



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: JR066

DATE VERIFIED: December 11, 2012

QUALITY ASSURANCE TECHNICIAN: Leah Hardenbergh

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA



Stormwater Division

MEMORANDUM

Date: April 5, 2012
To: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services
From: Leah Hardenbergh
PO: 110426
Re: Files Approved for Scanning

General File ID or BMP ID: JR066
PIN: 5420100001
Owner Name (if known): ASSOCIATION FOR THE PRESERVATION OF VA ANTIQUITIES
Legal Property Description: YEARDLEY HOUSE ON JAMESTOWN ISLAND
Site Address: 1365 COLONIAL PARKWAY

(For internal use only):

Box # 5

Agreements (in file as of scan date): Y Book or Doc #: DB 5 p 536 050006441

JR-066

Contents for Stormwater Management Facilities As-built Files

Each file is to contain:

1. As-built plan
- ✓ 2. Completed construction certification
3. Construction Plan
- ✓ 4. Design Calculations
- ✓ 5. Watershed Map *in bag of calc.*
6. Maintenance Agreement
7. Correspondence with owners
- ✓ 8. Inspection Records
9. Enforcement Actions

 **COPY**

COUNTY OF JAMES CITY, VIRGINIA

DECLARATION OF COVENANTS

INSPECTION/MAINTENANCE OF DRAINAGE SYSTEM

THIS DECLARATION, made this 25 day of February, 2005,
between The Association for the Preservation of VA Antiquities, and
all successors in interest, ("COVENANTOR(S),") owner(s) of the following property:
Street Address: 1365 Colonial National Parkway Jamestown Island
Legal Description: 22 AC± located on Jamestown Island
Project Name: Historic Jamestown Archaearium Building
Document No. NA, Deed Book 5, Page No. 536;
Instrument No. NA, 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, monitoring, 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 # 050006441

Page 1

Revised 06/04

Recorded on March 22, 2005

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)

Louis J. Malan

Print Name/Title Louis J Malan Director of Properties

ATTEST:

COVENANTOR(S)

Print Name/Title _____

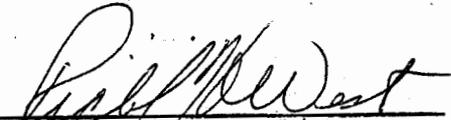
ATTEST:

COMMONWEALTH OF VIRGINIA

CITY/COUNTY OF Fredericksburg

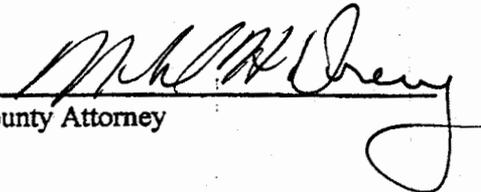
I hereby certify that on this 25th day of FEB, 2005, before the subscribed, a Notary Public of the State of Virginia, and for the City/County of Fredericksburg, aforesaid personally appeared Louis J. Malon and did acknowledge the foregoing instrument to be their Act.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal this 25th day of FEB, 2005.


Notary Public

My Commission expires: JAN 31, 2007

Approved as to form:


County Attorney

This Declaration of Covenants prepared by:

Louis J. Malon
(Print Name)

Director of Properties
(Title)

204 Franklin Street
(Address)

Richmond, VA 23220
(City) (State) (Zip)

(804) 648-1889
(Phone Number)

drainage1.pre

5420100001



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

Project Name: Archaeorum at Historic Jamestown (ARVA)

County Plan No.: SP-57-04; amend SP-87-05

Stormwater Management Facility: Bioretention Basin

BMP Phase #: I II HI

Information Package Received. Date/By: April 30, 2007 VHB

Completeness Check:

Record Drawing Date/By: April 30 2007

Construction Certification Date/By: April 27 2007

RD/CC Standard Forms (Required for all BMPs after Feb 1st 2001 Only)

Insp/Maint Agreement # / Date: # 05 000 6447 03/22/05

BMP Maintenance Plan Location: sheet C1 Approved Plan

Other: _____

Standard E&SC Note on Approved Plan Requiring RD/CC or County comment in plan review

Yes No Location: Note #20 sheet C1, ENV DIV Comm #4

Assign County BMP ID Code #: Code: JR 066

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: 3/27/07 Insp. Report

Record Drawing (RD) Review Date: 4/20/07

Construction Certification (CC) Review Date: 4/27/07

Actions:

No comments.

Comments. Letter Forwarded. Date: 3/27/07

Record Drawing (RD)

Construction Certification (CC)

Construction-Related (CR)

Site Issues (SI)

Other: _____

Second Submission: 6/27/07 Insp Report

Reinspection (if necessary): 1/23/08

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) NO

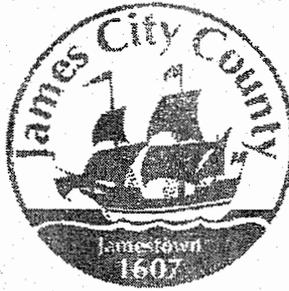
Add BMP to PRIDE BMP ratings database.

Final Sign-Off

Plan Reviewer: [Signature]

Date: 1/22/09

*** See separate checklist, if needed.



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: ARCHAEARUM - COLONIAL NATIONAL HISTORICAL PARK
Structure/BMP Name: BIORETENTION POND
Project Location: JAMESTOWN ISLAND - 1365 COLONIAL PARKWAY
BMP Location: NORTH OF ARCHAEARUM BUILDING
County Plan No.: SP - 57 - 04

Project Type: Residential Business Commercial Office Institutional Industrial Public Roadway Other _____
Tax Map/Parcel No.: 5420100001
BMP ID Code (if known): JR 066
Zoning District: R8 - RURAL RESIDENTIAL
Land Use: MUSEUM SPACE
Site Area (sf or acres): 22.0 ACRES

Brief Description of Stormwater Management/BMP Facility: THE ARCHAEARUM BIORETENTION POND IS LOCATED JUST NORTH OF THE ARCHAEARUM BUILDING AND EAST OF THE JAMES RIVER SEAWALL. FLOW TO THE POND IS FROM A GRASS SWALE THAT COLLECTS WATER FROM THE ROOF AND AREA AROUND THE BUILDING. THE POND OUTFALLS TO THE WETLAND NORTH OF THE POND

Nearest Visible Landmark to SWM/BMP Facility: ARCHAEARUM BUILDING

Nearest Vertical Ground Control (if known):

JCC Geodetic Ground Control USGS Temporary Arbitrary Other

Station Number or Name: VHB TRAV-113

Datum or Reference Elevation: U.S. CORP OF ENGINEERS

Control Description: DISK ELEV = 7.24

Control Location from Subject Facility: 110 LF. WEST OF POND ON SEA WALL

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: Spring 2005
Facility Monitored by County Representative during Construction: Yes No Unknown
Name of Site Work Contractor Who Constructed Facility: Daniel & Company Inc.
Name of Professional Firm Who Routinely Monitored Construction: Unknown
Date of Completion for SWM/BMP Facility: Spring 2006
Date of Record Drawing/Construction Certification Submittal: 4/27/07

(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: ASSOCIATION FOR THE PRESERVATION OF VIRGINIA ANTIQUITIES
Mailing Address: 1365 COLONIAL PARKWAY
WILLIAMSBURG, VA 23185
Business Phone: _____ Fax: _____
Contact Person: _____ Title: _____

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: VANASSE HANGEN BRUSTLIN
Mailing Address: 351 MCLAWS CIRCLE, SUITE 3
WILLIAMSBURG, VA 23185
Business Phone: 757.220.0500
Fax: 757.220.8544
Responsible Plan Preparer: TIM HOGAN
Title: PROJECT MANAGER
Plan Name: ARCHAEOLOGICAL BUILDING
Firm's Project No. 31005.13
Plan Date: 8/24/04
Sheet No.'s Applicable to SWM/BMP Facility: V1 / U2 / 1 / 1

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

Name: DANIEL & COMPANY, INC.
Mailing Address: 1800 ROSENEATH ROAD
RICHMOND, VA 23230-4310
Business Phone: 804.213.0400
Fax: 804.213.0401
Contact Person: L. J. SWAIN
Site Foreman/Supervisor: _____
Specialty Subcontractors & Purpose (for BMP Construction Only): _____

Section 4 - Professional Certifications:

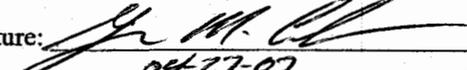
Certifying Professionals: (Note: A Registered Professional Engineer or Certified Land Surveyor is responsible for preparation of a Record Drawing, sometimes referred to as an As-Built plan, for the drainage system for the project including any Stormwater Management/BMP Facilities. A Registered Professional 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: VANASSE HANGEN BRUSTLIN
Mailing Address: 351 MCLAWS CIRCLE, SU. 3
WILLIAMSBURG, VA 23185
Business Phone: 757. 220. 0500
Fax: 757. 220. 8544

Name: GEORGE CUNHA
Title: LAND SURVEYOR

Signature: 
Date: 04/27/07

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.

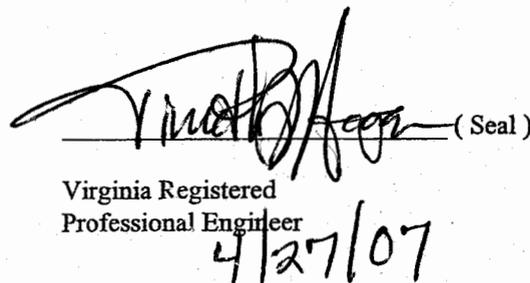
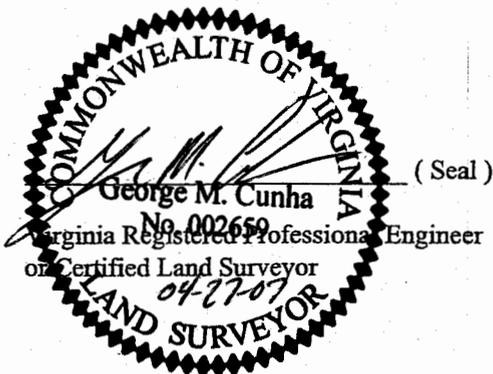
Construction Certification

Firm Name: VANASSE HANGEN BRUSTLIN
Mailing Address: 351 MCLAWS CIRCLE, SUITE 3
WILLIAMSBURG, VA 23185
Business Phone: 757. 220. 0500
Fax: 757. 220. 8544

Name: TIMOTHY S. HOWAN
Title: PROJECT MANAGER

Signature: 
Date: 4/27/07

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.



Section 5 - Record Drawing and Construction Certification Requirements and Instructions:

- PreConstruction Meeting - Provides an opportunity to review SWM /BMP facility construction, maintenance and operation plans and address any questions regarding construction and/or monitoring of the structure. The design engineer, certifying professionals (if different), Owner/Applicant, Contractor and County representative(s) are encouraged to attend the preconstruction meeting. Advanced notice to the Environmental Division is requested. Usually, this requirement can be met simultaneously with Erosion and Sediment Control preconstruction meetings held for the project.
- A fully completed ***STORMWATER MANAGEMENT / BMP FACILITIES, RECORD DRAWING and CONSTRUCTION CERTIFICATION FORM*** and ***RECORD DRAWING CHECKLIST***. All applicable sections shall be completed in their entirety and certification statements signed and sealed by the registered professional responsible for individual record drawing and/or construction certification.
- The Record Drawing shall be prepared by a Registered Professional Engineer or Certified Land Surveyor for the drainage system of the project including any Best Management Practices.
- Construction Certification. Construction of Stormwater Management / BMP facilities which contain impoundments, embankments and related engineered appurtenances including subgrade preparation, compacted soils, structural fills, liners, geosynthetics, filters, seepage controls, cutoffs, toe drains, hydraulic flow control structures, etc. shall be visually observed and monitored by a Registered Professional Engineer or his/her authorized representative. The Engineer must certify that the structure, embankment and associated appurtenances were built in accordance with the approved design plan, specifications and stormwater management plan and standard accepted construction practice and shall submit a written certification and/or drawings to the Environmental Division as required. Soil and compaction test reports, concrete test reports, inspection reports, logs and other required construction material or installation documentation may be required by the Environmental Division to substantiate the certification, if specifically requested. The Engineer shall have the authority and responsibility to make minor changes to the approved plan, in coordination with the assigned County inspector, in order to compensate for unsafe or unusual conditions encountered during construction such as those related to bedrock, soils, groundwater, topography, etc. as long as changes do not adversely affect the integrity of the structure(s). Major changes to the approved design plan or structure must be reviewed and approved by the original design professional and the James City County Environmental Division.
- Record Drawing and Construction Certifications are required within **thirty (30) days** of the completion of Stormwater Management / BMP facility construction. Submittals must be reviewed and accepted by James City County Environmental Division prior to final inspection, acceptance and bond/surety release.

Dual Purpose Facilities - Completion of construction also includes an interim stage for Stormwater Management / BMP facilities which serve dual purpose as temporary sediment basins during construction and as permanent stormwater management / BMP facilities following construction, once development and stabilization are substantially complete. For these dual purpose facilities, construction certification is required once the temporary sediment basin phase of construction is complete. Final record drawing and construction certification of additional permanent components is required once permanent facility construction is complete.

Interim Construction Certification is required for those dual purpose embankment-type facilities that are generally ten (10) feet or greater in dam height (*) and may not be converted, modified or begin function as a permanent SWM / BMP structure for a period generally ranging from six (6) to eighteen (18) months or more from issuance of a Land Disturbance permit for construction.

Interim or final record drawing and construction certifications are not required for temporary sediment basins which are designed and constructed in accordance with current minimum standards and specifications for temporary sediment basins per the Virginia Erosion and Sediment Control Handbook (VESCH); have a temporary service life of less than eighteen (18) months; and will be removed completely once associated disturbed areas are stabilized, unless a distinct hazard to the public's health, safety and welfare is determined by the Environmental Division due to the size or presence of the structure or due to evidence of improper construction.

(*Note: Dam Height as referenced above is generally defined as the vertical distance from the natural bed of the stream or waterway at the downstream toe of the embankment to the top of the embankment structure in accordance with 4VAC50-20-30, Virginia Impoundment Structure Regulations and the Virginia Dam Safety Program.)

- Record Drawings shall provide, at a minimum, all information as shown within these requirements and the attached **RECORD DRAWING CHECKLIST** specific to the type of SWM/BMP facility being constructed. Other additional record data may be formally requested by the James City County Environmental Division. *(Note: Refer to the current edition of the James City County Guidelines for Design and Construction of Stormwater Management BMP's manual for a complete list of acceptable BMP's. Currently there are over 20 acceptable water quality type BMP's accepted by the County.)*
- Record Drawings shall consist of blue/black line prints and a reproducible (mylar, sepia, diazo, etc.) set of the approved stormwater management plan including applicable plan views, profiles, sections, details, maintenance plans, etc. as related to the subject SWM / BMP facility. The set shall indicate "**RECORD DRAWING**" in large text in the lower right hand corner of each sheet with record elevations, dimensions and data drawn in a clearly annotated format and/or boxed beside design values. Approved design plan values, dimensions and data shall not be removed or erased. Drawing sheet revision blocks shall be modified as required to indicate record drawing status. Elevations to the nearest 0.1' are sufficiently accurate except where higher accuracy is needed to show positive drainage. Certification statements as shown in Section 4 of the Record Drawing and Construction Certification Form, *or similar forms thereof*, and professional signatures and seals, with dates matching that of the record drawing status in the revision or title block, are also required on all associated record drawing plans, prints or reproducibles.
- Submission Requirements. Initial and subsequent submissions for review shall consist of a minimum of one (1) blue/black line set for record drawings and one copy of the construction certification documents with appropriate transmittal. Under certain circumstances, it is understood that the record drawing and construction certification submissions may be performed by different professional firms. Therefore, record drawing submission may be in advance of construction certification or vice versa. Upon approval and prior to release of bond/surety, final submission shall include one (1) reproducible set of the record drawings, one (1) blue/black line set of the record drawings and one (1) copy of the construction certification. Also for current and/or future incorporation into the County BMP database and GIS system, it is requested that the record drawings also be submitted to the Environmental Division on a diskette or CD-ROM in an acceptable electronic file format such as *.dxf, *.dwg, etc. or in a standard scanned and readable format. The electronic file requirement can be discussed and coordinated with Environmental Division staff at the time of final submission.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

I. Methods and Presentation: (Required for all Stormwater Management / BMP facilities.)

- XX 1. All constructed facilities meet approved design plans, unless otherwise shown. Record information or deviations from approved design plan shown in clearly annotated format and/or boxed beside design values.
- XX 2. Elevations to the nearest 0.1' unless higher accuracy is needed to show positive drainage.
- XX 3. All plan sheets labeled with "RECORD DRAWING" in large text in lower right hand corner (Approved County Plan Number and BMP ID Code can be included if known).
- XX 4. All plan sheet revision blocks modified to indicate date and record drawing status.
- XX 5. All plan sheets have certification statements and certifying professional's signature and seal.

