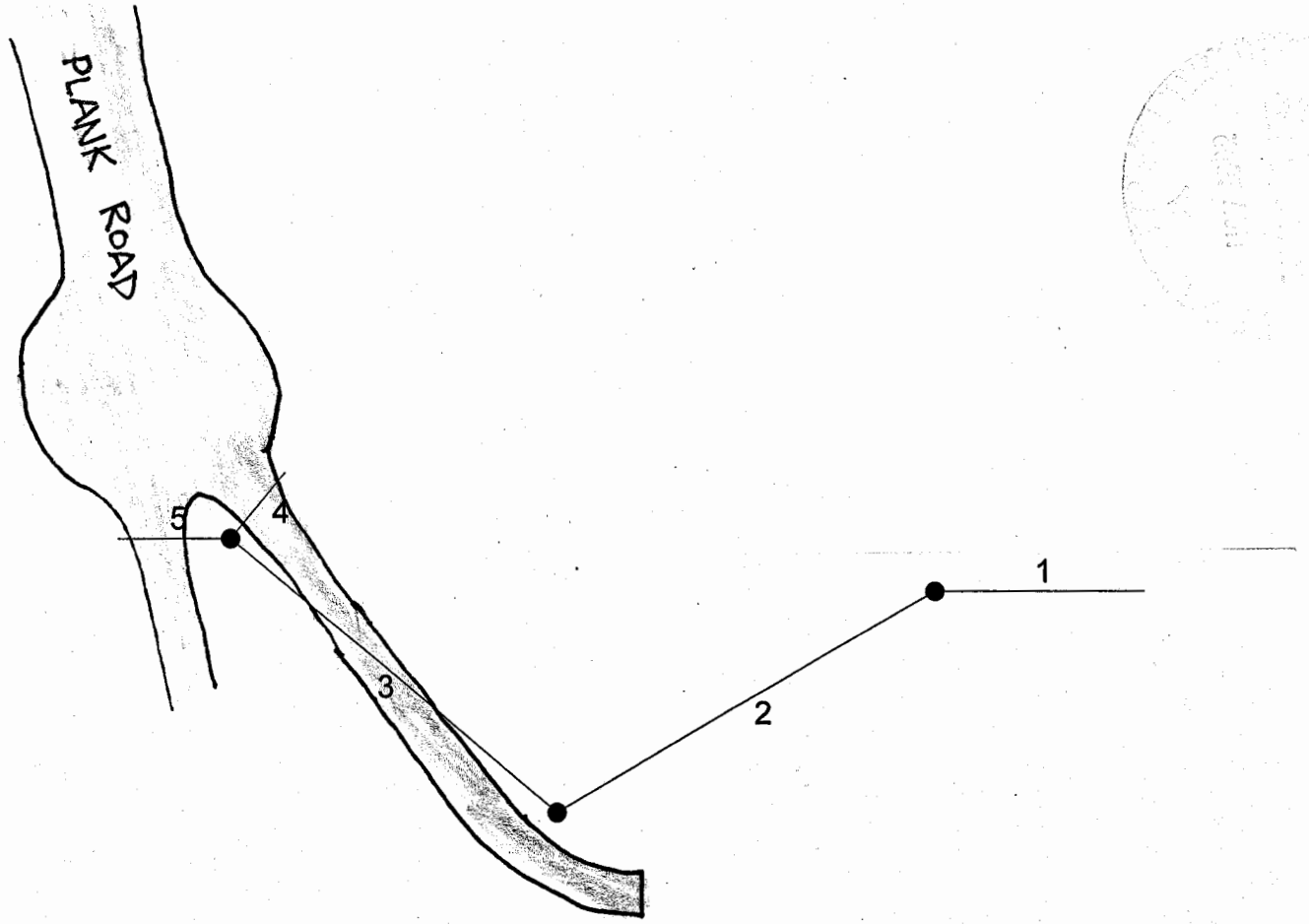
Source: USDA-SCS

Plate 3.18-3

3.18

Hydraflow Plan View

RICHARDSON'S MILL SEC 1
STORM SYSTEM 2



JAG

Project file: 902808_SS2REV1.stm	IDF file: JCChydrographs.IDF	No. Lines: 5	11-01-2002

Hydraflow Storm Sewer Tabulation

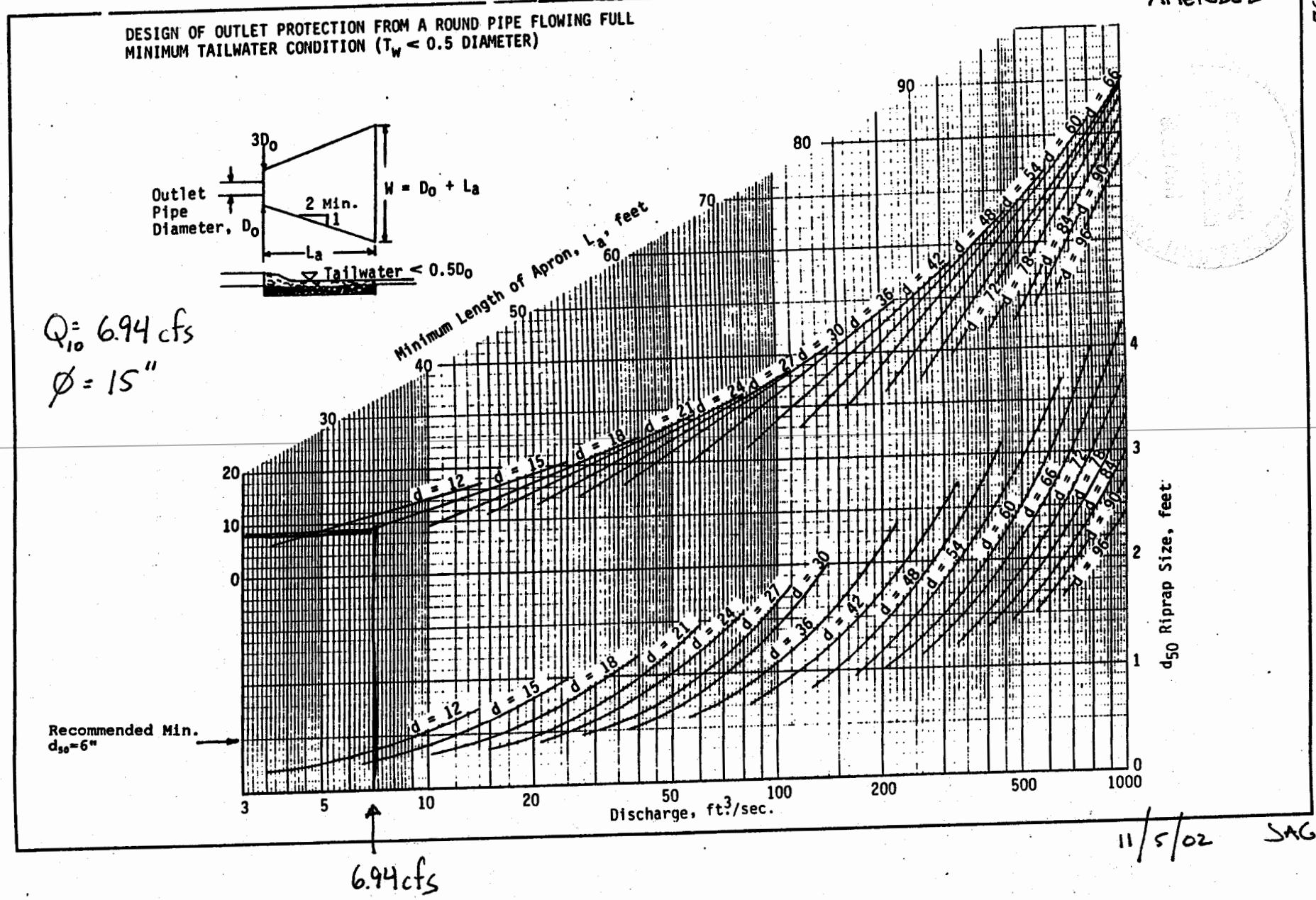
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr	Total		Incr	Total	Inlet	Syst					Size	Slope	Up	Dn	Up	Dn	Up	Dn	
		(ft)	(ac)	(ac)	(C)			(min)	(min)	(in/hr)	(cfs)	(cfs)	(ft/s)	(in)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	
1	End	78.0	0.10	1.43	0.45	0.04	1.07	5.0	7.6	6.5	6.94	24.25	5.97	15	14.10	39.50	28.50	40.55	29.75	42.00	32.00	SS#2-1 TO 2-2
2	1	165.0	0.10	1.33	0.45	0.04	1.03	5.0	7.1	6.6	6.77	24.11	5.86	15	13.94	62.50	39.50	63.54	40.83	66.00	42.00	SS#2-2 TO 2-3
3	2	160.0	0.80	1.23	0.80	0.64	0.98	5.0	6.7	6.7	6.58	8.07	5.73	15	1.56	65.00	62.50	66.03	64.05	70.14	66.00	SS#2-3 TO 2-4
4	3	32.0	0.34	0.34	0.80	0.27	0.27	5.0	5.0	7.1	1.94	27.37	2.62	15	17.97	70.75	65.00	71.31	66.61	72.00	70.14	SS#2-3 TO 2-5
5	3	42.0	0.09	0.09	0.80	0.07	0.07	5.0	5.0	7.1	0.51	24.41	1.42	15	14.29	71.00	65.00	71.29	66.61	72.25	70.14	SS#2-3 TO 2-6

