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: **CC-014**

DATE VERIFIED: **March 21, 2012**

QUALITY ASSURANCE TECHNICIAN: **Leah Hardenbergh**

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA

Stormwater Division

MEMORANDUM

DATE: March 11, 2010

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

FROM: Jo Anna Ripley, Stormwater

PO: 270712

RE: Files Approved for Scanning

General File ID or BMP ID: CC014

PIN: 4910100006

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

Property Description: Parcel B Section 5

Site Address: 110A Overlook Drive

(For internal use only) **Box** 12 **Drawer:** 7

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

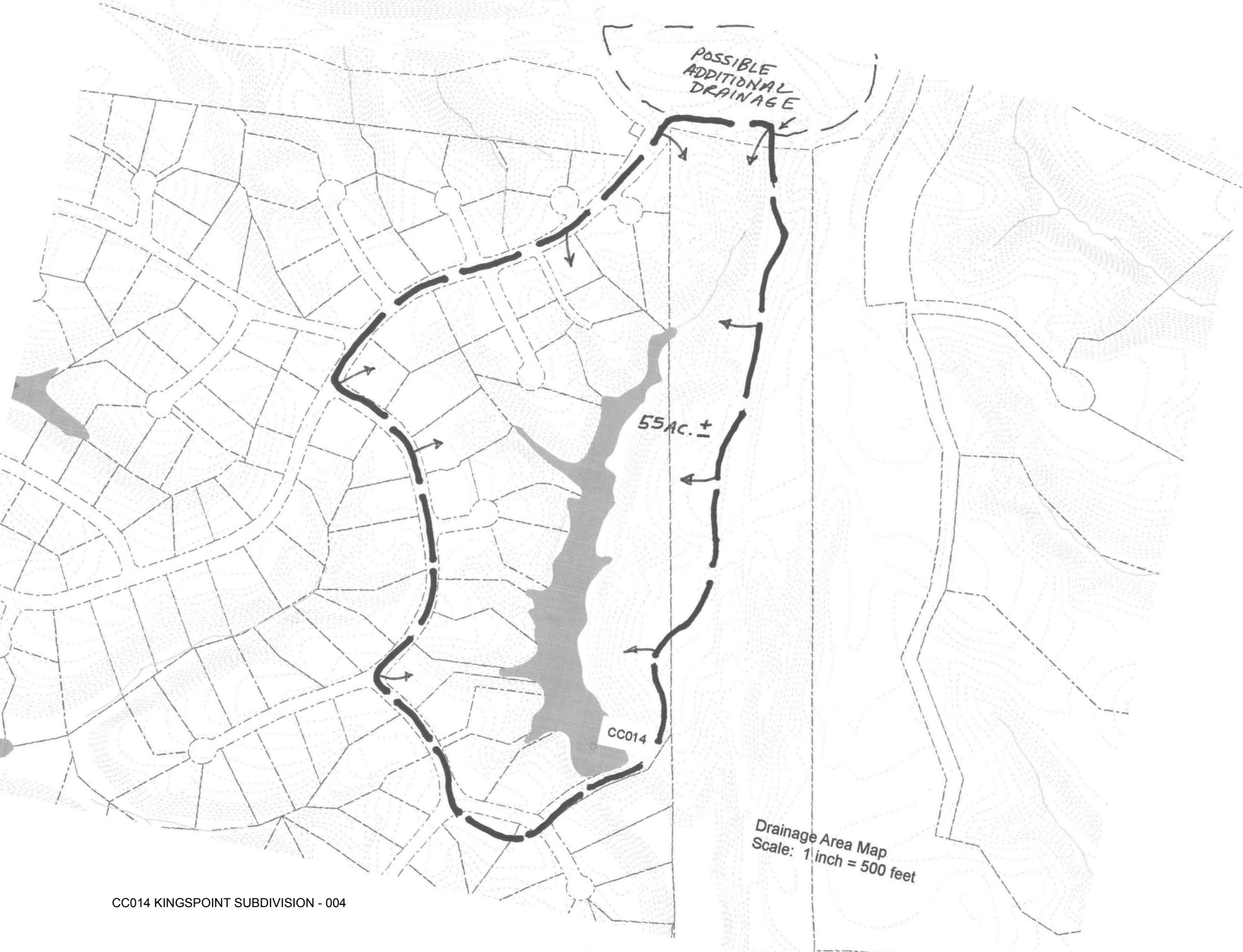
Comments
Private Dam

CC014

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
6. Maintenance Agreement
7. Correspondence with owners
8. Inspection Records
9. Enforcement Actions



CC014 KINGSPOINT SUBDIVISION - 004

Prudential McCardle

FACSIMILE TRANSMITTAL SHEET

PAGE 1 OF 6 DATE: 11-4-04

TO: Scott Thomas

FAX # (757) 259-4032

PHONE (757) 253-6639

FROM: Mike Lyttle (757) 564-0767

Providing Exceptional Service. Achieving Exceptional Results.

- ☐ 1201 Jamestown Rd., Williamsburg, VA 23185 (757) 253-5686 FAX: (757) 229-7227
- ☐ 811 Richmond Rd., Williamsburg, VA 23185 (757) 229-6151 FAX: (757) 220-5630
- ☐ 3449 John Tyler Hwy, Williamsburg, VA 23185 (757) 220-9500 FAX: (757) 220-0703
- ☐ 758 McGuire Place, Newport News, VA 23601 (757) 596-2000 FAX: (757) 599-6808
- ☐ 7405 Richmond Road, Williamsburg, VA 23188 (757) 565-4696 FAX: (757) 565-4727

REMARKS:

Scott, Is the County responsible for maintaining a possible entrance into the TAN lane lot, and if so who repairs the dam which a portion of the road entrance into the TAN Lot?

- Final Decree 5pgs.
- Map of Lot w/Dam 2pg.

Note: If you do not receive all pages as stated, please call us at the office indicated.

If the reader of this message is not the intended recipient, or the employee or agent responsible to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited.

If you have received this communication in error, immediately notify us by telephone and return the original message to us at the designated sender address via the U.S. Postal Service.

Prudential McCardle Realty

Independently Owned and Operated

LPO – TAN

Mike Roberts NEXT TO

- Dam letter should be addressed to all applicable owners/interest in dam.

- Letters from County has caused responsibility to fall on them unjustly (is BURDEN JUST MR. TAN)

- Asking for updated report: addressing to all applicable owners.

NO OBLIGATION! PRIVATE LAKE PRIVATE DAM

Wayland 1999 Snoff TAN documents before ownership was

1. CAN IT BE DONE?
2. HOW TO DO IT?

Very desparate Conservpmt? POR?

THIS LETTER WAS ISSUED. THIS IS A COPY.

February 23, 2001

Benson Dexter
6 Firethorn Place
Williamsburg, Va. 23185

Re: Kingspoint Subdivision
Large Lake (County ID No. CC 014)
East Side/Overlook Drive Vicinity

Dear Mr. Dexter:

In response to your recent request and a joint visit to the site on February 20th 2001, the Environmental Division is forwarding the following information to you relative to the above referenced facility.

The subject facility is an older, large lake impoundment which provides for stormwater quantity control. It has very limited stormwater quality control aspects. The facility has a high earthen embankment which bridges across a narrow, deep valley and contains a brick-box riser structure with a corrugated metal outlet barrel. The facility suffered considerable downstream embankment and outlet barrel damage (but not a complete failure) as a result of Hurricane Floyd in September 1999. Damage, as observed, included severe surface erosion and a slope/bank (slide) failure on the downstream embankment in the vicinity above and around the outlet barrel. The downstream portion of the outlet barrel has completely separated from an existing junction box which was located about midway through the downstream embankment.

It is presumed, pending further detailed investigation, that the cause of the partial failure was due to the following four (4) causes, either working separately or in conjunction with each other:

1) Storm runoff from the paved channel on the west abutment toe (adjacent lot and access roadway) caused accelerated surface erosion of the embankment in the vicinity of the junction box, the outlet barrel and on downstream portions of the embankment.

2) Seepage and piping along the outlet barrel due to internal corrosion of the corrugated metal pipe (CMP). Flow through the pipe may have found its way into small holes in the walls of the pipe and subsequently into the pipe's backfill material. A seepage condition of this kind can result in internal and subsurface erosion within the embankment and can cause piping failure. Piping is well documented to be a leading cause of dam failures.

3) Loss of compaction on the engineered soil embankment due to the presence of tree (root mats) or improper construction. Compaction of earthen embankment soil is an essential component as it increases the strength of the fill and its resistance to erosion from surface runoff.

4) A considerable amount of older, established trees (pines), shrubs and woody vegetation were present on the downstream embankment. Saturated roots mats combined with high wind can cause trees to overtop during storm events and accelerate soil erosion and embankment failure.

As such, immediate repair of the damage is necessary. The integrity of the dam embankment is now questionable from a structural and stormwater control perspective. Based on our inspection, the repair plan should generally consist of, but is not limited to, the following items. Any repair plans for the structure should strive to eliminate or reduce the causes as outlined above.

Recommended Repair Plan:

1. Clear and remove existing debris and unsuitable soils from the repair (slide) area.

2. Replace embankment fill material with acceptable soil fill, properly compacted. New fill shall be properly keyed into the existing embankment soils.

3. Clean and repair the existing brick box riser structure as necessary.

4. Reline the existing CMP from the riser structure to the repair (slide) area. Grout the void space between the new culvert and the host pipe. Also, pressure inject grout into any eroded areas along the pipe barrel to the greatest extent possible.

5. Similar to the previous design, a well-anchored access structure (manhole or inlet) will be necessary at the end of the reline pipe where the outlet barrel changes direction. Provide adequate means to convey surface drainage from the west abutment paved toe channel into the access structure or to the base (toe) of embankment without causing surface erosion.

6. Provide a new outlet barrel from the new access structure to the base (toe) of embankment. Reinforced concrete pipe is recommended for this application, although other pipe material types may be considered if adequately designed for hydraulic and structural conditions.

7. Provide adequate outlet protection (riprap) at the outfall end of the new barrel.

8. Stabilize all disturbed areas with seed and mulch. Any embankment slopes steeper than 3H:1V would require erosion control matting.

9. Based on County and State requirements, trees, shrubs and woody vegetation are not permitted to grow on any part of pond embankments constructed using engineered (compacted) fills; therefore all trees present on the downstream embankment should be cut flush to or below ground level and be maintained in that fashion as to not disturb root systems that may already be extensive. Efforts should then be made to reduce tree re-growth and establish a low-maintenance grass covering.

10. Adequate mechanisms would need to be in place from applicable property owners to access and repair the facility.

County Permit and Review Requirements:

Since it appears that access and repair work activities would result in 2,500 square feet or more of land-disturbance, the repair plan for the facility would be subject to the plan of development review process under the provisions of the Chapter 23 Chesapeake Bay Preservation and Chapter 8 Erosion and Sediment Control ordinances of James City County. Review of this plan would be mainly through the Environmental Division, since it would appear to only involve land-disturbance activity consisting of installation of erosion and sediment controls and repair activities to an existing structure.

Since the repair plan would involve work on an engineered embankment, the plan should be prepared by a qualified professional engineer who is qualified to prepare plans, details, sequences of construction, computations (hydraulic, structural, etc.) and specifications as necessary for dam construction and in accordance with the requirements of the County ordinances. *Note: Based on available County mapping, it appears that Resource Protection Area (RPA) is located in the surrounding vicinity downstream of the repair area. There will be distinct restrictions on impact to RPA.*

Over the past year, we have waived land-disturbance permit bond and application fee requirements for Hurricane Floyd damage-related projects that involved repair to stormwater management facilities. As time passes, we have also become more discretionary as to whether projects should still fall under that category. Based on our review of this particular project, our division would waive bonding and application fees associated with the land-disturbance permit process. However, a land-disturbance permit would still be required. Also, although not required, it is highly recommended that repairs made to the facility be certified by a registered land surveyor and/or engineer under the current County Record Drawing and Construction Certification process to ensure work is performed in accordance with the project plans and specifications.

We fully support repair of this facility and are here to assist you at any time. If you have any additional questions or comments regarding this issue, please contact me at 757-253-6639 or Darryl Cook at 757-253-6673.

Sincerely,

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

SJT/sjt

File: SWMProg\Education\Subdivisions\Kingspoint.let1

Benson
Detter
2/16/07
CAC
(Built 1969)

108
110 Overlook Dr.

DEVELOPMENT MANAGEMENT

101-E MOUNTS BAY ROAD, P.O. BOX 8784, WILLIAMSBURG, VIRGINIA 23187-8784
(757) 253-6671 Fax: (757) 253-6850 E-MAIL: devtman@james-city.va.us

CODE COMPLIANCE
(757) 253-6626
codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
(757) 253-6670
environ@james-city.va.us

PLANNING
(757) 253-6685
planning@james-city.va.us

COUNTY ENGINEER
(757) 253-6678

INTEGRATED PEST MANAGEMENT
(757) 259-4116

February 23, 2001

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Sincerely,

Scott J. Thomas

Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

SJT/sjt

File: SWMProg\Education\Subdivisions\Kingspoint.let1

James City County Environmental Division
Stormwater Management / BMP Inspection Report
Detention and Retention Pond Facilities

Database Inventory No. (if known): CC 014

Name of Facility: KINGSPONTE SUBDIVISION LARGE BMP LAKE BMP No.: ___ of ___ Date: 02/20/01

Location: 110 OVERLOOK DRIVE (GPIN 49102500 2b & 49101000 6b)

Name of Owner: ___

Inspector: SJ Thomas

Type of Facility: Wet POND

Weather Conditions: Sunny, Warm, Mid 50's

N

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.
Routine - The item checked requires attention, but does not present an immediate threat to the function 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
Embankments and Side Slopes:	LARGE, HIGH EMBANKMENT			
Grass Height	X			
Vegetation Condition	X			
Tree Growth		X	X	LARGE TREES & PINES ON TOP & D/S EMBANKMENT
Erosion		X	X	D/S SLIDE FAILURE @ END BARREL.
Trash & Debris	X			
Seepage		X		SEEPAGE NOTED D/S LEFT (EAST) TOE WITH NAT. GROUND.
Fencing or Benches	X			
Interior Landscaping/Planted Areas:	☒ None	☐ Constructed Wetland/Shallow Marsh	☐ Naturally Established Vegetation	
Vegetated Conditions				LARGE PERM. POOL.
Trash & Debris				
Floating Material				
Erosion				
Sediment				
Dead Plant				
Aesthetics				
Other				

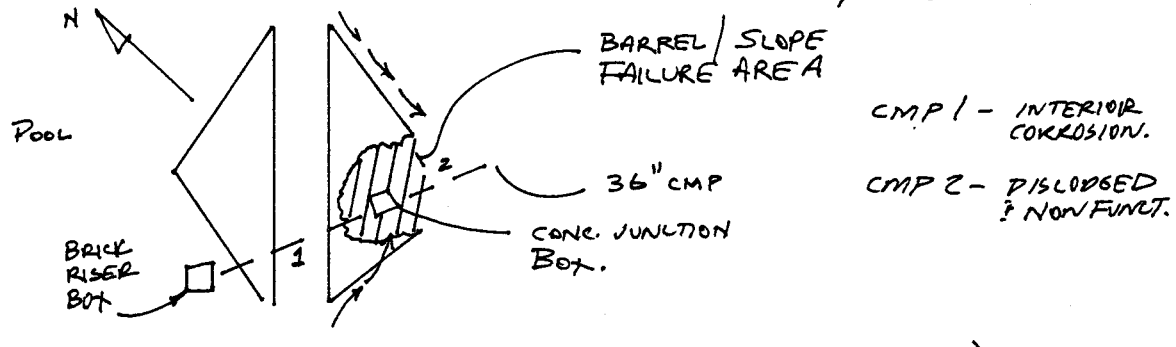
NOTE: Inspection direct result of request by HOA members who may want to Repair the facility, which was damaged during Hurr. Floyd Sept 1999.

Facility Item	O.K.	Routine	Urgent	Comments
Water Pools ☒ Permanent Pool (Retention Basin) ☐ Shallow Marsh (Detention Basin) ☐ None (Detention Basin)				
Shoreline Erosion	X			NATURAL VEG.
Algae	X			None observed in Winter.
Trash & Debris	X			
Sediment	X			
Aesthetics	X			
Other				
Inflow Stuctures (Describe Locations): DID NOT OBSERVE. CHANNELS & Storm Drain INFLOWS.				
Condition of Structure	X			Appear adequate based
Erosion	X			on driveby & walk at back
Trash and Debris	X			end of lake & embankment
Sediment	X			area. (Was not scope of
Aesthetics	X			inspection).
Other				
Principal Flow Control Structure - Intake, Riser, etc. (Describe Location): Brick Box w/ rect. slots.				
Condition of Structure	X	X		Old structure but relatively clean.
Corrosion	X			Bricks are discolored.
Trash and Debris	X	X		Minor.
Sediment	X			
Aesthetics	X			Appears ok for age.
Other				
Principal Outlet Structure - Barrel, Conduit, etc. : 36" CMP BARREL.				
Condition of Structure			X	D/S Barrel & Embankment FAILURE.
Settlement			X	Erosion cutting back into D/S
Trash & Debris		X		EMBANKMENT ALMOST 1/2.
Sediment			X	Severe Potential for failure
Erosion			X	unless corrective action taken.
Other			X	(Conc. Junction Box displaced.)
Emergency Spillway (Overflow): None Present.				
Vegetation				None.
Lining				None.
Erosion				None.
Trash & Debris				None
Other				None.
ADJ. SF LOTS + ROADWAY DRAINAGE & WOODED AREAS TO FACILITY.				

Facility Item	O.K.	Routine	Urgent	Comments
Nuisance Type Conditions:				
Mosquito Breeding	X			
Animal Burrows	X			
Graffiti	X			
Other				
Surrounding Perimeter Conditions: SF LOTS, ROADS & WOODED AREA				
Land Uses	X			
Vegetation	X			
Trash & Debris	X			
Aesthetics	X			
Access /Maintenance Roads or Paths		X		EASEMENT thru 110 overlook Drive to TAN PARCEL. ADEQUATE IN FIELD.
Other				RPA Downstream.

Remarks:

- LARGE Trees ON TOP & D/S EMBANK NEED REMOVED.
- D/S SLOPE EMBANKMENT & BARREL FAILURE. NEEDS IMMEDIATE CORRECTIVE ACTION. REMAINING EMBANKMENT IS THREATENED.
- CMP OUTLET BARREL → INTERIOR CORROSION / LEAKAGE.
- Potential LAND Problems with ACCESS for repair plan.



Overall Environmental Division Internal Rating: 1 (BARREL - SLOPE FAILURE)

NOTE: FAILURE APPEARED TO BE CAUSED BY SURF. EROSION FROM WEST TOE CHANNEL & BARREL SEEPAGE DUE TO PIPE CORROSION.

Signature: [signature] P.E. **Date:** 02/20/07

Title: Civil Engineer, JCC Environmental Div.

SWMProg\BMP\CoInspProg\DetRet.wpd

WATERSHED	CC	MAINTENANCE PLAN	No	CTRL STRUC DESC	Brick Riser B
BMP ID NO	014	SITE AREA acre		CTRL STRUC SIZE inches	
PLAN NO		LAND USE	SF Residential	OTLT BARRL DESC	CMP
TAX PARCEL		old BMP TYP	Wet Pond	OTLT BARRL SIZE inch	36
PIN NO	4910100006	JCC BMP CODE			
CONSTRUCTION DATE		POINT VALUE		EMERG SPILLWAY	No
PROJECT NAME	Kingspoint Subdiv Large BMP Lake			DESIGN HW ELEV	
FACILITY LOCATION	110 Overlook Drive (Lot 26 Sec 5)			PERM POOL ELEV	
CITY-STATE	Williamsburg, Va. 23185	SVC DRAIN AREA acres		2-YR OUTFLOW cfs	0.00
CURRENT OWNER				10-YR OUTFLOW cfs	0.00
OWNER ADDRESS				REC DRAWING	No
OWNER ADDRESS 2		SERVICE AREA DESCRI	SF Residential Lots, Roads & Woods		
CITY-STATE-ZIP CODE		IMPERV AREA acres	0	CONSTR CERTI	No
OWNER PHONE		RECV STREAM	UT of Halfway Creek		
MAINT AGREEMENT	No	EXT DET-WQ-CTRL	No	LAST INSP DATE	2/20/2001
		WTR QUAL VOL acre-ft		INTERNAL RATING	1
EMERG ACTION PLAN	No	CHAN PROT CTRL	No	MISC/COMMENTS	
		CHAN PROT VOL acre-ft		Failure d/s end barrel and d/s embankment slope. Principal spill still funct.	
		SW/FLOOD CONTROL	Yes		
		GEOTECH REPORT	No		

Get Last BMP No

Return to Menu

WATERSHED	CC	MAINTENANCE PLAN	No	CTRL STRUC DESC	Brick Riser B
BMP ID NO	014	SITE AREA acre		CTRL STRUC SIZE inches	
PLAN NO		LAND USE	SF Residential	OTLT BARRL DESC	CMP
TAX PARCEL		old BMP TYP	Private Dam/Lake	OTLT BARRL SIZE inch	36
PIN NO	4910100006	JCC BMP CODE			
CONSTRUCTION DATE		POINT VALUE		EMERG SPILLWAY	No
PROJECT NAME	Kingspoint Large Lake (Private)			DESIGN HW ELEV	
FACILITY LOCATION	110 Overlook Drive (Lot 26 Sec 5)			PERM POOL ELEV	
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		CHAN PROT CTRL	No	MISC/COMMENTS	
		CHAN PROT VOL acre-ft		Partial fail d/s embank & barrel. Princ spill still funct. Letter sent 02/23/01	
		SW/FLOOD CONTROL	Yes		
		GEOTECH REPORT	No		

Get Last BMP No

Return to Menu

4/23 Public Meeting

SJT - 6+ years 20% Private BMPs

4/23 Meeting

• College Creek Watershed

Kingspoint Dam at Overlook Drive

General Information & Facts

- One of two larger dam structures in the Kingspoint subdivision
- East Dam near Colonial Parkway
- FEMA Special Flood Hazard Area Zone AE directly downstream of dam.
- Drainage from dam to Halfway Creek then to College Creek.
- Considered a private dam by the County. Not a BMP or stormwater management facility.
- Inventoried as a private dam by the County under the County BMP Inventory/Inspection program.
- Assigned County BMP ID identification number CC 014.
- Research in plans/plat (S-19-73) at County records office.
- Probably constructed as an amenity to the community.
- Dam constructed before current water quality and quantity control regulations, pre-1975 and pre-1990 respectively.
- Documented failure mode following during Hurricane Floyd (County letter February 23, 2001) condition repair ideas process.
- Normal pool of lake is about 5.5 acres (5.426 acres per County GIS)
- Drainage Area to lake is about 55 acres (based on County GIS)
- Increased runoff from improved lots and roadways drains to lake.
- 28 lots in Kingspoint drain to lake
- 17 land parcels directly border the lake perimeter
- 16 Kingspoint lots and one property to east of lake (Sections 1, 2 and 5 of Kingspoint)
- One additional downstream parcel may be affected by repair/improvement construction activities
- Actual dam ownership uncertain

PLAT 1969? Found 1973

• Discussed taxing district - service district

DCR Permit
Before CD permit
Worhill Ponds
CH Massit Pond
Cranstons Mill
LAKE NICE

Recent changes in laws may affect work plan

July 1, 2002 Commonwealth Dam Safety Regulations

- Any dam over 6 feet in height with over 50 acre-feet of storage
- Any dam over 25 feet in height with over 15 acre-feet of storage
- It is presumed that dam is over 25 feet high and has over 15 acre-feet of storage, thus falling under Dam Safety regulations
- Storage volume is measured to lowest point in top of dam.
- As dam is about 5 acres in size, would only need to be an average of 3 ft. deep to top of dam to qualify.
- Must be inventoried by owner. Alterations permit required for repairs/improvements.

2004 County Chesapeake Bay ordinance changes

- Below existing dam was historical Resource Protection Area (RPA) and RPA Buffer, back to 1990
- Changes effective January 1, 2004 resulted in the lake becoming an RPA feature and a RPA buffer around the lake
- Lake is perennial stream fed
- Routine maintenance of an existing dam in an RPA/RPA buffer, by itself may not require a Ches Bay exception.
- Dam repair/improvements would require a Ches Bay exception (administrative) as part of the plan review process.

Land-Disturbing Permit

- No longer under auspices of Hurricane Floyd damage related project (only lasted about 1 year after Hurr Floyd)
- Any repair/improvement plan in excess of 2,500 square feet of Land-Disturbing would require a LD permit.
- Due to RPA/RPA buffer, repair/improvement plan would require County review due to Section 23-10 of the CBPO
- Will require an erosion and sediment control plan for dam repair/improvement activities.
- Environmental Division review mainly for proper E&S control during work activities.
- Environmental Division will review work plan for consistency with standard accepted dam design & construction practices.
- Will offer comments about standard practice but not required.
- Environmental Division will not review plan to conform with County BMP manual requirements (not a BMP).
- Will not issue Land-Disturbing permit until evidence of permission from property owner(s) is provided.
- Will not issue Land-Disturbing permit until evidence of dam safety permit from DCR Dam Safety.
- Inspector will check compliance during land-disturbing operation.

Plan Expectations

Property Lines/Owners
Topography
Erosion & Sediment control
Access
Dam Repair/Improvement Plan
Must show proper erosion and sediment control measures.
Sequence of construction
Standard checklist requirements for E&S plan
Important to follow standard accepted practices for dam design & construction
Proper geotechnical investigation will be important to success of the repair/improvement plan

Parcel No.	*Address*	*Name*	*Section*
Kingspoint Lots Adjacent to Lake			
4910210021	102 Ivy Ct.	Buttice, Steven	Lot 21, Sec 1
4910220023	6 Firethorn Pl.	Dexter, Howard & Cornelia	Lot 23, Sec 2
4910220020	205 Woodbine Dr.	Dom, Bill M. & Charlotte	Lot 20, Sec 2
4910220019	204 Woodbine Dr.	Miller, Thomas J. & Maria	Lot 19, Sec 2
4910220017	104 Crownpoint Rd.	Warner, Marshall N. & Linda	Lot 17, Sec 2
4910250037	102 Aspen Ct.	Bill, James A. & Ann Marie	Lot 37, Sec 5
4910250036	105 Aspen Ct.	Wooten, Vernon E. & B. Elaine	Lot 36, Sec 5
4910250035	103 Aspen Ct.	Hill, Fred R. & Janet	Lot 35, Sec 5
4910250034	108 Crownpoint Rd.	Schiavone, Anthony & Margaret	Lot 34, Sec 5
4910250033	110 Crownpoint Rd.	Konefal, Stephan & Ogburn, Betsy	Lot 33, Sec 5
4910250032	112 Crownpoint Rd.	Henry, Lawrence & Margaret	Lot 32, Sec 5
4910250031	114 Crownpoint Rd.	Randolph, John H. & Maynard	Lot 31, Sec 5
4910250030	102 Overlook Dr.	O'Connell, William E. & Janet	Lot 30, Sec 5
4910250029	104 Overlook Dr.	Strom, Thomas L. & Curtis, Barbara	Lot 29, Sec 5
4910250028	106 Overlook Dr.	Biedenhorn, Cyril J. & Carla	Lot 28, Sec 5
49102500270	108 Overlook Dr.	Kellogg, Kirsten M.	Lot 27, Sec 5
Kingspoint Lots Downstream of Dam (Construction Impact)			
4910250026	110 Overlook Dr.	Roberts, James M. & Terri	Lot 26, Sec 5
Other Land Parcels Adjacent to Lake			
4910100006	110-A Overlook Dr.	Tan, Dr. Hoay T.	n/a

Scott F41

PO# 270637

TIMMONS GROUP

YOUR VISION ACHIEVED THROUGH OURS.