II. Minimum Standards: (Required for all Stormwater Management / BMP facilities, as applicable.)

- XX 1. All requirements of Section I (Methods and Presentation) apply to this section.
- XX 2. Plan Views: Show general location, arrangement and dimensions. Location and alignment shall generally match approved design plans.
- XX 3. Profile or elevations along top or berm of the facility. At a minimum, elevations are required at each end, at intervals not to exceed 50 feet and where low spots may be present. Top of embankment or berm elevations must be no less than design elevation plus any settlement allowances.
- XX 4. Top widths, berm widths and embankment side slopes.
- XX 5. Show length, width and depth of facility or grading, contours or spot elevations as required to verify permanent pool and design storage volumes were met or were reasonably close to the approved design. Evaluation of as-built grading, contours, spot elevations, or cross-sections, may be necessary by the professional to ensure approved design configurations, depths and volumes were closely maintained. If grading or elevations are significantly different from the approved plan, the Environmental Division shall be contacted immediately to determine whether the variation is acceptable or whether further evidence will be required. Facilities which do not closely resemble approved plan grades, elevations or configurations may require regrading by the Contractor; check volumetric computations; and/or a check hydraulic routing to ensure approved design water surface elevations, discharges or freeboard were closely maintained.
- N/A 6. Cross-section of the embankment through the principal spillway or outlet barrel. Must extend at least 100 ft. downstream of the pipe outlet or to recorded site property line, whichever is closer. Proper correlation is required between principal spillway (control structure) crest, emergency spillway crest, orifice and weirs and the top of the dam or facility. All elevations and dimensions must reasonably match the design plan or be sequentially relative to each other and the facility must reflect the required design storage volume(s) and/or design depth.
- N/A 7. Profile or elevations along the entire centerline of the emergency spillway. Emergency spillway may be steeper, but no flatter or narrower than design.
- N/A 8. Elevation of the principal spillway crest or outlet crest of the structure.

- N/A 9. Primary control structure (riser) diameter or dimensions, height, type of material and base size. Indicate provisions for access that are present such as steps, ladders, etc.
- XX 10. Dimensions, locations and elevations of outlet orifices, weirs, slots and drains.
- N/A 11. Type and size of anti-vortex and trash rack device. Height, diameter, dimensions, bar spacings (if applicable) and elevations relative to the principal spillway crest. Indicate if lockable hatch is present or not.
- N/A 12. Type, location, size and number of anti-seep collars or documentation of other methods utilized for seepage control. **May need to obtain this information during construction.**
- N/A 13. Top of impervious core embankment, core trench limits and elevation of cut-off trench bottom. **May need to obtain this information during construction.**
- XX 14. Elevation of the principal spillway barrel (outlet pipe) inlet and outlet invert.
- XX 15. Outlet barrel diameter, length, slope, type and thickness class of material and type of flared end sections, headwall or endwall.
- XX 16. Outfall protection dimension, type and depth of rock and if underlain filter fabric is present.
- XX 17. BMP interior and periphery landscaping zones conform with arrangements and requirements of the approved design plan.
- N/A 18. Maintenance plan taken from approved design plan transposed onto record drawing set.
- N/A 19. Fencing location and type, if applicable to facility.
- XX 20. BMP vicinity properly cleaned of stockpiles and construction debris.
- XX 21. No visual signs of erosion or channel degradation immediately downstream of facility.
- N/A 22. Any other information formally requested by the Environmental Division specific to the constructed SWM/BMP facility.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

III. Group A - Wet Ponds (Includes A-1 Small Wet Ponds; A-2 Wet Ponds; A-3 Wet Ext Det Ponds.)

- XX A1. All requirements of Section II, Minimum Standards, apply to Group A facilities.
- N/A A2. Principal spillway consists of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.
- N/A A3. Sediment forebays or pretreatment devices provided at inlets to pond. Generally 4 to 6 ft. deep.
- N/A A4. Access for maintenance and equipment is provided to the forebay(s). Access corridors are at least 12 ft. wide, have a maximum slope of 15 percent and are adequately stabilized to withstand heavy equipment or vehicle use.
- N/A A5. Adequate fixed vertical sediment depth markers installed in the forebay(s) for future sediment monitoring purposes.
- N/A A6. Pond liner (if required) provided. Either clay liners, polyliners, bentonite liners or use of chemical soil additives based on requirements of the approved plan.
- N/A A7. Minimum 6 percent slope safety bench extending a minimum of 15 feet outward from normal pool edge and/or an aquatic bench extending a minimum of 10 feet inward from the normal shoreline with a maximum depth of 12 inches below the normal pool elevation, if applicable, per the approved design plans. (Note: Safety benches may be waived if pond side slopes are no steeper than 4H:1V).
- N/A A8. No trees are present within a zone 15 feet around the embankment toe and 25 feet from the principal spillway structure.
- XX A9. Wet permanent pool, typically 3 to 6 feet deep, is provided and maintains level within facility.
- N/A A10. Low flow orifice has a non-clogging mechanism.
- N/A A11. A pond drain pipe with valve was provided.
- XX A12. Pond side slopes are not steeper than 3H:1V, unless approved plan allowed for steeper slope.
- N/A A13. End walls above barrels (outlet pipe) greater than 48 inch in diameter are fenced to prevent a fall hazard.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

IV. Group B - Wetlands (Includes B-1 Shallow Marsh; B-2 Ext Det Shallow Wetlands; B-3 Pond Wetland System and B-4 Pocket Wetland)

- N/A B1. Same requirements as Group A Wet Ponds.
- N/A B2. Minimum 2:1 length to width flow path provided across the facility.
- N/A B3. Micropool provided at or around outlet from BMP (generally 3 to 6 ft. deep).
- N/A B4. Wetland type landscaping provided in accordance with approved plan. Includes correct pondscaping zones, plant species, planting arrangements, wetland beds, etc. Wetland plants include 5 to 7 emergent wetland species. Individual plants at 18 inches on center in clumps.
- N/A B5. Adequate wetland buffer provided (Typically 25 ft. outward from maximum design water surface elevation and 15 ft. setback to structures).
- N/A B6. No more than one-half (½) of the wetland surface area is planted.
- N/A B7. Topsoil or wetland mulch provided to support vigorous growth of wetland plants.
- N/A B8. Planting zones staked or flagged in field and locations subsequently established by appropriate field surveying methods for record drawing presentation.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

V. Group C - Infiltration Practices (Includes C-1 Infiltration Trench; C-2 Infiltration Trench;
C-3 Infiltration Basin; and C-4 Infiltration Basin)

- XX C1. All requirements of Section II, Minimum Standards, apply to Group C facilities as applicable.
- XX C2. Facility is not located on fill slopes or on natural ground in excess of six (6) percent.
- XX C3. Pretreatment devices provided prior to entry into the infiltration facility. Acceptable pretreatment devices include sediment forebays, sediment basins, sediment traps, sump pits or inlets, grass channels, plunge pools or other acceptable measures.
- XX C4. Three (3) or more of the following pretreatment devices provided to protect long term integrity of structure: grass channel; grass filter strip; bottom sand layer; upper filter fabric layer; use of washed bank run gravel aggregate.
- XX C5. ~~Sides~~ ^{BOTTOM} of infiltration practice lined with filter fabric.
- XX C6. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
- XX C7. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.
- XX C8. Minimum one hundred (100) foot separation horizontally from any known water supply well and minimum one hundred (100) foot separation upslope from any building.
- XX C9. Minimum twenty-five (25) foot separation down gradient from any structure.
- XX C10. Stormwater outfalls provided for overflow associated with larger design storms.
- XX C11. No visual signs of erosion or channel degradation immediately downstream of facility.
- XX C12. Facility does not currently cause any apparent surface or subsurface water problems to downgrade properties.
- XX C13. Observation well provided.
- XX C14. Adequate, direct access provided to the facility for future maintenance, operation and inspection.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VI. Group D - Filtering Systems (Includes D-1 Bioretention Cells; D-2 Surface Sand Filters; D-3 Underground Sand Filters; D-4 Perimeter Sand Filters; D-5 Organic Filters; and D-6 Pocket Sand Filters)

- N/A D1. All requirements of Section II, Minimum Standards, apply to Group D facilities.
- N/A D2. Sediment pretreatment devices provided.
- N/A D3. For D-1 BMPs (Bioretention Cells), pretreatment consisting of a grass filter strip below level spreader (deflector); a gravel diaphragm; and mulch and planting soil layers were provided.
- N/A D4. For D-1 BMPs (Bioretention Cells), plantings consist of native plant species; vegetation provided was based on zones of hydric tolerances; trees and understory of shrubs and herbaceous materials were provided; woody vegetation is absent from inflow locations; and trees are located around facility perimeter.
- N/A D5. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
- N/A D6. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed .
- N/A D7. Filtering system is off-line from storm drainage conveyance system.
- N/A D8. Overflow outlet has adequate erosion protection.
- N/A D9. Deflector, diversion, flow splitter or regulator structure provided to divert the water quality volume to the filtering structure.
- N/A D10. Minimum four (4) inch perforated underdrain provided in a clean aggregate envelope layer beneath the facility.
- N/A D11. Minimum fifty (50) foot separation from any slope fifteen (15) percent or greater. Minimum one hundred (100) foot separation horizontally from any known water supply well. Minimum one hundred (100) foot separation upslope and twenty-five (25) foot separation downslope from any building.
- N/A D12. Stabilization and acceptable vegetative cover established over contributing drainage area prior to conveyance of stormwater to the facility.
- N/A D13. No visual signs of erosion or channel degradation immediately downstream of facility.
- N/A D14. Adequate, direct access provided to the pretreatment area and/or filter bed for future maintenance.

**STORMWATER MANAGEMENT / BMP FACILITIES
AS-BUILT PLAN CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VII. Group E - Open Channel Systems (Includes E-1 Wet Swales (Check Dams); E-2 Dry Swales; and E-3 Biofilters)

- N/A E1. All requirements of Section II, Minimum Standards, apply to Group E facilities as applicable.
- N/A E2. Open channel system has constructed longitudinal slope of less than four (4) percent.
- N/A E3. No visual signs of erosion in the open channel system's soil and/or vegetative cover.
- N/A E4. Open channel side slopes are no steeper than 2H:1V at any location. Preferred channel sideslope is 3H:1V or flatter.
- N/A E5. No visual signs of ponding are present at any location in the open channel system, except at rock check dam locations for E-1 systems (Wet Swales).
- N/A E6. For E-2 BMPs (Dry Swales), an underdrain system was provided.
- N/A E7. Treated timber or rock check dams provided as pretreatment devices for the open channel system.
- N/A E8. Gravel diaphragm provided in areas where lateral sheet flow from impervious surfaces are directly connected to the open channel system.
- N/A E9. Grass cover/stabilization in the open channel system appears adaptable to the specific soils and hydric conditions for the site and along the channel system.
- N/A E10. Open channel system areas with grass covers higher than four (4) to six (6) inches were properly mowed.
- N/A E11. Facility was not used for erosion and sediment control purposes and sediment was prevented from entering the facility to the greatest extent possible during construction.
- N/A E12. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.
- N/A E13. For E-3 BMPs (Biofilters), the bottom width is six (6) feet maximum at any location.
- N/A E14. For E-3 BMPs (Biofilters), sideslopes are 3H:1V maximum at any location.
- N/A E15. For E-3 BMPs (Biofilters), the constructed channel slope is less than or equal to three (3) percent at any location.
- N/A E16. For E-3 BMPs (Biofilters), the constructed grass channel is approximately equivalent to the constructed roadway length.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

VIII. Group F - Extended Dry Detention (Includes F-1 Timber Walls; and F-2 Dry Extended Detention with Forebay)

- N/A F1. All requirements of Section II, Minimum Standards, apply to Group F facilities.
- N/A F2. Basin bottom has positive slope and drainage from all basin inflow points to the riser (or outflow) location.
- N/A F3. Timber wall BMP used in intermittent stream only. (ie. Prohibited in perennial streams.)
- N/A F4. Forebay provided approximately 20 ft. upstream of the facility. Forebays generally 4 to 6 feet in depth.
- N/A F5. A reverse slope pipe, vertical stand pipe or mini-barrel and riser was provided to prevent clogging.
- N/A F6. Principal spillway and outlet barrel provided consisting of reinforced concrete pipe with O-Ring gaskets for watertight joint construction.
- N/A F7. Mini-barrel and riser, if used, contains a removable trash rack to reduce clogging.
- N/A F8. Low flow orifice, if used, has a minimum diameter of three (3) inches or two (2) inches if internal orifice control was utilized and a small, cage type external trash rack.
- N/A F9. Timbers properly reinforced or concrete footing provided if soil conditions were prohibitive.
- N/A F10. Timber wall cross members extended to a minimum depth of two (2) feet below ground elevation.
- N/A F11. Protection against erosion and scour from the low flow orifice and weir-flow trajectory provided.
- N/A F12. Stilling basin or standard outlet protection provided at principal spillway outlet.
- N/A F13. Adequate, direct access provided to the facility. Access corridor to facility is at least ten (10) feet wide, slope is less than twenty (20) percent and appropriate stabilization provided for equipment and vehicle use. Access extends to forebay, standpipe and timber wall, as applicable.
- N/A F14. No visual signs of undercutting of timber walls or clogging of the low orifice were present.
- N/A F15. No visual signs of erosion or channel degradation immediately downstream of facility.
- N/A F16. No visible signs of accumulated silt/sediment were present in the facility following construction or alternately, accumulated silt/sediment was properly removed and no adverse affects to the function of the facility are anticipated.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

IX. Group G - Open Spaces (Includes All Open Space Types G-1; G-2; and G-3)

- N/A G1. All requirements of Section II, Minimum Standards, apply to Group G facilities as applicable.
- N/A G2. Constructed impervious areas appear to conform with locations indicated on the approved plan and appear less than sixty (60) percent impervious in accordance with the requirements of the James City County Chesapeake Bay Preservation Ordinance.
- N/A G3. Dedicated open space areas are in undisturbed common areas, conservation easements or are protected by other enforceable instruments that ensures perpetual protection.
- N/A G4. Provisions included to clearly specify how the natural vegetated areas utilized as dedicated open space will be managed and field identified (marked).
- N/A G5. Adequate protection measures were implemented during construction to protect the defined dedicated open space areas.
- N/A G6. Dedicated open space areas were not disturbed during construction (ie. cleared, grubbed or graded).

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

(Key for Checklist is as follows: XX Acceptable N/A Not Applicable Inc Incomplete)

X. Storm Drainage Systems (Associated with BMP's Only)

(Includes all incidental stormwater drainage conveyance systems associated with SWM/BMP facilities such as onsite or offsite storm drains, open channels, inlets, manholes, junctions, outlet protections, deflectors, etc. These facilities are external to the treatment function of, but are directly associated with drainage to and/or from a constructed SWM/BMP facility. The intent of this portion of the certification is to accurately identify the type and quantity of inflow or outflow points associated with the facility for future reference. The Professional may use his/her own discretion to determine inclusive facilities to meet the intent of this section. As a general rule, storm drainage systems would include incidental facilities to the nearest access structure upslope or downslope from the normal physical limits of the facility or 800 feet of storm drainage conveyance system length, whichever is less.)