Project File: 902808_SS2REV1.stm | IDF File: JCChydrographs.IDF | Total number of lines: 5 | Run Date: 11-05-2002

NOTES: Intensity = 143.72 / (Inlet time + 19.20) ^ 0.94; Return period = 10 Yrs. ; Initial tailwater elevation = 29.75 (ft)

STORM SYSTEM 2

Δ STONEHOUSE RICH. MILL SECT 1
'AMENDED'



11/5/02 JAG

Source: USDA-SCS

Plate 3.18-3

1992

3.18

Scott Thomas

To: Mike Randall
Subject: RE: Timber Dam BMP Acceptance at Stonehouse

Mike

Hello and I hope all is well. I know this is an older email; however, I am just using it because it had your email address. Anyways, I am sending it to to let you know we have requests in now, as expected, for release of siltation bond associated with Stonehouse Phase (Area) 1, Section 7-A, Richardson Mill Section 1 (S-99-01:S-100-02) and Richardson Mill Section (S-64-02), which as you know contains the four timber walls.

WC 075 BMP # 7.3 Timber Crib Wall End of Morning Mist Lane
WC 076 BMP # 7.4 Timber Crib Wall South of Sawyer Way
WC 077 BMP # 7.2 Timber Crib Wall End of Mill Pond Run cul-de-sac
WC 078 BMP # 7.1 Timber Crib Wall West of Yarding Way

10/29/08 10:30AM

- CALLED MIKE RANDALL
- Association is ok w/ release of siltation bond
- Was happy with staffs reaction and resolve
- Mike Majdeski worked closely with HOA in conversion of BMPs to dry pond.
- Scott & Mike did joint insp. on 10/23/08. No issues.

Scott J. Thomas, P.E.
Director
James City County Environmental Division

Visit:
www.protectedwithpride.org
www.jccegov.com

From: Mike Randall [mailto:mhrandall@cox.net]
Sent: Thursday, July 31, 2008 7:52 PM
To: Scott Thomas; Michael Majdeski
Cc: Ellen Clark; Dave Lehnertz
Subject: Timber Dam BMP Acceptance at Stonehouse

Scott,
After walking all four BMPs, it looks like the developer is at or near finalizing work on BMPs WC075, 76, 77, & 78 for acceptance by JCCED and turn over to the Stonehouse HOA for continuing maintenance. Please let me know if/when we can expect a final acceptance inspection. As we have previously discussed, I would like to accompany your staff on the final inspection(s) if at all possible.
Thanks,
Mike Randall
Stonehouse Grounds & Maintenance
Tel 757-566-3405
Cell 757-293-8205
Email mhrandall@cox.net

THE ASSOCIATION AT STONEHOUSE, INC.

RECEIVED
JUN 6 2008
ENVIRONMENTAL DIVISION

June 4, 2008

Mr. Scott Thomas
Environmental Director
101E Mounts Bay Road
P. O. Box 8784
Williamsburg, VA 23287

Dear Mr. Thomas:

The Association at Stonehouse, Inc. appreciates the decision of your office to require that Dominion be compelled to restore the four BMPs for which it is responsible to a dry condition, as originally envisioned in the plan for Stonehouse.

We now have a concern about two BMPs located in the Lisburn section of Stonehouse that are presently owned by GCR, Inc. We have received a letter from D. Wayne Moore, the attorney for GCR, Inc., which appears to indicate that GCR wants to convey the common property it owns, including the BMPs, to Stonehouse. It must be made clear to GCR that the BMPs must be left in a dry condition.

We would appreciate it if you could advise me if GCR contacts your office concerning the transfer of these two BMPs, and you insist that GCR have these two BMPs established as dry BMPs before they are transferred to us.

Very truly yours,

Robert W. Spencer
President Emeritus

SJT
Joe B
MIKE M
I am not aware of any asbuilts or const cert coming in for Lisburn yet to even start to think about bond release. When they do come in + we do our final inspection, I want to "try" to include the HAA in as a courtesy. I committed to try that

Return letter to me.

9701 MILL POND RUN TOANO, VA 23168 (757) 566-0128 PHONE (757) 566-1198 FAX

Scott Thomas

From: Bains, Victoria A. [vbains@aesva.com]
Sent: Tuesday, May 23, 2006 4:30 PM
To: Scott Thomas
Cc: ggoder@kaufcanconsulting.com
Subject: Stonehouse - BMP Inspection List

Scott,

Here is the list of BMP's that need to be inspected.

Bent Tree:

	AES No.	JCC No.	
5-3-99	BMP 5.1	WC071	✓ REINSPECT 5/30/06. OK. WILL CLEAN LFO.
5-42-99	BMP 5.4	WC072	✓ REINSPECT 5/30/06. OK. " "
5-42-99	BMP 5.2	WC073	✓ REINSPECT 5/30/06. OK " "
5-81-99	BMP 5.3	WC074	✓ REINSPECT 5/30/06. OK " " + MOW DAM.

Richardson's Mill:

AES No.	JCC No.	
BMP 7.3	WC075	✓ REINSPECT 5/30/06. OK. NO PROBLEMS. Deep Valley. PP
BMP 7.4	WC076	✓ Reinspect 5/30/06. OK. NO " " . PP
BMP 7.2	WC077	✓ Reinspect 5/30/06. OK. " " "
BMP 7.1	WC078	Reinspect 5/30/06. BMP ok, Inflow pipe undercut. Process Letter.