INVOICE

CC014

Wayland Bass
James City County Dept
of Development Management
101-A Mounts Bay Road
Williamsburg, VA 23187

September 25, 2007
Project No: 24300
Invoice No: 107649

Project 24300 Kingspoint Dam

Professional Services through August 31, 2007

Billing Phase	Fee	Percent Complete	Earned	Previous Billing	Current Billing
Site Inspection	1,000.00	100.00	1,000.00	1,000.00	0.00
Hydrologic & Hydraulic Calcs	4,500.00	100.00	4,500.00	4,500.00	0.00
Dam Failure Analysis & Classification	3,500.00	100.00	3,500.00	3,500.00	0.00
Hazard Area Mapping	1,000.00	100.00	1,000.00	1,000.00	0.00
Dam Safety Reports	2,000.00	100.00	2,000.00	800.00	1,200.00
Current Fee Billing	12,000.00		12,000.00	10,800.00	1,200.00
		Current Fee Billing		**1,200.00**	

RECEIVED
OCT - 1 2007
DEVELOPMENT MANAGEMENT

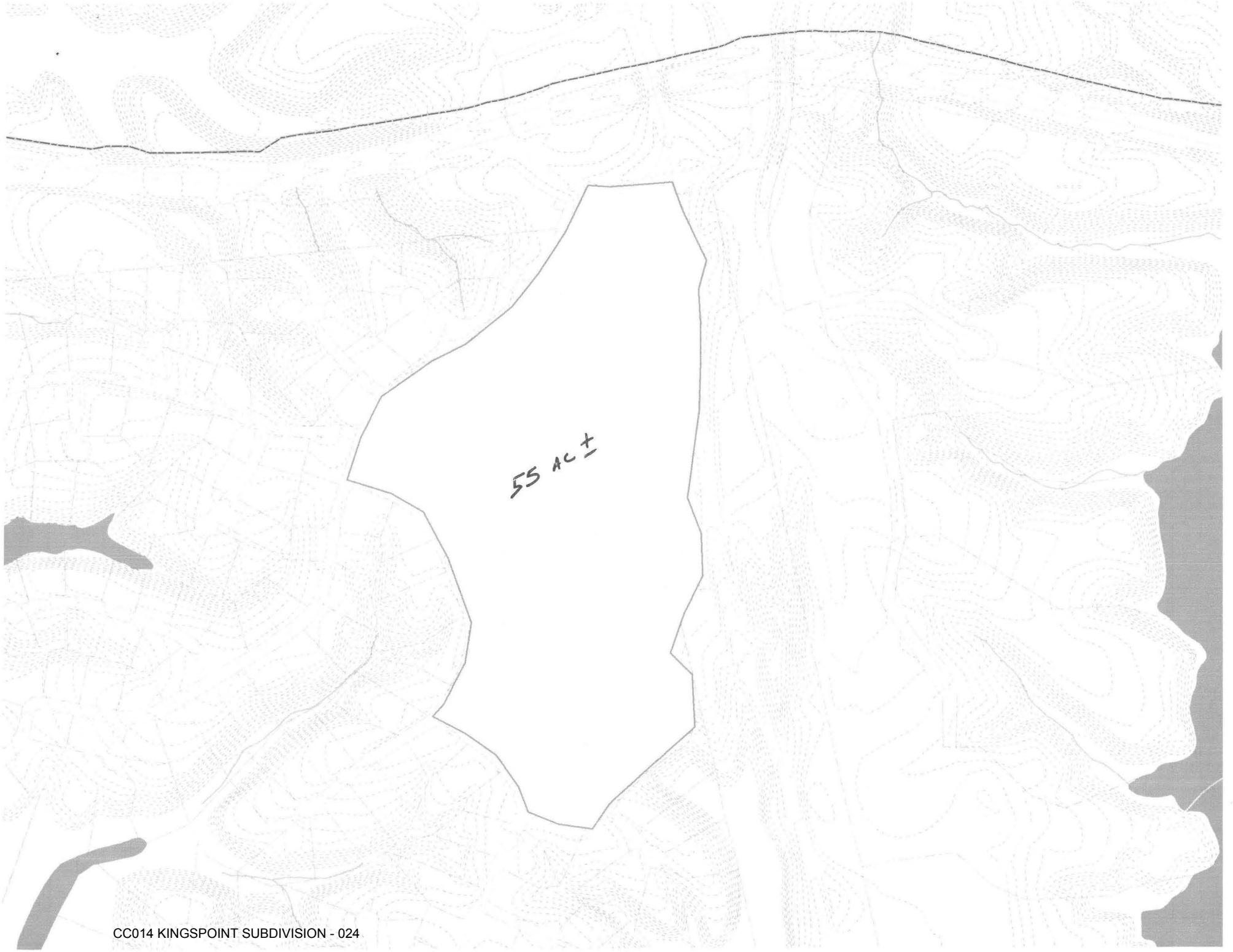
Total this Invoice **$1,200.00**

OK/WMB

$60.00 LEFT on PO#

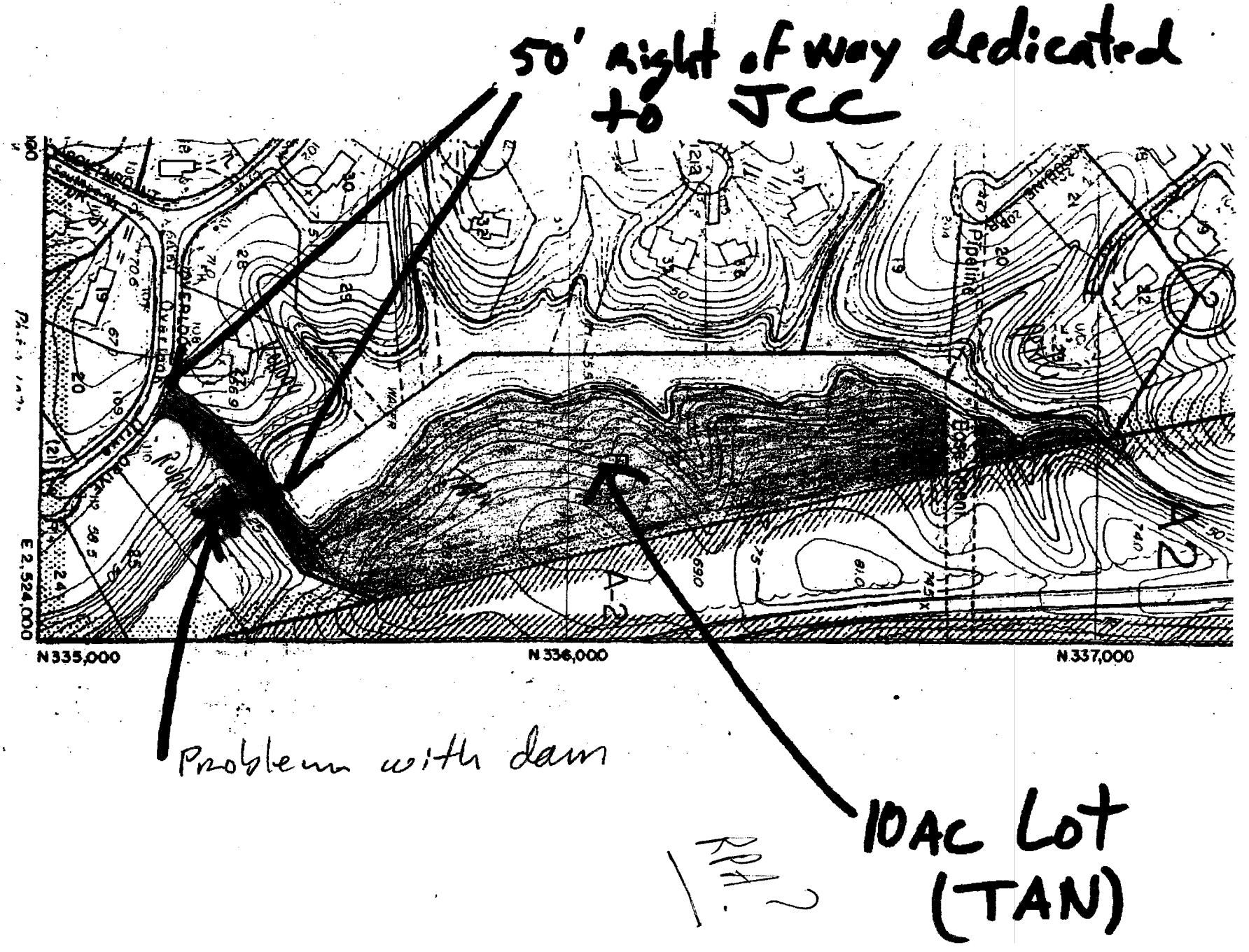
Please Remit to:
1001 Boulders Parkway, Suite 300
Richmond, VA 23225
804.200.6500

We thank you for your business!
Due and payable upon receipt
Any balances over 30 days will accrue interest
Federal Tax ID: 54-1301413


55 AC ±

ZONE X
ZONE AE
(EL 8.5)
ZONE X
CREEK
COLLEGE
CC027
ZONE AE
(EL 8.5)
CC020
HISTORICAL
PARKWAY
CC014
ZONE X
ZONE X
ZONE X
ZONE X
CARTERS
GROVE
ZONE
AE
(EL 8.5)
CREEK
HALEBAY

CC014 KINGSPOINT SUBDIVISION - 027


50' Right of Way dedicated to JCC
Problem with dam
10AC Lot (TAN)
N335,000
N336,000
N337,000
E2,524,000
Pipeline
Easement
Overflow
Dam
Ruins
Dam
Ruins
Dam
Ruins

CC014 KINGSPOINT SUBDIVISION - 029

CC014 KINGSPOINT SUBDIVISION - 030

Scott Thomas

From: Scott Thomas
Sent: Tuesday, November 09, 2004 11:21 AM
To: Leo Rogers
Subject: W&M Game/Tan Lot

Leo,

Thanks for going to the game with us this past Saturday. It was a good time.

On the Tan Lot issue, I called Mike Lyttle (Prudential-McCardle) back and told him that I spoke with you and gave him NO answers to the two questions he asked me (via fax).

1. Is the County responsible for maintaining a passable entrance into the Tan 10 acre lot? NO
2. If so, is the County responsible to repair the dam which a portion of the road entrance is situated? NO

I told him that these were legal issues and that I had no authority to make determination and if he needed to speak with you further he should call you himself.
Attached is the letter I sent back in February of 2001 about what was necessary to repair the dam, regardless of who was responsible. My letter was addressed to the HOA.

Scott J. Thomas, P.E.
James City County
Environmental Division

Visit:
http://www.james-city.va.us/resources/devmgmt/div_devmgmt_environ.html
and
www.protectedwithpride.org

Mike Woods LANDMARK
757-463-3563

To: Scott Thomas
From: Mike Lyttle (757) 564-0767

#040705

VIRGINIA: IN THE CIRCUIT COURT FOR THE CITY OF WILLIAMSBURG AND COUNTY OF JAMES CITY

DR. HOAY T. TAN,

Plaintiffs.

v. **Chancery No. CH14702**

JAMES M. ROBERTS

and

TERRI T. ROBERTS,

Defendants.

FINAL DECREE

Plaintiff, Dr. Hoay T. Tan ("Tan") and Defendants, James M. Roberts and Terri T. Roberts ("Robertses"), have come before the Circuit Court for the City of Williamsburg and the County of James City ("Circuit Court") representing that all matters between them have been settled and resolved.

UPON CONSIDERATION OF the pleadings, the statements of the parties and for other good cause shown, the Circuit Court does hereby find as follows:

1. Tan is the owner of that certain parcel of property known as 110-A Overlook Drive, Williamsburg, Virginia ("Tan Property") and more fully described as follows:

> All that certain piece or parcel of land situate, lying and being in James City County, Virginia, (formerly located in Jamestown District), known and designated as 10.0308 acres as shown on a plat entitled "Plat of Kingspoint Corporation, Parcel 'B', Section 5", made by E. E. Paine, Consulting Engineer, dated February 9, 1968, recorded in Plat Book 33, at Page 59, and to which said plat reference is here made for a more complete description of the property.
>
> Subject to rights of Kingspoint Corporation, its successors and assigns, to construct a lake and to flood a portion of said land not to exceed that line shown on the Plat of Section 5, Kingspoint Subdivision, and labeled "Maximum High

Water Flood Level", and subject to the nonexclusive right of other owners of lots adjoining said lake to the use of the surface of the lake, in common with the Grantee herein, provided the waters of such lake, when built, actually flood a portion of any of such lots adjoining.

Together with all right, title and interest of the Grantor herein in and to the dam and the Fifty foot right-of-way leading from the property herein conveyed to Overlook Drive.

2. The Robertses are the owners of that certain parcel of property known as 110 Overlook Drive, Williamsburg, Virginia ("Robertses Property") and more fully described as follows:

All that certain lot, piece or parcel of land situate, lying and being in James City County (formerly situate in Jamestown District), Virginia, known and designated as Lot Twenty-Six (26) as shown on that certain plat entitled "KINGSPOINT SECTION 5, KINGSPOINT CORPORATION, OWNER AND SUBDIVIDER, LOCATED IN JAMESTOWN MAGISTERIAL DISTRICT, JAMES CITY COUNTY, VIRGINIA" dated February 9, 1968, and made by R. M. Mackintosh, Certified Land Surveyor, recorded in the Clerk's Office of the Circuit Court of the City of Williamsburg and County of James City in Plat Book 26, at Page 27, to which said plat reference is here made for a more complete description of the property.

3. There exists a fifty-foot wide right of way extending from Overlook Drive to the Tan Property and adjacent to the Robertses Property ("50" Right of Way"), all as more fully shown on the plat of subdivision dated February 7, 1969, and recorded at Plat Book 26, page 27, in the clerk's office of the Circuit Court ("Subdivision Plat"). The 50" Right of Way terminates midway across the dam at the boundary of the Tan Property as shown on the plat dated February 9, 1968, and recorded in Plat Book 33, at Page 59.

4. The 50" Right of Way was dedicated to the County of James City for use as a public road as shown on the Subdivision Plat although it has not been accepted into the secondary system of highways by the Virginia Department of Transportation. James City County is the current fee simple owner of the 50" Right of Way subject to the public's right to use it as a public road.

5. The public in general, including Tan and the Robertses, have the right to use the 50" Right of Way as they would any other public road, including using it to access the Tan Property and the Robertses Property.

6. Neither party has acquired exclusive rights in and to the 50" Right of Way by adverse possession or other prescriptive use because such rights cannot, as a matter of law, arise upon property owned by any governmental entity.

WHEREFORE, based upon these finding of facts, the Circuit Court does ORDER, ADJUDGE and DECREE as follows:

a. Neither Tan nor the Robertses shall block, impede or otherwise interfere with the use of the 50" Right of Way by any person so long as that use is lawful and consistent with the use of a public road. Either party may take such lawful action is necessary should the 50" Right of Way become blocked or if use of the 50" Right of Way is not consistent with the use of a public road.

b. So long as any person is lawfully within the 50" Right of Way and using it in compliance with this Order, the Robertses are enjoined from directing any comments or taking any action toward Tan, his agents, assigns, employees, successors or invitees, including real estate agents and prospective purchasers, on the 50" Right of Way and Tan is enjoined from directing any comments or taking any action toward the Robertses, their agents, assigns, employees, successors or invitees, within the 50" Right of Way.

c. Both parties are enjoined from claiming that either party has the exclusive right to use the 50" Right of Way.

d. After entry, this decree shall be recorded in the land records of the Circuit Court by counsel for Tan so as to provide notice to future owners of the Tan and Robertses Properties. **Hoay T. Tan** shall be indexed as both grantor and grantee. **James M. Roberts and Terri T.**

Roberts shall be indexed as both grantors and grantees. **James City County shall be indexed as both grantor and grantee.**

e. After entry of this decree the clerk of the Circuit Court shall place certified copies in the courthouse boxes of undersigned counsel.

f. This action is DISMISSED and the clerk of the Circuit Court shall place it among the ended causes.

Entered this 12th day of October, 2004.

Judge of the Circuit Court for the City of Williamsburg and the County of James City

We ask for this:

Sheldon M. Franck, Esq.
Geddy, Harris, Franck & Hickman P.C.
1177 Jamestown Road
Williamsburg, Virginia 23185
Counsel for James M. Roberts and Terri T. Roberts

James M. Roberts

Terri T. Roberts

John Valdivielso, Esq.
Kaufman & Canoles, P.C.
P.O. Box 6000

Williamsburg, Virginia 23188
Counsel to Dr. Hoay T. Tan

Dr. Hoay Tan

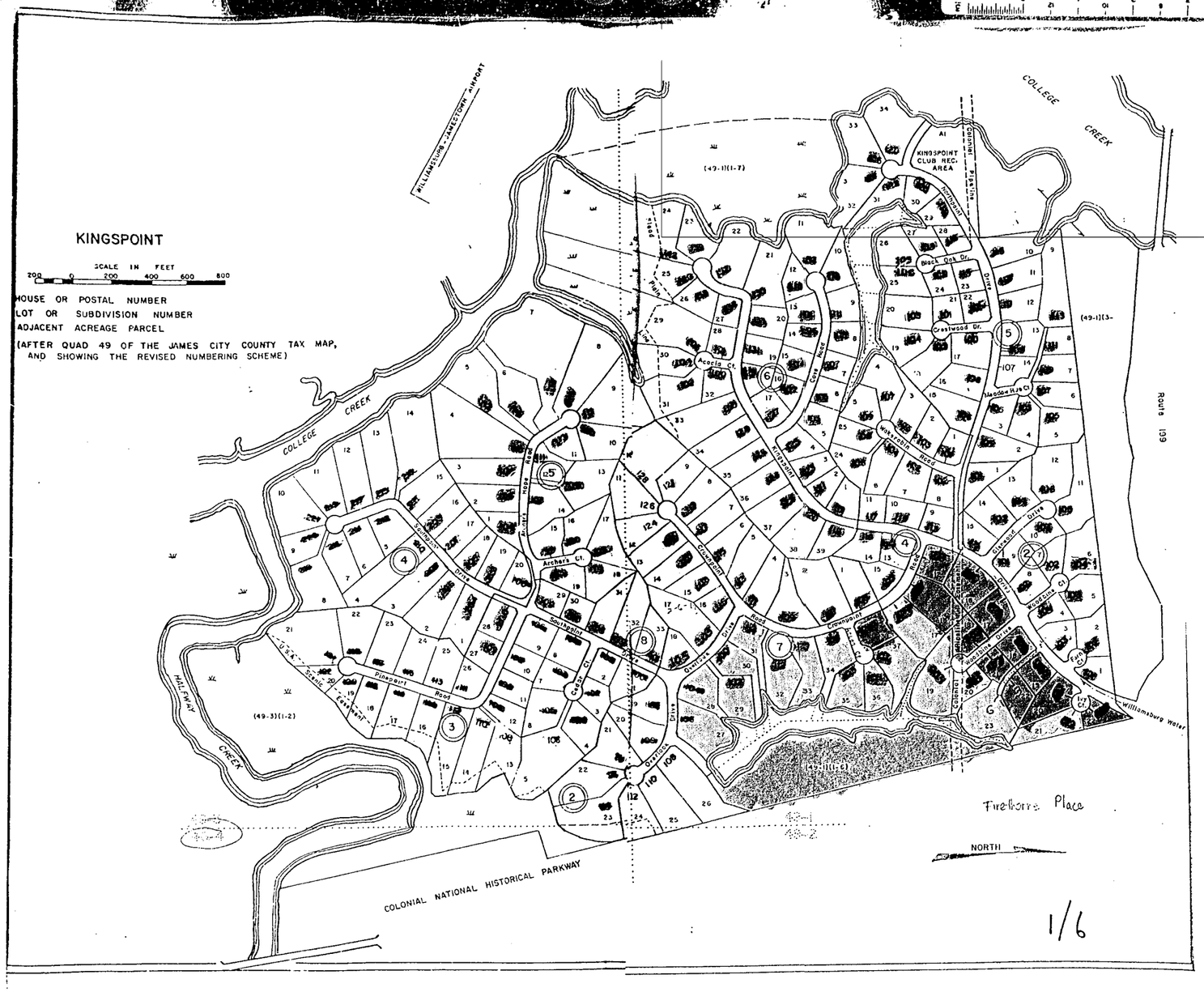
Seen and agreed:

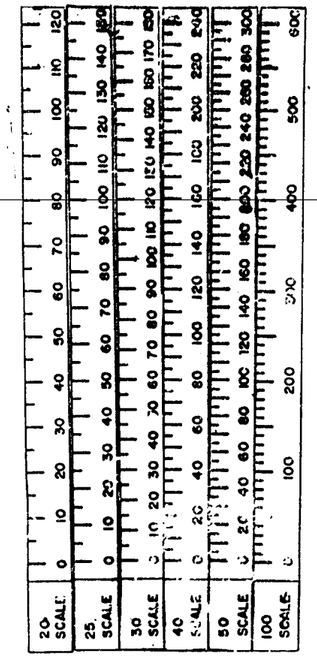
Leo P. Rogers, Esq.
Deputy County Attorney
James City County
101-C Mounts Bay Road
P.O. Box 8784
Williamsburg, Virginia 23187

#6054452 v1

A COPY TESTE:
BETSY B. WOOLRIDGE, CLERK
City of Williamsburg and County
of James City, VA
BY: Deputy Clerk

REEL 33





5-19-73

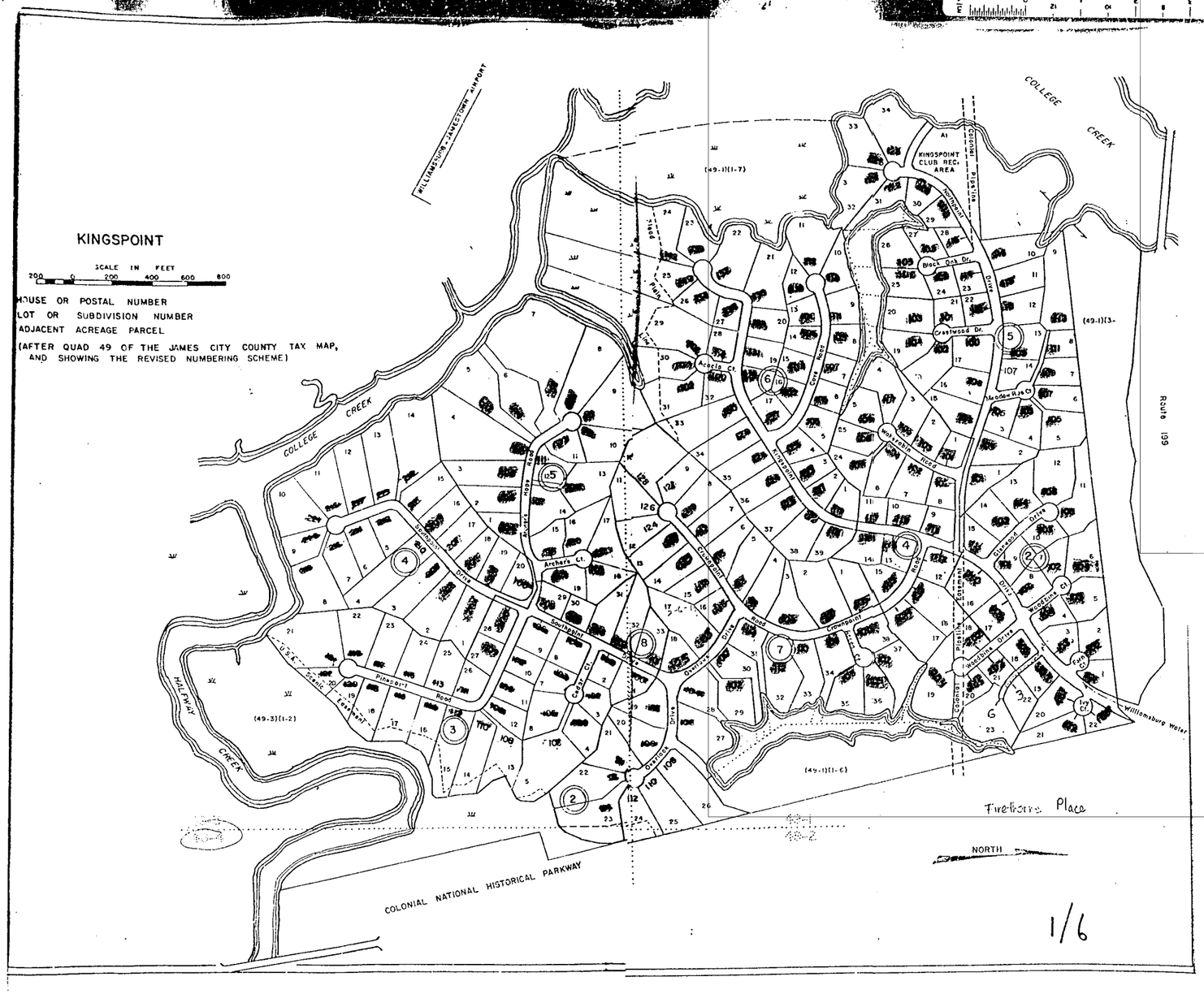
COPY

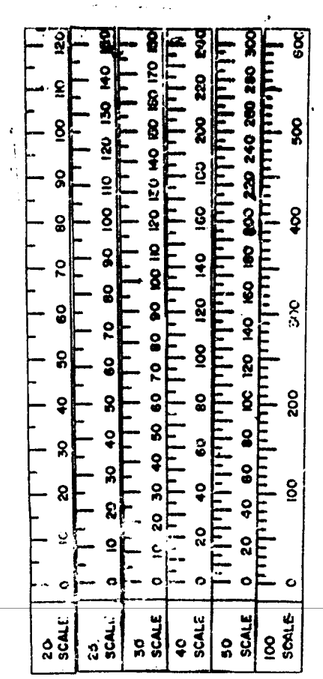
Kingspoint Lots Adjacent to Lake

Other Land Parcels adjacent to Lake

Other Kingspoint parcels in Lake watershed

REEL 333





5-19-73

COPY

Scott Thomas

From: Scott Thomas
Sent: Wednesday, April 25, 2007 2:26 PM
To: Leo Rogers
Cc: Wayland Bass
Subject: RE: Please review and comment
Attachments: KingspointDam.cc014.doc

1. Per Sandy' s request to Wayland today, me and Wayland talked late this morning. Me and Wayland both have knowledge about this dam over the last 8 years. I gave Wayland an update of what was discussed at Monday's meeting and discussions I had with the citizen group from the technical end and possible dam safety permit issues. Wayland is normally the one to organize the procurement of an engineer through our annual service contract (like Lake Powell, Jolly Pond, etc.)

2. I have read and have no issues with the access agreement as long as the study & evaluation by the County's agent can confirm that the dam does indeed fall under the Commonwealth's dam safety requirements. I believe that is indeed the case, but that needs to be confirmed right away by the study. If it can be done within the framework of that language (which it appear to) then I have no comments.

3. I've attached the notes I prepared for myself for this past Monday's meeting with you, Bruce and the citizen group. I provide it for information purposes only for your file. It gives some general facts and information on the dam and anticipated land-disturbing permit requirements.

As I talked to Wayland today, I copied this email to him also as a courtesy. If you need him to review and comment on the agreement, you can call him or email him.

Scott J. Thomas, P.E.
Chief Engineer - Stormwater
James City County
Environmental Division

From: Leo Rogers
Sent: Wednesday, April 25, 2007 1:41 PM
To: Scott Thomas
Subject: Please review and comment

ACCESS AGREEMENT

THIS ACCESS AGREEMENT ("Agreement"), dated this _____ day of April, 2007, by and between the County of James City, Virginia and the James City Service Authority (collectively the "County"), and Kirsten M. Kellogg ("Ms. Kellogg"), Hoay T. Tan ("Mr. Tan"), and James M. and Terri T. Roberts ("Mr. and Mrs. Roberts"), (Ms. Kellogg, Mr. Tan and Mr. and Mrs. Roberts are collectively referred to as "Owners").

WHEREAS, the County is the owner of certain dedicated unimproved right-of-way off Overlook Drive in the Kingspoint subdivision of James City County; and

WHEREAS, Ms. Kellogg is the owner of certain real property commonly known as 108 Overlook Drive in James City County, Virginia 23185; and

WHEREAS, Mr. Tan is the owner of certain real property commonly known as 110A Overlook Drive in James City County, Virginia 23185; and

WHEREAS, Mr. and Mrs. Roberts are the owners of certain real property commonly known as 110 Overlook Drive in James City County, Virginia 23185; and

WHEREAS, the County is willing to perform or have performed by its agents certain tests, studies, evaluations and assessments to determine the integrity of the dam, intake facilities, piping and out flow area to determine its condition and assess the nature and extent of repairs which may be necessary; and

WHEREAS, the Owners desire to have the County perform such tests, studies, evaluations and assessments and agree to allow the County and its agents to access and use his/her/their property for such purposes.

THEREFORE, for and in consideration of the mutual covenants herein set forth, it is agreed as follows:

I. The Owners authorizes and permits the County, designated agents and representatives a right of ingress and egress across his/her/their property for the purpose of testing, studying, evaluating and assessing the dam and any inflow or outflow structures, pipes and discharge areas to determine their condition and assess the nature and extent of repairs which may be necessary. This right of use and ingress and egress shall be effective for twelve months (12) months from the execution of this Agreement provided, however, that this Agreement may be terminated at any time by Owners upon 60 days prior written notice to the County. Any tests, studies, evaluations and assessments conducted by the County, its representatives or agents shall be at the County's own risk, cost and expense. The County shall, at its expense, restore the properties to their prior condition to the extent of any changes made by its agents or representatives. The County agrees to share the information it receives with the Owners.

II. The County hereby agrees to be responsible for any and all claims, judgments, damages, fines, penalties, liability, costs and expenses arising from acts or omissions by its agents or representatives exercising the above rights on the properties. The County agrees to name maintain insurance for itself and require insurance coverage from its agents. Such insurance shall provide at least One Million Dollars ($1,000,000.00) worth of liability insurance coverage for any claims arising from the County use of the properties.

III. Notwithstanding the place where this Agreement may be executed by any of the parties hereto, the parties expressly agree that all terms and provisions hereof shall be construed and enforced in accordance with the laws of the Commonwealth of Virginia.