- XX SD1. All requirements of Section II, Minimum Standards, apply to Storm Drainage Systems.
- XX SD2. Horizontal location of all pipe and structures relative to the SWM/BMP facility.
- XX SD3. Type, top elevation and invert elevation of all access type structures (inlets, manholes, etc.).
- XX SD4. Material type, size or diameter, class, invert elevations, lengths and slopes for all pipe segments.
- XX SD5. Class, length, width and depth of riprap and outlet protections or dimensions of special energy dissipation structures.

XII. Other Systems

(Includes any non-typical, specialty, manufactured or innovative stormwater management/BMP practices or systems generally accepted for use as or in conjunction with other acceptable stormwater management / BMP practices. Requires evidence of prior satisfactory industry use and prior Environmental Division approval, waiver or exception .)

- N/A O1. All requirements of Section II, Minimum Standards, apply to this section.
- N/A O2. Certification criteria to be determined on a case-by-case basis by the Environmental Division specific to the proposed SWM/BMP facility.

**STORMWATER MANAGEMENT / BMP FACILITIES
RECORD DRAWING CHECKLIST**

XIII. References *(The James City County Record Drawing and Construction Certification Forms and Checklists for Stormwater Management / BMP facilities were developed using the following sources and references.)*

- Baltimore County, Maryland Soil Conservation District, As-Built Stormwater Management Pond Checklist.
- James City County, Virginia, Guidelines for Design and Construction of Stormwater Management BMP's (October 1999).
- James City County, Virginia, Stormwater Detention/Retention Basin Design Checklist and Erosion and Sediment Control and Stormwater Management Design Plan Checklists.
- James City County Stormwater Policy Framework, Final Report of the James City County BMP Policy Project, October 1998, The Center for Watershed Protection.
- Prince Georges County, Maryland, As-Built Requirements Retention or Detention Pond/Basin.
- Prince William County, Virginia, Stormwater Management Fact Sheet.
- Stafford County, Virginia, As-Built Plan Checklist.
- Stormwater Management Design Manual, NRCS Maryland Code No. 378, Pond Standards and Specifications.
- USEPA/Watershed Management Institute, Stormwater Management Inspection Forms.
- Virginia Impounding Structure Regulations (Dam Safety), Department of Conservation & Recreation, 1997.
- Virginia Erosion and Sediment Control Handbook, Third Edition 1992, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.
- Virginia Stormwater Management Handbook, 1999 edition, Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation.

File: Shared\SWMPProg\BMP\Certif\RDCC.wpd



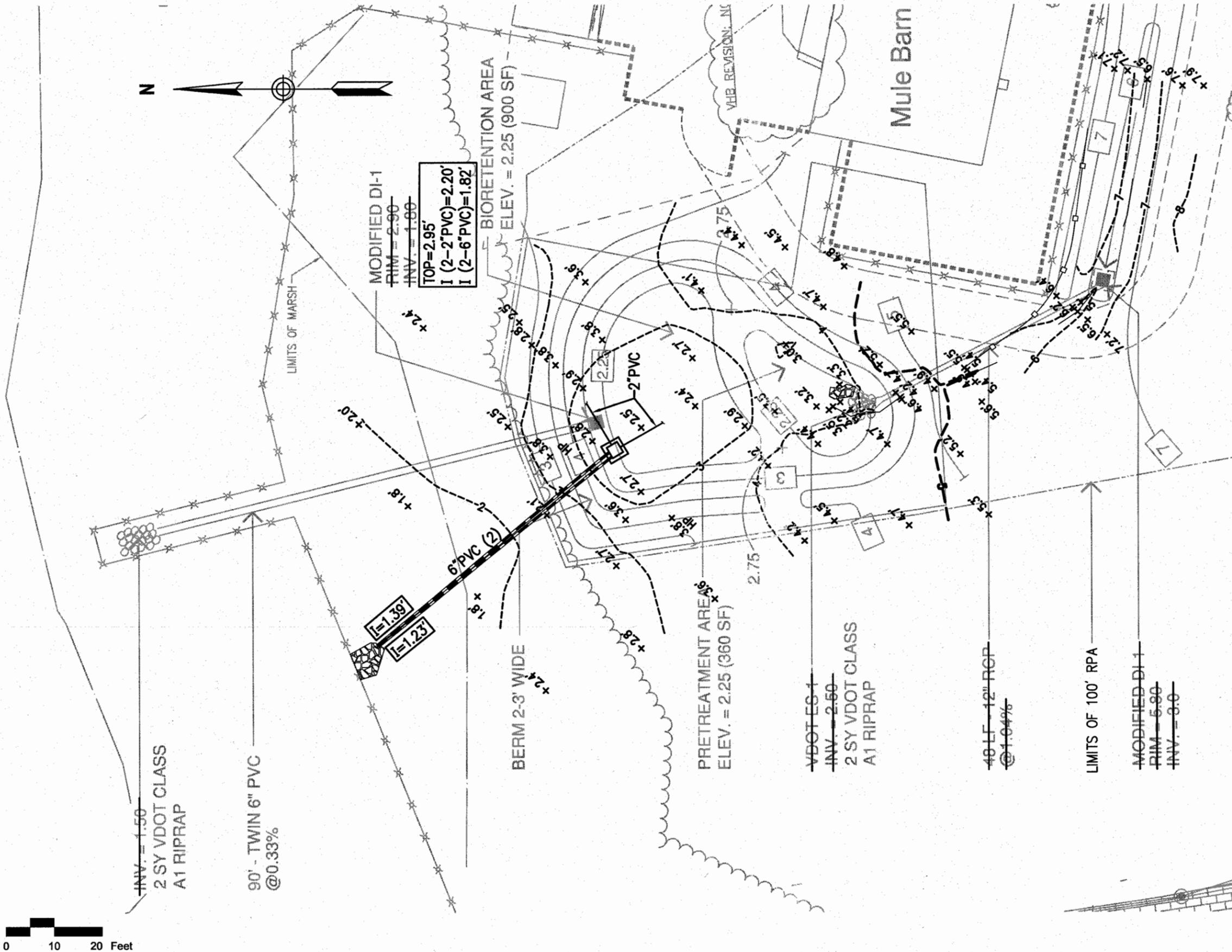
James City County, Virginia
Environmental Division

**Stormwater Management / BMP Facilities
Record Drawing and Construction Certification**

Standard Forms & Instructions

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*Issue Date
February 1, 2001*



Legend

RIM=X.XX' AS-BUILT INFORMATION

I HEREBY CERTIFY TO THE BEST OF MY KNOWLEDGE AND BELIEF THAT THIS DRAWING REPRESENTS THE ACTUAL CONDITION OF THE STORMWATER/BMP FACILITY. THE FACILITY APPEARS TO GENERALLY CONFORM WITH THE APPROVED SITE PLAN.

George M. Cunha
 GEORGE M. CUNHA, L.S. #002659

04-30-2007
 DATE

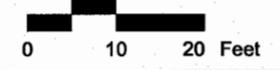


**JCC PLAN NO.: SP-57-04
 RECORD DRAWING**

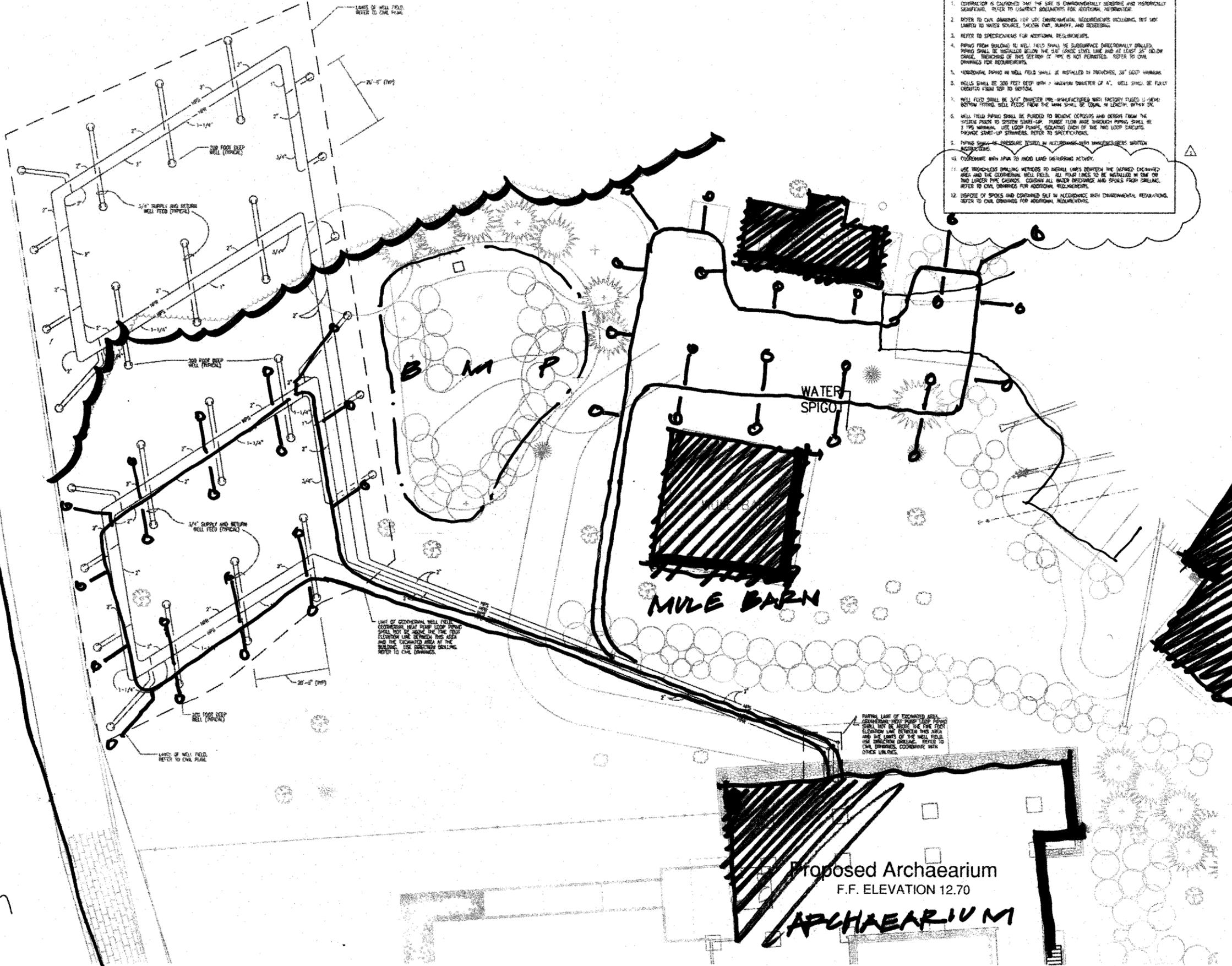
Vanasse Hangen Brustlin, Inc.

1 4/30/07

JAMESTOWN ARCHAERARIUM
 BMP AS-BUILT RECORD DRAWING



JAMES RIVER



- GEOTHERMAL WELL FIELD NOTES**
- CONTRACTOR IS GUARANTEED THAT THE SITE IS COMMERCIALLY FEASIBLE AND HISTORICALLY SIGNIFICANT. REFER TO CONTRACT DOCUMENTS FOR ADDITIONAL REQUIREMENTS.
 - REFER TO CIVIL DRAWINGS FOR UTILITY ENCUMBRANCES INCLUDING, BUT NOT LIMITED TO WATER SOURCE, SEWER, GAS, RAINFALL, AND RECREATION.
 - REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
 - PIPING FROM BUILDING TO WELL FIELD SHALL BE SUBSURFACE DIRECTIONALLY DRILLED. PIPING SHALL BE INSTALLED BELOW THE 10' GRADE LEVEL LINE AND AT LEAST 30" BELOW GRADE. TRENCHING OF THIS DEPTH OR DEEPER IS NOT PERMITTED. REFER TO CIVIL DRAWINGS FOR REQUIREMENTS.
 - HORIZONTAL PIPING IN WELL FIELD SHALL BE INSTALLED BY TRENCHING, NOT SHIP WINDING.
 - WELLS SHALL BE 200 FEET DEEP WITH A MINIMUM DIAMETER OF 4". WELL SHALL BE PLANT ORGANOLOGIC FROM TOP TO BOTTOM.
 - WELL FIELD SHALL BE 3/4" DIAMETER PIPE MANUFACTURED WITH FACTORY PLATED 15-16MM BORE PIPING. WELL FEEDS FROM THE MAIN SHALL BE EQUAL IN LENGTH. REFER TO CIVIL DRAWINGS FOR REQUIREMENTS.
 - WELL FIELD PIPING SHALL BE PLACED TO REMOVE DEPOSITS AND REMOVE FROM THE SYSTEM PRIOR TO SYSTEM START-UP. PURGE FLOW RATE THROUGH PIPING SHALL BE 2 TPD MINIMUM. USE LOOP PIPING. CLEANING JACKS OF THE TWO LOOP CIRCUITS. PURGE STATE-UP STRONG. REFER TO SPECIFICATIONS.
 - PIPING SHALL BE PRESSURE TESTED IN ACCORDANCE WITH IMMEDIATELY WRITTEN REQUIREMENTS.
 - COORDINATE WITH AEA TO AVOID LAND DISTURBING ACTIVITY.
 - USE TRENCHLESS DRILLING METHODS TO INSTALL LINES BETWEEN THE DEFINED EXCAVATED AREA AND THE GEOTHERMAL WELL FIELD. ALL PUMP LINES TO BE INSTALLED IN ONE OF TWO LAYERS PER CIRCUIT. CLEANING ALL UNDER EXCAVATED AND SPILLS FROM DRILLING. REFER TO CIVIL DRAWINGS FOR ADDITIONAL REQUIREMENTS.
 - DISPOSE OF SPILLS AND CONTAMINATED SOIL IN ACCORDANCE WITH ENVIRONMENTAL REGULATIONS. REFER TO CIVIL DRAWINGS FOR ADDITIONAL REQUIREMENTS.

GEOTHERMAL WELL FIELD SITE PLAN
SCALE: 1" = 10' 0"

CHECKED BY: JCSW
FILE NO. 04989M2
REVISED:

MECHANICAL SITE PLAN
Archaearium at Historic Jamestowne

Carlton Abbott and Partners, P.C.
Architects/Landscape Architects/Planners
P.O. BOX 81
Williamsburg, Virginia 23187
(757) 220-1095
cabbott@carltonabbott.com

M2

WELFELD REVISION 11.04.04
bom/c.a.s.

SITE DATA

ZONING CLASSIFICATION : R-8, RURAL RESIDENTIAL
PARCEL SIZE: 22.0 ACRES
PARCEL NUMBER : (54-2)(1-1)
OWNER : ASSOCIATION FOR THE PRESERVATION
OF VIRGINIA ANTIQUITIES
EXISTING BULILDINGS : 18,683 SF
TOTAL OPEN SPACE : 21.40 ACRES

NOTES AND DETAILS

NEW BUILDING : 7,500 SF
TOTAL AREA WITHIN LIMIT OF WORK (DOTTED LINES): 1.70 ACRES
TOTAL DISTURBED AREA: 1.43 ACRES
TOTAL IMPERVIOUS AREA : 0.32 ACRES
PERCENT IMPERVIOUS AREA: 19%
SPECIAL USE PERMIT NO. SUP-21-02

BUILDING HEIGHT: THE MAXIMUM HEIGHT
OF THE ARCHAERIUM IS 22 FEET.

UTILITIES: THIS PROJECT WILL BE SERVED BY PUBLIC WATER
AND A PRIVATE SANITARY PUMP SYSTEM INTO A MUNICIPAL GRAVITY SYSTEM.

SPECIAL USE CONDITIONS:

1. AN ARCHAEOLOGICAL STUDY, PERFORMED IN
ACCORDANCE WITH COUNTY POLICY SHALL BE
SUBMITTED TO AND APPROVED BY THE DIRECTOR OF
PLANNING BEFORE ANY LAND DISTURBING ACTIVITY WILL
BE ALLOWED TO TAKE PLACE.

2. SITE PLANS SHALL BE SUBMITTED TO AND APPROVED
BY THE PLANNING DIRECTOR.

3. PRIOR TO PRELIMINARY SITE PLAN APPROVAL, AND
ENGINEERING STUDY SHALL BE SUBMITTED TO AND
APPROVED BY THE JAMES CITY SERVICE AUTHORITY
CONFIRMING THE SANITARY SYSTEM CAPACITY.