Let me know if you cannot find any of the certifications or calculations and I can have copies sent to you before we meet. See you at the Sales Center next Tuesday May 30 at 1:00pm.

Thank you,

Tory

Victoria (Tory) A. Bains
Project Engineer

AES Consulting Engineers
Williamsburg | Richmond | Gloucester
(757) 253-0040
www.aesva.com

AES Consulting Engineers Confidentiality Note: This e-mail and any attachments are confidential and may be protected by legal privilege. If you are not the intended recipient, be aware that any disclosure, copying, distribution or use of this e-mail or any attachment is prohibited. If you have received this e-mail in error, please notify us immediately by returning it to the sender and deleting this copy from your system. Thank you for your cooperation.

CONSULTING ENGINEERS

5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@aesva.com

March 27, 2006

Mr. Scott J. Thomas, P.E.
James City County Environmental Division
101-E Mounts Bay Road
P.O. Box 8784
Williamsburg, VA 23187-8784

BMP 7.1 WC075
7.2 WC077
7.3 WC075
7.4 WC076

RE: Stonehouse Richardson's Mill, Section 1
Timber Structure BMPs
AES Project No. 9028-08

Dear Mr. Thomas:

Mr. Marc Bennett of my office has asked me to review my design for the timber structures being used as dams for the BMPs at the above referenced project. He has informed me that our client would like to forego conversion of the sediment basins to the permanent BMPs and simply let them operate as shallow marshes that would eventually silt in. The reason for this is that the contractor has indicated that "more damage than good" would result from his activities to fill in the wet pool portion of the sediment trap. This is the only activity required to convert the sediment basins to the permanent dry detention basins.

Attached for your reference are the calculations for the poles which carry the load for the structure and transfer it to the ground. The height of the wall, h_w, is shown in the calculations as 8.5 feet. This is the height of the structure above the existing grade at the maximum point. The exposed height of the wall is closer to 4.5 feet as soil was placed on both sides of the structure. The soil on the downstream side is ignored, even though some passive resistance is permitted. On the upstream side of the wall, the height of soil, h_s, is shown in the calculations as 6.0 feet. This takes into account sedimentation within 2.5 feet of the top of the wall. Both the sediment and the water load generate forces on the wall which is ultimately resisted by the poles. This resistance is dependent on the diameter of the pole, the depth of embedment, and the soil characteristics.

Soil values used are based upon conservative assumptions as well as soil borings performed throughout the subdivision. Pole diameter is 12 inches as designed and verified by as-builts. The only variable is the depth. Based upon design and the as-builts, 20 feet long poles were used in both structures. The original design calculations only used a height of wall of 8.0 feet and required a minimum 19.0 feet long pole. The as-builts show an increased height of the wall of 8.5 feet, a 20.0 feet long pole is required (the actual calculations require 19.7 feet which is then rounded up to 20.0 feet). Therefore the as-built structures are still adequate.

The structures are designed for the worst case condition which is the configuration where the dry detention facility is silted in over 2 feet above the proposed bottom elevation of the basin. As a result, leaving the sediment basins as is and allowing them to develop into shallow marshes will not adversely impact the structure but may actually increase the life of the BMPs by increasing the time before dredging of accumulated sediments would be required.

I trust that I have satisfactorily alleviated your concerns over the stability of the structures. If you have any questions or require additional information regarding this matter, please do not hesitate to contact me at your earliest convenience.

Sincerely,

AES Consulting Engineers

Aaron B. Small, P.E.
Project Manager
asmall@aesva.com

Attachments: Timber Structure Calculations

S:\Jobs\9028\08-Mill Pond Sub\Wordproc\Document\902808L19.abs.doc

Mill Pond Section 1 @ Stonehouse
BMP Timber Structure Wall Calculations
AES Job No. 9028-8

2/10/2006
ABS

COMMONWEALTH OF VIRGINIA
AARON B. SMALL
No. 030712
2/10/06
PROFESSIONAL ENGINEER

Given:

butt Diameter =	12	inches =	1 ft
Spacing =	4	ft	
hw =	8.5	ft	
hs =	6	ft	
γw =	62.4	pcf	

Assumptions:

γsoil =	120	pcf
esoil =	50	%
γsat =	131	pcf
Ka =	0.31	(Rankine Active Coefficient)

Average Soil at Site (medium clay/compact sandy loam):

p =	200 PSF	* From Table 4.8 in Timber
S =	2500 PSF	Construction Manual

Loads:

Assume total soil pressure acts horizontally on pole

Load due to Saturated Soil =	382.788	lb / LF
Load due to Water =	2254.2	lb / LF
Total Moment about toe, Mo =	7152.476	lb-ft / LF
Equivalent Load at top =	841.4678	lb / LF
Load at each pole =	3365.871	lbs

Calculate Pole Depth:

Calculations based on procedure outlined in Timber Construction Manual Section 4 on Pole-Type Framing.

Assume initial pole depth is same as height (pole is twice length of height)

iteration	d	S1	A	d
1	8.50	566.67	13.90	13.31
2	13.31	887.12	8.88	10.10
3	10.10	673.18	11.70	11.94
4	11.94	796.16	9.89	10.78
5	10.78	718.40	10.96	11.47
6	11.47	764.86	10.30	11.04
7	11.04	736.11	10.70	11.30
8	11.30	753.52	10.45	11.14
9	11.14	742.83	10.60	11.24
10	11.24	749.34	10.51	11.18
11	11.18	745.36	10.57	11.22
12	11.22	747.79	10.53	11.19
13	11.19	746.30	10.55	11.21
14	11.21	747.21	10.54	11.20
15	11.20	746.66	10.55	11.20

USE 20.0 FT MINIMUM LENGTH POLE

AES CONSULTING ENGINEERS
5248 Olde Towne Road, Suite 1, Williamsburg, VA 23188
614 Moorefield Park Drive, Richmond, VA 23236
(757) 253-0040
(804) 330-8040
www.aesva.com

February 15, 2005

RECEIVED
FEB 17 2005
ENVIRONMENTAL DIVISION

Mr. Darryl E Cook, P.E.
Mr. Scott J Thomas, P.E.
James City County Environmental Division
101-E Mounts Bay Road
Williamsburg, Virginia 23187

RE: Stonehouse, Richardson's Mill, Section 1
AES Project No. 9028-08
James City County Case Number S-99-01

And

Stonehouse, Richardson's Mill, Section 2
AES Project No. 9028-13
James City County Case Number S-25-03

Dear Mr. Cook and Mr. Thomas;

We would appreciate your consideration of the configuration of permanent SWM/BMP structures for the Stonehouse subdivisions referenced above.

Site improvements to the subdivisions of Richardson's Mill, Section 1 and 2 are substantially complete, and have been inspected by James City County Environmental Staff. There are four-timber structure SWM/BMP's between the two subdivisions: WC075, WC076, WC077, and WC078. These temporary sediment basins can be converted or completed to be permanent SWM/BMP facilities.

The design and construction of these facilities provided an excavated area for sediment accumulation during the construction period. Final conversion of the facilities, by design, involves the restoration of the existing ground contour, and altering the discharge to the final configuration. However, the current installations, after some repairs, meet the intent of the original design for erosion and sediment control facility, and storm water management needs. The question is whether the current installations need to be converted to the final design.