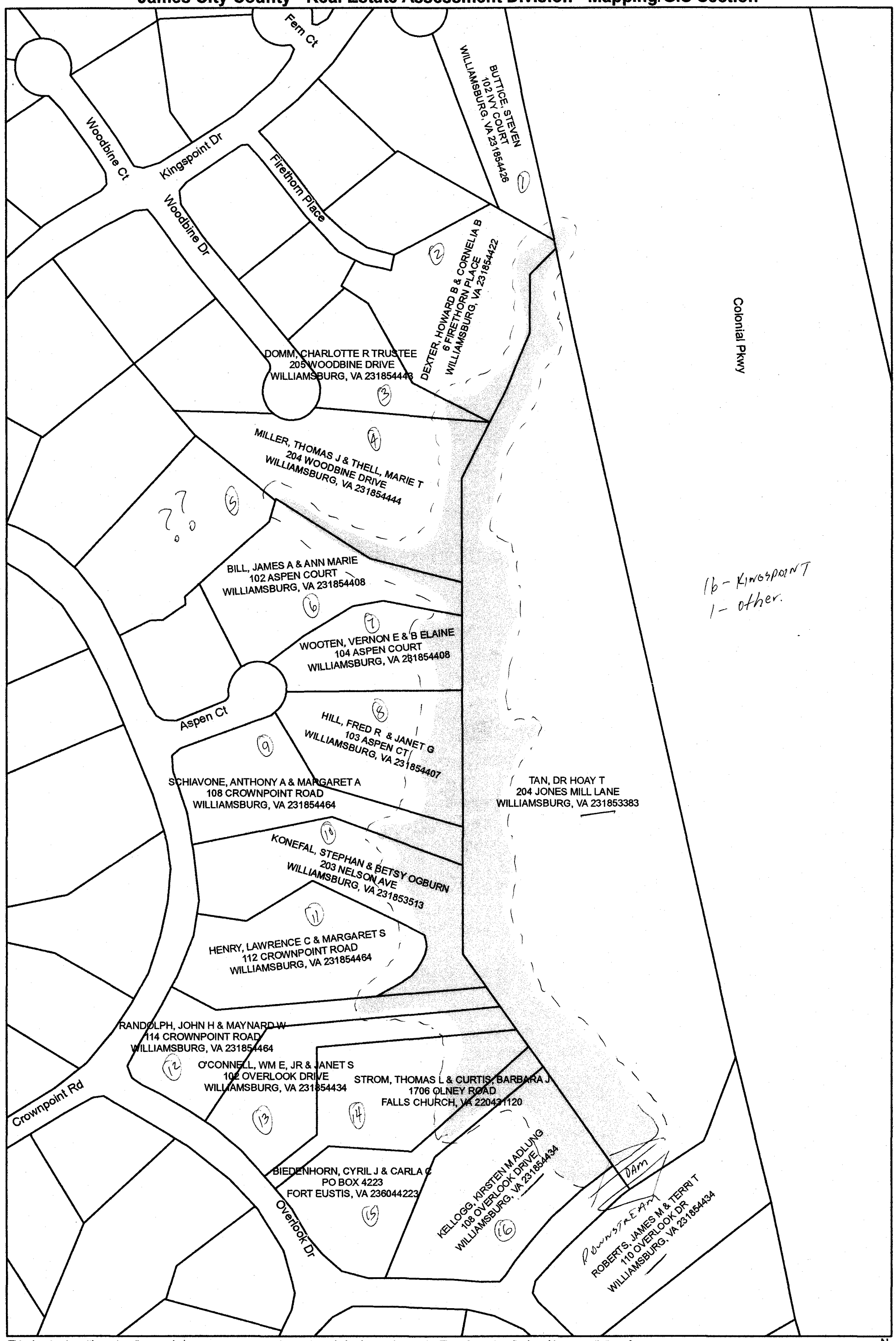
IN WITNESS WHEREOF, the parties have hereunto set their hands and seals:

_____	_____
Kirsten M. Kellogg	James M. Roberts
_____	_____
Hoay T. Tan	Terri T. Roberts
James City County, Virginia	James City Service Authority
By:_____	By:_____
Sanford B. Wanner County Administrator	Larry M. Foster General Manager

Approved as to form:

_____
County Attorney

James City County - Real Estate Assessment Division - Mapping/GIS Section



This drawing is neither a legally recorded map nor a survey and is not intended to be used as such. The information displayed is a compilation of records, information, and data obtained from various sources, and James City County is not responsible for its accuracy or how current it may be. If discrepancies are found, please contact the Office of Real Estate Assessments of James City County, Mapping/GIS Section.

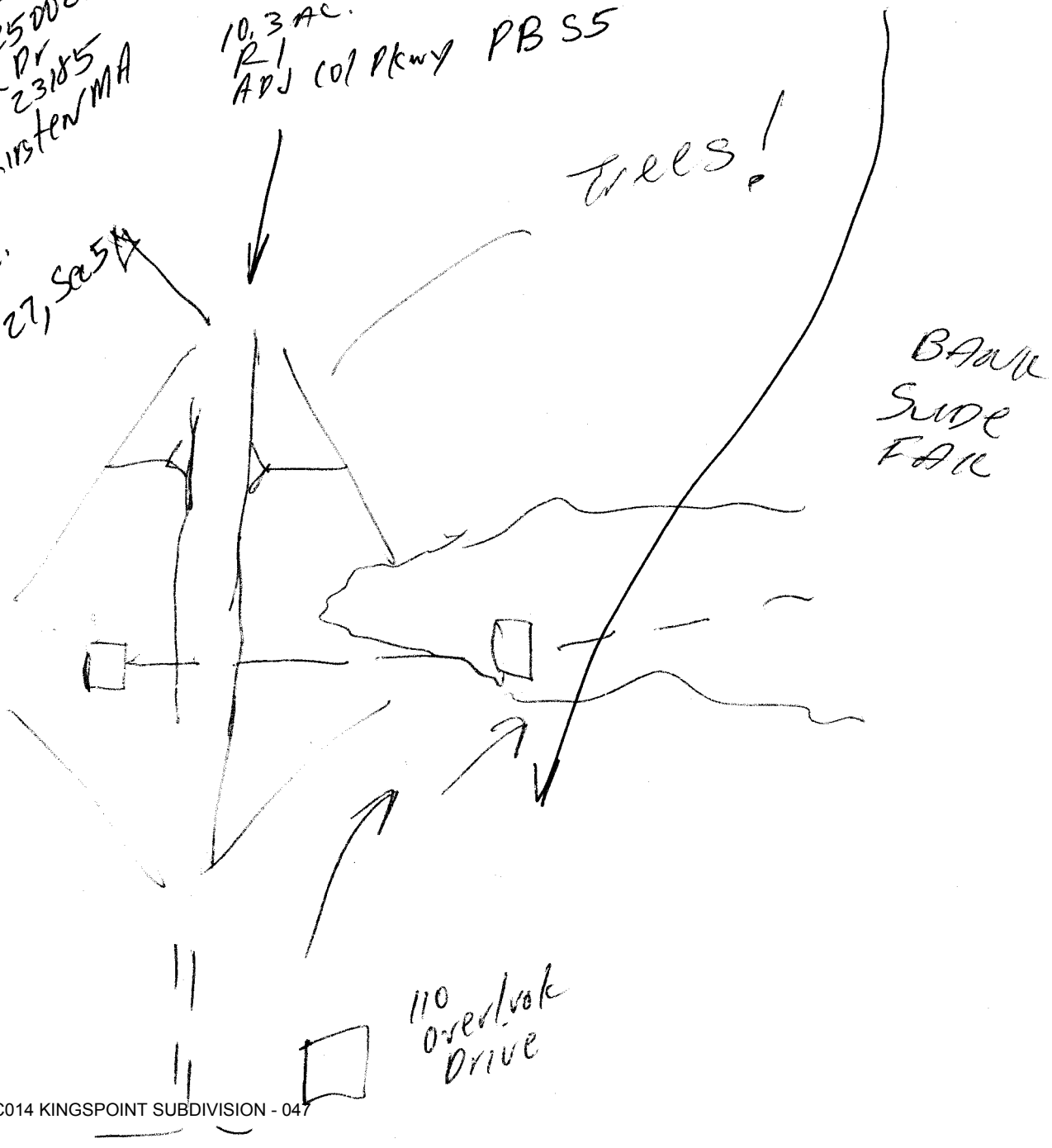
Notes:

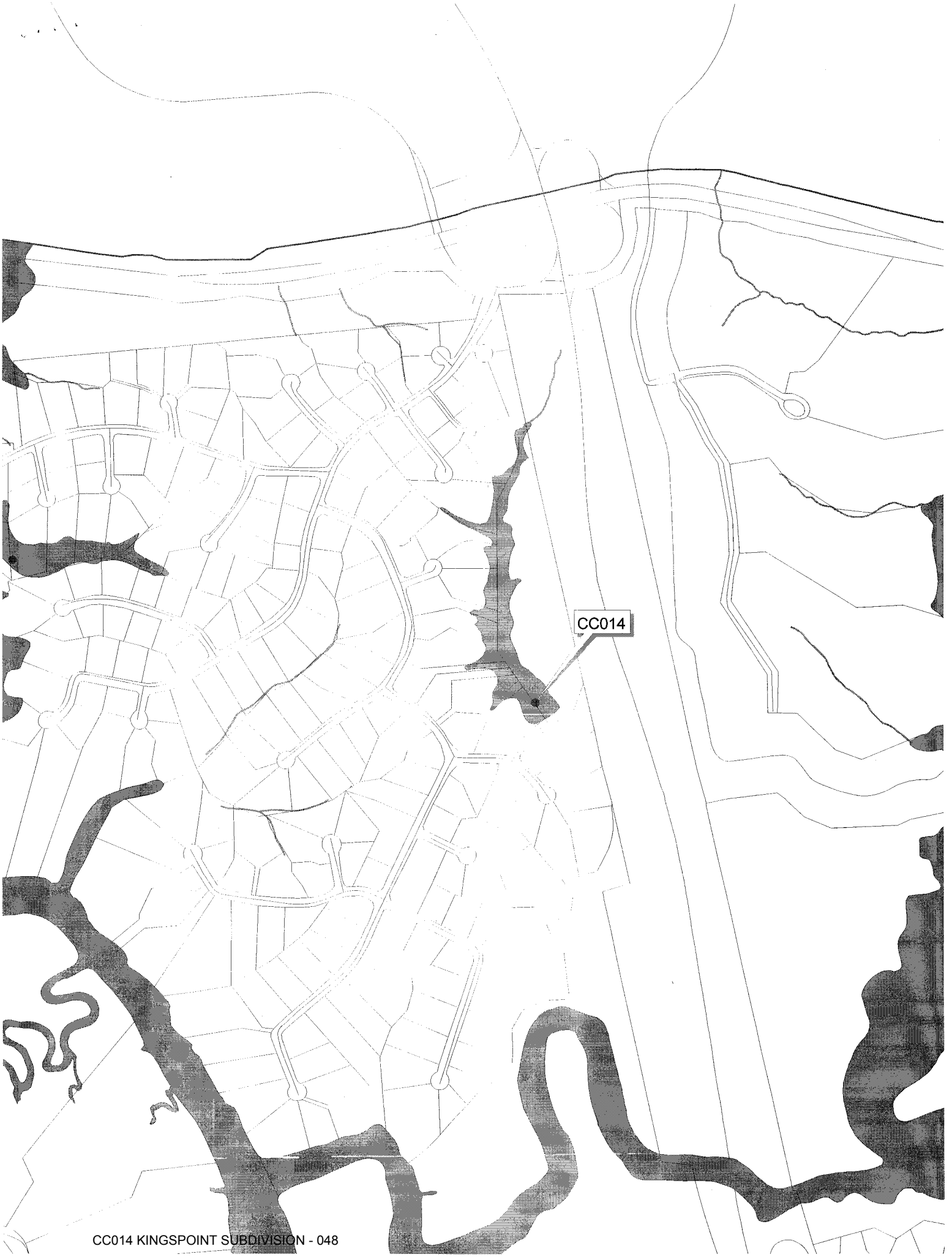
cause progressive erosion failure at disemb base & outlet barrel. Adj the runoff from

110 Overlook Drive
GPIN 4910250026
110 Overlook Drive WMB VA 23185
Eloise A. JACOBS (Trustee)
1.728 AC
Zone A1
Lot 26 Sec 5 KP

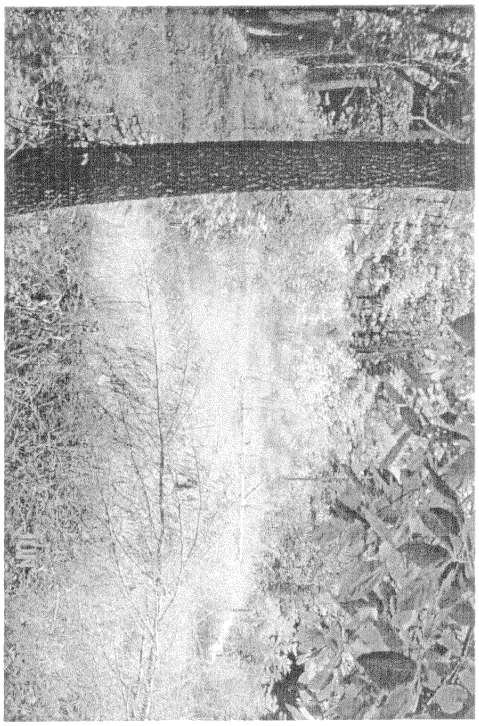
RAM EMB
GPIN 4910100006
TAN, DR. HOAI T.
204 Jones Mill Lane
WMBG VA 23185
10.3 AC.
R1
ADJ Col Pkwy PB 55

ADJ North Lot
GPIN 4910250027
108 Overlook Dr
WBMG VA 23185
PATRICK D + Kirsten MA
KELLOGG
1.713 AC.
R1
KP Lot 27, Sec 5





CC014 KINGSPOINT SUBDIVISION - 048



Mike Roberts
345-2412

Steve Menaquale
steve.menaquale@longandfoster.com
fax: 757-229-1068

March 12, 2014

Ms. Mary Ann Freeman
1490 Quarterpath Road, Ste 5-196
Williamsburg, VA 23185

RE: Kingspoint Pond Dam – Letter Report

Williamsburg Environmental Group, Inc. (WEG), now Stantec, was retained by you to evaluate the condition of Kingspoint Dam, located in James City County, Virginia. Kingspoint Pond Dam is located in part on 110A Overlook Drive, a property that you consider to purchase. The other part of the dam embankment is located on a James City County undeveloped right-of-way. Your primary interests concern the estimated costs for the rehabilitation of the dam, the suitability of the dam to support a driveway or access road to the property, and the potential impact of a mandate by James City County that water and sewer will be provided from Overlook Drive, potentially by way of the dam embankment.

The author met with you for an initial site visit on December 19, 2013. At this occasion a first impression was shared with you, including needed repairs and maintenance, and the steps needed to bring the subject dam in compliance with the *Virginia Impounding Structure Regulations* (Regulations). It was further discussed that the dam embankment should be investigated by a geotechnical engineer to determine whether there are additional issues with the dam, and that a cost estimate should be obtained from a contractor experienced with dam repairs. Based on this discussion and initial site visit, you contacted with us to provide and coordinate such services.

Based on an appraisal for the property prepared in 2012, the pond was built in the early 1970s as a subdivision amenity and stormwater retention pond. Maintenance apparently was sporadic and the embankment became overgrown with vegetation. The impoundment suffered partial failure during Hurricane Floyd in 1999. It appears that pipe separation in the downstream portion of the outfall barrel led to partial slope failure. In addition, storm events toppled some of the trees that have grown on the dam embankment, leading to some erosion. It appears that the trees have been removed in recent years, however, large stumps remain, and the downstream face of the embankment is covered with wood chips.

Geotechnical Evaluation

Stantec contracted with Blue Ridge Geotechnical, LLC (BRG) for the geotechnical evaluation of the dam embankment. Under BRGs direction, a driller performed two (2) standard penetration test borings on February 4, 2014. Soil samples taken from these were submitted for laboratory testing. On February 14, 2014, BRG provided a draft *Report of Geotechnical Exploration – Kingspoint Dam*, summarizing the results of their investigation (a copy of the report is enclosed). The section dealing with the cause of failure states the following:

> *It is difficult to determine whether the leak in the CMP caused the failure of the downstream slope of the dam, or whether the failure resulted in the pipe becoming severed. Additionally, it is not known what impact, if any, that overtopping may have played in the failure. It seems likely that the pipe began to leak at some point, which ultimately resulted in the failure of the dam.*

When a buried pipe leaks, it will saturate the soil, which can significantly reduce the shear strength of the soil. Additionally, the soil that surrounds the pipe can progressively enter the pipe, which can create loss of ground, eventually resulting in a large-scale failure.

Based on the overall observations made at the dam embankment, including the fact that no piping is evidenced in the failure zone, it appears likely that piping from the barrel is the primary cause for the failure. However, as the dam embankment is not equipped with an auxiliary/emergency spillway, it cannot be excluded that overtopping occurred and contributed to the failure. A number of significant storm events have occurred since Hurricane Floyd that could have resulted in overtopping of the dam, including Gaston in 2003 and Isabel in 2011. A hydrologic and hydraulic analysis of the watershed, pond, and outlet structure would be needed to evaluate the potential contribution of overtopping to the failure.

The geotechnical engineer provides the following recommendations:

Although the failed zone of the dam is large and a significant portion of the dam has been removed, no apparent seepage was noted in the shear face of the scarp. This seems to indicate that the dam is still able to function in spite of the failure. Based on our borings, the material with which the dam was constructed (at least in the center of the dam) appears to be predominantly clay. Clay has a low permeability, which is good for controlling seepage. The following corrective measures are recommended:

1. *Evaluate the condition of the primary spillway, the riser pipe and the CMP barrel. This can be accomplished with video camera that can be fed both from the top, extending down the riser pipe, and up the CMP barrel from the severed portion. For best results, this work will likely have to be performed when the pond level is low, so that water is not flowing within the pipe. The camera can be used to determine if the pipe is corroded, severed at any joints, or otherwise compromised. One sign of a potential future problem might be if there is an area where soil appears to be entering the pipe.*
2. *Once it is confirmed that the portions of the riser and barrel that remain in the dam are sound, the failed material at the toe of the dam can be removed. As this area is currently being inundated with water exiting the barrel, this work should be performed when the pond level is below the primary spillway. Alternatively, the water should be collected at the current discharge point and piped downstream, until the water can be conveyed within a new extended barrel.*
3. *Soft, weak soil that is currently present at the base of the failed area should be carefully removed, and the subgrade evaluated. A limited portion of the soft material can probably remain; however, this must be determined in the field. If some soft soils must remain, it may be necessary to utilize a bridge lift of large stone (e.g., VDOT No. 2 stone). It is imperative that this material be completely wrapped in geosynthetic fabric for separation. It will also be important that this excavation not undermine the existing dam in any way.*
4. *Extend the barrel and construct a proper outfall. The lower half of the barrel should be supported on a cradle of concrete or flowable fill, as it is not possible to compact around the lower portion of the pipe.*
5. *Replace the failed portion of the dam using compacted soil fill.*

The geotechnical engineer indicates that the dam appears capable of supporting a proposed driveway. Recommendations are given in the report that prior to construction of the driveway the wood chips should be removed and the subgrade thoroughly proof-rolled with a fully loaded tandem-axel dump truck to identify any soft or weak areas. Such areas should be improved based on field conditions, under consultation of a geotechnical engineer.

It is understood that the placement of water and sewer lines is considered across the dam. In order to redcued the risk that the dam will be harmed by localized inundation, it is imperative that measures be taken to keep these lines from leaking or rupturing during their service life, especially at the joints. Alternative routes for these utility connections should be explored.

Dam Safety Technical Inspection

Regardless of whether an impounding structure is subject to the Regulations or not, completing a *Dam Safety Technical Inspection* will yield significant information about the status of an impounding structure, and provide guidelines for the repair and/or maintenance recommended. While to our knowledge Kingspoint Pond Dam has not been certified in the past, preliminary calculations indicate that the impoundment is subject to the Regulations.

Stantec conducted a *Dam Safety Technical Inspection* on February 25, 2014. During the inspection the Department of Conservation and Recreation (DCR) *Annual Inspection Report for Virginia Regulated Impounding Structures* as well as our own inspection form was completed, and pictures taken for documentation. Copies of the forms and the photo documentation are enclosed.

The most significant issue for this impounding structure is the pipe separation of the outfall barrel, which apparently led to slope failure on the downstream face. While there is no indication that seepage through the dam embankment occurs, the flows from the dislodged pipe can cause further erosion at the bottom of the slope failure, which in turn can further the slope failure. In the extreme, embankment failure should be expected in the future if the dam is not repaired.

While large trees have been removed from the dam embankment in recent years, some of the large stumps remain. These stumps and roots with a diameter exceeding one (1) inch should be removed, and the face of the dam re-graded and seeded. Further, the trees apparently have been chipped in place and the wood chips applied on the downstream face of the dam. While these wood chips act as mulch and suppress most of the herbaceous growth, they make it impossible to inspect the downstream face of the dam for rutting, animal burrow, etc. The layer of wood chips also masks the face of the dam to an extent that makes it impossible to observe deformations or slumping. It is recommended that the wood chips be removed and a healthy stand of grass established.

The upstream face of the dam embankment is covered with remnants of herbaceous vegetation to a degree that makes it impossible to inspect the dam properly. This vegetation should be removed and the embankment re-seeded, with soil amendments determined by soils tests, so that a healthy stand of grass can be established. The grass should be mowed at least twice per growing season to prevent the re-establishment of woody vegetation.

In keeping with the general lack of maintenance of this impoundment, debris, including tree trunks and branches, has accumulated along the shoreline and to a smaller degree at the inlet to the principal spillway.

Such debris accumulation will reduce the capacity and reliability of the spillway. In the extreme the debris can clog the spillway to a degree that will block the spillway and raise the water level in the reservoir. Such debris should be removed on a regular basis.

Based on our preliminary assessment, this impounding structure is subject to the Regulations, and either an Operation & Maintenance (O&M) Certificate or a General Permit needs to be obtained to operate the impounding structure. Aside from the recommended repair and maintenance, a dam break inundation zone study will need to be prepared for this dam. As it appears that this dam likely is a low hazard dam, a simplified dam break inundation study can be commissioned through the DCR at a cost of $2,000. The results of this simplified study can then be used to prepare an *Emergency Preparedness Plan*, provided the low hazard classification can be confirmed. With the repairs and maintenance completed, and the referenced materials developed, the prerequisites are met to obtain an O&M Certificate or a General Permit.

Contractor Estimate

Once the draft geotechnical report was available we contacted Bander Smith, LLC, a Richmond based contractor that is specialized in dam and spillway rehabilitation work, for a budget level cost estimate for the needed repair work on the spillway and dam embankment. We provided the geotechnical report and photo documentation for an off-site budget estimate.

The contractor proposes, similarly to the recommendations made by the geotechnical engineer, that an inspection of the outfall barrel and the riser structure be conducted to review the condition of the spillway and it's suitability for the proposed repair method. Bander Smith, LLC, proposes to conduct such an inspection for a fixed fee of $2,200.

Bander Smith provides a budget level cost estimate for the repair of the spillway and the dam embankment with a cost range of $85,000 - $100,000, excluding permitting as needed. The repair will result in a fully functioning primary spillway system, and consists of the following steps:

- Mobilization, Erosion and Sediment Control Measures, Water Control/Diversion
- Existing Structure Removal (separated barrel only) and Embankment Preparation
- Slip line of the remaining corrugated metal pipe
- Re-construction of the Embankment, including removal of tree stumps
- Demobilization, Clean-up

The contractor has indicated that the cost range provided contains some contingency adjustments, and that once site access and conditions of the pipe are assessed, a firm proposal can be provided that likely will tend towards the lower end of the cost range shown. A copy of the contractor estimate is enclosed.

Additional Considerations

The appraisal indicates that "*15 other lots abut the pond, and at least 11 lots appear to have some Fee ownership of a portion of the pond.*" The pond obviously serves as an amenity for the adjacent properties, but it also serves as a stormwater management facility for the sub-division.

According to the appraisal, it appears that there have been efforts to repair the dam, whereas "*a special taxing district was contemplated for the pond owners, which would result in shared cost and spreading*

those costs over a defined period of years." Based on the appraisal, "*unilateral repair of the dam, given pond and dam ownership issues as well as the pond's value as a storm water retention basin, is not considered reasonable and fair.*"

The overall situation appears to be somewhat complex, with no clear path how cost sharing can be achieved among interested parties. We suggest that an in-depth discussion with County representatives would be valuable, with the goal to:

1. Gain an understanding of what considerations have been made regarding repair and cost sharing, and
2. To explore alternative approaches in light of recent regulatory developments.

Of specific interest is, whether the County may be willing to support the repair of the impoundment in combination with a retrofit of the spillway that would allow for water quality credits towards the County's pollution reduction requirements for the Chesapeake Bay TMDL or for the County's Municipal Separate Storm Sewer System (MS4) permit. Stantec will gladly assist you with such discussions with the County.

It also should be noted that a singular access to a property, especially across a dam embankment or a bridge, always entails a certain risk of failure, thus making the property at least temporarily inaccessible. We believe it would be prudent to incorporate a secondary ingress/egress route, maybe from the north, that can be used in case of an emergency.

Stantec appreciates the opportunity to working with you on this project. In case of questions or for discussion, please contact us at 757-220-6869, or via email at chris.kuhn@stantec.com.

Best regards,

Stantec Consulting Services Inc.

Chris Kuhn

Enclosure

Cc: Jeffrey T. Hancock, P.E., Stantec

Kingspoint Pond Dam – Photo Documentation

View along top of dam, from right abutment.

View along upstream face of dam, from right abutment.

Brick principal spillway with four (4) control orifices.

Moss and bare spots on embankment.

Tree stump that should be removed.

Downstream part of separated outfall barrel, corrugated metal pipe (CMP).

Displaced junction box within outfall barrel.

View of downstream face of embankment, covered with wood chips from tree removal.

View of downstream portion of displaced outfall barrel, from downstream end towards slope failure area.

Overview of displaced outfall barrel and slope failure area.

Slope failure area.

Displaced junction box.

Downstream penetration of remaining outfall barrel, with displaced portion of barrel and junction box.

Outfall barrel, pipe separation area.

View of failure area.

Overview of failure area.

Downstream face of embankment.

Wood chip cover and remaining tree stump.

Groin swale on left abutment, downstream face.

View along top of embankment, from left abutment.

View along upstream face of embankment, from left abutment.

Herbaceous vegetation on upstream face of abutment.

Pipe separation area.

Dam Inspection and Maintenance Inspection Checklist

Name of Facility: **Kingspoint Pond Dam** **Project #:** **203451640**

Date of Inspection: **February 25, 2014** **Inspected by:** **Chris Kuhn**

Embankment

Yes	No	
☐	☒	Are there any surface cracks?
☒	☐	Is there any unusual movement or cracking at or beyond the toe? Slope failure
☐	☒	Is there erosion on upstream face from wave action or changes in pool level?
☒	☐	Is there erosion from runoff, either gullies or bare areas? Downstream toe area?
☒	☐	Is there erosion from traffic (people, animals, vehicles)?
N/A	☐	Are there animal burrows? Not observable due to herbaceous vegetation on US face and wood chips on DS face.
☐	☒	Are there depressed areas on the dam?
☐	☒	Is there any evidence of piping? (Piping is evidenced by muddy flow through the dam and/or the formation of soil deposits beyond the dam and depressions on its slopes)
☐	☒	Does the crest appear to have shifted or settled excessively? (Look for cracks in the embankment and associated structures. Compare alignment with plans if they are available).
N/A	☐	If the upstream face is protected by riprap, is it in good condition? (Riprap is a layer, facing, or protective mound of stone in random size pieces, randomly placed to prevent erosion, scour, or sloughing of an embankment or structure).
N/A	☐	If there is riprap in discharge channels or in the stilling basin downstream, is it in good condition?
N/A	☐	If drainage channels at ends of embankments are protected by riprap, is it in good condition?
N/A	☐	If there is riprap in miscellaneous areas (on downstream slope, on crest, etc.) is it in good repair?
N/A	☐	If there are any drains to collect and remove seepage, are they operating properly?
N/A	☐	If there are foundation drains outlets, are they clear and flowing?
☒	☐	Are there wet spots or areas on the downstream face, at the toe, or beyond the dam? (Such spots are often indicated by a change in color or type of vegetation, such as from grass to cattails.) Some wet spots, likely due to runoff
☐	☒	Are there seeps or springs with flowing water? Attention should be paid to the transition areas from embankment to abutments, around any penetrations passing through the embankment, on downstream tact, at the toe of the dam and beyond, at the base of trees on/near/below the dam.
☒	☐	Is there swamp or marsh type vegetation present on the downstream face or beyond the toe (cattails, tall grass, etc.)? Downstream area is floodplain of James River
☐	☒	Is the dam overgrown with trees and/or underbrush? Stumps, herbaceous vegetation, wood chips on DS face.

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☐	☒	Has the dam ever been overtopped? Unknown, but unlikely. No signs of overtopping observed in the field.
☐	☒	Have there been any modifications to the embankment, such as raising the crest, changing the shape or size of the principal spillway, or changing the shape or size of the embankment?

Principal Spillway

Yes	No	
☐	☒	Can water flow into the principal spillway unobstructed, as designed? Some debris accumulation at principal inlet.
☐	☒	Is outlet pipe or discharge channel clear and open to allow for free passage of the principal spillway discharge? Pipe separation with associated slope failure. Dislodged pipe and soil divert flow.
☐	☒	Is the primary spillway structure in good condition (check concrete, wood, and metal portions for damage or deterioration)? Outfall pipe failure with slope failure
N/A	☐	Does the lake have a low level drain to lower the water level in emergencies or for maintenance? None observed
N/A	☐	If low level drain present, is it known to be in working condition? Note: Care should be taken when operating a low level drain that has not been operated for a long time. It may be impossible to close it once opened.
N/A	☐	If there are additional valves, operating equipment, or appurtenances, are they in working condition?