4. PRIOR TO PRELIMINARY SITE PLAN APPROVAL, THE
RESOURCE PROTECTION AREA AND BUFFER IN THE
VICINITY OF THE POLE SHED AND PROPOSED BMP
EASEMENT 2 (As Shown In The Drawing: Proposed NPS
Easements At APVA Property, In The Conceptual Stormwater
Management Plan For The James City County Special Use
Permit Application) SHALL HAVE EXISTING EQUIPMENT AND
DEBRIS REMOVED, AS APPROVED BY THE COUNTY
ENVIRONMENTAL DIRECTOR. THIS AREA SHALL BE
RESTORED WITH VEGETATION, AS APPROVED BY THE
COUNTY ENVIRONMENTAL DIRECTOR.

5. GRID PAVERS OR OTHER PERVIOUS PAVING SURFACES
SHALL BE USED IN PLACE OF IMPERVIOUS SURFACES FOR
THE CONSTRUCTION OR RELOCATION OF ACCESS
ROADWAYS OR PATHS WITHIN THE 50-FOOT RESOURCE
PROTECTION BUFFER, AS APPROVED BY THE COUNTY
ENVIRONMENTAL DIRECTOR.

MENT

REQUEST
ON JUNE 7,
NORTH OF
G LOT ON
ED THROUGH
HE HISTORIC
ART OF THE
E.

JAMESTOWNE IS TO BE LOCATED NEAR THE EXISTING
HOUSES THE ARTIFACT COLLECTION OF THE ASSOCIATION
QUITIES AND THE NATIONAL PARK SERVICE. THE
E FEET OF MUSEUM SPACE IN WHICH TO DISPLAY
SES OF ARCHAEOLOGICAL DISCOVERY TO THE PUBLIC. THE
VIEWS TO THE HISTORIC LANDSCAPE WHICH COUPLED
PROVIDE THE VISITOR A VISUAL TIMELINE OF THE
E. THE FACILITY ALSO PROVIDES APPROPRIATE VISITOR
ACILITIES AND WORK AREAS. THE ARCHAERIUM IS
E AND IS AND INTEGRAL PART OF THE VISITOR EXPERIENCE
HIS FACILITY IS IN THE EXISTING VISITOR CENTER PARKING

*SP-57-02
Archaearium at
Historic Jamestown
SP-87-05
Amend*

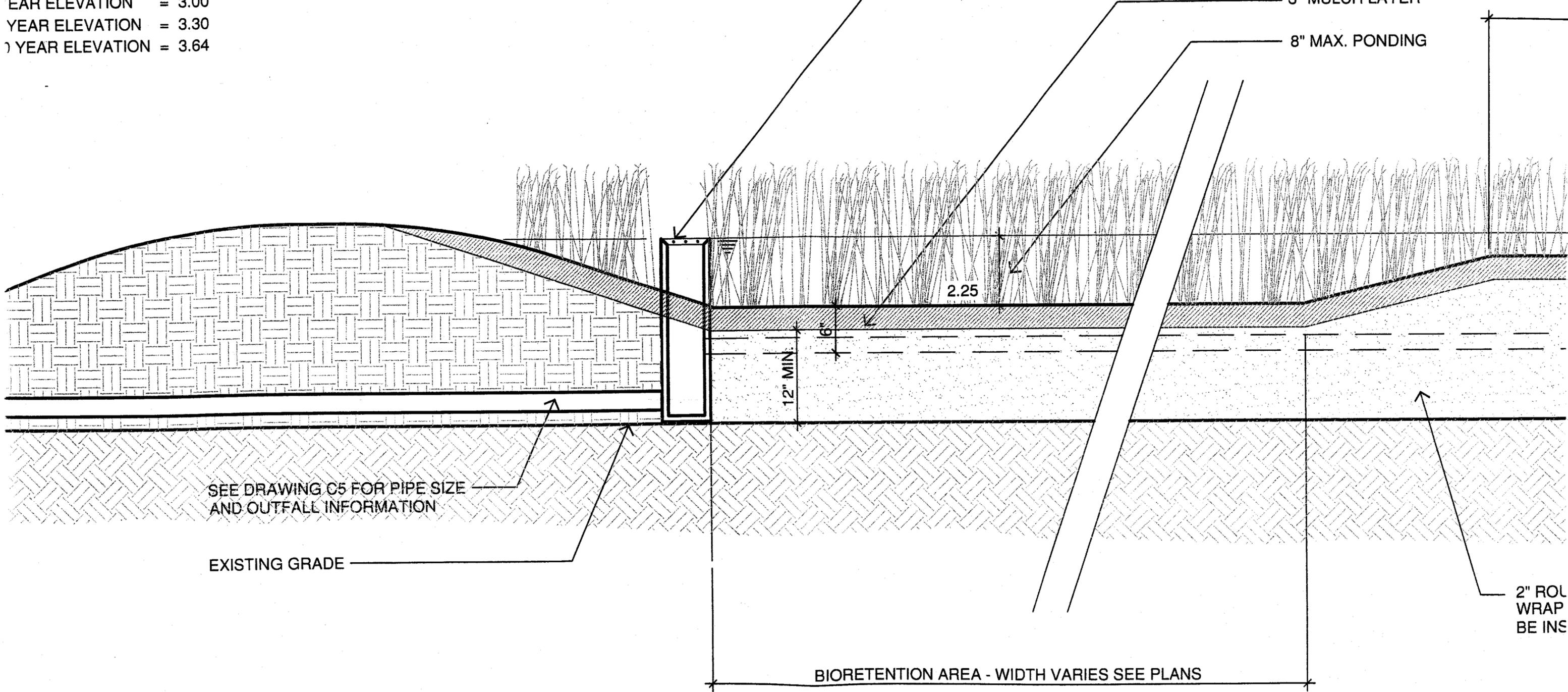
SIN WATER SURFACE ELEVATIONS

1 YEAR ELEVATION = 2.92
2 YEAR ELEVATION = 3.00
5 YEAR ELEVATION = 3.30
10 YEAR ELEVATION = 3.64

OVERFLOW DROP INLET
MODIFIED VDOT DI-1 TOP= 2.90

3" MULCH LAYER

8" MAX. PONDING



SEE DRAWING C5 FOR PIPE SIZE
AND OUTFALL INFORMATION

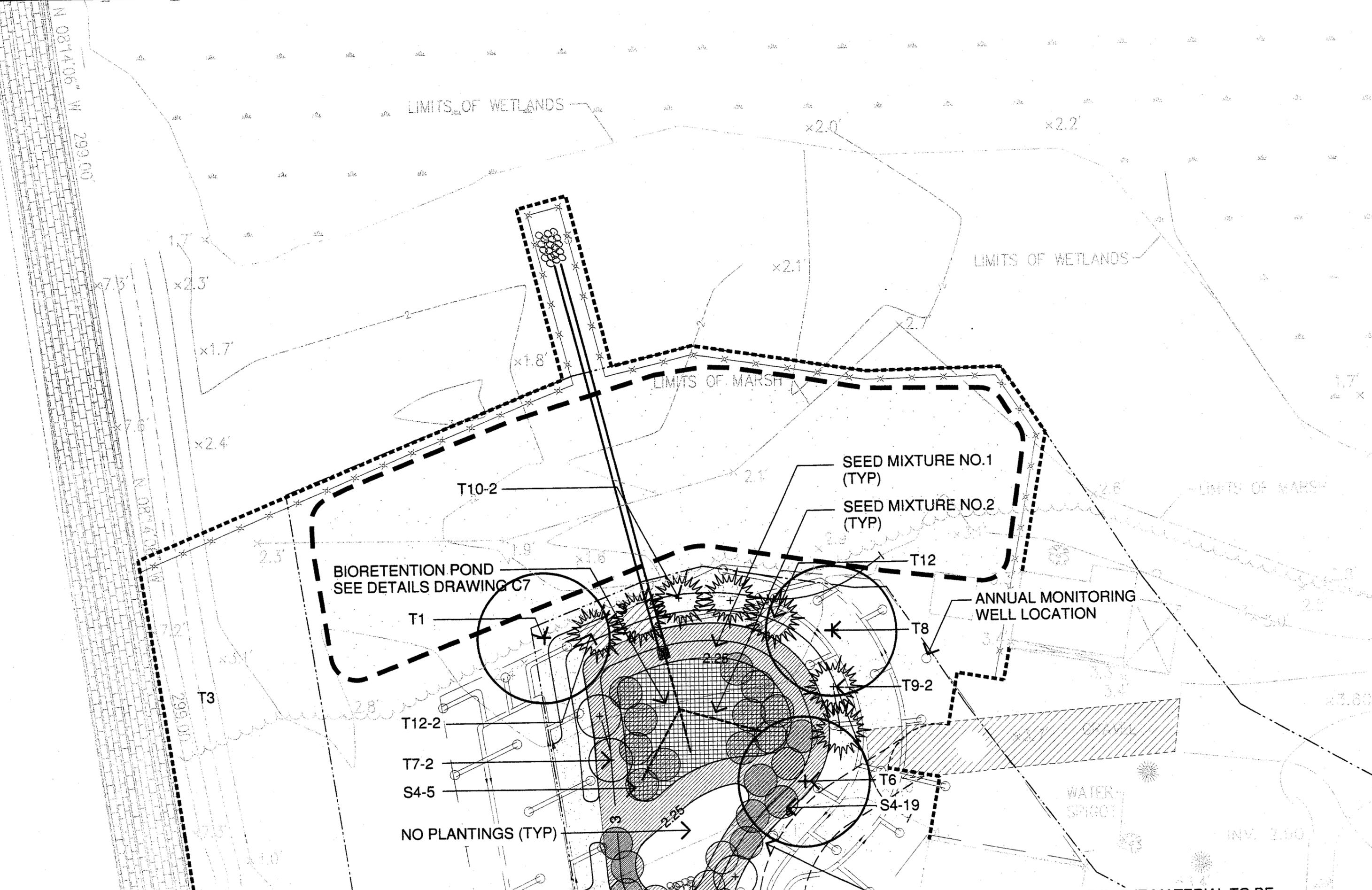
EXISTING GRADE

2" ROLL
WRAP
6" BE INS

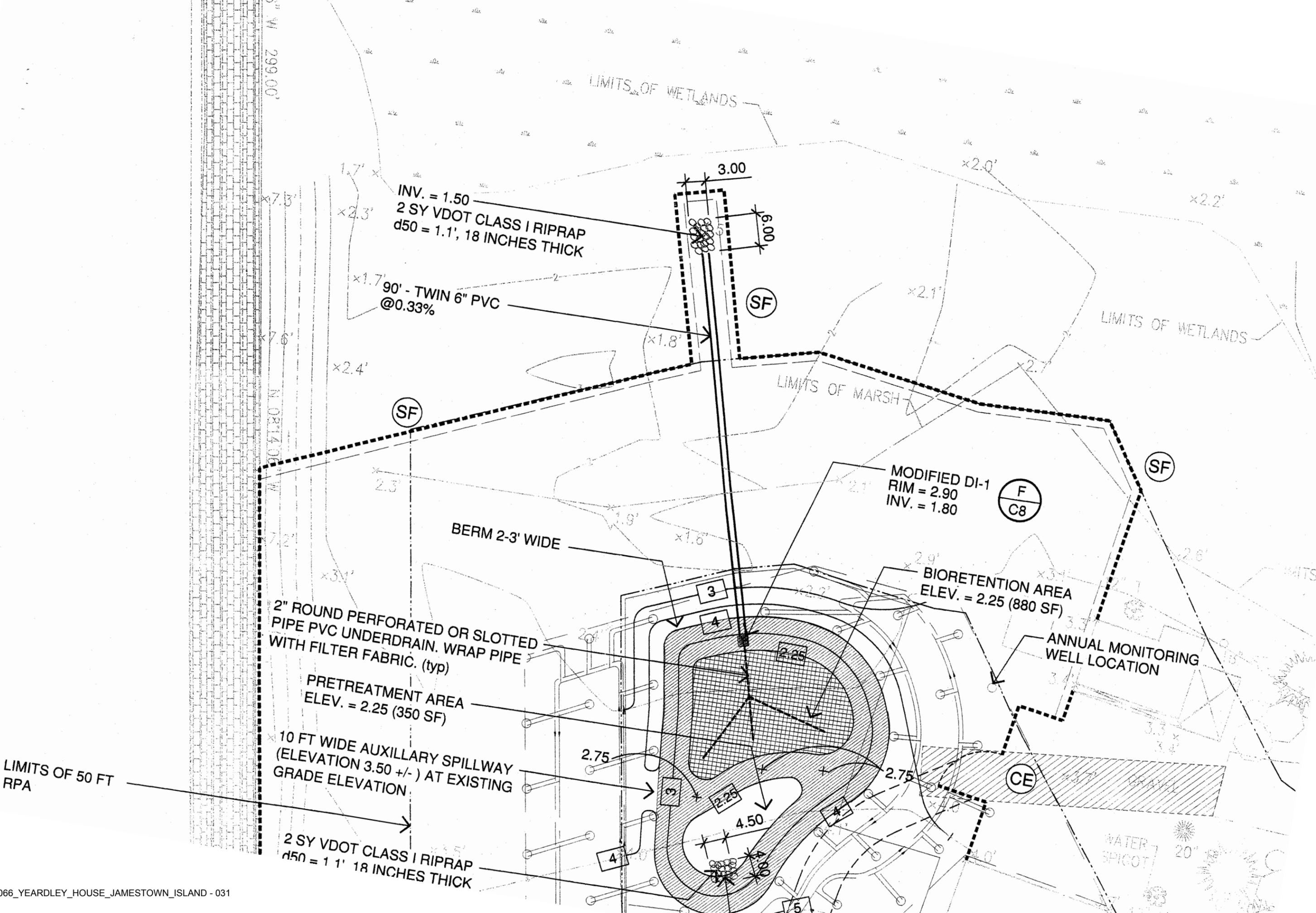
BIORETENTION AREA - WIDTH VARIES SEE PLANS

BIORETENTION AREA

NOT TO SCALE



NOTE: LOCATION OF PLANT MATERIAL TO BE FIELD ADJUSTED TO AVOID ANY CONFLICTS



INV. = 1.50
2 SY VDOT CLASS I RIPRAP
d50 = 1.1', 18 INCHES THICK

90' - TWIN 6" PVC
@0.33%

BERM 2-3' WIDE

2" ROUND PERFORATED OR SLOTTED
PIPE PVC UNDERDRAIN. WRAP PIPE
WITH FILTER FABRIC. (typ)

PRETREATMENT AREA
ELEV. = 2.25 (350 SF)

MODIFIED DI-1
RIM = 2.90
INV. = 1.80

BIORETENTION AREA
ELEV. = 2.25 (880 SF)