Under these conditions, we believe it is more beneficial to maintain the current configuration, and we offer the following supporting reasons:

WC076_STONEHOUSE_SEC_7A_RICHARDSON_MILL - 221

- That, left in the current configuration, we fully expect that a wetland environment will naturally establish upland of the timber structure, within the remaining wet pool of the sediment basin.
- That with transition of the wet pool area to a shallow marsh, the timber structure BMP will have nutrient up-taking capability, removing more non-point source pollutants than a Timber Dry Detention Basin.
- That the developing shallow marsh component assists to slow the flow of runoff through the facility, which allows more runoff to infiltrate into the ground or evaporate.
- That further disturbances of the perimeter of the timber structure for the conversion would be eliminated, thereby eliminating the potential of sediment runoff, and erosion.
- And, that the remaining wet capacity of the pool can be used to capture any erosion and sediment runoff that any upland construction may cause in the future.

Given this information, we would appreciate a response from you to determine whether it is permissible to maintain the current configuration.

If you have any questions or concerns, feel free to contact me at any time.

Sincerely,

AES Consulting Engineers

Victoria Bains

Victoria A. Bains
Project Engineer
vbains@aesva.com

cc: file

S:\Jobs\9028\13-Mill Pond Sub. Sect. 2\Wordproc\Document\902813110.vmb.doc

Scott Thomas

From: Scott Thomas
Sent: Wednesday, March 16, 2005 2:31 PM
To: 'Tory Bains'
Cc: Darryl Cook
Subject: RE: Richardson's Mill Section 1 & 2 Conversion of BMP's

Based on my recollection, the approved plan(s) allowed for an excavated micropool in front of the wall/mound area for temporary sediment basin purposes which would be restored to existing ground once the BMP was converted. Mainly are there any further geotechnical aspects for the wall and it's soil base (mound) that need to be considered due to a proposed permanent pool on the front sides of the wall/mound. For the approved design, this was only intended to be a temporary pooling condition, now it will be permanent. Secondly will having a permanent micropool result in addition maintenance burden (adjustments to the approved BMP maintenance plan) and would there be any mosquito-vector related issues involved.

Also, the request letter states a question whether the current installations need to be converted to the final approved design and lists lots of reasons to support leaving it alone, but the letter does not state the main reason why the applicant/contractor does not want to follow the approved plan.

Scott J. Thomas, P.E.
James City County
Environmental Division

Visit:
http://www.james-city.va.us/resources/devmgmt/div_devmgmt_environ.html
and
www.protectedwithpride.org

-----Original Message-----
From: Tory Bains [mailto:vbains@aesva.com]
Sent: Wednesday, March 16, 2005 2:17 PM
To: Scott Thomas
Subject: RE: Richardson's Mill Section 1 & 2 Conversion of BMP's

Scott,

What are your concerns with the timber crib walls remaining in the current state?

Thanks,

Tory

Victoria (Tory) A. Bains
Project Engineer
AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Tele: (757) 253-0040
Fax: (757) 220-8994
vbains@aesva.com
www.aesva.com

AES Consulting Engineers a Professional Corporation Confidentiality Note: This e-mail and any attachments are confidential and may be protected by legal privilege. If you are not the intended recipient, be aware that any disclosure, copying, distribution or use of this

e-mail or any attachment is prohibited. If you have received this e-mail in error, please notify us immediately by returning it to the sender and delete this copy from your system. Thank you for your cooperation.

From: Scott Thomas [mailto:SCOTTT@james-city.va.us]
Sent: Tuesday, March 15, 2005 9:22 AM
To: Bains, Victoria A.
Subject: RE: Richardson's Mill Section 1 & 2 Conversion of BMP's

I have read the request and do not want to render a decision until I look at these four timber crib walls (if time does not permit, maybe one that represents all of them).

Scott J. Thomas, P.E.
James City County
Environmental Division

Visit:
http://www.james-city.va.us/resources/devmgmt/div_devmgmt_environ.html
and
www.protectedwithpride.org

-----Original Message-----
From: Bains, Victoria A. [mailto:vbains@aesva.com]
Sent: Monday, March 14, 2005 4:53 PM
To: Scott Thomas
Cc: ccloughly@stonehouseva.com; ggoder@kaufcanconsulting.com
Subject: Richardson's Mill Section 1 & 2 Conversion of BMP's

Scott,

I sent you a letter dated February 15, 2005 requesting the county to allow these BMP's to remain in the current state. I wanted to check on the status of the review for not converting the BMP's in Richardson's Mill Section 1 & 2 to final design. Please let me know if you have any questions or concerns with the design.

If you are planning a site visit to these or any other facilities within Stonehouse please inform me of the time and I will schedule to meet you on site.

Thank you,

Tory

Victoria (Tory) A. Bains
Project Engineer
AES Consulting Engineers
5248 Olde Towne Road, Suite 1
Williamsburg, VA 23188
Tele: (757) 253-0040
Fax: (757) 220-8994
vbains@aesva.com
www.aesva.com

AES Consulting Engineers a Professional Corporation Confidentiality Note: This e-mail and any attachments are confidential and may be protected by legal privilege. If you are not the intended recipient, be aware that any disclosure, copying, distribution or use of this e-mail or any attachment is prohibited. If you have received this e-mail in error, please notify us immediately by returning it to the sender and delete this copy from your system. Thank you for your cooperation.

CONSULTING ENGINEERS

5248 Olde Towne Road • Suite 1 • Williamsburg, Virginia 23188
(757) 253-0040 • Fax (757) 220-8994 • E-mail aes@aesva.com

November 1, 2002

Mr. Paul D. Holt, III
Senior Planner
James City County
Development Management
101-E Mounts Bay Road
Williamsburg, VA 23187-8784

NOV 2002
RECEIVED
PLANNING DEPARTMENT

RE: Stonehouse Section VII-A
Richardson's Mill Subdivision, Section 1- Amended
AES Project No. 9028-08

Dear Mr. Holt:

We have made some minor modifications to the approved Richardson's Mill Section 1 Subdivision Plan. The modifications include the addition of a common drive to serve Lots 32 and 33 (with water and sewer services). In addition, Storm System 2 has been modified to follow the existing clearing for the common drive serving Lots 8 and 9 to minimize disturbed area. Amended plans and calculations have been provided for review.

Should any questions concerning this project arise, please feel free to contact us.

Sincerely,

AES Consulting Engineers

Jason Grimes
Project Engineer

S:\JOBS\9028\08-Mill Pond Sub\Wordproc\Document\902808I13.jag.doc

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Detention and Retention Pond Facilities

County BMP ID Code (if known): WC 077

Name of Facility: TIMBER STRUCTURE DRY POND BMP No.: 3 of 4 Date: 10/10/2008

Location: RICHARDSON'S MILL SECTION 2 - STONEHOUSE (OFF END OF MILL POND RUN)

Name of Owner: STONEHOUSE DEVELOPMENT COMPANY, LLC.