Auxiliary/Emergency Spillway **No Auxiliary/Emergency Spillway**

Yes	No	
N/A	☐	Are the approach and the control section of the emergency spillway without obstruction, as designed and constructed?
N/A	☐	Is the discharge channel clear and without obstruction, allowing free flow of emergency spillway discharge?
N/A	☐	Is the emergency spillway constructed in a way that flow through it will not expose other portions of the dam to erosion?
N/A	☐	Is the emergency spillway in good working condition overall? (Check for erosion within channel, adequacy of grass cover, integrity of concrete structures, etc.)

Reservoir Area

Yes	No	
☐	☒	Does nature and land use of the surrounding area present any problems for the impoundment?
☐	☒	Is there evidence of landslides or instabilities along the shoreline?
☐	☒	Is serious wave erosion occurring along the shoreline?
☐	☒	Are significant amounts of sediment entering the impoundment, currently or in the past?

Watershed

Yes	No	
☐	☒	Have there been any major modifications or significant changes in the watershed, such as urban development (commercial, residential), clear-cutting of woodlands, or other changes in landuse?

Downstream Channel

Yes	No	
☒	☐	Is the downstream channel free of obstructions? Past the toe of the embankment

Downstream Area

Yes	No	
☐	☒	In case of dam failure, is loss of life or significant economic loss likely?
☐	☒	Are current telephone numbers of persons living or working in the areas downstream of the dam, as well as telephone numbers of those responsible for facilities that would be affected (highways, public utilities) on file?
☐	☒	Are current telephone numbers of local authorities who will need to be informed if the dam is imperiled (sheriff, county administrator, emergency services coordinator) on file?
☐	☒	Is the Emergency Action Plan up-to-date and have drills been performed?

Notes:

To our knowledge this dam is not currently certified, and no Emergency Preparedness Plan has been prepared.

The most significant issue for this dam is the pipe separation of the outfall barrel, which apparently led to slope failure on the downstream face. While there is no indication that seepage through the dam embankment occurs, the flows from the dislodged pipe can cause further erosion at the bottom of the slope failure, which in turn can further the slope failure. In the extreme, embankment failure should be expected in the future if the dam is not repaired.

While large trees have been removed from the dam embankment in recent years, at least some of the large stumps remain. These stumps and roots with a diameter exceeding 1 inch should be removed, the face of the dam re-graded and seeded. Further, the trees apparently have been chipped in place and the wood chips applied on the downstream face of the dam. While these wood chips act as mulch and suppress most of the herbaceous growth, they make it impossible to inspect the downstream face of the dam for rutting, animal burrow, etc. The layer of wood chips also masks the face of the dam to an extent that makes it impossible to observe deformations or slumping. It is recommended that the wood chips be removed and a healthy stand of grass established.

The upstream face of the dam embankment is covered with remnants of herbaceous vegetation to a degree that makes it impossible to inspect the dam properly. This vegetation should be removed and the embankment re-seeded, with soil amendments determined by soils tests, so that a healthy stand of grass can be established. The grass should be mowed at least twice per growing season to prevent the re-establishment of woody vegetation.

In keeping with the general lack of maintenance of this impoundment, debris, including tree trunks and branches, has accumulated along the shoreline and to a smaller degree at the inlet to the principal spillway. Such debris accumulation will reduce the capacity and reliability of the spillway. In the extreme the debris can clog the spillway to a degree that will block the spillway and raise the water level in the reservoir. Such debris should be removed on a regular basis.

Date Prepared: Feb. 26, 2014
Prepared By: Chris Kuhn

ANNUAL INSPECTION REPORT FOR VIRGINIA REGULATED IMPOUNDING STRUCTURES

Reference: Impounding Structures Regulations, 4VAC 50-20-10 et seq., including 4VAC 50-20-105, Virginia Soil and Water Conservation Board

Owner's Information

Name of Dam: Kingspoint Pond Dam
Inventory Number: N/A
Owner's Name: Dr. Hoay T. Tan, Trustee
Location-County/City: James City County
Contact Person (if different from above): Mr. A. John Tan
Owner's Address: 415N 2nd Street, Unit 244, San Jose, CA 95112
Hazard Classification:
Name of reservoir: Kingspoint Pond
Purpose of reservoir: Amenity, Stormwater Management
Telephone No.: (Residential) (Business)
Other means of communication:

Owner's Engineer

Name of Engineering Firm and Engineer: **Stantec, Jeffrey T. Hancock, P.E.**
Professional Engineer Virginia License Number: **37017**
Mailing Address: **5209 Center Street, Williamsburg, VA 23188**

Telephone No.: (Business) **757-220-6869**

Directions: Make note of all pertinent conditions and changes since the last inspection, or, if this is the first inspection, since the filing of a design report.

Date of This Inspection **Feb. 25, 2014**
Date of Last Inspection **unknown**

1. EMBANKMENT

a. Any alteration made to the embankment? **No**

b. Erosion on embankment? **Slope failure associated with pipe separation of principal spillway, DS face of dam**

c. Settlement, misalignment or cracks in embankment? **No**

d. Seepage? If so, seepage flow rate and location (describe any turbidity and observed color within the flow): **No**

2. UPSTREAM SLOPE

a. Woody vegetation discovered? **Herbaceous vegetation, some large stumps**
b. Rodent burrows discovered? **Not observable due to herbaceous vegetation**
c. Remedial work performed? **Tree removal in recent years**

3. INTAKE STRUCTURE

a. Deterioration of concrete? **No**
b. Exposure of rebar reinforcement? **No**
c. Is there a need to repair or replace the trash rack? **No trash rack.**
d. Any problems with debris? **Some debris accumulation**
e. Was the drawdown valve operated? **No valve present**

4. ABUTMENT CONTACTS

a. Any seepage? If so, estimate the flow rate and describe the location of the seep or damp areas (describe any turbidity and observed color within the flow):

No seepage observed. Right US groin has concrete ditch installed for some road drainage.
Evidence of runoff in left DS groin, with light erosion. Right DS groin is in failure area

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5. EARTHEN EMERGENCY SPILLWAY **Not present**

a. Obstructions to flow? If so, describe plans to correct:

b. Rodent burrows discovered?

c. Any deterioration in the approach or discharge channel?

---

6. CONCRETE EMERGENCY SPILLWAY **Not present**

a. Deterioration of concrete?

b. Exposed steel reinforcement?

c. Any leakage below concrete spillway?

d. Obstructions to flow? If so, lists plans to correct:

---

7. DOWNSTREAM SLOPE **Slope failure associated with failure of outfall barrel due to pipe separation**

a. Woody vegetation discovered? **Some large remaining stumps. Wood chips cover the whole face**

b. Rodent burrows discovered? **Not observable due to layer of wood chips**

c. Are seepage drains flowing? **No drains present**

d. Any seepage or wet areas? **No seepage or wet areas on embankment. Failure area shows no sign of seepage**

---

8. OUTLET PIPE **Pipe Separation**

a. Any water flowing outside of discharge pipe through the Impounding Structure? **no**

b. Describe any deflection or damage to the pipe: **Pipe separation approx. half way through DS slope**

---

9. STILLING BASIN **Not present**

a. Deterioration of concrete structures?

b. Exposure of rebar reinforcement?

c. Deterioration of the basin slopes?

d. Repairs made?

e. Any obstruction to flow?

---

10. GATES **Not present**

a. Gate malfunctions or repairs?

b. Corrosion or damage?

c. Were any gates operated? If so, how often and to what extreme?

---

11. RESERVOIR/WATERSHED

a. New developments upstream of dam? **No**

b. Slides or erosion of lake banks around the rim? **No**

c. General comments to include silt, algae or other influence factors: **Woody debris accumulation along shoreline and at the principal outlet structure. Algae**

---

12. INSTRUMENTS **Not present**

a. List all instruments

b. Any readings of instruments?

c. Any installation of new instruments?

13. DOWNSTREAM/HAZARD ISSUES

a. New development in downstream inundation zone? **No**

b. Note the maximum storm water discharge or peak elevation during the previous year. **Unknown**

c. Was general maintenance performed on dam? If so, when? **Tree removal in recent years**

d. List actions that need to be accomplished before the next inspection: **Repair of the pipe separation and slope failure Removal of the stumps and roots with diameter larger than 1 inch. Removal of herbaceous vegetation. Re-grading of the dam faces, re-seeding and soil amendments based on testing. Debris removal along shoreline and at inlet structure.**

14. OVERALL EVAULATION OF IMPOUNDING STRUCTURE AND APPURTENANCES

(Check one) ☐ **EXCELLENT** ☐ **GOOD** ☒ **POOR**

General Comments: The impounding structure is not well maintained. Obviously the most significant issue is the pipe separation and associated slope failure. Without repair the impounding structure is at risk for breach in the future.

Recommendations: Tree stumps and roots as well as the layer of wood chips need to be removed and a healthy stand of grass established, which is mowed at least twice a growing season.
Debris should be removed from the shoreline and around the outlet structure.
Efforts should be undertaken to obtain an Operation & Maintenance Certificate or a General Permit for the operation of this Impoundment. Preliminary calculations demonstrate that the impoundment is subject to the Dam Safety Regulations.

CERTIFICATION BY OWNER'S ENGINEER (required only when an inspection by an engineer is required)

I hereby certify that the information provided in this report has been examined by me and found to be true and correct in my professional judgment.

Signed: _____ Virginia Number: _____
Professional Engineer's Signature Print Name

This _____ day of _____ , 20 _____ .

Engineer's Virginia Seal:

CERTIFICATION BY OWNER

I hereby certify that the information provided in this report has been examined by me.

Signed: _____
Owner's Signature Print Name

This _____ day of _____ , 20 _____ . _____

Mail the executed form to the appropriate
Department of Conservation and Recreation
Division of Dam Safety and Floodplain Management
Regional Engineer

Blue Ridge Geotechnical, LLC

REPORT OF GEOTECHNICAL EXPLORATION

KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

Prepared for:

STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP

WILLIAMSBURG, VIRGINIA

Prepared by:

BLUE RIDGE GEOTECHNICAL, LLC

RICHMOND, VIRGINIA

BRG PROJECT NO. 150

REVISED MARCH 10, 2014

INTRODUCTION AND AUTHORIZATION

Blue Ridge Geotechnical, LLC (BRG) is pleased to submit this report of the geotechnical exploration program performed for the Kingspoint Dam in James City County, Virginia. This work was performed in general accordance with the proposal submitted to Stantec/**Williamsburg Environmental Group (WEG)** on January 21, 2014 and accepted on January 22, 2014.

PURPOSES AND SCOPE OF SERVICES

The purposes of our involvement on this project were to execute a subsurface exploration program, to evaluate the subsurface conditions at the site, and to prepare this report, which contains our geotechnical recommendations. The tasks that **BRG** performed are summarized below.

A. Reviewed the available geologic literature and soils maps of the area.

B. Performed two site visits (January 27, 2014 and February 4, 2014).

C. Performed two (2) Standard Penetration Test (SPT) borings and two (2) shallow hand auger borings.

D. Performed laboratory testing on selected soil samples.

E. Estimated the engineering properties of the subsurface materials within the depths explored.

F. Performed analyses in order to develop geotechnical recommendations regarding the existing dam based on the estimated soil parameters and our understanding of the project.

G. Prepared this report presenting our findings and recommendations.

Our scope of services did not include subsequent site visits, construction observation work, attendance at meetings, or any other task not explicitly identified herein or in our proposal.

PROJECT INFORMATION AND CURRENT SITE CONDITIONS

Kingspoint Dam is located within the Kingspoint subdivision in James City County, Virginia as shown on the Project Location Map (Drawing No. 1) in Appendix "A." The dam is located

northeast of 110 Overlook Drive and is generally located on the south side of the pond. From the downstream toe, the dam appears to have a maximum height of approximately 25 to 30 feet at its center and is approximately 300 feet in length. The crest (top) of the dam is approximately 20 to 25 feet wide. The dam appears to have been constructed across a natural swale; steep natural slopes were observed on both sides of the ravine. Large trees were once present on the dam, but have recently been removed (cut even with the surface of the dam). Several large stumps were observed in the dam. The crest and downstream surface of the dam is covered with what appears to be mulch or chipped wood, which is likely the remnants of the trees. The age of the dam is unknown. Additionally, it is not known if the dam was constructed of zoned material (separate core and shell zones, each consisting of different material), or whether the dam is made of a relatively homogeneous material.

The primary spillway consists of a brick riser structure that is capped with concrete located on the right side of the pond, adjacent to the dam. (Note that the terms "right" and "left" are relative to one viewing the dam in a downstream direction. In this case, the right and left sides are the southwest and northeast sides, respectively.) The downstream slope of the dam ranges between 24° and 26°, and the upstream slope (above the pond water level) ranges from 22° to 23°. The pond water level appeared to be approximately 6 to 7 feet below the crest of the dam at the time the drilling was performed, and pond water was entering the primary spillway. A portion of the top of the spillway structure appeared to be clogged with debris.

Mature trees are present in the flat area approximately 25 feet beyond the downstream toe of the dam, and the ground in this area was saturated at the time of our site visit. Rain had fallen the day prior to drilling; however, this area may remain marshy during the wet time of the year.

A large failure zone is present on the right, downstream portion of the dam. This failure is directly over the primary spillway barrel pipe. The barrel pipe, which is made of corrugated metal, is completely severed at the bottom of the failed zone. Water is flowing through the portion of pipe that extends out of the dam. The face of the failed zone (scarp) appears to be nearly vertical, and extends up to the downstream edge of the dam's crest. No seepage was observed in the vertical face of the failed zone.

GEOLOGIC CONDITIONS

According to the geologic references cited, the site is located within the Coastal Plain Physiographic Province. The site appears to be located within the Chesapeake Group ***(Tc)***, which is comprised of several formations. The material within this group can consist of fine to coarse sand, silt, clay, variably shelly and diatomaceous.

2003 Digital Representation of the 1993 Geologic Map of Virginia, Commonwealth of Virginia, Department of Mines, Minerals and Energy, Division of Mineral Resources

FIELD EXPLORATION PROGRAM

On January 27, 2014, two (2) hand auger borings (HA-1 and HA-2) were performed at the toe of the dam. On February 4, 2014, two (2) Standard Penetration Test (SPT) borings were performed on the crest of the dam. The boring locations are shown on the Approximate Boring Location Plan (Drawing No. 2) in Appendix "A." The borings (designated B-1 and B-2) were advanced to a depth of 40 feet below the crest of the dam. The locations of the borings were recorded in the field using a hand-held GPS unit.

The borings were performed by Ayers and Ayers, Inc. of Powhatan, Virginia and were advanced using a CME 45B drill rig mounted on an all-terrain vehicle. Hollow-stem augers having an inside diameter of 2¼ inches were used. The SPT, as defined by ASTM D 1586, involves drilling to predetermined depths using hollow-stem augers, removing the center plug, and driving a split-spoon sampler with a 140-pound hammer falling 30 inches through the hollow-stem augers. The blow counts required to drive the split-spoon sampler are recorded for three successive, 6-inch increments. The last two, 6-inch increments are added together, and this value is referred to as the N-value for that particular sample. The N-value can be used to estimate the relative density of the soil (for granular soils), or the consistency (for fine-grained soils), and can be used to estimate geotechnical engineering properties. A manual hammer was used during the SPT work. Upon completion, all borings were filled and sealed with a grout consisting of a mixture of extra high yield bentonite and cement.

HAND AUGER RESULTS

The results of the hand auger borings are summarized in the table below:

Hand Auger Location	Material Encountered	Groundwater Depth	Termination Depth	Reason for Termination
HA-1 37.24095° -76.70018°	0-2': Very moist, brown, lean CLAY with sand, large stick at 2' 2'-3.4': Very moist, dark gray, silty fine to medium SAND	2.6'	3.4'	Refusal
HA-2 37.24102° -76.70008°	0-2.75': Moist to very moist, red brown to yellow brown lean CLAY with sand	2.5'	2.75'	Below water table

USDA SOIL MAP

The USDA Soil Map of this area was reviewed. A copy of this map is provided in Appendix C (Drawing No. 3). The predominant soil unit indicated was **Unit 15F** (Emporia complex, 25% to 50% slopes). The parent material is indicated to be marine deposits. Appendix C contains additional information obtained from the USDA website.

LABORATORY TESTING PROGRAM

The soil samples obtained during drilling operations were visually classified in general accordance with ASTM D 2487 (Standard Test Method for Classification of Soils for Engineering Purposes) and ASTM D 2488 (Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)). This system is also known as the Unified Soil Classification System (USCS) and was used to develop the soil descriptions presented on the logs. The logs and supplemental information regarding the USCS procedure are provided in Appendix "B."

Selected soil samples were sent to GeoTesting Express in Acton, Massachusetts for laboratory testing. Water Content determinations (ASTM D 2216), Atterberg Limits (ASTM D 4318), and Grain-size Analyses (ASTM D 422) were performed. Detailed laboratory results are included in Appendix "D" of this report and summarized below.

Location	Depth (ft.)	Water Content (%)	Liquid Limit (%)	Plasticity Index (%)	Fines Content (%)	USCS
B-1	2.0-3.5	16.2	49	28	70.6	CL
B-1	9.0-10.5	22.0	37	18	75.0	CL
B-1	14.0-15.5	17.6	25	11	61.7	CL
B-2	7.0-8.5	19.9	32	16	70.3	CL

SUBSURFACE CONDITIONS

Soil Stratigraphy

Three general soil units were encountered during our subsurface exploration program:

Unit "A": Surficial Materials
Unit "B": Fill (Dam Embankment)
Unit "C": Alluvium/Marine Sediments

Unit "A" surficial materials consisted of approximately 1 to 2 inches of mulch (chipped trees). This unit was encountered in all borings locations.

Unit "B" fill soils that make up the dam embankment consist primarily of lean CLAY with sand. Occasional organic matter and wood fragments were encountered in this unit. This unit, which was encountered in borings B-1 and B-2, extends to a depth of approximately 23 feet below the crest of the dam. The Standard Penetration Test N-values ranged from 2 to 17 blows per foot (bpf), with an average value of approximately 8 bpf, which represents a "medium stiff" consistency for the cohesive soils.

Unit "C" alluvial/marine soils were encountered in all borings and consist lean CLAY (CL) with sand and clayey SAND (SC). The N-values in this unit range from 3 to 12 with an average of 6.

A detailed description of the soils encountered at each boring is presented on the boring logs provided in Appendix "B." Although the delineations between these units, as well as the delineations between the various soil strata within each unit, are depicted as a solid line on the boring logs, the transition between strata may be gradual or abrupt. BRG will retain the soil samples for 60 days, unless it is requested that they be kept for a longer period of time.

Groundwater/Seepage Line Observations

The groundwater (seepage line) was encountered at the depths/elevations shown in the table below.

Boring	**Groundwater Measurements** (Depth)		
	During Drilling	Upon completion (through hollow-stem auger)	Upon completion (through uncased borehole)
B-1	Not observed	Not observed	33 ft.
B-2	22 ft.*	Not observed	36 ft.
HA-1	3.4	N/A	N/A
HA-2	2.75	N/A	N/A

*possibly perched

Long-term water level (seepage line) measurements using piezometers were not obtained. Unless long-term water measurements are made over a long period of time, it is difficult to know precisely where the water surface (seepage line) is located. The water may not simply be the point at which the soil samples have a "wet" appearance. The actual phreatic surface may be lower than the point at which "wet" soils are encountered. This is due to the presence of a saturated capillary fringe zone above the actual water level, especially common in fine-grained soils. Additionally, the soil augers typically alter the sides of the borehole (smear the sidewalls of the hole), which inhibits groundwater recharge, resulting in possible erroneous readings when taken immediately upon completion of the boring. In some cases, the groundwater that is encountered during drilling is not a static phreatic surface, but rather is under artesian pressure. Alternatively, subsurface water may be "perched" on top of an impervious stratum. Seasonal fluctuations and extended periods of drought or rain can also significantly affect the water levels.

OVERALL CONDITION OF DAM

Based on observations made at the time of our site visits, except for the large failed area, the condition of the dam generally appears satisfactory. No signs of localized slope failure or excessive seepage were noted on the downstream slope face, nor on the portion of the upstream face that is visible above pond level. The ground surface near the toe of the dam and beyond was wet; however, this appears to be the result of recent heavy rain and snowfall. The Standard Penetration Test N-values tended to be lower in boring B-2 than in boring B-1, possibly indicating that the dam may contain localized zones of weaker material. However, the dam appears to have been in place and stable for a relatively long period of time.

The dam appears capable of supporting a proposed driveway that will provide access to the property on the east side of the pond from Overlook Drive. Prior to driveway construction, the wood chips should be removed, and the subgrade thoroughly proofrolled with a fully loaded, tandem-axle dump truck to identify any soft or weak areas. All areas that pump or rut during proofrolling operations should be improved based on field conditions. This driveway appears to be the sole access point for this property, as the pond and the Colonial National Historic Parkway border the property on the west and east sides, respectively. However, if possible, it would be prudent to incorporate a secondary ingress/egress route (possible from the north) that can be used in case of an emergency.

It is recommended that the stumps and large roots present in the dam be removed and replaced with compacted structural fill as described later in this report. Roots larger than approximately one inch in diameter should be removed; however, this work should be performed as carefully as possible. It would be preferable to leave isolated roots in place rather than to damage the dam by attempting to remove roots that extend deep into the embankment. As a guide, excavations performed for the purpose of stump and root removal should be limited to a depth of approximately 3 feet.

CAUSE OF FAILURE

It is difficult to determine whether the leak in the CMP cause the failure of the downstream slope of the dam, or whether the failure resulted in the pipe becoming severed. Additionally, it is not known what impact, if any, that overtopping may have played in the failure. It seems likely that the pipe began to leak at some point, which ultimately resulted the failure of the dam.

When a buried pipe leaks, it will saturate the soil, which can significantly reduce the shear strength of the soil. Additionally, the soil that surrounds the pipe can progressively enter the pipe, which can create loss of ground, eventually resulting in a large-scale failure.

RECOMMENDATIONS

Although the failed zone of the dam is large and a significant portion of the dam has been removed, no apparent seepage was noted in the shear face of the scarp. This seems to indicate that the dam is still able to function in spite of the failure. Based on our borings, the material with which the dam was constructed (at least in the center of the dam) appears to be predominantly clay. Clay has a low permeability, which is good for controlling seepage.

The following corrective measures are recommended:

1. Evaluate the condition of the primary spillway, the riser pipe and the CMP barrel. This can be accomplished with video camera that can be fed both from the top, extending down the riser pipe, and up the CMP barrel from the severed portion. For best results, this work will likely have to be performed when the pond level is low, so that water is not flowing within the pipe. The camera can used to determine if the pipe is corroded, severed at any joints, or otherwise compromised. One sign of a potential future problem might be if there is an area where soil appears to be entering the pipe.

2. Once it is confirmed that the portions of the riser and barrel that remain in the dam are sound, the failed material at the toe of the dam can be removed. As this area is currently being inundated with water exiting the barrel, this work should be performed when the pond level is below the primary spillway. Alternatively, the water should be collected at the current discharge point and piped downstream, until the water can be conveyed within a new extended barrel.

3. Soft, weak soil that is currently present at the base of the failed area should be carefully removed, and the subgrade evaluated. A limited portion of the soft material can probably remain; however, this must be determined in the field. If some soft soils must remain, it may be necessary to utilize a bridge lift of large stone (e.g., VDOT No. 2 stone). It is imperative that this material be completely wrapped in geosynthetic fabric for separation. It will also be important that this excavation not undermine the existing dam in any way.

4. Extend the barrel and construct a proper outfall. The lower half of the barrel should be supported on a cradle of concrete or flowable fill, as it is not possible to compact around the lower portion of the pipe.

5. Replace the failed portion of the dam using compacted soil fill as described below.

COMPACTED FILL

Compacted fill for the dam should consist of lean CLAY with sand (CL), sandy CLAY (CL/CH), or clayey SAND (SC), providing the fines content is at least 35%. The fill should be free of organics, root matter, debris and all other deleterious material and should be placed in thin horizontal layers having a maximum loose lift thickness of 8 inches. Compacted fill placed in close proximity to the barrel extension should be placed in 4-inch loose lifts and compacted with hand tampers.

The fill should be compacted to a minimum density of 95% of the maximum dry density based on the Standard Proctor compaction test (ASTM D 698). The water content (moisture content) at the time of compaction should be within (-1) percentage point to (+3) percentage points of the optimum water content based on the Standard Proctor. Otherwise, wetting or drying the material may be necessary prior to compaction. Fill should not be placed on ground that is saturated, frozen or snow-covered.

In many cases, a soil cannot be properly compacted due to excessive moisture. If scarification and aeration is not practical, the use of lime or some other admixture can be considered to help facilitate earthwork operations.

It is typically recommended that all fill lifts be benched into existing slopes a minimum of 4 to 6 feet horizontal to help prevent the development of a smooth failure plane between the compacted fill and the existing ground (existing dam embankment). However, this must be weighed against the effect that cutting into the existing dam will have. Using a detailed survey of the failed area, it will be necessary to develop a series of steps into the existing dam that accomplish this goal while also limiting the impact to the dam.

UTILITY CONSTRUCTION

It is understood that the placement of water and sewer lines are being considered across the dam. In order to reduce the risk that the dam will be harmed by localized inundation, it will be imperative that measures be taken to keep these lines from leaking or rupturing during their service life, especially at the joints.

CONSTRUCTION INSPECTION AND SAFETY

It is strongly recommended that a qualified inspector monitor all aspects of earthwork construction, especially fill placement and moisture-density (compaction) testing. A full-time inspector can often help identify earthwork problems so they can be quickly corrected.

It is imperative that all OSHA regulations be followed. This work will be performed at the base of steep slope, and the safety of those working in this area must be maintained. It may be necessary for the contractor to utilize temporary shoring to ensure the safety of the construction crew.

LIMITATIONS

This report has been prepared specifically for Stantec/Williamsburg Environmental Group, or their authorized representatives, for the proposed Kingspoint Dam in James City County, Virginia.

The recommendations contained herein are based on the information obtained during our subsurface exploration program and our understanding of the project. If the details of this project differ from those described herein, or if any details of this project change after the date of this report, we should be contacted. Our recommendations may have to be amended as a result of the project modifications.

It is important to realize that subsurface conditions can vary (sometimes significantly) from those encountered during the subsurface exploration program. If, during construction operations, site conditions appear different than those described herein, we should be contacted. Again, our recommendations may have to be amended as a result of the conditions revealed during construction.

The report should be made available to other designers involved with the project, as well as perspective contractors bidding on the project. However, it should be known that this report is "for information only" and should not be considered part of the Contract Documents. This report was intended to provide recommendations for design only. The recommendations contained herein represent our opinions and interpretations; no other warranty, explicit or implicit, is made.

ACKNOWLEDGEMENT

We appreciate the opportunity to serve as your geotechnical engineering consultant on this project. If you have any questions, please do not hesitate to contact us at 804/357-4157 or BlueRidgeGeotech@comcast.net.