ANNUAL MONITORING
WELL LOCATION

GRAVEL

WATER
SPICOT

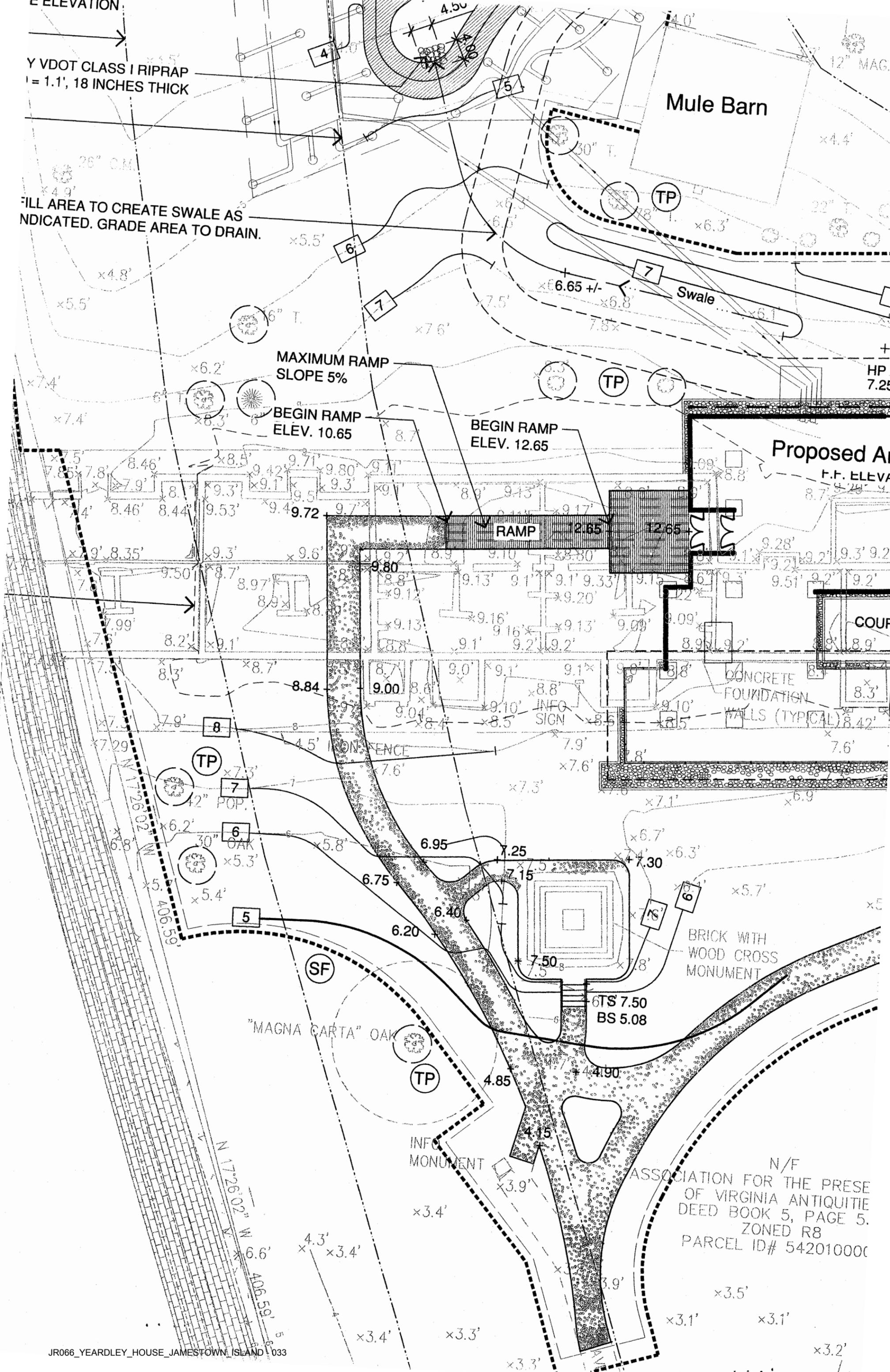
SF

SF

SF

F
C8

CE



Y VDOT CLASS I RIPRAP
 = 1.1', 18 INCHES THICK

Mule Barn

FILL AREA TO CREATE SWALE AS
 INDICATED. GRADE AREA TO DRAIN.

MAXIMUM RAMP
 SLOPE 5%

BEGIN RAMP
 ELEV. 10.65

BEGIN RAMP
 ELEV. 12.65

RAMP

Proposed Addition

F.F. ELEV.

COUP

CONCRETE FOUNDATION

WALLS (TYPICAL)

BRICK WITH
 WOOD CROSS
 MONUMENT

6TS 7.50
 BS 5.08

"MAGNA CARTA" OAK

INFO
 MONUMENT

N/F
 ASSOCIATION FOR THE PRESE
 OF VIRGINIA ANTIQUITIE
 DEED BOOK 5, PAGE 5.
 ZONED R8
 PARCEL ID# 54201000

NATIONAL PARK SERVICE
OWNED LAND

EX. ACCESS ROAD

EXIS
PRO
COL
COM
EXIS

PROJECT SITE

MARSH AREA

JAMES RIVER

GODSPEED COTT

APVA/NPS COLLECTIONS
FACILITY

MONUMENT



LOCATION MAP

*Archaearium Building
Colonial National Historical
Park, Jamestown Island*

James City County, Virginia

Prepared by **Vanasse Hangen Brustlin, Inc. (VHB, Inc.)**
477 McLaws Circle, Suite One
Williamsburg, Virginia 23185
757.220.0500 Fax 757.220.8544

SP-57-04

April 15, 2004
Revised August 12, 2004



Computations

Project: ARCHAEARIUM
 Location: JAMESTOWN
 Calculated by: LP
 Checked by:
 Title: BMP DESIGN

Project # 31005.22
 Sheet 1 of
 Date: 4-15-04
 Date: Rev. 8-12-04

BMP DESIGN SUMMARY

- POST DRAINAGE AREA FOR DETENTION = 19,150 SF (0.44 AC.)
- POST IMPERVIOUS AREA TO INCLUDE BUILDING & GRVEL OUTSIDE DRAINAGE RIDGE THAT IS PART OF ARCHAEARIUM PROJECT.
- HYDROLOGIC SOIL GROUP = USE "C" Moderately drained
 #35 "Udorthents, Loamy" PER SOIL SURVEY
- USE SCS 24 HOUR TYPE II STORM DISTRIBUTION FOR OVERALL BASIN MODELING & ROUTINGS
- JCC 24 HOUR RAINFALL DEPTHS:
 - 1-YEAR = 2.8"
 - 2-YEAR = 3.5"
 - 10-YEAR = 5.8"
- ATTENUATE 1-YEAR, 2-YEAR & 10 YEAR POST DEVELOPMENT DISCHARGES TO EXISTING (PRE DEVELOPMENT) FLOWS

• ROUTING SUMMARY:

<u>PRE DEVELOPMENT</u>	<u>POST DEVELOPMENT</u>
1 YEAR Q = 0.45 CFS	1 YEAR Q = 0.06 CFS
2 YEAR Q = 0.72 CFS	2 YEAR Q = 0.44 CFS
10 YEAR Q = 1.74 CFS	10 YEAR Q = 1.34 CFS

- BASIN TO BE DESIGNED AS A BIORETENTION / INFILTRATION FACILITY PER J.C.C. & VA SWM MANUAL.
 - MINIMUM DESIGN FOR BIORETENTION IS WQV = 1.0" PER IMPERVIOUS ACRE (50% EFFICIENCY PER JCC & 65% EFFICIENCY PER VA SWM).
 - AVERAGE PONDING DEPTH = 6"
 MAXIMUM PONDING DEPTH @ OVERFLOW = 8"
 - INFILTRATION EFFICIENCY = 65% JCC



Computations

Project: ARCHAERIUM
 Location: JAMESTOWN
 Calculated by: LP
 Checked by:
 Title

Project # 31005.22
 Sheet 2 of
 Date: 4-15-04
 Date: REV. 8-12-04

PRE DEVELOPMENT CONDITIONS TO DETENTION BASIN

D.A. = 9630 SF

BLDG = 650 SF @ CN = 98

GRAVEL WALK = 0 SF @ CN = 98

GRASSED/OPEN = 9000 SF @ CN = 74

T_c = 150' OVERLAND n = 0.130 S₀ = 4.2% = 8.6 min.

POST DEVELOPMENT TO DETENTION BASIN

D.A. = 19,150 SF

BLDG = 5355 SF @ CN = 98

GRAVEL WALK = 0 SF @ CN = 98

CONG. WALK, etc. = 525 SF @ CN = 98

GRASSED/OPEN = 13,270 SF @ CN = 74

T_c = ROOF TO SWALE = 5 min
 SWALE & PIPE FLOW = 1.8 min } = 6.8 min.

PRE DEVELOPMENT TO EXISTING BMP FOR COLLECTION'S BIRS.

(THIS AREA IS DIVERTED TO ARCHAERIUM BMP)

D.A. = 6160 SF

CN = 74 (OPEN)

T_c = 2.0 min. (75' OVERLAND @ 6±%)



Computations

Project: ARCHAEARIUM
 Location: JAMESTOWN
 Calculated by: LP
 Checked by:
 Title

Project # 31005.22
 Sheet 3 of
 Date: 4-15-04
 Date: REV 8-12-04

POST DEVELOPMENT IMPERVIOUS AT "LUDWELL SITE" OUTSIDE DRAINAGE LIMITS TO PROPOSED BMP:

$$\begin{array}{l}
 \text{BLDG} = 2530 \text{ SF} \\
 \text{GRAVEL/CONC.} = 2900 \text{ SF}
 \end{array}
 \left. \vphantom{\begin{array}{l} \text{BLDG} \\ \text{GRAVEL/CONC.} \end{array}} \right\}
 \begin{array}{l}
 5480 \text{ SF IMPERVIOUS} \\
 \text{LESS } 2900 \text{ SF GRAVEL TO BE REMOVED} \\
 = \underline{\text{NET } 2470 \text{ SF IMPERVIOUS}}
 \end{array}$$

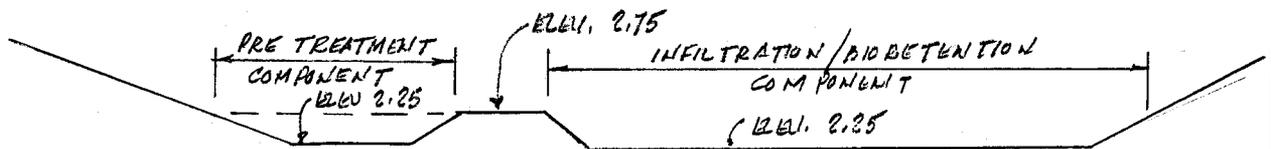
INFILTRATION DESIGN:

- IMPERVIOUS AREA SHALL INCLUDE ALL IMPERVIOUS AREA (AREA OUTSIDE DRAINAGE LIMITS TO BMP) PROPOSED, LESS IMPERVIOUS AREA TO BE REMOVED. THIS WILL YIELD A HIGHER EFFICIENCY FOR THE ACTUAL IMPERVIOUS AREA ACCOMODATED TO COMPENSATE FOR THE IMPERVIOUS AREA UNABLE TO BE TREATED.

- IMPERVIOUS AREA SUMMARY:

$$\begin{array}{l}
 \text{POST TO DETENTION BASIN} = 5880 \text{ SF} \\
 \text{POST AT 'LUDWELL SITE'} = \underline{2470 \text{ SF}} \\
 \text{TOTAL} = \underline{8350 \text{ SF}}
 \end{array}$$

- WQ VOLUME @ 1" PER IMPERVIOUS ACRE =
 $1.0" \times 8350 \text{ SF} = \underline{696 \text{ C.F. REQUIRED}}$
- PRE TREATMENT @ 25% WQ VOLUME -
 $25\% \times 696 \text{ CF} = \underline{174 \text{ CF REQUIRED}}$





Computations

Project: ARCHAERARIUM

Project # 31005.22

Location: JAMESTOWN

Sheet 4 of

Calculated by: LP

Date: 4-15-04

Checked by:

Date: REV. 8-12-04

Title

PRE TREATMENT VOLUME PROVIDED:

<u>ELEV.</u>	<u>AREA (SF)</u>	<u>A1+A2/2</u>	<u>VOL (CF)</u>	
2.25	350	0	0	} 174 CF REQ'D ✓ (OK)
2.75	650	500	250 CF	

DETENTION BASIN VOLUME (NEGLECT PRE TREATMENT)

<u>ELEV.</u>	<u>AREA (SF)</u>	<u>VOL (CF)</u>	<u>E VOL (CF)</u>
2.25	880	0	0
2.75	1210	523	523
2.86	1900	78	600
3.00	2120	402	1002
4.00	2880	2500	3502

INFILTRATION VOLUME (NEGLECT PRE TREATMENT)

ABOVE BASIN SURFACE ELEV. 2.25

<u>ELEV.</u>	<u>AREA (SF)</u>	<u>VOL (CF)</u>	<u>E VOL (CF)</u>
2.25	880	0	0
2.75	1210	523	523
3.00	2120	416	939
4.00	2880	2500	3439



Computations

Project: ARCHAERBIUM
 Location: JAMESTOWN
 Calculated by: LP
 Checked by:
 Title

Project # 31005,02
 Sheet 5 of
 Date: 4-15-04
 Date: REV 8-12-04

INFILTRATION RATE:

ESTIMATED PER SOILS REPORT: $K = 1 \times 10^{-3}$ to 1×10^{-4} cm/sec.
 1×10^{-4} cm/sec = 0.0010 cm/sec $\times 118.1102 \times 12 = \underline{1.42''/hr}$
 ↙ conversion factor
 cm/sec → foot/hr.

INFILTRATION DISCHARGE RATE (CFS)

$$Q = fISA \div 3600$$

$$f = \text{infiltration rate (FT/HR)} = 1.42'' \div 12 = 0.118 \text{ FT/HR}$$

$$SA = \text{BOTTOM AREA} = 880 \text{ SF}$$

$$I = \text{Hydraulic gradient} = 1$$

$$\therefore Q = (0.118)(1)(880) \div 3600 = \underline{0.03 \text{ CFS}}$$

MAXIMUM PONDING TIME & DEPTH:

FOR 10 YR DESIGN STORM, DRAWDOWN = 32 HOURS \checkmark (OK)
 (LESS THAN 48 HRS)

FOR 10 YR DESIGN STORM, DEPTH = 1.05 FT \checkmark (OK)
 (LESS THAN 2 FT)

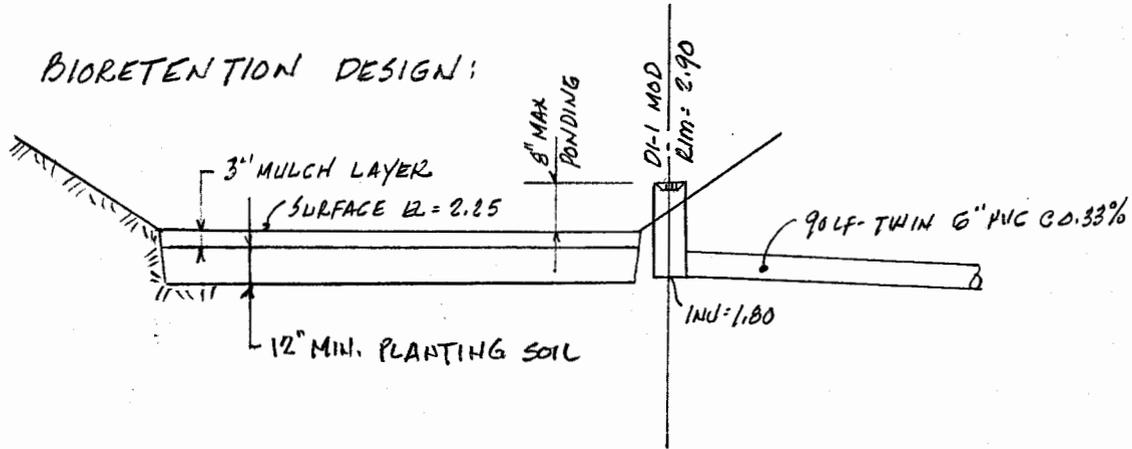
2. INFILTRATION DESIGN MEETS/EXCEEDS CRITERIA



Computations

Project: ARCHAERIUM
 Location: JAMESTOWN
 Calculated by: LP
 Checked by:
 Title

Project # 31005.22
 Sheet 6 of
 Date: 4-15-04
 Date: REV. 8-12-04

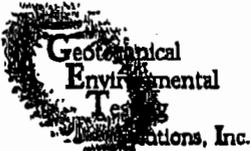


- BASIN SURFACE AREA = 880 SF
- CAPTURE VOLUME = 1.0" x IMPERVIOUS AREA
- EFFICIENCY = 65%

FOR 1" WQV DESIGN: MIN. SURFACE AREA = 5% IMPERVIOUS AREA
 IMPERVIOUS AREA = 8350 SF
 $\therefore 5\% \times 8350 \text{ SF} = \underline{418 \text{ SF MIN}}$ (880 SF PROVIDED)

DESIGN SURFACE AREA AS % IMPERVIOUS AREA = $880 \text{ SF} \div 8350 \text{ SF} = 10.5\%$
 $\therefore \text{ACTUAL TREATMENT VOLUME} = 10.5 \div 5.0 = \underline{2.1}$

\therefore BIORETENTION DESIGN MEETS/EXCEEDS CRITERIA



LOG OF BORING
No. BMP-1

PROJECT: Proposed NPS Easement at APVA **PROJECT NO.:** VB03-200G
CLIENT: Landmark Design Group
PROJECT LOCATION: James City County, VA
LOCATION: See Attached Location Plan **ELEVATION:** _____
DRILLER: Atlantic Drilling Services **LOGGED BY:** Allan Mushett, BIT
DRILLING METHOD: Rotary Wash "Mud" Drilling **DATE:** 4/11/03
DEPTH TO - WATER: INITIAL: 5 AFTER 24 HOURS: 5 **CAVING:** C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Sample No.	Blow Counts % < #200	TEST RESULTS					
					Plastic Limit	Liquid Limit	Water Content - ●	Penetration - ▨		
	EAST									
	4 Inches Topsoil									
0.33	Brown, moist, Silty CLAY (CL), very soft, [impervious]		1	1						
2	ELEV 2.5 ± Brown, moist, Silty Fine to Medium SAND (SM), very loose to loose [estimated infiltration rate of $k=1 \times 10^{-3}$ to 1×10^{-4} cm/sec]		2	2 3						
4			3	3 8						
6			4	1 3 1						
7	Boring terminated at 7 ft.									
10										
12										
14										



LOG OF BORING
No. BMP-2

PROJECT: Proposed NPS Easement at APVA **PROJECT NO.:** VB03-200G
CLIENT: Landmark Design Group
PROJECT LOCATION: James City County, VA
LOCATION: See Attached Location Plan **ELEVATION:**
DRILLER: Atlantic Drilling Services **LOGGED BY:** Allan Mushett, EIT
DRILLING METHOD: Rotary Wash "Mud" Drilling **DATE:** 4/11/03
DEPTH TO - WATER> INITIAL: \approx .5 **AFTER 24 HOURS:** \approx **CAVING>** C

This information pertains only to this boring and should not be interpreted as being indicative of the site.