Name of Inspector: M. MAJDEBKI

Type of Facility: DETENTION BASIN

Weather Conditions: PTLY CLDY 75° Type: ☑ Final Inspection ☐ County BMP Inspection Program ☐ Owner Inspection

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.
Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and to prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:				
Grass Height	✓			
Vegetation Condition	✓			
Tree Growth	✓			
Erosion		✓		MATTING ON ACCESS RD.
Trash & Debris	✓			
Seepage	✓			
Fencing or Benches	✓			
Interior Landscaping/Planted Areas: ☐ None ☐ Constructed Wetland/Shallow Marsh ☑ Naturally Established Vegetation				
Vegetated Conditions	✓			
Trash & Debris	✓			
Floating Material	✓			
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics	✓			
Other	✓			
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ❒ Permanent Pool (Retention Basin) ❒ Shallow Marsh (Detention Basin) ☑ None, Dry (Detention Basin)				
Shoreline Erosion				
Algae				
Trash & Debris				
Sediment				
Aesthetics				
Other				
Inflows (Describe Types/Locations):				
Condition of Structure		✓		
Erosion	✓			
Trash and Debris	✓			
Sediment	✓			
Outlet Protection	✓			
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type):				
Condition of Structure	✓			
Corrosion	✓			
Trash and Debris	✓			
Sediment	✓			
Vegetation	✓			
Other	✓			
Principal Outlet Structure - Barrel, Conduit, etc. :				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris	✓			
Erosion/Sediment	✓			
Outlet Protection	✓			
Other	✓			
Emergency Spillway (Overflow):				
Vegetation	✓			
Lining	✓			
Erosion	✓			
Trash & Debris	✓			
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows	✓			
Graffiti	✓			
Other				
Surrounding Perimeter Conditions:				
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			
Access /Maintenance Roads or Paths	✓			
Other				

Remarks:

Overall Environmental Division Internal Rating: 3/5

Signature: [illegible]

Date: 10/10/08

Title: ENVIRONMENTAL INSPECTOR

SWMProg\BMP\CoInspProg\InspForms\DetRet.wpd

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Detention and Retention Pond Facilities

Process w.p. waiver request.

County BMP ID Code (if known): WC078

Name of Facility: BMP #7.1 Sec 7A RMP BMP No.: ____ of ____ Date: 5/30/06

Location: EAST YARDING WAY, 5' HIGH,

Name of Owner: ____

Name of Inspector: SJ Thomas

Type of Facility: ____

Weather Conditions: ____ Type: ☒ Final Inspection REINSPECT ☐ County BMP Inspection Program ☐ Owner Inspection

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory. No action required.
Routine - The item checked requires attention, but does not present an immediate threat to the function/integrity of the BMP.
Urgent - The item checked requires immediate attention to keep the BMP operational and to prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:	5' HIGH T.C.W Perm. Pool, 2' below			
Grass Height	✓			
Vegetation Condition	✓			
Tree Growth	✓			
Erosion	✓			
Trash & Debris	✓			
Seepage	✓			
Fencing or Benches	✓			
Interior Landscaping/Planted Areas:	☐ None ☐ Constructed Wetland/Shallow Marsh ☒ Naturally Established Vegetation			
Vegetated Conditions	✓			
Trash & Debris	✓			
Floating Material	✓			
Erosion	✓			
Sediment	✓			
Dead Plant	✓			
Aesthetics	✓			
Other	✓			
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools: ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None, Dry (Detention Basin)				
Shoreline Erosion	✓			T.C.W w/ wet pool
Algae	✓			See geotech report.
Trash & Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other	✓			
Inflows (Describe Types/Locations): Erosion Inflow Pipe				
Condition of Structure	✓			
Erosion	✓		✓	Needs repaired.
Trash and Debris	✓			
Sediment	✓			
Outlet Protection	✓			
Other				
Principal Flow Control Structure - Riser, Intake, etc. (Describe Type):				
Condition of Structure	✓			
Corrosion	✓			
Trash and Debris	✓			
Sediment	✓			
Vegetation	✓			
Other	✓			
Principal Outlet Structure - Barrel, Conduit, etc. :				
Condition of Structure	✓			
Settlement	✓			
Trash & Debris	✓			
Erosion/Sediment	✓			
Outlet Protection	✓			
Other	✓			
Emergency Spillway (Overflow): Timber Wall				
Vegetation				
Lining				
Erosion				
Trash & Debris				
Other				
Notes:				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	✓			
Animal Burrows	✓			
Graffiti	✓			
Other	✓			
Surrounding Perimeter Conditions:				
Land Uses	✓			
Vegetation	✓			
Trash & Debris	✓			
Aesthetics	✓			
Access /Maintenance Roads or Paths	✓			
Other	✓			

Remarks:

Timber Wall with 3" PVC outlet
Engineers report for permanent pool.

Overall Environmental Division Internal Rating: 3

Signature: Scott Thomas P.E. **Date:** 5/30/06

Title: Chief Engineer

SWMProg\BMP\CoInspProg\InspForms\DetRet.wpd

Date Record Created: [redacted]

Created By: [redacted]

WS_BMPNO: WC078

Print Form

PRINTED ON:
Friday, March 12, 2010
3:30:20 PM

WATERSHED	WC
BMP ID NO	078
PLAN NO	S-99-01
TAX PARCEL	
PIN NO	
CONSTRUCTION DATE	8/16/2004
PROJECT NAME	SH 7A Richardson Mill Pond Sec 1
FACILITY LOCATION	West of Yarding Way
CITY-STATE	Toano, VA 23168
CURRENT OWNER	Stonehouse Development Company LLC
OWNER ADDRESS	9701 Mill Pond Run
OWNER ADDRESS 2	
CITY-STATE-ZIP CODE	Toano, VA 23168
OWNER PHONE	234-5000
MAINT AGREEMENT	Yes
EMERG ACTION PLAN	No

Get Last BMP No | Return to Menu

MAINTENANCE PLAN	Yes
SITE AREA acre	45.63
LAND USE	Planned Unit Dev
old BMP TYP	Timber Wall
JCC BMP CODE	F1 Timber Walls
POINT VALUE	0
SVC DRAIN AREA acres	10.79
SERVICE AREA DESCRI	SF Lots and Roads
IMPERV AREA acres	0.00
RECV STREAM	UT of Ware Cr Bird Swamp
EXT DET-WQ-CTRL	No
WTR QUAL VOL acre-ft	0
CHAN PROT CTRL	Yes
CHAN PROT VOL acre-ft	0.766
SW/FLOOD CONTROL	Yes
GEOTECH REPORT	No

CTRL STRUC DESC	Timber Wall
CTRL STRUC SIZE inches	
OTLT BARRL DESC	PVC Outlet
OTLT BARRL SIZE inch	3
EMERG SPILLWAY	Yes
DESIGN HW ELEV	28.74
PERM POOL ELEV	n/a
2-YR OUTFLOW cfs	1.12
10-YR OUTFLOW cfs	17.55
REC DRAWING	Yes
CONSTR CERTIF	Yes

LAST INSP DATE 5/30/2006 Inspected by: [redacted]

INTERNAL RATING 3

MISC/COMMENTS

BMP #7.1, amend S-100-02

Additional Comments: [redacted]

Mill Pond Section 1

for

STONEHOUSE, VIRGINIA

Live where the future is wide open.

James City County, Virginia

Calculations
For
James City County Environmental Division

Prepared for

Stonehouse Development Company, L.L.C.