Respectfully Submitted,
Blue Ridge Geotechnical, LLC

J. Michael Hall, P.E.
Geotechnical Engineer/Founder

REFERENCES

Commonwealth of Virginia, Department of Mines, Minerals and Energy, Division of Mineral Resources, Publication 174, *Digital Representation of the 1993 Geologic Map of Virginia, Expanded Explanation*, 2003

USDA Soil Survey Maps (www.websoilsurvey.nrcs.usda.gov)

Army Corp of Engineers Engineering Manual (EM 1110-2-1901), September 30, 1986

APPENDICES

- Appendix A (Figures)
  - Project Location Map (Drawing No. 1)
  - Approximate Boring Location Plan (Drawing No. 2)

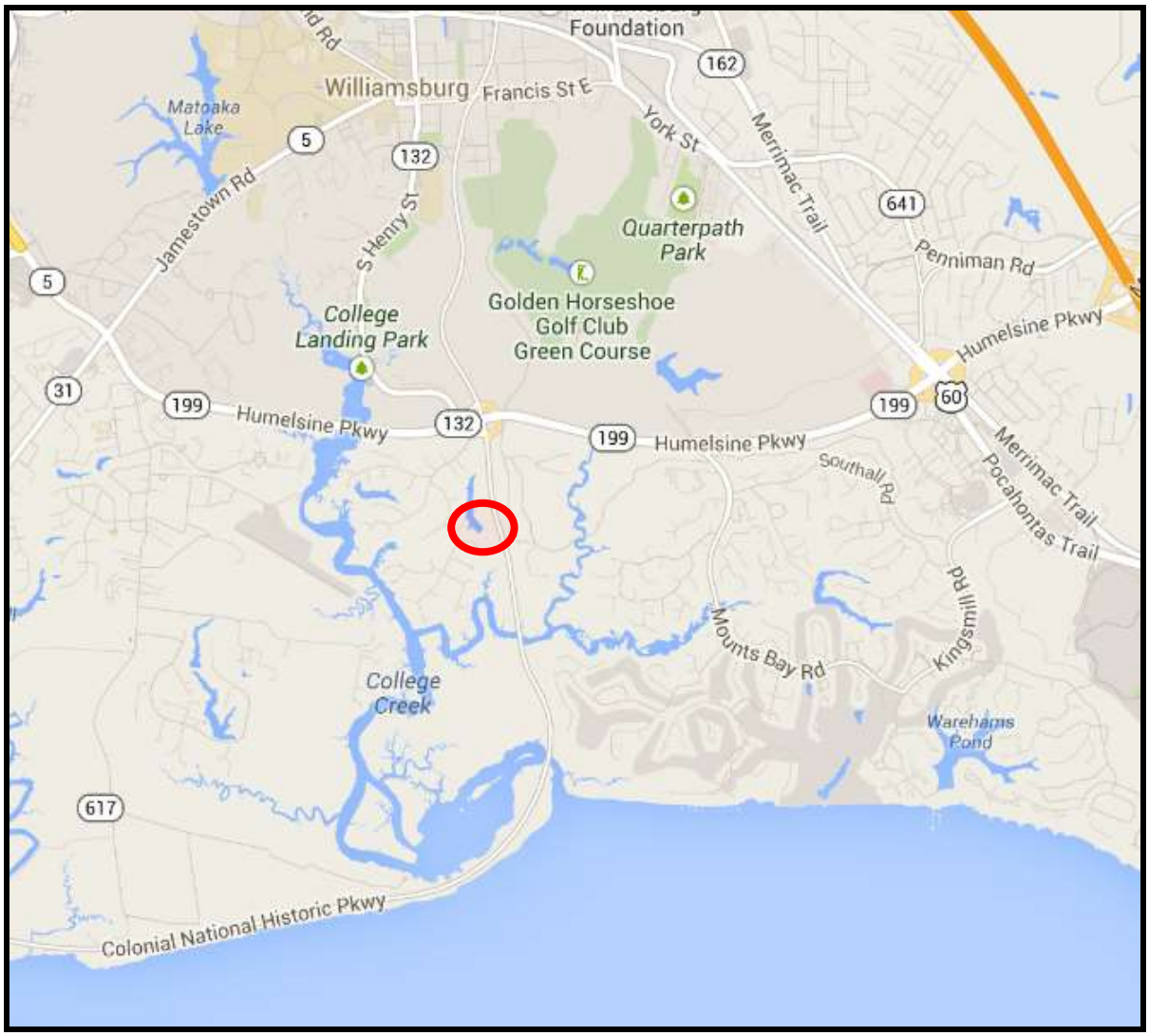
- Appendix B (Boring Logs)
  - Boring Logs B-1 and B-2
  - Boring Log Interpretation (2 pages)

- Appendix C (USDA Soil Map Data)
  - USDA Soils Map (Drawing No. 3)
  - Map Unit Description – (15F) Emporia Complex, 25% to 50% slopes
  - Engineering Properties (9 pages)
  - Physical Properties (8 pages)
  - Particle Size and Coarse Fragments (5 pages)

- Appendix D (Laboratory Test Results) (9 pages)

APPENDIX "A"

FIGURES



** Map obtained from Virginia.gov website*

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STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP
WILLIAMSBURG, VIRGINIA

PROJECT LOCATION MAP

KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

BRG NO. 150
FEBRUARY 2014
DRAWN BY: JMH *
SCALE: N/A

DRAWING NO. 1

** Adapted itouchmap.com*

N

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STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP
WILLIAMSBURG, VIRGINIA

APPROXIMATE BORING LOCATION PLAN

KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

BRG NO. 150
FEBRUARY 2014
DRAWN BY: JMH *
SCALE: AS NOTED

DRAWING NO. 2

APPENDIX "B"

BORING LOGS

Blue Ridge Geotechnical, LLC

Boring Log

B-1 (Sht. 1 of 2)

Project: *Kingspoint Dam*
James City County, Virginia

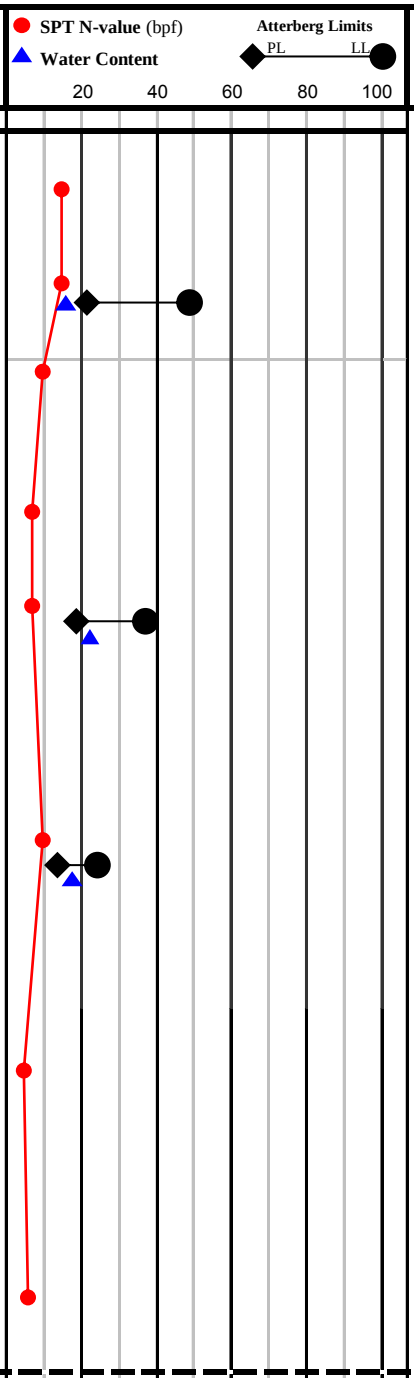
BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unknown
Boring Location: N 37.24099° W -76.70048°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value
	Moist, stiff, red brown, brown and gray, lean **CLAY** with sand, trace organic matter (occasional sticks, roots) *(Fill)*	(F)		0.0	6	6	9	15
				1.5				
				2.0	6	7	8	15
				3.5				
	Moist, stiff, yellow brown and orange brown, lean **CLAY** with sand, trace organic matter (occasional sticks, roots)	(F)		4.0	7	6	4	10
				5.5				
	Below 7': Medium stiff consistency			7.0	4	3	5	8
				8.5				
	Below 9': Tan and gray color			9.0	4	4	4	8
				10.5				
	Below 14': Stiff consistency			14.0	4	5	5	10
				15.5				
	Below 19': Medium Stiff consistency, orange brown and brown color *(Fill)*			19.0	3	2	3	5
				20.5				
				23.0				
	Very moist, medium stiff, brown, fine sandy lean **CLAY**, trace organics, trace shell *(Alluvial/Marine)*	(CL)		24.0	3	3	3	6
				25.5				
				27.0				

Continued on Sheet 2



Remarks

~2 inches mulch on surface

Water:
-Not encountered during drilling
-Not encountered upon completion (through HSA) - 33 ft. (through uncased borehole)

Cave-in: 37 ft.

2.0'-3.5':
LL=49 PI=28
FC=70.6%
w_c=16.2%

9.0'-10.5':
LL=37 PI=18
FC=75.0%
w_c=22.0%

14.0'-15.5':
LL=25 PI=11
FC=61.7%
w_c=17.6%

Blue Ridge Geotechnical, LLC

Boring Log

B-1 (Sht. 2 of 2)

Project: *Kingspoint Dam*
James City County, Virginia

BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unkknown
Boring Location: N 37.24099° W -76.70048°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value	SPT N-value (bpf) / Water Content / Atterberg Limits (PL–LL) 20 40 60 80 100	Remarks
	Continued from Sheet 1			27.0						
				28.0						
	Very moist, medium stiff, brown and gray, fine to medium sandy **CLAY** *(Alluvial/Marine)*	(CL)		29.0	1	2	3	5		
				30.5						
				32.0						
	Very moist, medium stiff, brown and gray, fat **CLAY** with fine sand *(Alluvial/Marine)*	(CH)		34.0	2	3	3	6		
				35.5						
				36.0						
	Very moist, medium dense, tan and gray, clayey fine to medium **SAND** *(Alluvial/Marine)*	(SC)		38.5	4	5	7	12		
				40.0						
	Boring Terminated at 40.0 ft.									

Blue Ridge Geotechnical, LLC

Boring Log

B-2 (Sht. 1 of 2)

Project: *Kingspoint Dam*
James City County, Virginia

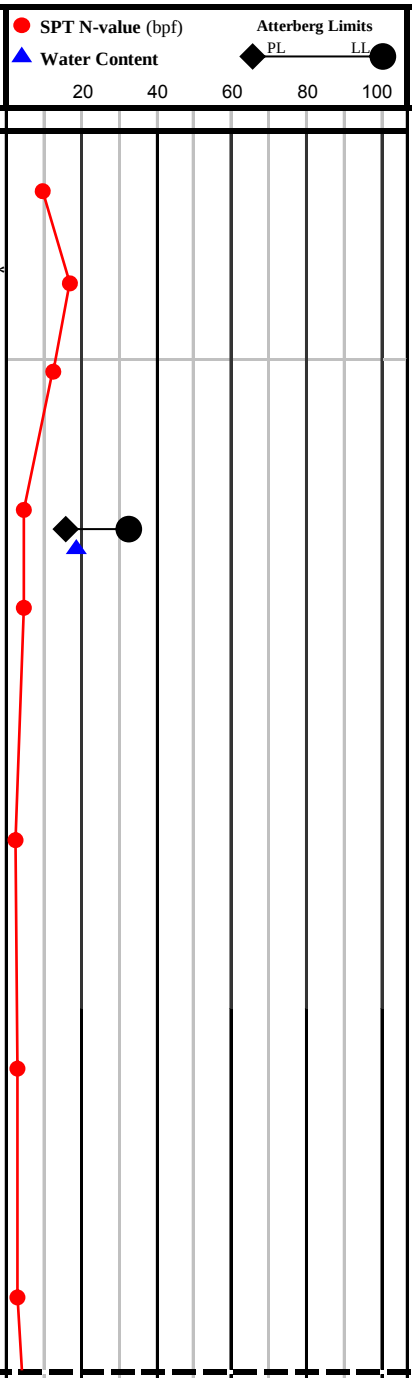
BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unknown
Boring Location: N 37.24113° W -76.70025°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value
	Moist to very moist, stiff, red brown, tan and gray, lean **CLAY** with sand, trace organic matter (occasional sticks, roots) *Below 2': "Moist"* *(Fill)*	(F)		0.0	2	4	6	10
				1.5				
				2.0	3	6	11	17*
				3.5				
				4.0	6	6	6	12
				5.5				
				7.0	1	2	3	5
				8.5				
	Very moist, medium stiff, gray and brown, lean **CLAY** with sand, isolated zones of sand *(Fill)*	(F)		9.0	3	3	2	5
				10.5				
	Very moist, soft, gray and red brown (mot.), lean **CLAY,** with sand *(Fill)*	(F)		12.0				
				14.0	1	1	1	2
				15.5				
	Very moist, soft, gray and brown, sandy lean **CLAY,** trace organics *(Fill)*	(F)		17.0				
				19.0	1	1	2	3
				20.5				
	Very moist, soft, brown, fine sandy lean **CLAY**, trace organics *(Alluvial/Marine)*	(CL)		23.0				
				24.0	1	2	1	3
				25.5				
				27.0				

Continued on Sheet 2



Remarks

~1 inches mulch on surface

* Spoon driven through large stick

Water:
-Apparent perched water at approx. 22 ft.
-Not encountered upon completion (through HSA) - 36 ft. (through uncased borehole)

Cave-in: 37 ft.

7.0'-8.5':
LL=32 PI=16
FC=70.3%
w_c=19.9%

Blue Ridge Geotechnical, LLC

Boring Log

B-2 (Sht. 2 of 2)

Project: *Kingspoint Dam*
James City County, Virginia

BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unkknown
Boring Location: N 37.24113° W -76.70025°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value	SPT N-value (bpf) / Water Content / Atterberg Limits (PL–LL) 20 40 60 80 100	Remarks
	Continued from Sheet 1			27.0						
				28.0						
	Very moist, medium stiff, brown and gray, lean **CLAY,** with sand *(Alluvial/Marine)*	(CL)		29.0	1	3	2	5		
				30.5						
				32.0						
	Very moist, medium stiff, brown and gray, sandy lean **CLAY** *(Alluvial/Marine)*	(CL)		34.0	2	3	3	6		
				35.5						
				36.0						
	Very moist, stiff, dark gray, fine sandy **CLAY** *(Marine)*	(CL/ CH)		38.5	2	4	5	9		
				40.0						
	Boring Terminated at 40.0 ft.									

Boring Log Interpretation

The convention used to describe the soil strata on the boring logs is described below. This procedure in general accordance with ASTM D 2487 and ASTM D 2488. The soil descriptions typically follow this format:

"Moisture, Relative Density/Consistency, Color, Secondary component, PRIMARY COMPONENT, minor components and additional comments"

Moisture:
"Dry" – Absence of moisture
"Moist" – Damp, but no visible water
"Wet" – Visible water within sample.

Relative Density/Consistency:

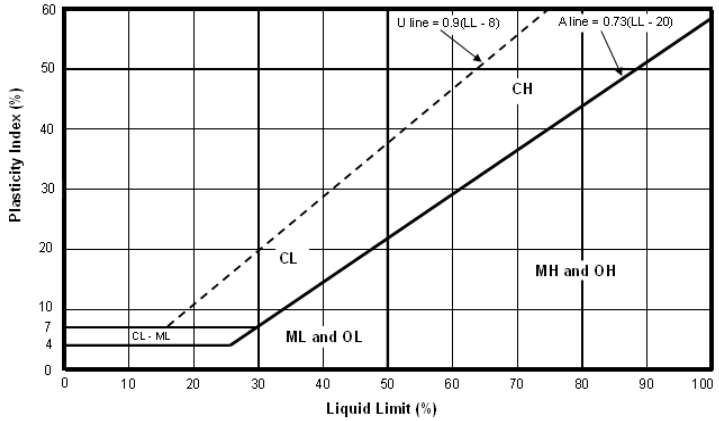
Relative Density is used to describe soils that are predominantly Coarse-Grained (Sands and Gravels).
Consistency is used to describe soils that are predominantly Fine-Grained (Silts and Clays).
Relative Density/Consistency descriptions are based on the SPT N-values as follows:

Relative Density		Consistency	
	SPT N-value		SPT N-value
Very Loose	0 – 4	Very Soft	0 – 1
Loose	5 – 10	Soft	2 – 4
Medium Dense	11 – 30	Medium Stiff	5 – 8
Dense	31 – 50	Stiff	9 – 15
Very Dense	> 50	Very Stiff	16 – 30
		Hard	> 30

Primary and Secondary Components:

Soil Type in Terms of Sieve Size	
Boulder	< 12 inches
Cobble	3 – 12 inches
Gravel (coarse)	¾" – 3 inches
Gravel (fine)	#4 – ¾"
Sand (coarse)	#10 – #4
Sand (medium)	#40 – #10
Sand (fine)	#200 – #40
Silt	< #200
Clay	< #200

Coarse-grained soils can be classified based on their grain-size distribution (gradation curves). Fine-grained soils are classified according to their plasticity, which can be determined using performance tests (e.g., Atterberg Limits plotted on the Plasticity chart shown below).



Boring Log Interpretation (con't)

USCS (Unified Soil Classification System) Group Symbols:

USCS Group Symbols are two letter designations.

The first letter represents the primary constituent (all soil types). The second letter represents the secondary constituent (in the case of predominantly coarse-grained soils) or the second letter represents the plasticity (in the case of predominantly fine-grained soils):

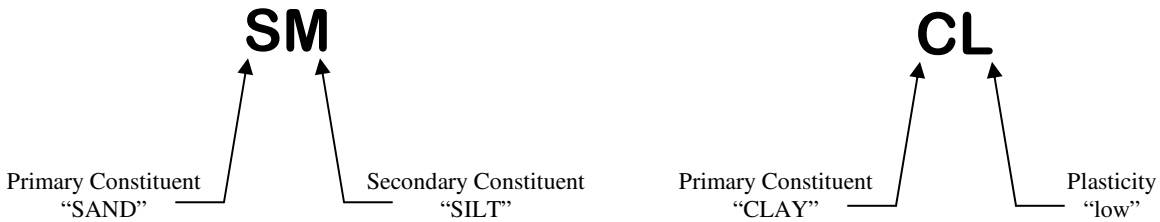
First Letter (Primary Constituent)

G = Gravel
S = Sand
M =Silt
C = Clay

Second Letter (Secondary Constituent or Plasticity)

Coarse-Grained Soils	Fine-Grained Soils
M = Silt	H = High Plasticity
C = Clay	L = Low Plasticity

For example,



Description: "silty SAND"

Description: "lean CLAY"

Minor Components:

According to ASTM D 2488, the terms used to describe to describe the minor components are based on estimations of the quantity of that component within the sample as follows:

Term	Estimated Quantity (by weight)
"trace"	< 5%
"few"	5 – 10 %
"little"	15 – 25%
"some"	30 – 45%

Miscellaneous Terms:

PP – Pocket Penetrometer
FC – Fines Content (quantity of silt and clay)
w_c – Water Content
LL – Liquid Limit
PL – Plastic Limit
PI – Plasticity Index
Mot. – Mottled appearance

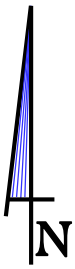
APPENDIX "C"

USDA SOIL MAP DATA

Map obtained from websoilsurvey.nrcs.usda.gov

Primary Soil Unit:

Map Unit Symbol	Map Unit Name	Typical Profile
15F	Emporia complex, 25 to 50% slopes	0-13": Fine sandy loam 13"-58": Loam 58"-75": Sandy clay loam



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STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP
WILLIAMSBURG, VIRGINIA

USDA SOILS MAP

KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

BRG No. 150
February 2014
Drawn by: JMH *
Scale: As noted

DRAWING NO. 3

James City and York Counties and the City of Williamsburg, Virginia

15F—Emporia complex, 25 to 50 percent slopes

Map Unit Setting

Elevation: 20 to 150 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 165 to 193 days

Map Unit Composition

Emporia and similar soils: 75 percent
Minor components: 5 percent

Description of Emporia

Setting

Landform: Marine terraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Marine deposits

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: About 36 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 13 inches: Fine sandy loam
13 to 58 inches: Loam
58 to 75 inches: Sandy clay loam

Minor Components

Johnston

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash.

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
4—Beaches														
Beaches	70		0-60	Coarse sand, sand, fine sand	SP	A-1, A-3	0	0	80-100	78-100	39-80	4-35	7-9	NP
8B—Caroline fine sandy loam, 2 to 6 percent slopes														
Caroline	85	C	0-13	Loam, sandy loam, fine sandy loam	CL, CL-ML	A-4	0	0	90-100	85-100	85-100	50-90	20-30	4-10
			13-47	Clay loam, clay, sandy clay loam, sandy clay	CH, CL	A-7	0	0	90-100	85-100	80-100	35-95	25-61	7-27
			47-72	Clay loam, clay, fine sandy loam, sandy clay	CH, CL, SC, SC-SM, ML	A-4, A-6, A-7	0	0	90-100	85-100	60-100	30-95	20-61	4-27
10B—Craven fine sandy loam, 2 to 6 percent slopes														
Craven	80	D	0-9	Fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	58-100	29-90	13-31	NP-10
			9-53	Clay, silty clay, silty clay loam, clay loam, sandy clay loam, sandy clay	CL, CH	A-7	0	0	100	98-100	83-100	44-95	34-61	12-27
			53-80	Sandy clay loam, sandy loam, loamy sand	SC, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	49-100	14-55	12-38	NP-14

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
10C—Craven fine sandy loam, 6 to 10 percent slopes														
Craven	80	D	0-9	Fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	58-100	29-90	13-31	NP-10
			9-53	Clay, silty clay, silty clay loam, clay loam, sandy clay loam, sandy clay	CL, CH	A-7	0	0	100	98-100	83-100	44-95	34-61	12-27
			53-80	Sandy clay loam, sandy loam, loamy sand	SC, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	49-100	14-55	12-38	NP-14
11C—Craven-Uchee complex, 6 to 10 percent slopes														
Craven	35	D	0-9	Fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	58-100	29-90	13-31	NP-10
			9-53	Clay, silty clay, silty clay loam, clay loam, sandy clay loam, sandy clay	CL, CH	A-7	0	0	100	98-100	83-100	44-95	34-61	12-27
			53-80	Sandy clay loam, sandy loam, loamy sand	SC, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	49-100	14-55	12-38	NP-14
Uchee	35	B	0-24	Loamy fine sand, sand, loamy sand	SM	A-1-b, A-2	0	0	80-100	78-100	40-70	15-30	10-16	NP-2
			24-56	Sandy loam, sandy clay loam, clay, sandy clay	SC, SC-SM	A-2, A-4, A-6	0	0	80-100	78-100	46-100	23-95	14-52	1-22
			56-65	Sandy loam, sandy clay loam, sandy clay	CL, SC	A-2-6, A-6, A-7	0	0	80-100	78-100	46-95	23-60	18-43	3-17

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
14B—Emporia fine sandy loam, 2 to 6 percent slopes														
Emporia	80	B	0-13	Fine sandy loam, loam, sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-4, A-6	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Clay loam, sandy clay loam, loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14
15D—Emporia complex, 10 to 15 percent slopes														
Emporia	75	B	0-13	Sandy loam, loam, fine sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-6, A-4	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Clay loam, sandy clay loam, loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
15F—Emporia complex, 25 to 50 percent slopes														
Emporia	75	B	0-13	Sandy loam, loam, fine sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-4, A-6	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Loam, sandy loam, clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14
17—Johnston complex														
Johnston	75	A/D	0-34	Silty clay loam, silt loam, loam, fine sandy loam	CL-ML, ML, OL	A-4, A-6	0	0	100	100	70-100	40-95	13-38	NP-14
			34-60	Sandy clay loam, sandy loam, sand, fine sandy loam	SC, SM	A-2, A-4	0	0	100	100	50-90	5-55	7-34	NP-12
18B—Kempsville fine sandy loam, 2 to 6 percent slopes														
Kempsville	80	A	0-14	Fine sandy loam, sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-3	90-100	85-100	51-85	26-55	12-20	NP-4
			14-55	Sandy loam, fine sandy loam, loam, sandy clay loam	SC-SM, CL, ML, SC, SM	A-2, A-4	0	0-3	90-100	85-100	51-90	26-55	18-38	3-14
			55-68	Loamy sand, fine sand, loamy fine sand, sandy loam, fine sandy loam, sandy clay loam	SM, ML	A-2	0	0-8	85-100	80-100	40-95	12-60	9-25	NP-7

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes														
Kempsville	50	A	0-14	Fine sandy loam, sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-3	90-100	85-100	51-85	26-55	12-20	NP-4
			14-55	Sandy loam, fine sandy loam, loam, sandy clay loam	SC-SM, CL, ML, SC, SM	A-2, A-4	0	0-3	90-100	85-100	51-90	26-55	18-38	3-14
			55-68	Loamy sand, fine sand, loamy fine sand, sandy loam, fine sandy loam, sandy clay loam	SM, ML	A-2	0	0-8	85-100	80-100	40-95	12-60	9-25	NP-7
Emporia	30	B	0-13	Sandy loam, loam, fine sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-4, A-6	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Clay loam, sandy clay loam, loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14
21—Levy silty clay														
Levy	85	C/D	0-18	Silty clay	ML, CH, CL	A-6, A-7	0	0	100	100	95-100	90-95	38-61	14-27
			18-80	Silty clay, clay, silty clay loam	ML, CH, CL	A-6, A-7	0	0	100	100	95-100	85-95	38-61	14-27

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
29B—Slagle fine sandy loam, 2 to 6 percent slopes														
Slagle	80	C	0-9	Fine sandy loam, sandy loam, loam	SC-SM, SM	A-2, A-4	0	0-3	95-100	90-100	54-95	27-75	14-23	1-6
			9-25	Sandy clay loam, loam, clay loam	ML, CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-3	95-100	90-100	72-100	32-80	18-43	3-17
			25-60	Sandy clay loam, loam, clay loam, clay, sandy clay, sandy loam, loamy sand	ML, CL, SC	A-4, A-6, A-7	0	0-3	95-100	90-100	45-100	14-95	10-52	NP-22
31B—Suffolk fine sandy loam, 2 to 6 percent slopes														
Suffolk	80	B	0-14	Sandy loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	98-100	98-100	58-85	29-55	14-23	1-6
			14-40	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-4, A-2, A-6	0	0	98-100	98-100	58-90	29-55	16-38	2-14
			40-64	Fine sandy loam, sandy loam, fine sand, sand, loamy fine sand, loamy sand	SC-SM, SM, SP	A-1, A-2, A-3, A-4	0	0	98-100	98-100	30-80	3-50	8-25	NP-7

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
4—Beaches														
Beaches	0-60	-99-	- 2-	0- 0- 2	1.35-1.85	141.00	0.03-0.05	0.0-2.9	0.0-0.1				1	220
8B—Caroline fine sandy loam, 2 to 6 percent slopes														
Caroline	0-13	-58-	-25-	15-18- 25	1.35-1.45	4.00-14.00	0.16-0.22	0.0-2.9	0.5-1.0	.32	.32	5	3	86
	13-47	-40-	-20-	20-40- 60	1.40-1.50	0.01-4.00	0.13-0.20	3.0-5.9	0.0	.24	.24			
	47-72	-35-	-20-	15-45- 60	1.40-1.55	0.01-4.00	0.11-0.17	3.0-5.9	0.0	.20	.20			
10B—Craven fine sandy loam, 2 to 6 percent slopes														
Craven	0-9	-69-	-15-	7-17- 27	1.30-1.45	1.40-14.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-53	-23-	-29-	30-48- 60	1.30-1.45	0.42-1.40	0.12-0.15	3.0-5.9	0.0	.24	.24			
	53-80	-57-	-18-	5-25- 35	1.35-1.60	1.40-42.00	0.08-0.14	0.0-2.9	0.0	.20	.20			
10C—Craven fine sandy loam, 6 to 10 percent slopes														
Craven	0-9	-69-	-15-	7-17- 27	1.30-1.45	1.40-14.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-53	-23-	-29-	30-48- 60	1.30-1.45	0.42-1.40	0.12-0.15	3.0-5.9	0.0	.24	.24			
	53-80	-57-	-18-	5-25- 35	1.35-1.60	1.40-42.00	0.08-0.14	0.0-2.9	0.0	.20	.20			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
11C—Craven-Uchee complex, 6 to 10 percent slopes														
Craven	0-9	-69-	-15-	7-17- 27	1.30-1.45	1.40-14.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-53	-23-	-29-	30-48- 60	1.30-1.45	0.42-1.40	0.12-0.15	3.0-5.9	0.0	.24	.24			
	53-80	-57-	-18-	5-25- 35	1.35-1.60	1.40-42.00	0.08-0.14	0.0-2.9	0.0	.20	.20			
Uchee	0-24	-77-	-16-	3- 7- 10	1.30-1.70	42.00-141.00	0.05-0.10	0.0-2.9	0.3-3.0	.28	.28	5	2	134
	24-56	-57-	-18-	8-25- 50	1.40-1.60	4.00-14.00	0.10-0.15	0.0-2.9	0.0	.24	.24			
	56-65	-65-	-17-	12-18- 40	1.40-1.60	1.40-14.00	0.10-0.16	3.0-5.9	0.0	.24	.24			
14B—Emporia fine sandy loam, 2 to 6 percent slopes														
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			
15D—Emporia complex, 10 to 15 percent slopes														
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
15F—Emporia complex, 25 to 50 percent slopes														
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			
17—Johnston complex														
Johnston	0-34	-31-	-57-	7-13- 35	1.30-1.55	14.00-42.00	0.20-0.26	0.0-2.9	3.0-8.0	.37	.37	5	5	56
	34-60	-52-	-36-	0-13- 30	1.45-1.65	42.00-141.00	0.06-0.12	0.0-2.9	0.0	.37	.37			
18B—Kempsville fine sandy loam, 2 to 6 percent slopes														
Kempsville	0-14	-69-	-22-	5-10- 15	1.30-1.40	14.00-42.00	0.08-0.14	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	14-55	-57-	-18-	12-25- 35	1.30-1.45	14.00-42.00	0.12-0.18	0.0-2.9	0.0	.20	.20			
	55-68	-71-	-17-	2-12- 20	1.35-1.65	4.00-14.00	0.12-0.18	0.0-2.9	0.0	.28	.28			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes														
Kempsville	0-14	-69-	-22-	5-10- 15	1.30-1.40	14.00-42.00	0.08-0.14	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	14-55	-57-	-18-	12-25- 35	1.30-1.45	14.00-42.00	0.12-0.18	0.0-2.9	0.0	.20	.20			
	55-68	-71-	-17-	2-12- 20	1.35-1.65	4.00-14.00	0.12-0.18	0.0-2.9	0.0	.28	.28			
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			
21—Levy silty clay														
Levy	0-18	- 6-	-47-	35-48- 60	0.50-1.10	0.42-1.40	0.16-0.22	6.0-8.9	5.0-10.0	.24	.24	5	8	0
	18-80	- 6-	-47-	35-48- 60	0.50-1.10	0.42-1.40	0.16-0.22	6.0-8.9	1.0-3.0	.28	.28			
29B—Slagle fine sandy loam, 2 to 6 percent slopes														
Slagle	0-9	-71-	-17-	8-13- 18	1.30-1.45	14.00-42.00	0.10-0.14	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-25	-34-	-37-	12-30- 40	1.30-1.45	4.00-14.00	0.10-0.18	0.0-2.9	0.0	.32	.32			
	25-60	-34-	-37-	3-30- 50	1.35-1.60	0.01-4.00	0.12-0.18	3.0-5.9	0.0	.32	.32			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
31B—Suffolk fine sandy loam, 2 to 6 percent slopes														
Suffolk	0-14	-69-	-16-	10-15- 18	1.35-1.45	14.00-42.00	0.10-0.16	0.0-2.9	0.5-2.0	.24	.24	5	3	86
	14-40	-57-	-18-	10-25- 35	1.40-1.50	4.00-14.00	0.10-0.15	0.0-2.9	0.0	.24	.24			
	40-64	-71-	-17-	1-12- 20	1.40-1.50	14.00-141.00	0.04-0.10	0.0-2.9	0.0	.24	.24			
W—Water														
Water	—	—	—	—	—	—	—	—	—					

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

Particle Size and Coarse Fragments

This table shows estimates of particle size distribution and coarse fragment content of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Total fragments is the content of fragments of rock and other materials larger than 2 millimeters in diameter on volumetric basis of the whole soil.