Depth (feet)	Description	Graphic	Sample No.	Blow Counts % < #200	TEST RESULTS	
					Plastic Limit	Liquid Limit
	WEST					
	6 Inches Topsoil					
0.5	Gray, moist, Silty CLAY (CL), very soft to medium stiff [impervious]	[Hatched Pattern]	1	1		
2				2		
3				3		
4	Gray and Brown, moist, Silty Fine to Medium SAND (SM), trace Clay to 6 feet, very loose to medium dense [estimated infiltration rate of $k=1 \times 10^{-3}$ to 1×10^{-4} cm/sec]	[Vertical Line Pattern]	3	6		
5				1		
6				3		
7	Boring terminated at 7 ft.					
10						
12						
14						

Archaearium Revised

Type II 24-hr 1yr Rainfall=2.80"

Prepared by VHB, Inc

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8/10/2004

Stage-Area-Storage for Pond 4P: Infiltration Basin

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
2.25	880	0	3.29	2,340	1,664
2.27	893	21	3.31	2,356	1,714
2.29	906	42	3.33	2,371	1,764
2.31	920	63	3.35	2,386	1,814
2.33	933	84	3.37	2,401	1,864
2.35	946	105	3.39	2,416	1,914
2.37	959	125	3.41	2,432	1,964
2.39	972	146	3.43	2,447	2,014
2.41	986	167	3.45	2,462	2,064
2.43	999	188	3.47	2,477	2,114
2.45	1,012	209	3.49	2,492	2,164
2.47	1,025	230	3.51	2,508	2,214
2.49	1,038	251	3.53	2,523	2,264
2.51	1,052	272	3.55	2,538	2,314
2.53	1,065	293	3.57	2,553	2,364
2.55	1,078	313	3.59	2,568	2,414
2.57	1,091	334	3.61	2,584	2,464
2.59	1,104	355	3.63	2,599	2,514
2.61	1,118	376	3.65	2,614	2,564
2.63	1,131	397	3.67	2,629	2,614
2.65	1,144	418	3.69	2,644	2,664
2.67	1,157	439	3.71	2,660	2,714
2.69	1,170	460	3.73	2,675	2,764
2.71	1,184	481	3.75	2,690	2,814
2.73	1,197	502	3.77	2,705	2,864
2.75	1,210	523	3.79	2,720	2,914
2.77	1,283	556	3.81	2,736	2,964
2.79	1,356	589	3.83	2,751	3,014
2.81	1,428	622	3.85	2,766	3,064
2.83	1,501	656	3.87	2,781	3,114
2.85	1,574	689	3.89	2,796	3,164
→ 2.87	1,647	722	3.91	2,812	3,214
2.89	1,720	756	3.93	2,827	3,264
2.91	1,792	789	3.95	2,842	3,314
2.93	1,865	822	3.97	2,857	3,364
2.95	1,938	856	3.99	2,872	3,414
2.97	2,011	889			
2.99	2,084	922			
3.01	2,128	964			
3.03	2,143	1,014			
3.05	2,158	1,064			
3.07	2,173	1,114			
3.09	2,188	1,164			
3.11	2,204	1,214			
3.13	2,219	1,264			
3.15	2,234	1,314			
3.17	2,249	1,364			
3.19	2,264	1,414			
3.21	2,280	1,464			
3.23	2,295	1,514			
3.25	2,310	1,564			
3.27	2,325	1,614			

696

REQUIRED WATER QUALITY VOLUME

Archaearium Revised

Type II 24-hr 10yr Rainfall=5.80"

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Hydrograph for Pond 3P: Detention Basin

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Secondary (cfs)
5.00	0.00	0	2.25	0.00	0.00	0.00	0.00
6.00	0.00	0	2.25	0.00	0.00	0.00	0.00
7.00	0.00	0	2.25	0.00	0.00	0.00	0.00
8.00	0.01	0	2.25	0.01	0.01	0.00	0.00
9.00	0.02	0	2.25	0.02	0.02	0.00	0.00
10.00	0.03	2	2.25	0.03	0.03	0.00	0.00
11.00	0.08	85	2.33	0.03	0.03	0.00	0.00
12.00	2.63	1,558	3.22	1.30	0.03	1.27	0.00
13.00	0.15	896	2.95	0.16	0.03	0.13	0.00
14.00	0.09	860	2.93	0.10	0.03	0.07	0.00
15.00	0.07	845	2.92	0.07	0.03	0.04	0.00
16.00	0.05	834	2.92	0.06	0.03	0.03	0.00
17.00	0.05	827	2.91	0.05	0.03	0.02	0.00
18.00	0.04	822	2.91	0.04	0.03	0.01	0.00
19.00	0.04	816	2.91	0.04	0.03	0.01	0.00
20.00	0.03	809	2.90	0.03	0.03	0.00	0.00
21.00	0.03	803	2.90	0.03	0.03	0.00	0.00
22.00	0.03	797	2.90	0.03	0.03	0.00	0.00
23.00	0.03	788	2.89	0.03	0.03	0.00	0.00
24.00	0.03	775	2.89	0.03	0.03	0.00	0.00
25.00	0.00	677	2.84	0.03	0.03	0.00	0.00
26.00	0.00	569	2.78	0.03	0.03	0.00	0.00
27.00	0.00	461	2.69	0.03	0.03	0.00	0.00
28.00	0.00	353	2.59	0.03	0.03	0.00	0.00
29.00	0.00	245	2.48	0.03	0.03	0.00	0.00
30.00	0.00	137	2.38	0.03	0.03	0.00	0.00
31.00	0.00	29	2.28	0.03	0.03	0.00	0.00
32.00	0.00	0	2.25	0.00	0.00	0.00	0.00
33.00	0.00	0	2.25	0.00	0.00	0.00	0.00
34.00	0.00	0	2.25	0.00	0.00	0.00	0.00
35.00	0.00	0	2.25	0.00	0.00	0.00	0.00
36.00	0.00	0	2.25	0.00	0.00	0.00	0.00
37.00	0.00	0	2.25	0.00	0.00	0.00	0.00
38.00	0.00	0	2.25	0.00	0.00	0.00	0.00
39.00	0.00	0	2.25	0.00	0.00	0.00	0.00
40.00	0.00	0	2.25	0.00	0.00	0.00	0.00

32 HR. DRAWDOWN

GUIDANCE CALCULATION PROCEDURE**WORKSHEET A: NEW DEVELOPMENT (Archaearium at Jamestown)****1. Compile site-specific data.****POST-DEVELOPMENT**

A	area	=	<u>0.44</u>	acres
I _a	structures	=	<u>0.12</u>	acres
	gravel, etc	=	<u>0.01</u>	acres
	roadway	=	<u>0.00</u>	acres
	other	=	<u>0.00</u>	acres
	total I _a =	=	<u>0.13</u>	acres
I	= (total I _a /A) x 100	=	<u>30</u>	% expressed in whole numbers

WHERE:

A = area of site (in acres)

I_a = actual amount of impervious area**2. Calculate the pre-development load (L_{pre}).**

$$L_{pre} = \underline{0.20} \text{ lbs/ac/yr} \quad L=45 \times 0.9 \times [0.05 + (0.009 \times 16)] \times 0.26 \times A \times 2.72/12$$

3. Calculate the post-development load (L_{post}).

$$L_{post} = \underline{0.33} \text{ lbs/ac/yr} \quad L=45 \times 0.9 \times [0.05 + (0.009 \times I_{site})] \times 0.26 \times A \times 2.72/12$$

4. Calculate the pollutant removal requirement (RR)

$$\begin{aligned} RR &= L_{post} - L_{pre} \\ &= \underline{.33} - \underline{.2} \\ &= \underline{0.13} \text{ lbs/yr} \end{aligned}$$

If RR < or = 0, STOP and submit analysis to this point

If RR > 0, CONTINUE

To determine the overall BMP efficiency required (%RR) when selecting BMP options:

$$\begin{aligned} \%RR &= RR/L_{post} \times 100 \\ &= \underline{0.13} / \underline{.33} \times 100 \\ &= \underline{38.59} \% \end{aligned}$$

GUIDANCE CALCULATION PROCEDURE

WORKSHEET C: COMPLIANCE (Archaearium at Jamestown)

Select BMP options using screening tools and list them below. Then calculate the load removed for each option.

1.	Selected Option	Removal Efficiency (%/100)	x	Fraction of CBPA Drainage Area Served (expressed in decimal form)	x	L _{post} (lbs/yr)	=	Load Removed (lbs/yr)	
	<u>Std 3.11</u>	<u>0.50</u>	X	<u>1.00</u>	X	<u>0.33</u>		<u>0.17</u>	
	<u> </u>	<u> </u>	X	<u> </u>	X	<u> </u>		<u> </u>	
	<u> </u>	<u> </u>	X	<u> </u>	X	<u> </u>		<u> </u>	
	<u> </u>	<u> </u>	X	<u> </u>	X	<u> </u>		<u> </u>	
	Total Pollutants Removed								0.17

2 Calculate overall compliance.

Post Developed Pollutants - Pollutants Removed = Net Pollutants Pounds per year

0.33 - 0.17 = 0.17 pounds per year

If total load removed > or = removal requirement, criteria are satisfied.

0.17 => 0.13 therefore the removal requirement has been meet

<u>BMP Options</u>	<u>Efficiency</u>
<u>Std. 3.11</u>	
Infiltration @ 1.0 in/imp ac	50% (Per JCC)

GUIDANCE CALCULATION PROCEDURE

WORKSHEET C: COMPLIANCE (Archaearium at Jamestown)

Select BMP options using screening tools and list them below. Then calculate the load removed for each option.

1.

Selected Option	Removal Efficiency (%/100)	X	Fraction of CBPA Drainage Area Served (expressed in decimal form)	X	L _{post} (lbs/yr)	=	Load Removed (lbs/yr)
Std 3.10	0.65	X	1.00	X	0.33		0.22
_____	_____	X	_____	X	_____		_____
_____	_____	X	_____	X	_____		_____
_____	_____	X	_____	X	_____		_____
Total Pollutants Removed							0.22

2 Calculate overall compliance.

Post Developed Pollutants - Pollutants Removed = Net Pollutants Pounds per year

0.33 - 0.22 = 0.12 pounds per year

If total load removed > or = removal requirement, criteria are satisfied.

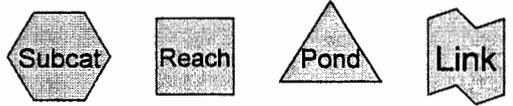
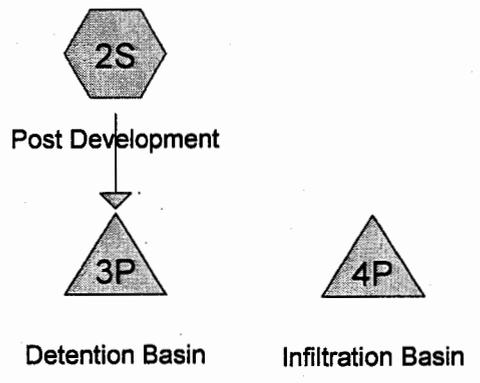
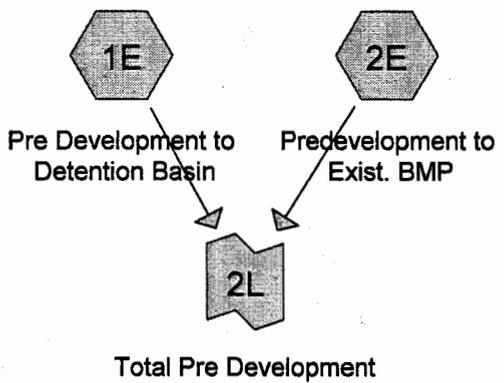
0.22 => 0.13 therefore the removal requirement has been meet

BMP Options

Efficiency

Std. 3.1

Infiltration @ 1.0 in/imp ac 65% (Per JCC)



Drainage Diagram for Archaearium Revised
 Prepared by VHB, Inc 8/12/2004
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Archaearium Revised

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Type II 24-hr 1yr Rainfall=2.80"

Page 2

8/12/2004

Time span=5.00-40.00 hrs, dt=0.05 hrs, 701 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1E: Pre Development to Detention Basin Runoff Area=9,630 sf Runoff Depth=0.88"
Flow Length=150' Tc=8.6 min CN=76 Runoff=0.30 cfs 0.016 af

Subcatchment 2E: Predevelopment to Exist. BMP Runoff Area=6,160 sf Runoff Depth=0.78"
Flow Length=75' Tc=2.0 min CN=74 Runoff=0.21 cfs 0.009 af

Subcatchment 2S: Post Development Runoff Area=19,150 sf Runoff Depth=1.16"
Flow Length=188' Tc=6.8 min CN=81 Runoff=0.87 cfs 0.043 af

Pond 3P: Detention Basin Peak Elev=2.92' Storage=840 cf Inflow=0.87 cfs 0.043 af
Discarded=0.03 cfs 0.039 af Primary=0.03 cfs 0.003 af Secondary=0.00 cfs 0.000 af Outflow=0.06 cfs 0.043 af

Pond 4P: Infiltration Basin Peak Elev=0.00' Storage=0 cf

Link 2L: Total Pre Development Inflow=0.45 cfs 0.026 af
Primary=0.45 cfs 0.026 af

Total Runoff Area = 0.802 ac Runoff Volume = 0.068 af Average Runoff Depth = 1.02"

Archaearium Revised

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Type II 24-hr 1yr Rainfall=2.80"

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8/12/2004

Subcatchment 1E: Pre Development to Detention Basin

Runoff = 0.30 cfs @ 12.01 hrs, Volume= 0.016 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 1yr Rainfall=2.80"

Area (sf)	CN	Description
630	98	Bldg
9,000	74	Grassed/open
9,630	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	150	0.0420	0.3		Sheet Flow, Range n= 0.130 P2= 3.50"

Subcatchment 2E: Predevelopment to Exist. BMP

Runoff = 0.21 cfs @ 11.93 hrs, Volume= 0.009 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 1yr Rainfall=2.80"

Area (sf)	CN	Description
6,160	74	Open

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0600	0.6		Sheet Flow, Fallow n= 0.050 P2= 3.50"

Subcatchment 2S: Post Development

Runoff = 0.87 cfs @ 11.99 hrs, Volume= 0.043 af, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 1yr Rainfall=2.80"