S-99-01
BMP 7.1 & 7.2
FINAL COMPS
ADEQUACY COMPS

Prepared by

AES CONSULTING ENGINEERS

AES Consulting Engineers
5248 Olde Towne Road. Suite 1
Williamsburg, VA 23188
(757) 253-0040 Fax: (757) 220-8994
http://www.aesva.com

JAMES CITY COUNTY
ENVIRONMENTAL DIVISION

ENVIRONMENTAL DIVISION

STONEHOUSE AREA 1
SEC 7 RICHARDSON MILL POND SEC 1 &2
TIMBER CRIB WALL ISSUE

101 MOUNTS BAY ROAD
P.O. BOX 8784
WILLIAMSBURG, VA 23185
757-253-6670
FAX 757-259-4032

This was a long-standing issue between the developer (Dominion), the Association at Stonehouse (HOA) and the County. In summary, plans for four timber crib walls WC075 (BMP 7.3), WC076 (BMP 7.4), WC077 (BMP 7.2), and WC078 (BMP 7.1) which are situated within Richardson Mill Section 1 (S-99-01; S-100-02) and Section 2 (S-64-02) were approved as dry ponds, quantity only, with a composite design (wall and embankment) which allowed the basins to serve as temporary sediment basins during construction. Given topography and anticipated erosion and sedimentation during Land-Disturbing activities, the most effective E&S control for these sites were determined to be temporary sediment basins. Around February 2005, the engineer for the project sent a letter to the County (February 15, 2005) requesting the County to consider allowing the structures to remain as wet pond features. The County entertained this request through investigation and knowledge of the plans and site features. From the County perspective, it was initially explored for six reasons 1) County RPA regulation changes in 2004 and disruption to what would now be RPA; 2) wet ponds are better for water quality than dry ponds; 3) base flows that were not disclosed during design but were clearly evident during construction; and 4) the basins were designed for temporary sediment basin wet pools thus could handle permanent pools; 5) function of dry versus wet and increased maintenance and hazards associated with dry ponds; and 6) the disruption to established neighborhoods and homes due to construction associated with backfilling the basins per the approved plans.

Without stating approval or disapproval of the request, the County required several issues to be addressed (March 16, 2005) including geotechnical, maintenance and mosquito-vector related. The engineer for the project provided various information to support these concerns. The County again requested additional information in March 16, 2006 and more information was provided by the engineer. Proper asbuilts and construction certifications were also received for the BMPs in a wet pool mode. Requests for information continued into early 2007.

The HOA got involved with the issue in July 2006 by specifically requesting that the HOA grounds and maintenance committee be allowed to accompany the County on all inspections of BMPs in Stonehouse. A response was provided by the County (August 2, 2006) as well as first contact BMP educational material. Around February of 2007, the HOA strongly began to insist that the four BMPs be installed per the plan in dry pond mode against the engineer and County's recommendation to allow the BMPs to be converted to wet pond mode, as they existed during construction. Emails from the HOA were received in early 2007 indicating opposition. The County's response at that time is that the developer was allowed a chance to present their case with supporting information before a decision was rendered.

A meeting with representatives of the developer occurred in April 2007. At this meeting the County and developer looked at status of the request and information provided. The County decided to play an intermediate role between the developer and HOA on the issue and would set a meeting with the HOA to present the position on allowing the four BMPs to remain with wet pools.

A second formal request to allow the BMPs to remain as wet pools was received from the engineer on May 21, 2007. The request did not address safety issues and long term effects to the wall as questioned by the County. An email was issued by the County on June 15, 2007. The County also performed a mosquito-vector analyses of the BMPs in their current wet pool (temporary sediment basin) condition.

This was performed by the Mosquito Control Specialist for the County on June 28, 2007. A report was issued and provided to the HOA.

County staff (Chief Civil Engineer, Scott Thomas) and Inspection Supervisor (Joe Buchite) met with the representatives of the HOA on July 5, 2007. The purpose of the meeting was BMP education, review of the approved plan configurations, and site visits to each of the timber wall BMPs. As County staff was receiving mixed signals from HOA representatives about their desires for the BMPs, the Chief Engineer asked that the HOA provide a letter stating their preference, so that it could be included in the overall County's decision. This was provided by the Association President on July 26, 2007.

Meeting and correspondence on this situation continued throughout the rest of 2007. On February 1st 2008, the County met with representatives of the developer and informed them that the basins would need to be constructed in accordance with the approved plans as dry detention facilities and consistent with the preferences by the HOA, who would be responsible for long-term maintenance of the facilities in accordance with recorded Inspection/Maintenance agreements.

Work by the contractor finished around September /October 2008 and HOA representatives accompanied the County inspector of final inspections on the four BMPs. This occurred on October 10, 2008. Both parties appeared to be satisfied with the work. Asbuilt drawings were also received and reviewed by County staff for the final configurations and found to be satisfactory. The Division Director (Scott Thomas) accompanied the assigned County Inspector (Mike Majdeski) in the field for a brief inspection on October 23, 2008 to visit the final products. All appeared satisfactory.

The Director followed up with a call to the HOA Grounds and Maintenance member, Mike Randall on September 29, 2008 to ensure that the HOA was satisfied with the work. Although not part of the County's normal process, this courtesy was warranted given the history of the issue and established partnerships between the County and HOA.

Throughout this whole process, County staff kept the Stonehouse District supervisor(s) appraised of the situation that had developed and was ongoing with this issue.

10-29-08

Timber Crib Wall Issue in Stonehouse Richardson Mill

- Stonehouse Development Area One
- Site Location
- Brief History of Stormwater Management in Stonehouse
- Typical Process (Bond Release)
- Approved Plans

Stonehouse, Sec 7A, Richardson Mill Pond Section 1, (S-99-01, amended S-100-02)
Stonehouse Sec 7A, Richardson Mill Pond Section 2, (S-64-02, amended S-07-03)
Neither were DRC cases as lots were below 50

- Project & BMP Information

WC 075	BMP # 7.1	Section 1	Timber Crib Wall design
WC 076	BMP # 7.2	Section 1	Timber Crib Wall design
WC 077	BMP # 7.3	Section 2	Timber Crib Wall design
WC 078	BMP # 7.4	Section 2	Timber Crib Wall design

$ 50,000	E&S Bond being held for Section 1;
$130,000	E&S Bond being held for Section 2;
Released	Subdivision Bond being held for Section 1
Released	Subdivision Bond being held for Section 2

- Photographs: Note steep slopes and remote location

- Plan Approval
  - Timber walls allowed in "intermittent" stream areas; followed prior Ches Bay regulations (USGS Blue Line)
  - Unique Temporary Sediment Basin Design
  - Staff review and approval
  - Staff compliance inspections

Parties Involved:

SDC
Bill Mistr
Eng Heath
Glenn Oder (Representative of owner)
Tori Bains (Engineer)
Marc Bennett (Engineer)
Aaron Small (Engineer)
Ray Nice (Contractor)

Association at Stonehouse, Inc.
Robert Spencer, President
Mike Randall, Ground & Maint
Caroline Lott
Ken Kievit
Bob Wargo
Ken Hook
Bruce Lanton
Jim Haynes
Charlie Purcer
Roger Schmidt

Various office meetings with both parties
Full day meeting with HOA (office & field) on July 5, 2007
Various miscellaneous emails from citizens in Stonehouse

Variance Request

- During construction, in accordance with 4VAC50-30-50 (administrative, if not approved within 10 days, then disapproved
- Originally received February 15, 2005
- County staff performed inspections & had some questions, concerns
- Reports and information forwarded by owner/engineer to address County remarks on:

  Structural
  Water Quality
  Safety
  Mosquito-Vector
  Water Quality

- Final reports and documentation received on October 8, 2007

ENVIRONMENTAL DIVISION REVIEW COMMENTS
STONEHOUSE MILL POND SECTION 1
COUNTY PLAN NO. S - 099 - 01
December 4, 2001

MDW/SJT

General Comments:

1. A Land Disturbing Permit and Siltation Agreement, with surety, are required for this project.

2. A Subdivision Agreement, with surety, shall be executed with the County prior to recordation of lots.

3. Water and sewer inspection fees must be paid prior to the issuance of a Land Disturbing Permit.

4. Wetlands. Prior to initiating grading or other on-site activities on any portion of a lot or parcel, all wetland permits required by federal, state and county laws and regulations shall be obtained and evidence of such submitted to the Environmental Division. Refer to Section 23-9(b)(8) of the Chapter 23 Chesapeake Bay Preservation ordinance. *(Note: This includes securing necessary state wetland permits in accordance with the Virginia Department of Environmental Quality non-tidal wetlands programs, which became effective October 1st 2001.)* "Request for Modification NOT FOUND"

5. An Inspection/Maintenance Agreement shall be executed with the County for the BMP facilities associated with this project.