Fragments 2-74 mm refers to the content of coarse fragments in the 2 to 74 millimeter size fraction.

Fragments 75-249 mm refers to the content of coarse fragments in teh 75 to 249 millimeter size fraction.

Fragments 250-599 mm refers to the content of coarse fragments in the 250 to 599 millimeter size fraction.

Fragments >=600 mm refers to the content of coarse fragments in the greater than or equal to 600 millimeter size fraction.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Particle Size and Coarse Fragments

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
4—Beaches										
Beaches	H1	0-60	-99-	- 2-	0- 0- 2	7	7	—	—	—
8B—Caroline fine sandy loam, 2 to 6 percent slopes										
Caroline	H1	0-13	-58-	-25-	15-18- 25	0	0	—	—	—
	H2	13-47	-40-	-20-	20-40- 60	0	0	—	—	—
	H3	47-72	-35-	-20-	15-45- 60	0	0	—	—	—
10B—Craven fine sandy loam, 2 to 6 percent slopes										
Craven	H1	0-9	-69-	-15-	7-17- 27	0	0	—	—	—
	H2	9-53	-23-	-29-	30-48- 60	0	0	—	—	—
	H3	53-80	-57-	-18-	5-25- 35	0	0	—	—	—
10C—Craven fine sandy loam, 6 to 10 percent slopes										
Craven	H1	0-9	-69-	-15-	7-17- 27	0	0	—	—	—
	H2	9-53	-23-	-29-	30-48- 60	0	0	—	—	—
	H3	53-80	-57-	-18-	5-25- 35	0	0	—	—	—

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
11C—Craven-Uchee complex, 6 to 10 percent slopes										
Craven	H1	0-9	-69-	-15-	7-17- 27	0	0	—	—	—
	H2	9-53	-23-	-29-	30-48- 60	0	0	—	—	—
	H3	53-80	-57-	-18-	5-25- 35	0	0	—	—	—
Uchee	H1	0-24	-77-	-16-	3- 7- 10	0	0	—	—	—
	H2	24-56	-57-	-18-	8-25- 50	0	0	—	—	—
	H3	56-65	-65-	-17-	12-18- 40	0	0	—	—	—
14B—Emporia fine sandy loam, 2 to 6 percent slopes										
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—
15D—Emporia complex, 10 to 15 percent slopes										
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—
15F—Emporia complex, 25 to 50 percent slopes										
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
17—Johnston complex										
Johnston	H1	0-34	-31-	-57-	7-13- 35	—	—	—	—	—
	H2	34-60	-52-	-36-	0-13- 30	—	—	—	—	—
18B—Kempsville fine sandy loam, 2 to 6 percent slopes										
Kempsville	H1	0-14	-69-	-22-	5-10- 15	0	0	0	—	—
	H2	14-55	-57-	-18-	12-25- 35	0	0	0	—	—
	H3	55-68	-71-	-17-	2-12- 20	0	0	0	—	—
19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes										
Kempsville	H1	0-14	-69-	-22-	5-10- 15	0	0	0	—	—
	H2	14-55	-57-	-18-	12-25- 35	0	0	0	—	—
	H3	55-68	-71-	-17-	2-12- 20	0	0	0	—	—
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—
21—Levy silty clay										
Levy	H1	0-18	- 6-	-47-	35-48- 60	—	—	—	—	—
	H2	18-80	- 6-	-47-	35-48- 60	—	—	—	—	—

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
29B—Slagle fine sandy loam, 2 to 6 percent slopes										
Slagle	H1	0-9	-71-	-17-	8-13- 18	0	0	0	—	—
	H2	9-25	-34-	-37-	12-30- 40	0	0	0	—	—
	H3	25-60	-34-	-37-	3-30- 50	0	0	0	—	—
31B—Suffolk fine sandy loam, 2 to 6 percent slopes										
Suffolk	H1	0-14	-69-	-16-	10-15- 18	0	0	—	—	—
	H2	14-40	-57-	-18-	10-25- 35	0	0	—	—	—
	H3	40-64	-71-	-17-	1-12- 20	0	0	—	—	—
W—Water										
Water	—	—	—	—	—	—	—	—	—	—

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

APPENDIX D

LABORATORY TEST RESULTS

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	---	Tested By:	jek
Sample ID:	---	Test Date:	02/13/14	Checked By:	jdt
Depth :	---	Test Id:	288530		

Moisture Content of Soil and Rock - ASTM D2216

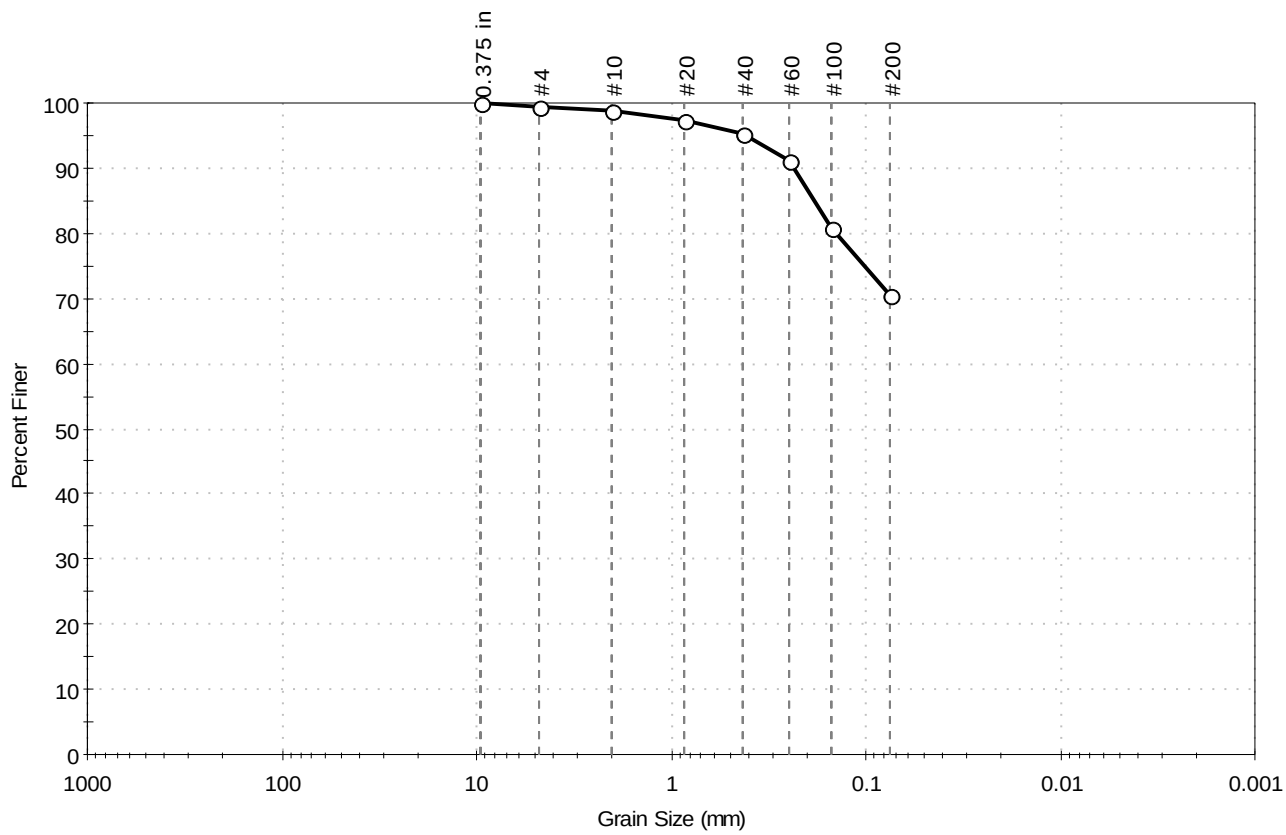
Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	B-1	2-3.5 ft.	Moist, yellowish brown clay with sand	16.2
---	B-1	9-10.5 ft.	Moist, yellowish brown clay with sand	22.0
---	B-1	14-15.5 ft.	Moist, yellowish brown sandy clay	17.6
---	B-2	7-8.5 ft.	Moist, yellowish brown clay with sand	19.9

Notes: Temperature of Drying : 110° Celsius

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	2-3.5 ft.	Test Id:	288523		

Test Comment: ---
Sample Description: Moist, yellowish brown clay with sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.5	28.9	70.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	97		
#40	0.42	95		
#60	0.25	91		
#100	0.15	81		
#200	0.075	71		

Coefficients

D_{85} = 0.1846 mm D_{30} = N/A
D_{60} = N/A D_{15} = N/A
D_{50} = N/A D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM lean clay with sand (CL)

AASHTO Clayey Soils (A-7-6 (19))

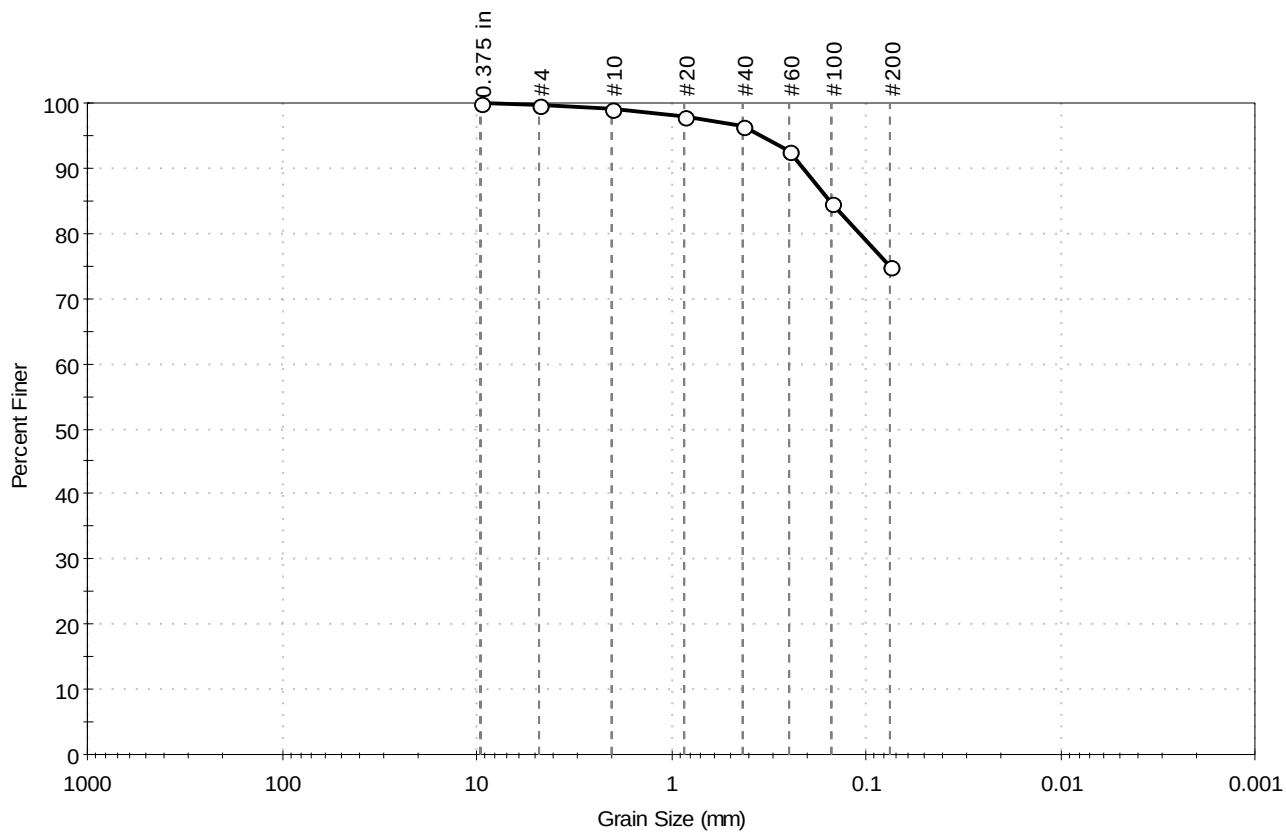
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	9-10.5 ft.	Test Id:	288524		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.4	24.6	75.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	96		
#60	0.25	93		
#100	0.15	85		
#200	0.075	75		

Coefficients

D_{85} = 0.1540 mm D_{30} = N/A
D_{60} = N/A D_{15} = N/A
D_{50} = N/A D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM lean clay with sand (CL)

AASHTO Clayey Soils (A-6 (12))

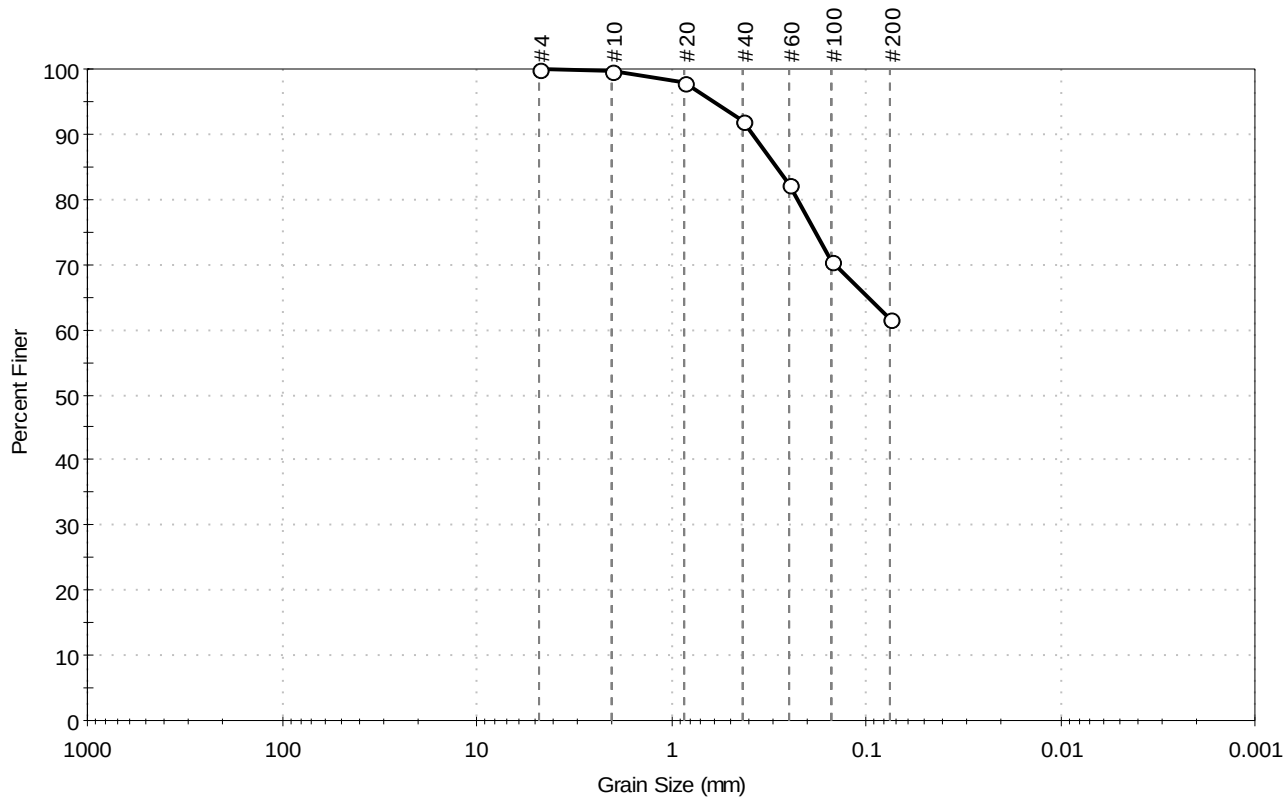
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	14-15.5 ft.	Test Id:	288525		
Test Comment:	---				
Sample Description:	Moist, yellowish brown sandy clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	38.3	61.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	92		
#60	0.25	82		
#100	0.15	70		
#200	0.075	62		

Coefficients

D_{85} = 0.2875 mm D_{30} = N/A
D_{60} = N/A D_{15} = N/A
D_{50} = N/A D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM Sandy lean clay (CL)

AASHTO Clayey Soils (A-6 (4))

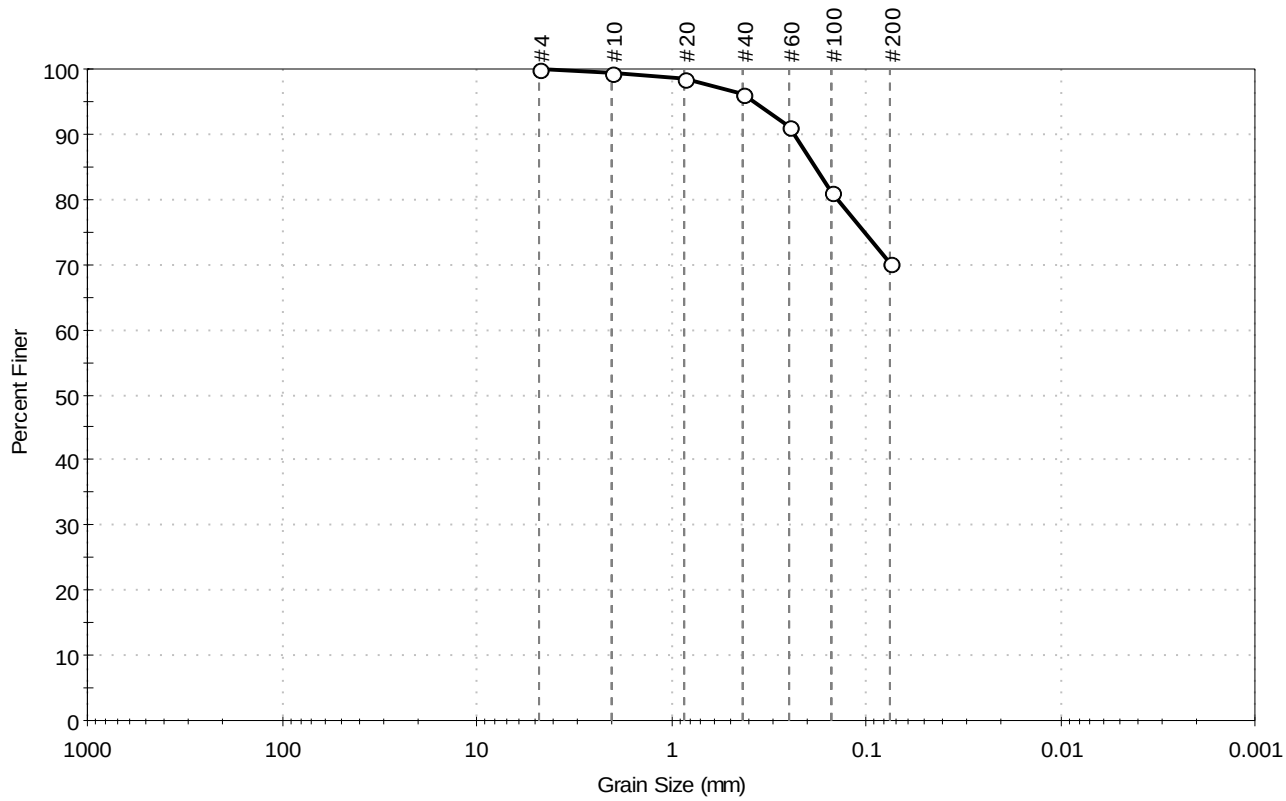
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-2	Test Date:	02/12/14	Checked By:	jdt
Depth :	7-8.5 ft.	Test Id:	288526		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	29.7	70.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	96		
#60	0.25	91		
#100	0.15	81		
#200	0.075	70		

Coefficients

D_{85} = 0.1817 mm D_{30} = N/A
D_{60} = N/A D_{15} = N/A
D_{50} = N/A D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM lean clay with sand (CL)

AASHTO Clayey Soils (A-6 (9))

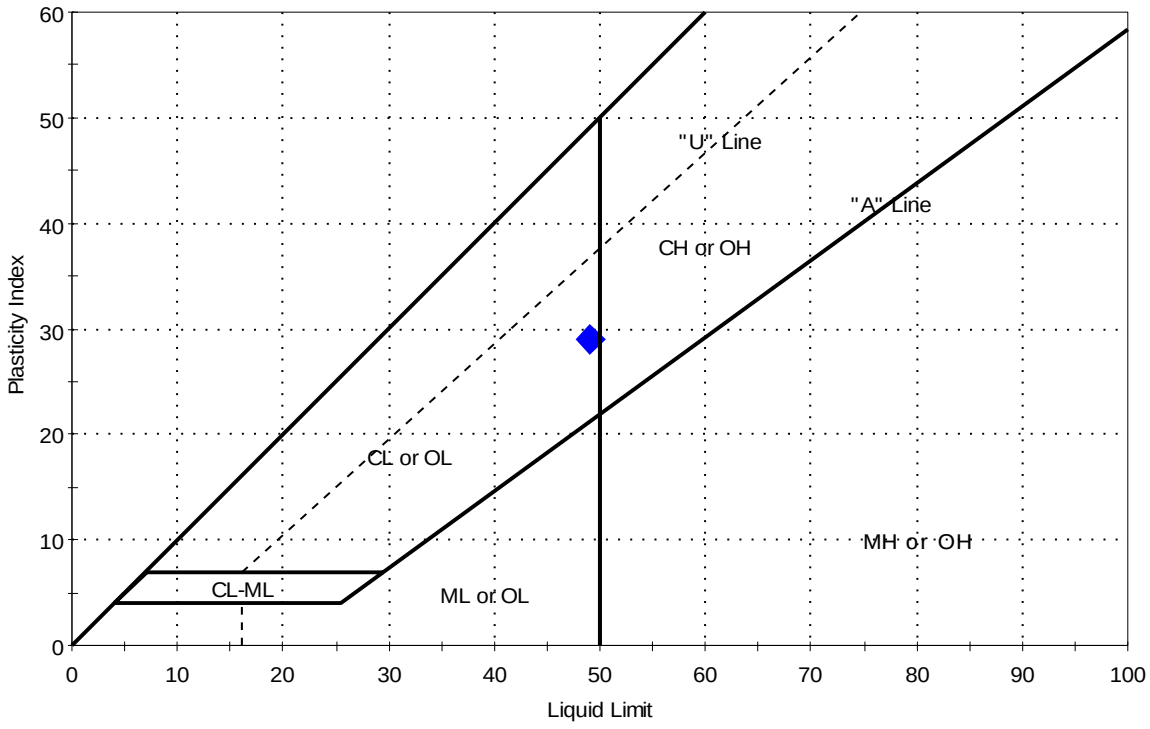
Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	2-3.5 ft.	Test Id:	288519		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-1	---	2-3.5 ft.	16	49	21	28	0	lean clay with sand (CL)

Sample Prepared using the WET method

5% Retained on #40 Sieve

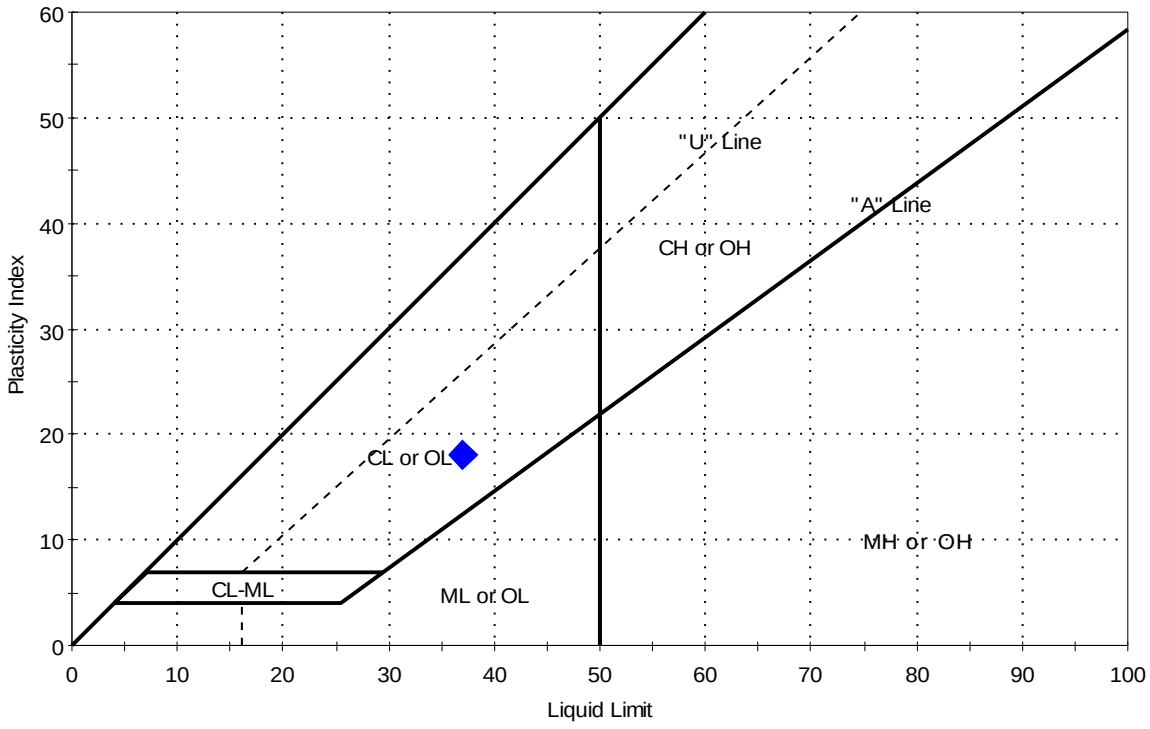
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	9-10.5 ft.	Test Id:	288520		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-1	---	9-10.5 ft.	22	37	19	18	0	lean clay with sand (CL)

Sample Prepared using the WET method

4% Retained on #40 Sieve

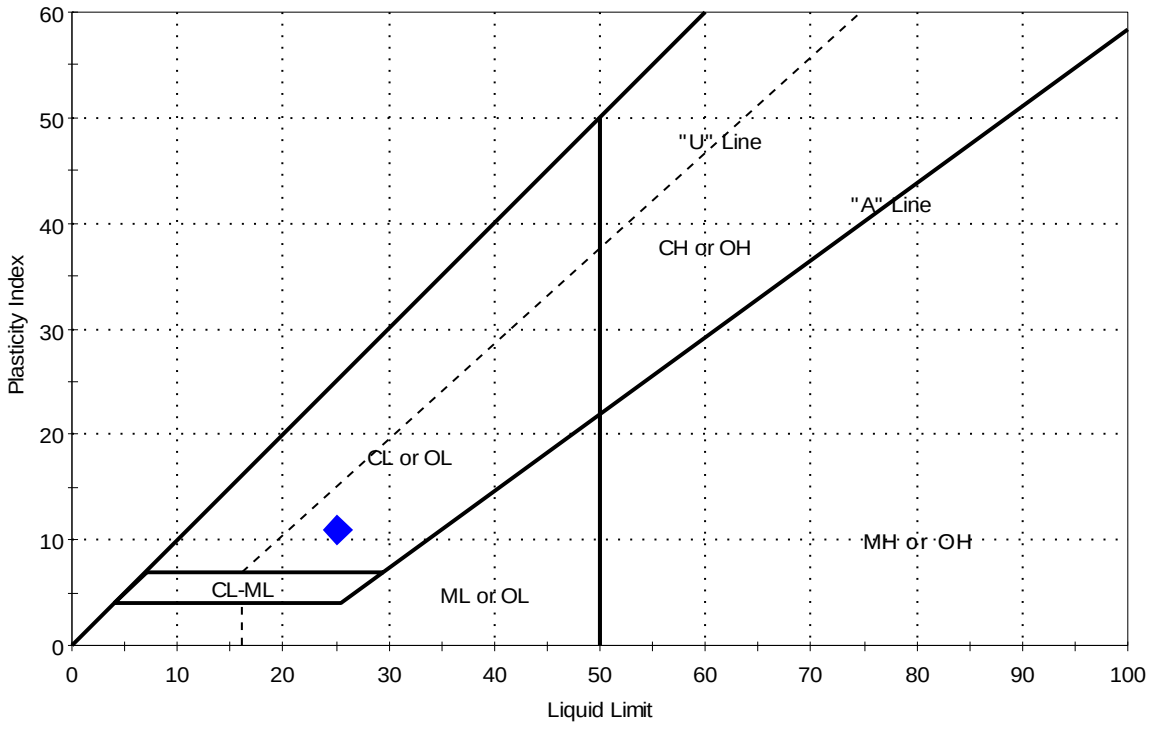
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	14-15.5 ft.	Test Id:	288521		
Test Comment:	---				
Sample Description:	Moist, yellowish brown sandy clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-1	---	14-15.5 ft.	18	25	14	11	0	Sandy lean clay (CL)