Area (sf)	CN	Description
5,355	98	Bldg
525	98	Conc/etc
13,270	74	Grassed/open
19,150	81	Weighted Average

Archaearium Revised

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Type II 24-hr 1yr Rainfall=2.80"

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8/12/2004

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Roof to swale
1.6	140	0.0100	1.5		Shallow Concentrated Flow, Swale Grassed Waterway Kv= 15.0 fps
0.2	48	0.0100	4.5	3.56	Circular Channel (pipe), Pipe flow Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.8	188	Total			

Pond 3P: Detention Basin

Inflow Area = 0.440 ac, Inflow Depth = 1.16" for 1yr event
 Inflow = 0.87 cfs @ 11.99 hrs, Volume= 0.043 af
 Outflow = 0.06 cfs @ 12.74 hrs, Volume= 0.043 af, Atten= 93%, Lag= 45.4 min
 Discarded = 0.03 cfs @ 11.70 hrs, Volume= 0.039 af
 Primary = 0.03 cfs @ 12.74 hrs, Volume= 0.003 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 2.92' @ 12.74 hrs Surf.Area= 2,031 sf Storage= 840 cf
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 268.4 min (1,112.2 - 843.8)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,502 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
2.80	1,900	78	600
3.00	2,120	402	1,002
4.00	2,880	2,500	3,502

#	Routing	Invert	Outlet Devices
1	Primary	1.80'	6.0" x 90.0' long Culvert X 2.00 CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1.50' S= 0.0033 '/ n= 0.012 Cc= 0.900
2	Device 1	2.90'	2.50' x 2.50' Horiz. Orifice/Grate X 0.40 Limited to weir flow C= 0.600
3	Discarded	0.00'	0.03 cfs Exfiltration at all elevations
4	Secondary	3.50'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

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Type II 24-hr 1yr Rainfall=2.80"

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Discarded OutFlow Max=0.03 cfs @ 11.70 hrs HW=2.27' (Free Discharge)
↑3=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.03 cfs @ 12.74 hrs HW=2.92' (Free Discharge)
↑1=Culvert (Passes 0.03 cfs of 1.10 cfs potential flow)
↑2=Orifice/Grate (Weir Controls 0.03 cfs @ 0.2 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=2.25' (Free Discharge)
↑4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 4P: Infiltration Basin

Routing by Dyn-Stor-Ind method

Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)

Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,439 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
3.00	2,120	416	939
4.00	2,880	2,500	3,439

Link 2L: Total Pre Development

Inflow Area = 0.362 ac, Inflow Depth = 0.84" for 1yr event
Inflow = 0.45 cfs @ 11.96 hrs, Volume= 0.026 af
Primary = 0.45 cfs @ 11.96 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

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Type II 24-hr 2yr Rainfall=3.50"

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Time span=5.00-40.00 hrs, dt=0.05 hrs, 701 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1E: Pre Development to Detention Basin

Runoff Area=9,630 sf Runoff Depth=1.37"

Flow Length=150' Tc=8.6 min CN=76 Runoff=0.48 cfs 0.025 af

Subcatchment 2E: Predevelopment to Exist. BMP

Runoff Area=6,160 sf Runoff Depth=1.24"

Flow Length=75' Tc=2.0 min CN=74 Runoff=0.34 cfs 0.015 af

Subcatchment 2S: Post Development

Runoff Area=19,150 sf Runoff Depth=1.71"

Flow Length=188' Tc=6.8 min CN=81 Runoff=1.28 cfs 0.063 af

Pond 3P: Detention Basin

Peak Elev=3.00' Storage=1,001 cf Inflow=1.28 cfs 0.063 af

Discarded=0.03 cfs 0.045 af Primary=0.41 cfs 0.018 af Secondary=0.00 cfs 0.000 af Outflow=0.44 cfs 0.063 af

Pond 4P: Infiltration Basin

Peak Elev=0.00' Storage=0 cf

Link 2L: Total Pre Development

Inflow=0.72 cfs 0.040 af

Primary=0.72 cfs 0.040 af

Total Runoff Area = 0.802 ac Runoff Volume = 0.102 af Average Runoff Depth = 1.53"

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Type II 24-hr 2yr Rainfall=3.50"

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Subcatchment 1E: Pre Development to Detention Basin

Runoff = 0.48 cfs @ 12.01 hrs, Volume= 0.025 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.50"

Area (sf)	CN	Description
630	98	Bldg
9,000	74	Grassed/open
9,630	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	150	0.0420	0.3		Sheet Flow, Range n= 0.130 P2= 3.50"

Subcatchment 2E: Predevelopment to Exist. BMP

Runoff = 0.34 cfs @ 11.93 hrs, Volume= 0.015 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.50"

Area (sf)	CN	Description
6,160	74	Open

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0600	0.6		Sheet Flow, Fallow n= 0.050 P2= 3.50"

Subcatchment 2S: Post Development

Runoff = 1.28 cfs @ 11.98 hrs, Volume= 0.063 af, Depth= 1.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 2yr Rainfall=3.50"

Area (sf)	CN	Description
5,355	98	Bldg
525	98	Conc/etc
13,270	74	Grassed/open
19,150	81	Weighted Average

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Type II 24-hr 2yr Rainfall=3.50"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Roof to swale
1.6	140	0.0100	1.5		Shallow Concentrated Flow, Swale
					Grassed Waterway Kv= 15.0 fps
0.2	48	0.0100	4.5	3.56	Circular Channel (pipe), Pipe flow
					Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.8	188	Total			

Pond 3P: Detention Basin

Inflow Area = 0.440 ac, Inflow Depth = 1.71" for 2yr event
 Inflow = 1.28 cfs @ 11.98 hrs, Volume= 0.063 af
 Outflow = 0.44 cfs @ 12.12 hrs, Volume= 0.063 af, Atten= 66%, Lag= 8.3 min
 Discarded = 0.03 cfs @ 11.55 hrs, Volume= 0.045 af
 Primary = 0.41 cfs @ 12.12 hrs, Volume= 0.018 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 3.00' @ 12.12 hrs Surf.Area= 2,120 sf Storage= 1,001 cf
 Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 219.7 min (1,052.4 - 832.7)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,502 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
2.80	1,900	78	600
3.00	2,120	402	1,002
4.00	2,880	2,500	3,502

#	Routing	Invert	Outlet Devices
1	Primary	1.80'	6.0" x 90.0' long Culvert X 2.00 CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1.50' S= 0.0033 '/ n= 0.012 Cc= 0.900
2	Device 1	2.90'	2.50' x 2.50' Horiz. Orifice/Grate X 0.40 Limited to weir flow C= 0.600
3	Discarded	0.00'	0.03 cfs Exfiltration at all elevations
4	Secondary	3.50'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

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Type II 24-hr 2yr Rainfall=3.50"

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Discarded OutFlow Max=0.03 cfs @ 11.55 hrs HW=2.27' (Free Discharge)
↳3=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.39 cfs @ 12.12 hrs HW=3.00' (Free Discharge)
↳1=Culvert (Passes 0.39 cfs of 1.14 cfs potential flow)
↳2=Orifice/Grate (Weir Controls 0.39 cfs @ 0.4 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=2.25' (Free Discharge)
↳4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 4P: Infiltration Basin

Routing by Dyn-Stor-Ind method

Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)

Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,439 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
3.00	2,120	416	939
4.00	2,880	2,500	3,439

Link 2L: Total Pre Development

Inflow Area = 0.362 ac, Inflow Depth = 1.32" for 2yr event
Inflow = 0.72 cfs @ 11.96 hrs, Volume= 0.040 af
Primary = 0.72 cfs @ 11.96 hrs, Volume= 0.040 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

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Type II 24-hr 10yr Rainfall=5.80"

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Time span=5.00-40.00 hrs, dt=0.05 hrs, 701 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1E: Pre Development to Detention Basin

Runoff Area=9,630 sf Runoff Depth=3.21"

Flow Length=150' Tc=8.6 min CN=76 Runoff=1.13 cfs 0.059 af

Subcatchment 2E: Predevelopment to Exist. BMP

Runoff Area=6,160 sf Runoff Depth=3.02"

Flow Length=75' Tc=2.0 min CN=74 Runoff=0.81 cfs 0.036 af

Subcatchment 2S: Post Development

Runoff Area=19,150 sf Runoff Depth=3.70"

Flow Length=188' Tc=6.8 min CN=81 Runoff=2.70 cfs 0.136 af

Pond 3P: Detention Basin

Peak Elev=3.30' Storage=1,748 cf Inflow=2.70 cfs 0.136 af

Discarded=0.03 cfs 0.057 af Primary=1.31 cfs 0.079 af Secondary=0.00 cfs 0.000 af Outflow=1.34 cfs 0.136 af

Pond 4P: Infiltration Basin

Peak Elev=0.00' Storage=0 cf

Link 2L: Total Pre Development

Inflow=1.74 cfs 0.095 af

Primary=1.74 cfs 0.095 af

Total Runoff Area = 0.802 ac Runoff Volume = 0.230 af Average Runoff Depth = 3.45"

Subcatchment 1E: Pre Development to Detention Basin

Runoff = 1.13 cfs @ 12.00 hrs, Volume= 0.059 af, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=5.80"

Area (sf)	CN	Description
630	98	Bldg
9,000	74	Grassed/open
9,630	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	150	0.0420	0.3		Sheet Flow, Range n= 0.130 P2= 3.50"

Subcatchment 2E: Predevelopment to Exist. BMP

Runoff = 0.81 cfs @ 11.92 hrs, Volume= 0.036 af, Depth= 3.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=5.80"

Area (sf)	CN	Description
6,160	74	Open

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0600	0.6		Sheet Flow, Fallow n= 0.050 P2= 3.50"

Subcatchment 2S: Post Development

Runoff = 2.70 cfs @ 11.98 hrs, Volume= 0.136 af, Depth= 3.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 10yr Rainfall=5.80"

Area (sf)	CN	Description
5,355	98	Bldg
525	98	Conc/etc
13,270	74	Grassed/open
19,150	81	Weighted Average

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Type II 24-hr 10yr Rainfall=5.80"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Roof to swale
1.6	140	0.0100	1.5		Shallow Concentrated Flow, Swale
					Grassed Waterway Kv= 15.0 fps
0.2	48	0.0100	4.5	3.56	Circular Channel (pipe), Pipe flow
					Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.8	188	Total			

Pond 3P: Detention Basin

Inflow Area = 0.440 ac, Inflow Depth = 3.70" for 10yr event
 Inflow = 2.70 cfs @ 11.98 hrs, Volume= 0.136 af
 Outflow = 1.34 cfs @ 12.08 hrs, Volume= 0.136 af, Atten= 51%, Lag= 6.2 min
 Discarded = 0.03 cfs @ 10.45 hrs, Volume= 0.057 af
 Primary = 1.31 cfs @ 12.08 hrs, Volume= 0.079 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 3.30' @ 12.08 hrs Surf.Area= 2,347 sf Storage= 1,748 cf
 Plug-Flow detention time= 136.3 min calculated for 0.135 af (100% of inflow)
 Center-of-Mass det. time= 136.9 min (947.5 - 810.6)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,502 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
2.80	1,900	78	600
3.00	2,120	402	1,002
4.00	2,880	2,500	3,502

#	Routing	Invert	Outlet Devices
1	Primary	1.80'	6.0" x 90.0' long Culvert X 2.00 CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1.50' S= 0.0033 '/ n= 0.012 Cc= 0.900
2	Device 1	2.90'	2.50' x 2.50' Horiz. Orifice/Grate X 0.40 Limited to weir flow C= 0.600
3	Discarded	0.00'	0.03 cfs Exfiltration at all elevations
4	Secondary	3.50'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

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Type II 24-hr 10yr Rainfall=5.80"

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Discarded OutFlow Max=0.03 cfs @ 10.45 hrs HW=2.27' (Free Discharge)
↳3=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.30 cfs @ 12.08 hrs HW=3.29' (Free Discharge)
↳1=Culvert (Barrel Controls 1.30 cfs @ 3.3 fps)
↳2=Orifice/Grate (Passes 1.30 cfs of 3.23 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=2.25' (Free Discharge)
↳4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond 4P: Infiltration Basin

Routing by Dyn-Stor-Ind method

Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)

Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,439 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
3.00	2,120	416	939
4.00	2,880	2,500	3,439

Link 2L: Total Pre Development

Inflow Area = 0.362 ac, Inflow Depth = 3.13" for 10yr event
Inflow = 1.74 cfs @ 11.95 hrs, Volume= 0.095 af
Primary = 1.74 cfs @ 11.95 hrs, Volume= 0.095 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

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Type II 24-hr 100yr Rainfall=8.00"

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Time span=5.00-40.00 hrs, dt=0.05 hrs, 701 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1E: Pre Development to Detention Basin Runoff Area=9,630 sf Runoff Depth=5.16"
Flow Length=150' Tc=8.6 min CN=76 Runoff=1.79 cfs 0.095 af

Subcatchment 2E: Predevelopment to Exist. BMP Runoff Area=6,160 sf Runoff Depth=4.93"
Flow Length=75' Tc=2.0 min CN=74 Runoff=1.30 cfs 0.058 af

Subcatchment 2S: Post Development Runoff Area=19,150 sf Runoff Depth=5.74"
Flow Length=188' Tc=6.8 min CN=81 Runoff=4.10 cfs 0.210 af

Pond 3P: Detention Basin Peak Elev=3.64' Storage=2,591 cf Inflow=4.10 cfs 0.210 af
Discarded=0.03 cfs 0.061 af Primary=1.47 cfs 0.139 af Secondary=1.16 cfs 0.010 af Outflow=2.66 cfs 0.210 af

Pond 4P: Infiltration Basin Peak Elev=0.00' Storage=0 cf

Link 2L: Total Pre Development Inflow=2.78 cfs 0.153 af
Primary=2.78 cfs 0.153 af

Total Runoff Area = 0.802 ac Runoff Volume = 0.363 af Average Runoff Depth = 5.44"

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Type II 24-hr 100yr Rainfall=8.00"

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Subcatchment 1E: Pre Development to Detention Basin

Runoff = 1.79 cfs @ 12.00 hrs, Volume= 0.095 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100yr Rainfall=8.00"

Area (sf)	CN	Description
630	98	Bldg
9,000	74	Grassed/open
9,630	76	Weighted Average

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.6	150	0.0420	0.3		Sheet Flow, Range n= 0.130 P2= 3.50"

Subcatchment 2E: Predevelopment to Exist. BMP

Runoff = 1.30 cfs @ 11.92 hrs, Volume= 0.058 af, Depth= 4.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100yr Rainfall=8.00"

Area (sf)	CN	Description
6,160	74	Open

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.0	75	0.0600	0.6		Sheet Flow, Fallow n= 0.050 P2= 3.50"

Subcatchment 2S: Post Development

Runoff = 4.10 cfs @ 11.98 hrs, Volume= 0.210 af, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
Type II 24-hr 100yr Rainfall=8.00"

Area (sf)	CN	Description
5,355	98	Bldg
525	98	Conc/etc
13,270	74	Grassed/open
19,150	81	Weighted Average

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Type II 24-hr 100yr Rainfall=8.00"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, Roof to swale
1.6	140	0.0100	1.5		Shallow Concentrated Flow, Swale Grassed Waterway Kv= 15.0 fps
0.2	48	0.0100	4.5	3.56	Circular Channel (pipe), Pipe flow Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
6.8	188	Total			

Pond 3P: Detention Basin

Inflow Area = 0.440 ac, Inflow Depth = 5.74" for 100yr event
 Inflow = 4.10 cfs @ 11.98 hrs, Volume= 0.210 af
 Outflow = 2.66 cfs @ 12.06 hrs, Volume= 0.210 af, Atten= 35%, Lag= 5.1 min
 Discarded = 0.03 cfs @ 9.10 hrs, Volume= 0.061 af
 Primary = 1.47 cfs @ 12.06 hrs, Volume= 0.139 af
 Secondary = 1.16 cfs @ 12.06 hrs, Volume= 0.010 af