6. Record Drawing and Construction Certification. The stormwater management/BMP facilities as proposed for this project require submission, review and approval of record drawings (as-builts) <u>and</u> construction certifications prior to release of the posted bond/surety. Include provisions on the plan accordingly to ensure this activity is adequately coordinated and performed before, during and following construction in accordance with current County guidelines.

7. Streetlights. The distance between proposed streetlights exceeds the stated James City County Streetlight policy for residential areas. The distances between lights should be between 300 and 400 feet. In addition, a streetlight rental fee for all proposed lights must be paid prior to the recordation of the subdivision plat.

8. VPDES. It appears land disturbance for the project may exceed five (5) acres. Therefore, it is the owners responsibility to register for a General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities, in accordance with current requirements of the Virginia Department of Environmental Quality and 9 VAC 25-180-10 et seq.

9. Irrigation Waterline. The proposed alignment of the relocated irrigation line at the end of Mill Pond Run (cul-de-sac area) to a new intake location at Richardson Mill Pond poses serious concerns. Firstly, the alignment as shown on Sheets 7, 9 and 11 shows no erosion and sediment control along the route and the line terminates abruptly with no inset maps or details to show final configuration of a new intake along the shoreline. Secondly, the alignment takes it through previously approved Mill Pond Park (SP-014-01). The end of the alignment is within defined steep slope, FEMA SFHA Zone A and Resource Protection area. This would require additional plan/detail information as well as appropriate waivers to the Chesapeake Bay Preservation ordinance, requested in writing as this type of utility does not fall under the provisions of Section 23-13 of the ordinance (exceptions). It would appear that an alternative should be explored as to not create disturbance in other environmental sensitive areas and the existing intake and corridor through CA-46 should be utilized. Also, in order to not interfere with single family house siting on Lot 37, swing the alignment southeast along the common lot line between Lot 36-37 to Mill Pond Run road. Thus critical features associated with Mill Pond Park could be avoided. CHANGES ALIGN

NOT WATER DEPENDENT

Floodplain:

10. FEMA Special Flood Hazard Areas. Zone A Special Flood Hazard area is located on the tract along the west sides of Richardson Mill Pond and Bird Swamp. Show the limits of Zone A Special Flood Hazard area on applicable plan sheets, especially environmental inventory Sheet 3 and Sheets 2, 8, 9, 10 & 11 respectively.

Chesapeake Bay Preservation:

11. Environmental Inventory. Although an environmental inventory plan sheet was provided in the plan set, an inventory showing whether or not components as listed under Section 23-10(2) of the Chesapeake Bay Preservation ordinance was not provided or listed. An inventory should list the components and state whether there are impacts or not. Also, provide a legend or text labels for resource protection area and non-tidal wetland delineations shown on Sheet 3. INVENTORY INCORRECT

Erosion & Sediment Control Plan:

12. Design Checklist. Please provide a standard James City County Erosion and Sediment Control and Stormwater Management Design Plan Checklist specific to this phase of the project.

13. Temporary Stockpile Areas. Show any onsite temporary soil stockpile, staging and equipment storage areas (with required erosion and sediment controls) on the plan. Step 3 and 5 of the construction sequence clearly show that topsoil must be stockpiled.

MAY NEED SEPARATE PERMIT

14. Offsite Land Disturbing Areas. Discussion of offsite land-disturbing in the E&SC narrative is acknowledged. Should offsite areas be utilized for disposal of topsoil or waste material, a new offsite plan or amendment to this erosion and sediment control plan and land-disturbing permit would be necessary. SEE GENERAL NOTES ON FRONT SHEET OF PLAN WE NEED L.D. PERMIT & SURETY

15. Irrigation Waterline. Provide erosion and sediment control measures along the 8-inch irrigation waterline corridors for both removal and replacement operations. Disturbance will occur due to access, clearing, grubbing and excavation. This is especially necessary outside the road corridors and in valley areas where no plan measures are currently proposed.

16. Critical Soils. Most of the grading associated with sitework activities is situated on Craven-Uchee complex soils (11C). This soil has severe erosion hazard characteristics. The E&SC narrative does not address any special considerations to be implemented to minimize accelerated erosion of these areas once denuded.

17. E&SC Plan. Due to the severe erosion characteristics of the soils, existing topography, changes in topography due to the development plan and the presence of 25 percent slope areas along the road corridors, there is serious concern about the adequacy of the initial erosion and sediment control plan for the site, especially when the site is first cleared and grubbed (construction sequence Steps 3 through 5). The four sediment traps as designed for the project will not be effective for control of most disturbed areas associated with the project until such time as the roads are at grade, channels are roughed in and connecting storm drain systems to the traps are installed and functional. There are several areas along Mill Pond Run, Road A and Road B where silt fences as proposed will be inadequate to control disturbed area runoff until the channels and storm drains are functional and runoff is diverted to the traps. In addition, there are several locations along the road alignments where the roads, once grading is started, will tend to serve as diversion channels and will tend to divert runoff from disturbed areas to the low points in topography where no sediment traps are provided. If the inlets/storm systems are not in place and functional prior to the road grading operation, runoff as conveyed to silt fences will be too much for silt fence to handle. As such, it appears that use of temporary diversion dikes instead of silt fence, additional diversion dikes and use of additional small sediment traps will be necessary for the project. *(Note: The erosion and sediment control plan and it's related control measures must be adequate to support Item # 3 as outlined in*

NEW ERSC PLAN
NEW REVIEW
STILL ISSUES

the 25% waiver request dated October 26th 2001. Appropriate sediment and erosion control measures must be utilized to prevent the transport of sediment-laden runoff from land-disturbing activities. It is highly recommended that a meeting be held between the Environmental Division and the plan preparer to fully discuss the erosion and sediment control plan for the site and issues as it relates to this comment.)

18. Sediment Traps. Sediment traps # 1, # 3 and # 4 do not comply with 2:1 length to width ratios per Minimum Standard 3.13 of the VESCH. Provide clean out elevations for each sediment trap on the trap table on Sheet 15. Drainage area information for Sediment Trap # 3 doesn't match between the construction plan and the design report. Also, in computations presented in the design report, show minimum required volume for wet and dry storage for each trap as only available total volume was indicated. LABEL BAFFLE, SHOW C.O. ELEV ST#1

19. Sediment Traps. The downstream (fill) embankment slopes for each of the 4 sediment traps are quite excessive and shown steeper than 3H:1V; therefore, temporary erosion control matting would be required. Place proper key symbols on E&SC plan Sheets 10 & 11. EC-2 ADDED ST#1 ST# 3+4 REMOVED

20. Sediment Traps. For the four sediment traps, extend the rock outlet through the traps down the fill slope to natural ground or utilize properly-sized slope drains. As these traps have larger earthen embankments due to the slopes they are situated on, the earthen slopes must be properly protected from erosion due to outflow from the traps. Specify the amount of stone to be used in accordance with Minimum Standard & Specification 3.19 of the VESCH.