Sample Prepared using the WET method

8% Retained on #40 Sieve

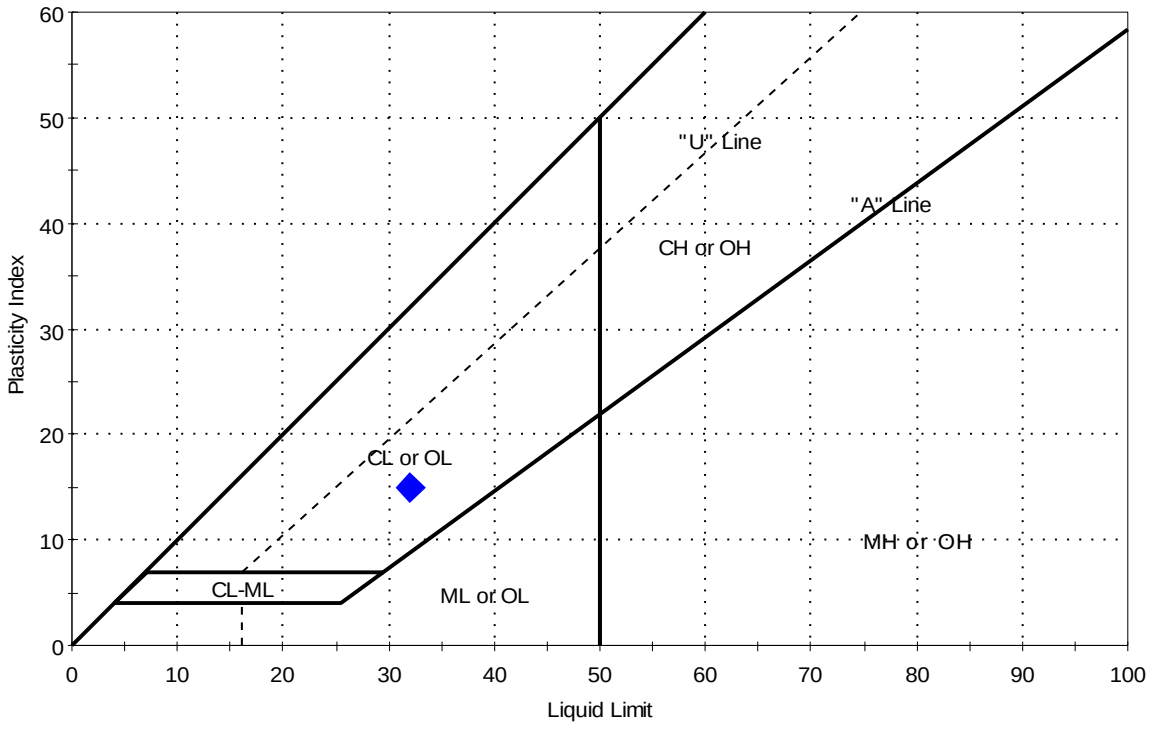
Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-2	Test Date:	02/12/14	Checked By:	jdt
Depth :	7-8.5 ft.	Test Id:	288522		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-2	---	7-8.5 ft.	20	32	16	16	0	lean clay with sand (CL)

Sample Prepared using the WET method

4% Retained on #40 Sieve

Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

BANDER SMITH LLC
DAM REPAIR, INSPECTION, CONSTRUCTION

Kingspoint Dam Repair

Budget Estimate & Scope of Work

BANDER SMITH, LLC ~ P.O. BOX 7188 ~ RICHMOND, VA 23221
PHONE: (804) 212-2898 ~ FAX (804) 545-0812 ~ WWW.BANDERSMITH.COM

Table of Contents

Table of Contents 2

Dam Repair Budget Estimate 4

Technical Management 5

Task No. 1 –Formal Site Inspection & Design 5

Task No. 2 – Mobilization, E& S, and Water Control/Diversion 5

Task No.3 – Existing Structure Removal & Embankment Preparation 6

Task No. 4 – Slipline 6

Task No. 5 – Restore Embankment 15

Task No. 6 – Demobilization, Clean-up 15

Project Schedule & Submittals 16

Statement of Qualifications 17

Company Background 17

Licensing & Insurance 17

Bander Smith, LLC - Team Personnel 19

Cameron J. Smith – Project Manager 19

Austen C. Bander – Project Superintendent 19

Paul L. Wood – Project Superintendent & Lead Diver 19

February 27, 2014

Sent via email to chris.kuhn@stantec.com

Chris Kuhn
WEG, now Stantec

Subject: Kingspoint Dam Repair Budget Estimate

Dear Mr. Kuhn,

Bander Smith, LLC is pleased to offer the following budget estimate for the repair to Kingspoint Dam. Bander Smith, LLC is a specialty contracting firm that focuses solely on dam repair and inspection. Our services draw from all facets of the construction industry but we apply those skills to the specific requirements of dam and marine construction.

We have included in this package a brief description of the work to be performed and information on our company. The estimates are based on information and pictures provided to us via email on Tuesday, February 25th, 2014.

I agree with your repair methodology outlined in your most recent email. The primary spillway outfall pipe should be evaluated with a pipe crawler system to confirm whether a slipline is possible and to accurately size the new liner pipe. The riser should also be inspected by a confined space entry penetration or the use of a drop camera system depending on the access. Once the site conditions are determined and a slipline is feasible, the outfall pipe should be rehabilitated and the downstream slope re-established. The root balls can be removed and re-compacted in conjunction with the spillway work.

The estimate provided is meant to assist the dam owner and/or future dam owner(s) with potential repairs costs. Until a formal site evaluate is made, several assumptions were made such as the size of the CMP outfall and construction access down to the dam.

Thank you for the opportunity to submit this package and please do not hesitate to contact us if you have any questions or concerns.

Sincerely,

Cameron J. Smith
Owner
Bander Smith, LLC
P.O. Box 7188
Richmond, VA 23221
cameron@bandersmith.com

Dam Repair Budget Estimate

Bander Smith, LLC proposes to rehabilitate the dam as outlined in tasks (found under the technical management section, in two phases:

1. **Phase 1 – Formal Site Evaluation (Task 1) - $2,200.00 (FIRM PROPOSAL)**

   This task will allow Bander Smith, LLC to evaluate the site in more detail and determine the feasibility of the a slipline. The evaluation will not be reflective of a formal engineered design or analysis and does not include the use of divers.

2. **Phase 2 – Primary Spillway Rehabilitation (Tasks 2 - 6) – $85,000.00 - $100,000.00**

   These phases will result in a fully function primary spillway system. All required permitting will be obtained before construction and is NOT included in this estimate.

Technical Management

All work will be performed by Bander Smith, LLC crews with proper insurance for dam work and experience in multiplel primary spillway rehabilitation projects. This proposal does not include any permits.

Task No. 1 –Formal Site Inspection & Design

Before any work is completed on site, the entire primary spillway will be evaluated. Important factors to determine are

1. Is a slipline is feasible
2. The condition and ID of the existing CMP
3. The size of the new HDPE liner
4. The condition of the riser and transition to new HDPE liner.

A pipe crawler system will be inserted into the outfall pipe starting on the downstream end. The water entering the riser should be controlled or completed during a period of dry weather. Water flowing into the primary spillway hampers the visual inspection. A permit confined space entry should be completed into the riser tower to determine the connection of the new outfall pipe liner into the riser. The riser should also be inspected for leaks and general stability. A brick riser structure is fairly uncommon.

Task No. 2 – Mobilization, E& S, and Water Control/Diversion

Access will be required for large equipment and concrete. Bander Smith assumes a significant amount of work will NOT be needed.

Depending on the amount of disturbance, an Erosion & Sediment control sediment plan may be required with the county. In which case, the parameters of that plan should be implemented. Regardless, E&S methods will be installed downstream to collect any muddy discharge that occurs during construction. Silt fence and straw bales will be installed where necessary.

Flows entering the pond will be accessed during initial construction. The lake will be need to be lowered several feet to provide adequate storage capacity while the slipline is being completed. Once the new liner is installed and any repairs made to the riser are finished, flows can be diverted back through the new primary spillway and discharged downstream. Pumps will be available if necessary.

Task No.3 – Existing Structure Removal & Embankment Preparation

The existing failed corrugated metal outfall pipe will be removed to stable CMP. Care needs to be taken when working around the failed embankment and a trench box may be required.

The eroded and un-compacted soils will be removed and the slopes cut back slightly. Ideally, 45 degree cuts are recommended to properly compact new soils into the existing earthen embankment. However, some concessions may need to be made due the proximity of the open cut in the embankment to the impoundment. The geotechnical report indicates good quality clay through the core of the dam which will help with the new/old soil cohesion when compacted.

The foundation conditions will need to be evaluated on site once all debris is removed.

Task No. 4 – Slipline

HDPE Pipe:

The most commonly used thermoplastic for sliplining is smooth walled HDPE pipe. HDPE pipe used for sliplining should meet the requirements of ASTM D 2447, D 3035, and F 714. The service life for HDPE pipe is 50- to 100-year service life.

HDPE pipe is very smooth. While the insertion of a new HDPE slipliner results in a smaller flow area, the reduced friction of the water passing through the slipliner results in only minimal losses of hydraulic capacity, if any. Typically, a new, smaller diameter HDPE slipliner has a hydraulic capacity equal to or greater than the original conduit. For example, the Manning's "n" value for smooth walled HDPE pipe is 0.009, compared to 0.010 for steel, 0.013 for concrete, and 0.022 for CMP.

Bander Smith, LLC proposes to line the existing CMP outfall with either an 18 inch DR26 or DR21 HDPE pipe. From the pictures, the existing CMP appears to be 24 inches. The pipe dimensions can be found in the chart below.

HDPE IRON PIPE SIZE (I.P.S.) PRESSURE PIPE

ANSI/NSF-61, 14 LISTED

PE 3408/3608		DR 21 (80 psi)			DR 26 (64 psi)			DR 32.5 (50 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
3	3.500	0.167	3.146	0.77	0.135	3.214	0.63	0.108	3.271	0.50
4	4.500	0.214	4.046	1.26	0.173	4.133	1.03	0.138	4.207	0.83
5⅜	5.375	0.256	4.832	1.80	0.207	4.936	1.47	0.165	5.025	1.18
5	5.563	0.265	5.001	1.93	0.214	5.109	1.57	0.171	5.200	1.27
6	6.625	0.315	5.957	2.73	0.255	6.084	2.23	0.204	6.193	1.80
7	7.125	0.339	6.406	3.16	0.274	6.544	2.58	0.219	6.661	2.08
8	8.625	0.411	7.754	4.64	0.332	7.921	3.79	0.265	8.063	3.05
10	10.750	0.512	9.665	7.21	0.413	9.874	5.87	0.331	10.048	4.75
12	12.750	0.607	11.463	10.13	0.490	11.711	8.26	0.392	11.919	6.67
14	14.000	0.667	12.586	12.22	0.538	12.859	9.96	0.431	13.086	8.05
16	16.000	0.762	14.385	15.96	0.615	14.696	13.01	0.492	14.957	10.50
18	18.000	0.857	16.183	20.20	0.692	16.533	16.47	0.554	16.826	13.30
20	20.000	0.952	17.982	24.93	0.769	18.370	20.34	0.615	18.696	16.41
22	22.000	1.048	19.778	30.18	0.846	20.206	24.61	0.677	20.565	19.86
24	24.000	1.143	21.577	35.19	0.923	22.043	29.30	0.738	22.435	23.62
26	26.000	1.238	23.375	42.14	1.000	23.880	34.39	0.800	24.304	27.74
28	28.000	1.333	25.174	48.86	1.077	25.717	39.88	0.862	26.173	32.19
30	30.000	1.429	26.971	56.12	1.154	27.554	45.79	0.923	28.043	36.93
32	32.000	1.542	28.730	63.84	1.231	29.390	52.10	0.985	29.912	42.04
34	34.000	1.619	30.568	72.06	1.308	31.227	58.81	1.046	31.782	47.43
36	36.000	1.714	32.366	80.78	1.385	33.064	65.94	1.108	33.651	53.20
42	42.000	2.000	37.760	109.97	1.615	38.576	89.71	1.292	39.261	72.37
48	48.000	2.286	43.154	143.65	1.846	44.086	117.18	1.477	44.869	94.56
54	54.000	2.571	48.549	181.75	2.077	49.597	148.33	1.662	50.477	119.70
63	63.000	3.000	56.640	247.42	2.423	57.863	201.88	1.938	58.891	162.84

* For custom DR, perforated pipe, please contact JM Eagle™ PE sales at (800) 621-4404 for availability.
* All dimensions are in inches unless noted otherwise.

I.D. : Inside Diameter
O.D. : Outside Diameter
T. : Wall Thickness

ISCO HDPE Product Catalog

Important Standards for High Density Polyethylene (HDPE) Pipe

Standards important for HDPE pipe relate to the resin the pipe is made from and the standards related to manufacturing sizes and tolerances. The American Society of Testing Materials (ASTM) standard for resin from which the pipe is made is **ASTM D 3350-05**, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials. This standard defines the physical properties of the resin that the pipe is made from.

Pipe dimensions and manufacturing requirements:

ASTM F 714-05 Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter. This standard is used for most large diameter HDPE pipe (4" to 63") applications other than gas pipe.

ASTM D 2513-05 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings. Polyethylene pipe and other plastic for natural gas distribution are described in great detail in this standard.

ASTM D 3035-03a Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. Most HDPE water tubing (1/2 inch to 3") is made to the dimensions in this standard. While pipe sizes up to 24" are provided, very little large diameter pipe is made to this standard.

Intallation Standards:

ASTM D 2321-05 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

ASTM D 2774-04 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings

ASTM F 585-94 Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

American Water Works Association Standards

ANSI/AWWA C 901-2005 Polyethylene Pressure Pipe and Tubing, .5 in (13 mm) Through 3 in. (76 mm) for Water Services

ANSI/AWWA C 906-2006 Polyethylene Pipe and Fittings, 4 in (100 mm) Through 63 In (1,575 mm) for Water Distribution

Pipe Joining Standards:

ASTM F 2620 – Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings

ASTM D 2657 – Standard Practice of Heat Fusion Joining of Polyolefin Pipe and Fittings

ASTM F 1290 – Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

Fitting Standards

ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM F 1055 Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

HDPE Pipe

1-800-345-ISCO

www.isco-pipe.com

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HDPE Pipe

Specifications for HDPE Pipe

The physical properties of high-density polyethylene pipe are described using ASTM D 3350-05, "Standard Specification for Polyethylene Plastic Pipe and Fittings Materials". Recently this standard was changed. The two key areas changed are, density and slow crack growth. In the 05 version, the cell classifications for density were increased from four cells to seven cells defining the density ranges for various resins.

New high performance bimodal resins, PE 4710 resins, have higher PENT test values. Slow crack grow properties can now be defined using eight cells.

As of December 2006, most HDPE pipe is made from resin with a cell classification of PE 345464C. The pipe is labeled as PE3408/3608. The physical properties for PE 345464C are:

PROPERTY VALUE		SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation		PPI / ASTM		PE3408
Material Designation		PPI / ASTM		PE 3408/3608
Cell Classification		ASTM D 3350		345464C
Density	(3)	ASTM D 1505	g/cm3	0.941-943
Melt Index	(4)	ASTM D 1238	gm/ 10 min	0.05 -.11
Flexural Modulus	(5)	ASTM D 790	psi	110,000 to 140,000
Tensile Strength	(4)	ASTM D 638	psi	3,200
Slow Crack Growth				
ESCR		ASTM D 1693	hours in 100% igepal	>5,000
PENT	(6)	ASTM F 1473	hours	>100
HDB @ 73 deg F	(4)	ASTM D 2837	psi	1,600
UV Stabilizer	(C)	ASTM D 1603	%C	2 to 2.5%

The density provided is without carbon black. Typical HDPE pipe has a density of .958 to .967 with carbon black.

Types of Polyethylene Pipe

All polyethylene (PE) is not the same. In ASTM D 3350-05, low density PE is defined as having a density range of 0.919 to 0.925 g/cc; medium density has a range of 0.926 to 0.940 g/cc and high density is defined with a range from 0.941 to 0.955. All densities are without carbon black.

Density influences key properties in polyethylene materials. As the density increases, the tensile strength increases; also chemical resistance increases.

Medium density PE resins have been used for gas distribution. This original selection was made based on superior slow crack growth properties of medium density resins. Medium density pipe is designated as PE 2406 and PE 2708.

Today new bimodal resins are being used in gas distribution because of higher pressure ratings plus superior slow crack growth. These resins are designated PE 3408, PE 3608, PE 3708, PE 3710 and PE 4710.

1-800-345-ISCO

www.isco-pipe.com

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Existing spillway preparation:

The existing CMP spillway will be flushed with water and all dirt and debris removed. Spacers will be installed on the new 18 inch HDPE pipe every 10 to 15 feet. Flotation of the liner is a concern when a liner is to be grouted. The spacers will be staggered and spaced out to allow grout to fill the entire annular space around the pipe.

HDPE Joints:

Bander Smith, LLC anticipates joining the new spillway pipe using heat fusion. The primary spillway at Kingspoint dam may only require one joint. The HDPE will be delivered to the site in either 40 or 50 foot sections. Heat fusion (ASTM D 2657) is a widely used and industry-accepted method for joining sections of smooth solid walled HDPE pipe. This method produces a joint that is watertight and is as strong as or stronger than the HDPE pipe material itself. The use of fusion machine operators who are skilled, knowledgeable, and certified by the manufacturer will produce a good quality joint

Heat fusion creates a continuous joint-free pipe of nearly constant outside diameter. Because the HDPE slipliner joint does not take up a large part of the original conduit, a larger inside diameter slipliner can be used.

Bulkhead & Thrust Block:

Bulkheads will be installed on the upstream and downstream side of the outfall pipe. The bulkhead will consist of anti-shrink concrete packed approximately 2 to 3 feet into the annular space between the old and new pipes. Vent ports will be installed on the bottom, middle, and top of the bulkhead to insure a complete grouting has occurred. A 2 inch diameter steel injection port will be installed at the top of the downstream bulkhead. Once all vent ports have passed grout and closed, the grouting operation is complete.

Figure 1 – Typical Grout injection port and vent ports

Grouting:

Careful grouting of the annular space between the existing conduit and the HDPE slipliner is essential. This can be a complex process, requiring the experience of a qualified contractor. The HDPE slipliner is typically designed to withstand all internal and external loadings independently from exterior conditions. A lightweight, low density grout containing no aggregate will ensure the best result. Usually the material used is a Fine grout ("flowable fill") amended with Tetraguard AS20 (anti-shrink) & super plasticizer. Depending on the conditions, additional admixtures may be required to obtain desired performance such as cellular grout.

ALLIED concrete company

MIX DESIGN	BC010					DATE:	1/15/13			SPECIFICATION REFERENCE	
CALCULATION	Non-shrink grout					MIX VERIFICATION:				Specification #	0031 33 73
PROJECT USE:	pipe annulus fill with Intraplast N					*Mix experience: none/ supplier provided mix*					
						Mix is in compliance with ACI 301, Sect. 4.2.3.3c,"Required				28 daystrength:	
PROJECT	Ragged Mountain Dam					average Compressive strength" when using Sect. 4.2.3.4b				1-entrained air content:	no added air
CONTRACTOR	Thalle					"Trial Mixtures" to establish mixture proportions.(ACI 211.1)				2-water/cement ratio:	<0.50
				5%						3-Minimum cement content:	
MATERIAL	*AMOUNT*	*DIVISOR*	*ABS VOL*	*TR.BTCH*	*MATERIAL*	*SUPPLIER/SPEC.*				4-Pozzolan/% of total cem.:	<33%
CEMENT(type I/II)	500	196.6	2.54	25	CEMENT	LEHIGH/UNION BRIDGE, MD/ASTM C150				5-Slump: (before/after HRWR):	
KOMPONENT (type K)	0	196.6	0.00	0	TYPE K	CTS CEMENT/Type K / Cypress,Calif.				before	<6"
FLY ASH	250	151.6	1.65	13	FLY ASH	BORAL /CHESAPEAKE, VA / C618				after	
ENT. AIR	3.00%	0.0	0.81		MB-AE90	MSTR BLDRS/ASTM C260				6-special additives:	
C.AGG.(#8)	0	176.0	0.00	0	C.AGG(57)	MARTIN MARIETTA/RED HILL,VA/ASTM C33				add Intraplast N at site: 7.5#/yard	
F.AGG.(#2)	0	169.7	0.00	0	F.AGG(#1)	AYLETT S & G/AYLETT, VA/ASTM C33					
WATER(GAL)	41.25		5.51	2	CITY	POTABLE					
WATER(LBS)	343.6125				F.AGG(#2)	VULCAN/ "A"SAND/STAUNTON,VA/ASTM C33				Mix design logic/back-up	supplier provided mix
MOR.FRAC.	27.00	TOTAL	10.51		MFG.SAND	MARTIN MARIETTA/C'VILLE				1-curve:	no
					LTWTA	SOLITE/CASCADE PLANT/ASTM C330				2-experience(30 breaks)	no
		REMAINING									
W.C. RATIO	*0.46*	VOLUME	16.49							3-special:	
(specification:	*<0.5*					ACI Table 4.2.1-Exposure categories and classes					
						F0 no exposure					
FINE AGG.(#1)	2696	163.5	16.49	135							
	2696		16.49								
						SPECIFIC GRAVITY INFO 1/12				REVIEW COMMENTS:	
		TOTAL FOR			STONE	2.82 (3/4" NOMINAL)					
		SAND PLUG	27.00	1	SAND	2.62 (F.M. =2.8)					
					SAND(#2)	2.72					
		OVER/UND	0.00		STALITE	1.51					
					8PGRVL	2.62					
TOTAL WT/YD	3790			189		ABSORPTION				NOTES:	
					STONE*	0.50% (8p & #57)					
UNIT WEIGHT	140.35	(@3% air)			SAND*	0.4%					
					STALITE	8.0%					
	#/cu ft.	air			*stone & sand meet ASTM C33						
						DESIGN SLUMP = 4"-6"					
						F.ASH/CEM :					
						33%					
ADMIXTURES	oz/100	total oz/yard									
AIR ENTR.	0	0.00		0	AIR-ENT/MB-AE 90/BASF/ASTM C 260						
LRWR(322n)	0	0.00		0	LRWR/POZZILITH 322N/BASF/ASTM C 494						
ACCEL./NC	0	0.00		0	ACC/NC 534/BASF/ASTM C 494						
RETARDER	0	0.00		0	RETARD/961 R/BASF/ASTM C 494						
HRWR(PLAST)	0	0.00		0	HRWR/GLENIUM 7500/BASF/ASTM C 494						
FIBER(Micro)	0	0			MasterFiber F70/BASF/ASTM C 1116						
FIBER(Macro)	0	0			MasterFiber MAC100/BASF/ASTM C 1116						
INTEGRAL WATERPRF	0	0.00			RHEOMAC 300D/BASF/Modified DIN 1048/ASTM 1585						
SHRINKAGE COMP.	1%	7.5#/yd			S.I.K.A.Corp/Intraplast N/New Jersey						
CORROSION INHIB	0	0.00			RHEOCRETE CNI/BASF/C494 type S					1000 Harris Street	
INTEGRAL COLOR	0	0.00			RHEOCOLOR L/BASF/ASTM C 979					Charlottesville, Virginia 22903	
										(ph)434-296-7181	
										(fx) 434-296-3200	
										www.alliedconcrete.com	

ALLIED CONCRETE co.

Construction

Intraplast-N®

Expanding / Fluidifying Grouting Aid

Description

Intraplast-N is a balanced blend of expanding, fluidifying, and water-reducing agents for portland-cement grouts. It produces a slow, controlled expansion prior to the grout hardening.

Applications

- Machinery base plates.
- Pre-packed aggregate cavities.
- Rock fissures and bolting.

Benefits

- High fluidity - Intraplast-N grout is extremely fluid, workable, non-settling, and cohesive.
- Versatile - use Intraplast-N with all types of grout incorporating Type I, II, or III cement, with or without pozzolanic materials or fly ash, and with or without fine aggregate.
- Controlled, gaseous expansion occurs before initial set and forces the grout into close contact with the surrounding surfaces.

Packaging

50 lb. multi-wall bag.

Typical Data *Material and curing conditions @ 73°F (23°C) and 50% R.H.*

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

Shelf Life	6 months in original, unopened bags.
Storage Conditions	Store dry at 40-95°F
Color	Gray powder
Dosage	Add 1% by weight of cementitious material, (portland-cement and, if used, fly ash)

How to Use

Forming

Where areas to be grouted require forming, forms should be tight and well fitted. When using Intraplast-N grout, expansion of the grout should be restrained in order to produce the highest possible density, bond, and strength. Top forms should be used where there are open areas. Unformed, exposed grout placements will have substantially lower physical characteristics.

Mixing

a) Water should be added to the mixer first, followed by portland-cement, fly ash, admixture, and sand as required.

b) Mixing should be of such duration as to obtain a uniform, thoroughly blended grout, without excessive temperature increase.

c) No water should be added to the grout to increase any flowability which has been lost by delayed use of grout.

d) It is essential that the water content of the grout be kept as low as possible. The water content should generally be less than 5.25 gal./100 lb. of cementitious material.

Sika®

Construction

Product	Size of Openings: 1/4 in. or less		Larger than 1/4 in.	
Cement[1]	2 parts	1 part	2 parts	1 part
Fly Ash[2]	1 part	none	1 part	none
Sand[3]	none	none	3 parts	1 part
Water[4]	4-5	4-5	4½-5½	4½-5½
Intraplast-N[5]	1%	1%	1%	1%

[1] ASTM C-150; [2] ASTM C-350; [3] 100% passing an 8-mesh sieve;
[4] Gallons per 100 lb. cementitious material; [5] By weight of cementitious material.

Water requirements will typically be lower than that of a non-Intraplast-N mix of equal fluidity.

Application

All pumps and hose fittings should be absolutely watertight to prevent loss of water and subsequent clogging. Be sure your batches are so limited in size that placement can be completed within one hour so that as much of the expanding action as possible occurs after the grout is placed.

Typical mix designs

The following typical mix designs serve only as a basis for trial mixes. Actual mix design must be tested prior to use. Proportions are by weight, unless noted.

Limitations

- Design mixes should always be tested to verify satisfactory performance, specifically as it relates to strength, bleed, flow and segregation. The use of this admixture will alter physical properties.
- Not recommended as a non-shrink admixture for conventionally placed concrete.

Caution

Irritant

Skin and eye irritant. Avoid contact. Dust may cause respiratory tract irritation. Avoid breathing dust. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. If PELs are exceeded, an appropriate, properly fitted NIOSH approved respirator is required. Remove contaminated clothing.

First Aid

In case of skin contact, wash thoroughly with soap and water. For eye contact, flush immediately with plenty of water for at least 15 minutes, and contact a physician. For respiratory problems, remove person to fresh air.

Clean Up

In case of spillage, scoop or vacuum into appropriate container, and dispose of in accordance with current, applicable local, state, and federal regulations. Keep container tightly closed and in an upright position to prevent spillage and leakage.

Maintenance:

No maintenance is typically required for the HDPE sliplined conduit, unless the conduit requires some type of cleaning. Periodic operation of the conduit usually is sufficient to flush sediments through the system. HDPE pipe is smooth and generally resists the adherence of sediment deposits.

Task No. 5 – Restore Embankment

The new liner will need a pipe cradle installed along its path to the plunge pool. It is recommended to install a filter drain around the outfall pipe as well. This would be fairly easy to complete since the downstream embankment is already open. The filter drain would consists of a combination of a sand and stone filter media with geotextile and 4 inch PVC pipe to collect the water.

Bander Smith, LLC will backfill and compact around the new outfall pipe to match the existing grade.

Several tree roots were noted in the geotechnical report. The root balls will be removed, backfilled, and compacted.

Task No. 6 – Demobilization, Clean-up

All denuded areas will be repaired, seeded, and straw placed. Once all vegetation is established, we will remove any E&S that is in place. All equipment will be removed and the access road returned to near pre-existing conditions.

Project Schedule & Submittals

Below is a general work schedule for the project

1. Bander Smith, LLC Pipe Inspection
2. Engineer Evaluation and Design
3. Owner Approval
    a. Financing Established
    b. Proposal Review and Approval
4. Contract Executed
5. Notice to Proceed Issued
6. Material Procurement
7. Construction

We respectively request the contract time be at least 60 days from the Notice to Proceed. We anticipate approximately 4 weeks of material procurement and fabrication. Installation on site should take an estimated 20 days with the majority of the work/disturbance occurring over 15 days.

This type of work, especially when working in a live watercourse, is heavily weather dependent.

Shop drawings will be submitted for each major item and owner approved before installation.

Statement of Qualifications

Company Background

Bander Smith, LLC was formed in 2009 to address the ageing dam infrastructure in Virginia and the surrounding states. Dams have unique challenges and Bander Smith meets them with an in-depth knowledge of the techniques, laws, regulations, and safety concerns related to work on impounding structures.