Routing by Dyn-Stor-Ind method, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs
 Peak Elev= 3.64' @ 12.06 hrs Surf.Area= 2,603 sf Storage= 2,591 cf
 Plug-Flow detention time= 97.9 min calculated for 0.210 af (100% of inflow)
 Center-of-Mass det. time= 98.5 min (896.7 - 798.2)

#	Invert	Avail.Storage	Storage Description
1	2.25'	3,502 cf	Custom Stage Data (Prismatic) Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2.25	880	0	0
2.75	1,210	523	523
2.80	1,900	78	600
3.00	2,120	402	1,002
4.00	2,880	2,500	3,502

#	Routing	Invert	Outlet Devices
1	Primary	1.80'	6.0" x 90.0' long Culvert X 2.00 CPP, square edge headwall, Ke= 0.500 Outlet Invert= 1.50' S= 0.0033 '/ n= 0.012 Cc= 0.900
2	Device 1	2.90'	2.50' x 2.50' Horiz. Orifice/Grate X 0.40 Limited to weir flow C= 0.600
3	Discarded	0.00'	0.03 cfs Exfiltration at all elevations
4	Secondary	3.50'	10.0' long x 4.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Archaearium Revised

Type II 24-hr 100yr Rainfall=8.00"

Prepared by VHB, Inc

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HydroCAD® 7.01 s/n 001238 © 1986-2004 Applied Microcomputer Systems

8/12/2004

Discarded OutFlow Max=0.03 cfs @ 9.10 hrs HW=2.27' (Free Discharge)
←3=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.46 cfs @ 12.06 hrs HW=3.62' (Free Discharge)
←1=Culvert (Barrel Controls 1.46 cfs @ 3.7 fps)
←2=Orifice/Grate (Passes 1.46 cfs of 8.05 cfs potential flow)

Secondary OutFlow Max=1.05 cfs @ 12.06 hrs HW=3.62' (Free Discharge)
←4=Broad-Crested Rectangular Weir (Weir Controls 1.05 cfs @ 0.8 fps)

Pond 4P: Infiltration Basin

Routing by Dyn-Stor-Ind method

Peak Elev= 0.00' @ 0.00 hrs Surf.Area= 0 sf Storage= 0 cf

Plug-Flow detention time= (not calculated)

Center-of-Mass det. time= (not calculated)

#	Invert	Avail.Storage	Storage Description	
1	2.25'	3,439 cf	Custom Stage Data (Prismatic) Listed below	
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
2.25	880	0	0	
2.75	1,210	523	523	
3.00	2,120	416	939	
4.00	2,880	2,500	3,439	

Link 2L: Total Pre Development

Inflow Area = 0.362 ac, Inflow Depth = 5.07" for 100yr event

Inflow = 2.78 cfs @ 11.95 hrs, Volume= 0.153 af

Primary = 2.78 cfs @ 11.95 hrs, Volume= 0.153 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-40.00 hrs, dt= 0.05 hrs

ARCHAERIUM BUILDING

SEQUENCE OF CONSTRUCTION

PROJECT DESCRIPTION

The National Park Service (NPS) and the Association for the Preservation of Virginia Antiquities (APVA) have initiated "The Jamestown Project," which has an overriding purpose to jointly research, protect and present to the public the resources at Jamestown Island. One component of this project is to construct a new archaeological exhibit facility

The APVA is proposing to construct this facility, the Archaearium Building, near the existing Jamestown Rediscovery Center, on the south side of Pitch and Tar Swamp at the west end of the historic site on APVA property (Old Towne part of the Townsite). The Archaearium would provide 7,500 square feet of museum space. The Archaearium also provides expansive views to the historic landscape which coupled with virtual reality technology will provide the visitor a visual timeline of the evolution of the Jamestown Landscape. The Facility also provides visitor and staff support such as comfort facilities and work areas. The Archaearium would be adjacent to an existing historical site and is an integral part of the visitor experience of Historic *Jamestowne*.

EXISTING SITE CONDITIONS

The elevation of the Archaearium Building site ranges from approximately 2.0 ft. at the Pitch and Tar Swamp to approximately 10 feet in the area of the Ludwell archaeological site. The proposed improvements are within the area of the existing landscaped areas.

ADJACENT AREAS

There are no adjacent areas that would be affected by the proposed project improvements. There is no disturbance proposed for areas outside the limits of work indicated on the plans.

OFF-SITE AREAS

There are no off-site land disturbing activities or areas that will be disturbed off-site as a result of the proposed Archaearium Building.

SOILS

The soils of Jamestown Island area are described and classified in the Soil Survey of James City and York Counties and the City of Williamsburg Virginia (Hodges et al, 1985).

The project area soil types are described below:

Soil Mapping Unit 23 - Newflat silt loam. The Newflat silt loam is a somewhat poorly drained soil that occurs on nearly level, broad flats of intermediate river terraces. The surface layer is a silt loam approximately 8 inches thick. The upper 3 inches of the subsoil is typically a silty clay loam, and below this layer is clay. Features of this soil type include a very slow permeability rate, slow surface runoff, and slight erosion hazard. The seasonal high water table occurs at a depth of 0.5 to 1.5 feet during the winter and early spring.

Soil Mapping Unit 32 - Tetotum silt loam. The Tetotum silt loam is a moderately well drained soil that occurs on low-lying terraces. The permeability is moderate, the surface runoff is slow, and the erosion hazard is slight. The surface layer of 5 inches is a silt loam, and the subsurface layer is a loam about 5 inches thick. The subsoil varies in texture either as a silt loam, silty clay loam, clay loam and loam approximately 41 inches thick. The seasonal high water table is at a depth of 1.5 to 2.5 feet in the winter and early spring.

Soil Mapping Unit 35- Udorthents, loamy. Udorthents are moderately well drained to well drained soils that have been previously disturbed due to excavation and/or grading. The permeability, runoff, and erosion rates vary widely based on the texture and gravel content. Generally, the topsoil has been removed, and further on-site studies should be performed to determine the suitability of any land use.

CRITICAL AREAS

There no critical areas or steep slopes located on the site.

EROSION AND SEDIMENT CONTROL MEASURES

The methods used during the construction of the Archaearium Building to control erosion and sedimentation on site are depicted on sheet C6. Erosion and Sediment Control Details are provided on sheet C2. The erosion and sediment control methods incorporated include silt fence, construction entrance, tree protection, inlet/outlet protection and other measures in accordance with Virginia Erosion and Sediment Control Handbook, 3rd Edition, 1992.

PERMANENT STABILIZAATION

Permanent stabilization will be accomplished by planting grasses, shrubs and trees as shown on the Landscape Plan, sheet C7.

STORMWATER RUNOFF CONSIDERATIONS

The project improvements do not increase the peak stormwater runoff rates. Existing outfalls remain in service at all times. Improvements to stormwater systems are depicted on sheet C6.

CALCULATIONS

Calculations for proposed sediment basins and stormwater management calculations for the systems depicted on the plans have been provided separately to James City County.

SEQUENCE OF CONSTRUCTION

GENERAL

SEQUENCE OF CONSTRUCTION AND E & SC NARRATIVE

\\Vawill\projects\31005.22\docs\letters\Archaearium\ARCHAEARIUM BUILDING SEQ OF Construction.doc

The Archaearium Building project consists of two project elements consisting of the construction of a new Archaearium Building adjacent to the existing Ludwell archaeology site and construction of a bio-retention BMP. The proposed building is outside the RPA whereas a portion of the BMP is within the RPA. A waiver from the James City County Chesapeake Bay Ordinance for construction of the BMP within the RPA has been requested from the James City County Environmental Division.

The project work will begin with the installation and construction of required erosion and sediment control measures as depicted on the plans and in the details. The required E&SC measures include, but are not limited to, silt fence, tree protection, construction entrance and inlet/outlet protection.

Once the E&SC measures have been installed, construction of the water and sanitary sewer lines extensions to the building will begin. The water and sanitary connections are made to the existing privately owned system. There is no water or sanitary sewer connections proposed to public JSCA systems. Immediately upon completion of the water and sanitary utilities, all disturbed areas will be topsoiled as required and properly stabilized.

Construction of the Archaearium building will begin in logical sequence to, or concurrent with, the site work. Existing E&SC measures will be checked to ensure effectiveness and additional measures, such as additional silt fence along the wetland and inlet/outlet protection will be added as required for the construction of the new Archaearium Building. The building will be constructed and connected to the new water and sanitary extensions.

The final project element to be constructed will be the BMP. The BMP area will be excavated as shown on the grading plan. The BMP will be backfilled with the specified planting soil to the required elevations. Upon completion of the BMP grading and planting, the RPA buffer area will be restored as indicated in the plans.

Once the BMP and surrounding areas have been fully planted with the specified seed mixtures and plantings and all the areas are stabilized, the E&SC measures will be removed.

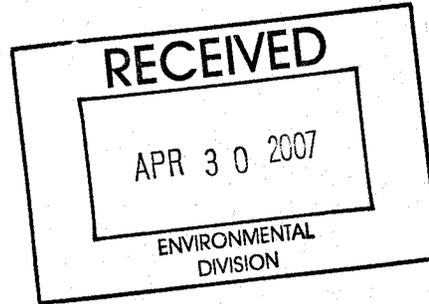
There are no proposed stock pile areas for the site. The contractor is to haul in material only as needed for immediate use. All excavated material that is not immediately reused, or is unsuitable for reuse, is to be removed immediately from the site.

Vanasse Hangen Brustlin, Inc.

Transportation
Land Development
Environmental Services



351 McLaws Circle, Suite 3
Williamsburg, Virginia 23185
757 220-0500
FAX 757 220-8544



Transmittal

Deliver To: Mr. Darryl E. Cook, P.E.
Environmental Director

From: Tim Hogan, PE
THogan@vhb.com

Company: James City County
Environmental Division

VHB Project No.: 31696.01

Telephone No.: 757.253.6673

FAX No.:

SP-57-04
JR 066

Date and Time:

April 30, 2007

Attached are the following for the Jamestown Archaearium Building Project (**JCC Plan No. SP - 57 - 04**):

- One (1) hard copy of Jamestown Archaearium BMP As-Built Record Drawing
- One (1) mylar of Jamestown Archaearium BMP As-Built Record Drawing
- Record Drawing Checklist

If you have any questions regarding the above, please call me at (757) 220-0500.



**James City County Environmental Division
Stormwater Management / BMP Inspection Report
Bioretention Facilities**

County BMP ID Code (if known): JR 066
 Name of Facility: Archaerum at Historic Jamestown BMP No.: _____ Date: _____
 Location: 1365 Colonial Parkway Jamestown Island
 Name of Owner: Association for the Preservation of VA Antiquities
 Name of Inspector: Gregory B. Johnson
 Type of Facility: Bioretention Basin
 Weather Conditions: _____ 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 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
Accessibility:				
Roads	✓			
Parking Areas	✓			
Gates	N/A			
Locks	N/A			
Safety Fencing	N/A			
Observation Wells/Areas:				
Trap Doors	N/A			
Manhole Covers	N/A			
Grates			NOT INSTAL	Grate needs to be installed
Steps	N/A			
Pretreatment Devices: <input checked="" type="checkbox"/> Inlet <input checked="" type="checkbox"/> Sump <input checked="" type="checkbox"/> Forebay <input type="checkbox"/> Other				
Sediment	✓			
Trash & Debris	✓			
Structure		Sediment		
Other	N/A			
Inflow Structure (Describe Type/Location):				

Facility Item	O.K.	Routine	Urgent	Comments
Condition	✓			
Erosion		✓		Area where pipe installed needs stabilized
Trash and Debris	✓			
Sediment	✓			
Aesthetics	✓			
Other				
Primary Infiltration (Bioretention Cell) Area:				
Specialty Landscaping	✓			
Mulch Layer	✓			
Planting Soil/Sand	✓			
Subgrade Soil	✓			
Aggregate	✓			
Underdrain	✓			
Sediment	✓			
Aesthetics	✓			
Overflow or Bypass Control Structure (Describe Type/Location):				
Condition	✓			
Erosion	✓			
Trash & Debris			✓	Needs cleaned of mulch and sediment
Sediment	✓			
Other	N/A			
Outlet Structure (Describe Type/Location):				
Condition	✓			
Erosion	✓			
Trash & Debris		●	✓	Blocked by mulch
Sediment			✓	
Other	N/A			
Contributing Drainage Area/Perimeter Conditions:				
Land Use	✓			
Stabilization	✓			
Trash & Debris	✓			
Pollutant Hazard	N/A			
Other	N/A			

Facility Item	O.K.	Routine	Urgent	Comments
<p>Sketch and/or Remarks:</p> <p>Area by sea wall and pond needs to be stabilized.</p> <p>1/23/08 - All issues addressed</p>				
<p>Overall Environmental Division Internal Rating: _____</p> <p>Signature: <u><i>[Signature]</i></u> Date: <u>1/23/08</u></p> <p>Title: <u><i>[Signature]</i></u></p>				

SWMPProg\BMP\CoInspProg\Bioret.wpd



JAMESTOWN ISLAND ARCHAERIUM BUILDING
JCC PLAN No. SP-57-04

STORMWATER MANAGEMENT FACILITY MAINTENANCE

THE OWNER SHALL BE RESPONSIBLE FOR ESTABLISHING THE SCHEDULED MAINTENANCE PLAN OF THE ON-SITE STORMWATER MANAGEMENT FACILITY. THE MAINTENANCE REQUIREMENTS ARE TO BE PERFORMED BY THE OWNER OR ITS DESIGNATED REPRESENTATIVE. THE MIMIMUM MAINTENANCE REQUIREMENTS ARE OUTLINED AS FOLLOWS:

ROUTINE MAINTENANCE:

A. MOWING - THE BASIN'S EMBANKMENT SLOPES SHALL BE MOWED TO DISCOURAGE WOODY GROWTH AND TO CONTROL WEEDS. THE FREQUENCY OF MOWING SHALL DEPEND ON VISUAL INSPECTIONS PERFORMED AT LEAST FOUR TIMES A YEAR. TREES AND SHRUBS SHOULD NOT BE PERMITTED TO GROW ON ANY PART OF THE GRADED EMBANKMENTS. VEGETATED AREAS SHALL BE RESEEDD AS NECESSARY TO MAINTAIN VEGETATIVE COVER.

B. INSPECTIONS - THE ENTIRE BASIN AREA, EMBANKMENT SLOPES, AND OUTLET CONTROL STRUCTURES SHALL BE INSPECTED ON AN ANNUAL BASIS. INSPECTION PRIORITIES SHALL AT A MINIMUM INCLUDE CHECKING FOR SIDE SLOPE OR EMBANKMENT EROSION; TREE AND SHRUB GROWTH; CONDITION OF THE OUTLET CONTROL STRUCTURE, AND THE ACCUMULATION OF SEDIMENT, DEBRIS OR CLOGGING OF THE OUTLET CONTROL STRUCTURE. AT LEAST ONCE PER YEAR, THE OUTLET CONTROL STRUCTURE SHALL BE CLEANED OF ANY ACCUMULATED SEDIMENT.

C. DEBRIS AND LITTER REMOVAL - ANY ACCUMULATION OF DEBRIS AND LITTER NEAR THE OUTLET CONTROL STRUCTURES, PARTICULARLY FLOATABLE DEBRIS, SHALL BE REMOVED DURING SCHEDULED MOWING OPERATIONS OR AS NEEDED. SEDIMENT AND DEBRIS SHALL BE REMOVED FROM THE FACILITY AND DISPOSED OF IN A MANNER ACCEPTIBLE BY THE OWNER.

NON-ROUTINE MAINTENANCE:

A. STRUCTURAL REPAIRS AND REPLACEMENT - REPAIRS OR REPLACEMENT OF THE EMBANKMENT AND OUTLET CONTROL STRUCTURES SHALL BE PERFORMED ON AN AS-NEEDED BASIS TO INSURE PROPER OPERATION.

B. SEDIMENT REMOVAL - AFTER EACH SIGNIFICANT RAINFALL (ONE INCH OR MORE WITHIN A 24 HOUR PERIOD), THE BASIN AREAS SHALL BE INSPECTED FOR ACCUMULATION OF SEDIMENT OR DEBRIS WHICH MAY HINDER THE PERFORMANCE OF THE OUTLET CONTROL STRUCTURE.