21. Outlet Protection. Label outlet protection or stilling basin as required at pipe outfalls SS # 1-1 and SS # 2-1. If standard outlet protections are utilized, show the La dimension, class of rock and thickness of rock required per Minimum Standard & Specification 3.18 and 3.19 of the VESCH and the pipe outlet protection detail shown on Sheet 15.

22. Stilling Basins. Provide the amount of stone to be used in the stilling basins and show dimensions required for each basin. Also, maximum interior side slope of the riprap portion of the stilling basins should be 2H:1V, not 1H:1V as interpreted on the detail on Sheet 14. Specify the maximum allowable slope for grading associated with the basin from top of riprap to tie to existing ground if required (3H:1V max. recommended). OK 1H:1V SAT 12-11-01

23. BMP Construction. Show proposed limits of clearing around BMP 7.2 on Sheet 11. Provide erosion and sediment control measures for construction/installation of BMP 7.1 and 7.2 including silt fences, downstream temporary rock check dams and access road stabilization/drainage control.

24. Timber Crib BMPs. Clearly specify on the erosion and sediment control plan or sequence of construction that BMP 7.1 and 7.2 are not to be utilized as sediment trapping facilities for the project. Include provisions for cleaning of the BMPs should sediment be transported to those facilities.

25. EC matting. Label EC matting as required in roadside stormwater conveyance channels along Mill Pond Run road and Road B on Sheet 11.

Stormwater Management / Drainage:

26. Lot-Lot Drainage. Address or provide a plan to prevent conveyance of increased or concentrated drainage due to lot development at the following locations: Lot 1 to Lot 2; Lot 2 to Lot 3; Lot 13 to Lot 12; Lot 16 to Lot 17; Lot 17 to Lot 18; Lot 27 to Lot 28; Lot 26 to Lot 29; Lot 25 to Lot 29; Lot 25 to Lot 24. In most of these cases, drainage easements are shown, but not labeled, and no drainage facilities are provided. Will address @ SF submission.

27. Design Rainfall. The stormwater management narrative in the design report indicates use of SCS 24 hour storm rainfalls of 3.2 inches for the 2-year event and 5.6 inches for the 10-year event. These values do not match traditionally assigned values for James City County at 3.5 inches and 5.8 inches, respectively.

28. Drainage Map. The 200 ft. scale inset drainage map provided in the design report appears incorrect. The postdevelopment drainage divide for BMP 7.1 should go through the intersection of Mill Pond Run and Road A. The map shows drainage area from Mill Pond road stations 92+58 to 97+45 as going to the BMP when it goes to Storm System 1 uncontrolled. Adjust the map and confirm the post-development drainage area of 11.79 acres.

29. BMP Designs. Explain how the 10-year routed outflow of 49.1 cfs for BMP 7.1 can be of a greater value than the post-development inflow into the basin at 46.6 cfs. For BMP 7.1 and 7.2, preference is for structures to discharge up to the 10-year storm through principal spillways, which is in this case the perforated pipe system and pass the 100-year through a combination of principal and emergency spillways. Therefore, the wall should contain (be constructed to or above) the 10-year design WSEL.

30. BMP Designs. For both BMP structures as shown on the details on Sheet 13, the vertical 8-inch perforated riser portions of the BMP orifice should be securely anchored or strapped to the timber crib walls for stability. Also, shown lengths required for the EC-1 outlet protection pads for both BMP facilities and type of PVC pipe required (Schedule 40, etc.) on the detail.

31. BMP Designs. Top of wall elevations should at least be to the brim-full elevation of the 1-year, 24-hour storm on the stage-storage curve (ie. basin immediately fills and orifice sized for a 24-hour drawdown). This would result in minimum top of wall at El. 26.2 for BMP 7.1 and El. 29.7 for BMP 7.2. Otherwise, computations in the design report would need to clearly show the 1-year, 24-hour storm event as routed through the facilities meets extended detention requirements (24 hours) between center of mass of the inflow and outflow hydrographs. Lowest size 3" ϕ even if less than 24-hour detention. SAT 12-11-01

32. Design Tailwater. Tailwater elevation used in the hydraulic model for BMP 7.1 appears to be almost one half foot lower than invert out elevation of the 4-inch low flow orifice. Similarly, the design tailwater elevation for BMP 7.2 appears to match the invert out elevation. Reasonable tailwater elevations should be used for depth of flow in the downstream natural channel.

33. BMP 7.2. The grading/drainage plan as shown on Sheet 9 for the end of Mill Pond Run and Storm System 4 is presented in such a way as BMP 7.2 could be shifted further upgradient to minimize wetland and 25% slope area impact. Also, it is preferred that design high water and the pond setback/buffer be situated on common area, rather than individual single family lots, to the greatest extent possible. Currently the arrangement for BMP 7.2 is such that a majority of the east side of the basin's extended detention pool area is situated on future Lots 30 and 31. LOTS 30, 31, 24, 23 POND BUFFER 20, 19

34. BMP 7.2. Show length of wall for BMP 7.2 (45 feet) on plan Sheet 9. LENGTHENED TO 50

35. Channel Adequacy. Channel adequacy computations were provided for natural channel segments below the four system pipe outfalls at SS # 1-1 (uncontrolled), SS # 2-1 (to BMP 7.1), SS # 3-1 (to BMP 7.1) and SS # 4-1 (to BMP 7.2). The selected Mannings n coefficient of 0.40 as used globally in the design report for channel adequacy computations does not appear consistent with typical natural streams segments in JCC and procedure as outlined in Chapter 5 of the VESCH, pages V-122 to V-141. A higher mannings value as such would tend to result in low channel velocities. Substantiate the selected value and revise adequacy computations accordingly. STILL PROBLEM SS#1

36. Storm Systems. Data for Storm Systems # 2 and # 4 are labeled incorrectly in the design report. Data in the report for System 2 is for System 4 and vice-versa. Correct heading labels in the report.

37. Culverts. Provide end sections and ensure adequate outfall protection is provided in the channel for the 15" RCP cross-culvert at Mill Pond Run Sta. 101+37. Provide culvert headwater computations for the 15" RCP culvert under the sidewalk at the intersection of Mill Pond Run and Road B. This culvert is just downstream of the culvert at Mill Pond Sta. 101+37 and should also have end sections and outfall protection in the channel if necessary.

38. Maintenance Plan. Provide maintenance plans for both stormwater management/BMP facilities. Section 23-10(4) of the Chesapeake Bay Preservation Ordinance requires stormwater management plans to include a long-term schedule for inspection and maintenance of stormwater management/BMP facilities. The plan should be specific for timber-crib wall County Type F-1 facilities and include cleanout elevations.

39. Miscellaneous. A waiver request to disturb 25 percent slopes dated October 26th 2001 is acknowledged. Consideration for approval of the variance will be delayed until such time as the Comment # 17 is adequately resolved enough to have confidence that erosion and sediment control plan measures are sufficient to control areas associated with disturbance of steep slope areas.

12-11-01 Meeting SJT, Marc Bennett + Rick Smith
SJT. AES. Discussed E+SC plan (Comment #17), Stilling basins, and SCP control requirements.