Our team has over 15 years of experience in the dam repair industry. Bander Smith, LLC is owned & operated by Cameron Smith and Austen Bander. We are located centrally in the Commonwealth of Virginia with our main office in Richmond, VA.

****Dams introduce variables to ordinary construction activities and the dynamics of a dam must be understood before safe, proper repairs are made.*

Licensing & Insurance

We are a licensed Class A Contractor in Virginia (License No. 2705129060). We are also a DMBE certified SWAM vendor. License Number 679769.

We have commercial general liability insurance that specifically includes coverage for projects on dams, which, unfortunately, many firms working on dams do not have. This is very important for the client who is ultimately responsible if the contractor is under insured.

BANDE-1 OP ID: CW

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 07/03/2013

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Premier Insurance Agency Ltd
13321-I Midlothian Turnpike
Midlothian, VA 23113
Premier Insurance Agency, Ltd

Phone: 804-794-8000
Fax: 804-794-9077

CONTACT NAME:
PHONE (A/C, No, Ext): FAX (A/C, No):
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Gemini Insurance Company	
INSURER B : AmGuard Insurance Co.	
INSURER C : Harleysville Insurance Company	23582
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Bander-Smith, LLC
Austen Bander
PO Box 7188
Richmond, VA 23221

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY PRO-JECT LOC			VIGP014317	07/28/2012	07/28/2013	EACH OCCURRENCE	$ 1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 50,000
							MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
							GENERAL AGGREGATE	$ 2,000,000
							PRODUCTS - COMP/OP AGG	$ 2,000,000
								$
C	AUTOMOBILE LIABILITY ANY AUTO ALL OWNED AUTOS X SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS			BA00000072471H	10/11/2012	10/11/2013	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
							BODILY INJURY (Per person)	$
							BODILY INJURY (Per accident)	$
							PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $						EACH OCCURRENCE	$
							AGGREGATE	$
								$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below		N / A	R2WC361064	10/17/2012	10/17/2013	X WC STATU-TORY LIMITS OTH-ER	
							E.L. EACH ACCIDENT	$ 100,000
							E.L. DISEASE - EA EMPLOYEE	$ 100,000
							E.L. DISEASE - POLICY LIMIT	$ 500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)
Addison Evans Water Treatment Plan, Chesterfield County, VA

CERTIFICATE HOLDER

SAMP000

Sample **********
****
****

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE
Premier Insurance Agency, Ltd

Bander Smith, LLC - Team Personnel

Key personnel for Bander Smith, LLC that will be on site for the inspection

Cameron J. Smith – Project Manager

Cameron Smith is a founding partner of Bander Smith, LLC and Project Manager. Mr. Smith graduated from Virginia Tech in 2004 with a degree in building construction and a minor in Real Estate. Prior to the formation of Bander Smith, LLC, Cameron Smith had over 8 years experience in the dam repair and inspection industry, working his way up to Project Manager and Vice President before pursing his own firm.

He has completed over 200 dam repair and inspection projects across the eastern half of the United States. He holds a current VA contractor's license as well as a private pilot license. He is also trained and certified in confined space entry.

Austen C. Bander – Project Superintendent

Austen Bander is a founding partner of Bander Smith, LLC and Project Superintendent. Mr. Bander graduated from Randolph-Macon College in 2004 with a degree in Physics and a minor in Astrophysics and Spanish. Prior to the formation of Bander Smith, Austen Bander had 6 years of experience in the dam repair and inspection industry.

Mr. Bander is currently designated an Engineer-in-Training in Virginia and actively pursuing a Professional Engineer's License.

Paul L. Wood – Project Superintendent & Lead Diver

Mr. Wood has over twenty five years of diving inspection and construction experience. During his 10 year career in the U.S. Navy, Mr. Wood conducted over 1,000 dives. After being honorably discharged from the Navy, Mr. Wood was employed by various commercial dive contractors, prior to starting his own company to provide diving inspection and related work. Mr. Wood is experienced in all aspects of diving operations, including air diving, mixed gas diving, SCUBA, surface air supplied and hyperbaric chamber operations. Mr. Wood has performed underwater inspections on all types of construction including wood, steel and concrete for bridges, piers, bulkheads, and wharfs. Mr. Wood is experienced in dealing with hazardous conditions including low visibility, confined space, high current, low temperature, and altitude diving.

Education & Certification:

- Association of Diving Contractors – Surface Air Diving Supervisor (#8112)
- National Highway Institute – Safety Inspection of In-Service Bridges (#13055) / 2004
- Int'L Association of Nitrox & Technical Diving (2001)
- Advance Rescue Diver (1996)
- Dive Control Specialist (1990)
- U.S. Navy 2nd Class Dive School / 1989 / Honor Graduate
- U.S. Navy Explosive Ordinance Disposal School / 1985 / Honor Graduate
- U.S. Navy SCUBA Dive School / 1984

James City County
VIRGINIA
Jamestown 1607

County Attorney's Office
101-D Mounts Bay Road
P.O. Box 8784
Williamsburg, VA 23187-8784
P: 757-253-6612

jamescitycountyva.gov

April 18, 2014

Mary Ann Freeman,
2891 Hidden Lake Drive,
Williamsburg, VA 23185

Re: 110-A Overlook Drive
Kingspoint Dam

Dear Ms. Freeman:

This letter is in response to your request for James City County ("County") to review a 103 page report dated March 12, 2014 prepared by Stantec Consulting Services, Inc., formerly Williamsburg Environmental Group, Inc., assessing the viability and current condition of the Kingspoint dam. Specifically, the report focused on repair and upgrade of the dam and the subsequent suitability of the dam to support a driveway to property located at 110-A Overlook Drive. It is my understanding that your lender has requested confirmation from the County that the repairs and upgrades outlined in the report would be satisfactory to the County to demonstrate that the dam can sustain a driveway to access the parcel at 110-A Overlook Drive you wish to purchase.

The County's Engineering and Resource Protection Division has reviewed the Stantec report and its recommendations for the repair and upgrade of the dam. Based on the representations and certifications made in the Stantec report, the County concurs with the report's assessment that the dam, if repaired and upgraded generally as suggested, could support a private driveway to access the parcel. The exact details would need to be determined as part of a County approved site development plan.

This letter does not create a vested right in development of the parcel and any future development of the parcel will be subject to County approval of a site plan and issuance of any necessary permits such as: erosion & sediment control, land disturbing, Chesapeake Bay exception and Virginia Stormwater Management Program (VSMP). The Stantec report identifies Kingspoint dam as a regulated dam which will also require registration with the Virginia Department of Conservation & Recreation. The installation of utilities would be subject to the review of the James City Service Authority.

As you are aware, the County continues to retain an ownership interest in a 50-foot-wide right-of-way extending over a portion of the dam. The adjacent property owners have a right, acquired by deed, to use this right of way. The process by which you could acquire the County's right-of-way is outside the scope of this correspondence but the County would be pleased to discuss these issues with you at such time as your purchase of the property is complete.

Sincerely,

M. Douglas Powell
Acting County Administrator

cc: Susan Bradford Tarley, Esquire (*via email*)
Scott Thomas, Director, Engineering & Resource Protection (*via email*)

James City County
VIRGINIA
Jamestown 1607

County Administration
101-C Mounts Bay Road
P.O. Box 8784
Williamsburg, VA 23187-8784
P: 757-253-6728

jamescitycountyva.gov

January 14, 2014

Mr. Jon E. May
Managing Broker CSP, CMP
Greg Garrett Realty
3705 Strawberry Plains Road
Williamsburg VA 23188

Dear Mr. May:

RE: Kingspoint Dam – Property at 110-A Overlook Drive

James City County (the "County") is the putative owner by plat of a portion of the Kingspoint Dam located adjacent to the property of your clients, Dr. and Mrs. Hoay T. Tan, at 110-A Overlook Drive in Kingspoint, consisting of approximately 10.029 acres further identified as James City County Real Estate Tax Map No. 4910100006 (the "Property"). I understand that it is necessary for the County to provide authorization to allow access to the dam for the purpose of conducting studies and evaluations.

On behalf of the County, I hereby grant the owners, their designated agents and representatives, and any contract purchasers of the Property access to the County's portion of the Kingspoint Dam to perform studies and site inspections in order to evaluate the condition of the dam. The County grants this access for a period of three months from the date of this letter. Any tests, studies, evaluations, and assessments conducted by you, your agents, or contract purchasers shall be at your own risk and expense. The access is granted with the understanding that you will share the results of the study with the County and that you will restore the dam property to its prior condition to the extent of any changes as a result of the studies.

If you have any questions, please call.

Sincerely,

M. Douglas Powell
Acting County Administrator

May.ltr
MDP/eey

Stantec Consulting Services Inc.
5209 Center Street
Williamsburg VA 23188
Tel: (757) 220-6869
Fax: (757) 229-4507

March 12, 2014

Ms. Mary Ann Freeman
1490 Quarterpath Road, Ste 5-196
Williamsburg, VA 23185

RE: Kingspoint Pond Dam – Letter Report

Williamsburg Environmental Group, Inc. (WEG), now Stantec, was retained by you to evaluate the condition of Kingspoint Dam, located in James City County, Virginia. Kingspoint Pond Dam is located in part on 110A Overlook Drive, a property that you consider to purchase. The other part of the dam embankment is located on a James City County undeveloped right-of-way. Your primary interests concern the estimated costs for the rehabilitation of the dam, the suitability of the dam to support a driveway or access road to the property, and the potential impact of a mandate by James City County that water and sewer will be provided from Overlook Drive, potentially by way of the dam embankment.

The author met with you for an initial site visit on December 19, 2013. At this occasion a first impression was shared with you, including needed repairs and maintenance, and the steps needed to bring the subject dam in compliance with the *Virginia Impounding Structure Regulations* (Regulations). It was further discussed that the dam embankment should be investigated by a geotechnical engineer to determine whether there are additional issues with the dam, and that a cost estimate should be obtained from a contractor experienced with dam repairs. Based on this discussion and initial site visit, you contacted with us to provide and coordinate such services.

Based on an appraisal for the property prepared in 2012, the pond was built in the early 1970s as a subdivision amenity and stormwater retention pond. Maintenance apparently was sporadic and the embankment became overgrown with vegetation. The impoundment suffered partial failure during Hurricane Floyd in 1999. It appears that pipe separation in the downstream portion of the outfall barrel led to partial slope failure. In addition, storm events toppled some of the trees that have grown on the dam embankment, leading to some erosion. It appears that the trees have been removed in recent years, however, large stumps remain, and the downstream face of the embankment is covered with wood chips.

Geotechnical Evaluation

Stantec contracted with Blue Ridge Geotechnical, LLC (BRG) for the geotechnical evaluation of the dam embankment. Under BRGs direction, a driller performed two (2) standard penetration test borings on February 4, 2014. Soil samples taken from these were submitted for laboratory testing. On February 14, 2014, BRG provided a draft *Report of Geotechnical Exploration – Kingspoint Dam*, summarizing the results of their investigation (a copy of the report is enclosed). The section dealing with the cause of failure states the following:

> *It is difficult to determine whether the leak in the CMP caused the failure of the downstream slope of the dam, or whether the failure resulted in the pipe becoming severed. Additionally, it is not known what impact, if any, that overtopping may have played in the failure. It seems likely that the pipe began to leak at some point, which ultimately resulted in the failure of the dam.*

Reference: Kingspoint Pond Dam

When a buried pipe leaks, it will saturate the soil, which can significantly reduce the shear strength of the soil. Additionally, the soil that surrounds the pipe can progressively enter the pipe, which can create loss of ground, eventually resulting in a large-scale failure.

Based on the overall observations made at the dam embankment, including the fact that no piping is evidenced in the failure zone, it appears likely that piping from the barrel is the primary cause for the failure. However, as the dam embankment is not equipped with an auxiliary/emergency spillway, it cannot be excluded that overtopping occurred and contributed to the failure. A number of significant storm events have occurred since Hurricane Floyd that could have resulted in overtopping of the dam, including Gaston in 2003 and Isabel in 2011. A hydrologic and hydraulic analysis of the watershed, pond, and outlet structure would be needed to evaluate the potential contribution of overtopping to the failure.

The geotechnical engineer provides the following recommendations:

Although the failed zone of the dam is large and a significant portion of the dam has been removed, no apparent seepage was noted in the shear face of the scarp. This seems to indicate that the dam is still able to function in spite of the failure. Based on our borings, the material with which the dam was constructed (at least in the center of the dam) appears to be predominantly clay. Clay has a low permeability, which is good for controlling seepage. The following corrective measures are recommended:

1. *Evaluate the condition of the primary spillway, the riser pipe and the CMP barrel. This can be accomplished with video camera that can be fed both from the top, extending down the riser pipe, and up the CMP barrel from the severed portion. For best results, this work will likely have to be performed when the pond level is low, so that water is not flowing within the pipe. The camera can be used to determine if the pipe is corroded, severed at any joints, or otherwise compromised. One sign of a potential future problem might be if there is an area where soil appears to be entering the pipe.*
2. *Once it is confirmed that the portions of the riser and barrel that remain in the dam are sound, the failed material at the toe of the dam can be removed. As this area is currently being inundated with water exiting the barrel, this work should be performed when the pond level is below the primary spillway. Alternatively, the water should be collected at the current discharge point and piped downstream, until the water can be conveyed within a new extended barrel.*
3. *Soft, weak soil that is currently present at the base of the failed area should be carefully removed, and the subgrade evaluated. A limited portion of the soft material can probably remain; however, this must be determined in the field. If some soft soils must remain, it may be necessary to utilize a bridge lift of large stone (e.g., VDOT No. 2 stone). It is imperative that this material be completely wrapped in geosynthetic fabric for separation. It will also be important that this excavation not undermine the existing dam in any way.*
4. *Extend the barrel and construct a proper outfall. The lower half of the barrel should be supported on a cradle of concrete or flowable fill, as it is not possible to compact around the lower portion of the pipe.*
5. *Replace the failed portion of the dam using compacted soil fill.*

Reference: Kingspoint Pond Dam

The geotechnical engineer indicates that the dam appears capable of supporting a proposed driveway. Recommendations are given in the report that prior to construction of the driveway the wood chips should be removed and the subgrade thoroughly proof-rolled with a fully loaded tandem-axel dump truck to identify any soft or weak areas. Such areas should be improved based on field conditions, under consultation of a geotechnical engineer.

It is understood that the placement of water and sewer lines is considered across the dam. In order to redcued the risk that the dam will be harmed by localized inundation, it is imperative that measures be taken to keep these lines from leaking or rupturing during their service life, especially at the joints. Alternative routes for these utility connections should be explored.

Dam Safety Technical Inspection

Regardless of whether an impounding structure is subject to the Regulations or not, completing a *Dam Safety Technical Inspection* will yield significant information about the status of an impounding structure, and provide guidelines for the repair and/or maintenance recommended. While to our knowledge Kingspoint Pond Dam has not been certified in the past, preliminary calculations indicate that the impoundment is subject to the Regulations.

Stantec conducted a *Dam Safety Technical Inspection* on February 25, 2014. During the inspection the Department of Conservation and Recreation (DCR) *Annual Inspection Report for Virginia Regulated Impounding Structures* as well as our own inspection form was completed, and pictures taken for documentation. Copies of the forms and the photo documentation are enclosed.

The most significant issue for this impounding structure is the pipe separation of the outfall barrel, which apparently led to slope failure on the downstream face. While there is no indication that seepage through the dam embankment occurs, the flows from the dislodged pipe can cause further erosion at the bottom of the slope failure, which in turn can further the slope failure. In the extreme, embankment failure should be expected in the future if the dam is not repaired.

While large trees have been removed from the dam embankment in recent years, some of the large stumps remain. These stumps and roots with a diameter exceeding one (1) inch should be removed, and the face of the dam re-graded and seeded. Further, the trees apparently have been chipped in place and the wood chips applied on the downstream face of the dam. While these wood chips act as mulch and suppress most of the herbaceous growth, they make it impossible to inspect the downstream face of the dam for rutting, animal burrow, etc. The layer of wood chips also masks the face of the dam to an extent that makes it impossible to observe deformations or slumping. It is recommended that the wood chips be removed and a healthy stand of grass established.

The upstream face of the dam embankment is covered with remnants of herbaceous vegetation to a degree that makes it impossible to inspect the dam properly. This vegetation should be removed and the embankment re-seeded, with soil amendments determined by soils tests, so that a healthy stand of grass can be established. The grass should be mowed at least twice per growing season to prevent the re-establishment of woody vegetation.

In keeping with the general lack of maintenance of this impoundment, debris, including tree trunks and branches, has accumulated along the shoreline and to a smaller degree at the inlet to the principal spillway.

Reference: Kingspoint Pond Dam

Such debris accumulation will reduce the capacity and reliability of the spillway. In the extreme the debris can clog the spillway to a degree that will block the spillway and raise the water level in the reservoir. Such debris should be removed on a regular basis.

Based on our preliminary assessment, this impounding structure is subject to the Regulations, and either an Operation & Maintenance (O&M) Certificate or a General Permit needs to be obtained to operate the impounding structure. Aside from the recommended repair and maintenance, a dam break inundation zone study will need to be prepared for this dam. As it appears that this dam likely is a low hazard dam, a simplified dam break inundation study can be commissioned through the DCR at a cost of $2,000. The results of this simplified study can then be used to prepare an *Emergency Preparedness Plan*, provided the low hazard classification can be confirmed. With the repairs and maintenance completed, and the referenced materials developed, the prerequisites are met to obtain an O&M Certificate or a General Permit.

Contractor Estimate

Once the draft geotechnical report was available we contacted Bander Smith, LLC, a Richmond based contractor that is specialized in dam and spillway rehabilitation work, for a budget level cost estimate for the needed repair work on the spillway and dam embankment. We provided the geotechnical report and photo documentation for an off-site budget estimate.

The contractor proposes, similarly to the recommendations made by the geotechnical engineer, that an inspection of the outfall barrel and the riser structure be conducted to review the condition of the spillway and it's suitability for the proposed repair method. Bander Smith, LLC, proposes to conduct such an inspection for a fixed fee of $2,200.

Bander Smith provides a budget level cost estimate for the repair of the spillway and the dam embankment with a cost range of $85,000 - $100,000, excluding permitting as needed. The repair will result in a fully functioning primary spillway system, and consists of the following steps:

- Mobilization, Erosion and Sediment Control Measures, Water Control/Diversion
- Existing Structure Removal (separated barrel only) and Embankment Preparation
- Slip line of the remaining corrugated metal pipe
- Re-construction of the Embankment, including removal of tree stumps
- Demobilization, Clean-up

The contractor has indicated that the cost range provided contains some contingency adjustments, and that once site access and conditions of the pipe are assessed, a firm proposal can be provided that likely will tend towards the lower end of the cost range shown. A copy of the contractor estimate is enclosed.

Additional Considerations

The appraisal indicates that "*15 other lots abut the pond, and at least 11 lots appear to have some Fee ownership of a portion of the pond.*" The pond obviously serves as an amenity for the adjacent properties, but it also serves as a stormwater management facility for the sub-division.

According to the appraisal, it appears that there have been efforts to repair the dam, whereas "*a special taxing district was contemplated for the pond owners, which would result in shared cost and spreading*

Reference: Kingspoint Pond Dam

those costs over a defined period of years." Based on the appraisal, "*unilateral repair of the dam, given pond and dam ownership issues as well as the pond's value as a storm water retention basin, is not considered reasonable and fair.*"

The overall situation appears to be somewhat complex, with no clear path how cost sharing can be achieved among interested parties. We suggest that an in-depth discussion with County representatives would be valuable, with the goal to:

1. Gain an understanding of what considerations have been made regarding repair and cost sharing, and
2. To explore alternative approaches in light of recent regulatory developments.

Of specific interest is, whether the County may be willing to support the repair of the impoundment in combination with a retrofit of the spillway that would allow for water quality credits towards the County's pollution reduction requirements for the Chesapeake Bay TMDL or for the County's Municipal Separate Storm Sewer System (MS4) permit. Stantec will gladly assist you with such discussions with the County.

It also should be noted that a singular access to a property, especially across a dam embankment or a bridge, always entails a certain risk of failure, thus making the property at least temporarily inaccessible. We believe it would be prudent to incorporate a secondary ingress/egress route, maybe from the north, that can be used in case of an emergency.

Stantec appreciates the opportunity to working with you on this project. In case of questions or for discussion, please contact us at 757-220-6869, or via email at chris.kuhn@stantec.com.

Best regards,

Stantec Consulting Services Inc.

Chris Kuhn

Enclosure

Cc: Jeffrey T. Hancock, P.E., Stantec

Stantec Consulting Services Inc.

5209 Center Street
Williamsburg VA 23188
Tel: (757) 220-6869
Fax: (757) 229-4507

Kingspoint Pond Dam – Photo Documentation

View along top of dam, from right abutment.

View along upstream face of dam, from right abutment.

Reference: Kingspoint Pond Dam – Photo Documentation

Brick principal spillway with four (4) control orifices.

Moss and bare spots on embankment.

Reference: Kingspoint Pond Dam – Photo Documentation

Tree stump that should be removed.

Downstream part of separated outfall barrel, corrugated metal pipe (CMP).

Reference: Kingspoint Pond Dam – Photo Documentation

Displaced junction box within outfall barrel.

View of downstream face of embankment, covered with wood chips from tree removal.

Reference: Kingspoint Pond Dam – Photo Documentation

View of downstream portion of displaced outfall barrel, from downstream end towards slope failure area.

Overview of displaced outfall barrel and slope failure area.

Reference: Kingspoint Pond Dam – Photo Documentation

Slope failure area.

Displaced junction box.

Reference: Kingspoint Pond Dam – Photo Documentation

Downstream penetration of remaining outfall barrel, with displaced portion of barrel and junction box.

Outfall barrel, pipe separation area.

Reference: Kingspoint Pond Dam – Photo Documentation

View of failure area.

Overview of failure area.

Reference: Kingspoint Pond Dam – Photo Documentation

Downstream face of embankment.

Wood chip cover and remaining tree stump.

Reference: Kingspoint Pond Dam – Photo Documentation

Groin swale on left abutment, downstream face.

View along top of embankment, from left abutment.

Reference: Kingspoint Pond Dam – Photo Documentation

View along upstream face of embankment, from left abutment.

Herbaceous vegetation on upstream face of abutment.

Reference: Kingspoint Pond Dam – Photo Documentation

Pipe separation area.

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Dam Inspection and Maintenance Inspection Checklist

Name of Facility: **Kingspoint Pond Dam** **Project #:** **203451640**

Date of Inspection: **February 25, 2014** **Inspected by:** **Chris Kuhn**

Embankment

Yes	No	
☐	☒	Are there any surface cracks?
☒	☐	Is there any unusual movement or cracking at or beyond the toe? Slope failure
☐	☒	Is there erosion on upstream face from wave action or changes in pool level?
☒	☐	Is there erosion from runoff, either gullies or bare areas? Downstream toe area?
☒	☐	Is there erosion from traffic (people, animals, vehicles)?
N/A	☐	Are there animal burrows? Not observable due to herbaceous vegetation on US face and wood chips on DS face.
☐	☒	Are there depressed areas on the dam?
☐	☒	Is there any evidence of piping? (Piping is evidenced by muddy flow through the dam and/or the formation of soil deposits beyond the dam and depressions on its slopes)
☐	☒	Does the crest appear to have shifted or settled excessively? (Look for cracks in the embankment and associated structures. Compare alignment with plans if they are available).
N/A	☐	If the upstream face is protected by riprap, is it in good condition? (Riprap is a layer, facing, or protective mound of stone in random size pieces, randomly placed to prevent erosion, scour, or sloughing of an embankment or structure).
N/A	☐	If there is riprap in discharge channels or in the stilling basin downstream, is it in good condition?
N/A	☐	If drainage channels at ends of embankments are protected by riprap, is it in good condition?
N/A	☐	If there is riprap in miscellaneous areas (on downstream slope, on crest, etc.) is it in good repair?
N/A	☐	If there are any drains to collect and remove seepage, are they operating properly?
N/A	☐	If there are foundation drains outlets, are they clear and flowing?
☒	☐	Are there wet spots or areas on the downstream face, at the toe, or beyond the dam? (Such spots are often indicated by a change in color or type of vegetation, such as from grass to cattails.) Some wet spots, likely due to runoff
☐	☒	Are there seeps or springs with flowing water? Attention should be paid to the transition areas from embankment to abutments, around any penetrations passing through the embankment, on downstream tact, at the toe of the dam and beyond, at the base of trees on/near/below the dam.
☒	☐	Is there swamp or marsh type vegetation present on the downstream face or beyond the toe (cattails, tall grass, etc.)? Downstream area is floodplain of James River
☐	☒	Is the dam overgrown with trees and/or underbrush? Stumps, herbaceous vegetation, wood chips on DS face.

clinic7258

☐	☒	Has the dam ever been overtopped? Unknown, but unlikely. No signs of overtopping observed in the field.
☐	☒	Have there been any modifications to the embankment, such as raising the crest, changing the shape or size of the principal spillway, or changing the shape or size of the embankment?

Principal Spillway

Yes	No	
☐	☒	Can water flow into the principal spillway unobstructed, as designed? Some debris accumulation at principal inlet.
☐	☒	Is outlet pipe or discharge channel clear and open to allow for free passage of the principal spillway discharge? Pipe separation with associated slope failure. Dislodged pipe and soil divert flow.
☐	☒	Is the primary spillway structure in good condition (check concrete, wood, and metal portions for damage or deterioration)? Outfall pipe failure with slope failure
N/A	☐	Does the lake have a low level drain to lower the water level in emergencies or for maintenance? None observed
N/A	☐	If low level drain present, is it known to be in working condition? Note: Care should be taken when operating a low level drain that has not been operated for a long time. It may be impossible to close it once opened.
N/A	☐	If there are additional valves, operating equipment, or appurtenances, are they in working condition?

Auxiliary/Emergency Spillway **No Auxiliary/Emergency Spillway**

Yes	No	
N/A	☐	Are the approach and the control section of the emergency spillway without obstruction, as designed and constructed?
N/A	☐	Is the discharge channel clear and without obstruction, allowing free flow of emergency spillway discharge?
N/A	☐	Is the emergency spillway constructed in a way that flow through it will not expose other portions of the dam to erosion?
N/A	☐	Is the emergency spillway in good working condition overall? (Check for erosion within channel, adequacy of grass cover, integrity of concrete structures, etc.)

Reservoir Area

Yes	No	
☐	☒	Does nature and land use of the surrounding area present any problems for the impoundment?
☐	☒	Is there evidence of landslides or instabilities along the shoreline?
☐	☒	Is serious wave erosion occurring along the shoreline?
☐	☒	Are significant amounts of sediment entering the impoundment, currently or in the past?

Watershed

Yes	No	
☐	☒	Have there been any major modifications or significant changes in the watershed, such as urban development (commercial, residential), clear-cutting of woodlands, or other changes in landuse?

Downstream Channel

Yes	No	
☒	☐	Is the downstream channel free of obstructions? Past the toe of the embankment

Downstream Area

Yes	No	
☐	☒	In case of dam failure, is loss of life or significant economic loss likely?
☐	☒	Are current telephone numbers of persons living or working in the areas downstream of the dam, as well as telephone numbers of those responsible for facilities that would be affected (highways, public utilities) on file?
☐	☒	Are current telephone numbers of local authorities who will need to be informed if the dam is imperiled (sheriff, county administrator, emergency services coordinator) on file?
☐	☒	Is the Emergency Action Plan up-to-date and have drills been performed?

Notes:

To our knowledge this dam is not currently certified, and no Emergency Preparedness Plan has been prepared.

The most significant issue for this dam is the pipe separation of the outfall barrel, which apparently led to slope failure on the downstream face. While there is no indication that seepage through the dam embankment occurs, the flows from the dislodged pipe can cause further erosion at the bottom of the slope failure, which in turn can further the slope failure. In the extreme, embankment failure should be expected in the future if the dam is not repaired.

While large trees have been removed from the dam embankment in recent years, at least some of the large stumps remain. These stumps and roots with a diameter exceeding 1 inch should be removed, the face of the dam re-graded and seeded. Further, the trees apparently have been chipped in place and the wood chips applied on the downstream face of the dam. While these wood chips act as mulch and suppress most of the herbaceous growth, they make it impossible to inspect the downstream face of the dam for rutting, animal burrow, etc. The layer of wood chips also masks the face of the dam to an extent that makes it impossible to observe deformations or slumping. It is recommended that the wood chips be removed and a healthy stand of grass established.

The upstream face of the dam embankment is covered with remnants of herbaceous vegetation to a degree that makes it impossible to inspect the dam properly. This vegetation should be removed and the embankment re-seeded, with soil amendments determined by soils tests, so that a healthy stand of grass can be established. The grass should be mowed at least twice per growing season to prevent the re-establishment of woody vegetation.

In keeping with the general lack of maintenance of this impoundment, debris, including tree trunks and branches, has accumulated along the shoreline and to a smaller degree at the inlet to the principal spillway. Such debris accumulation will reduce the capacity and reliability of the spillway. In the extreme the debris can clog the spillway to a degree that will block the spillway and raise the water level in the reservoir. Such debris should be removed on a regular basis.

Date Prepared: Feb. 26, 2014
Prepared By: Chris Kuhn

ANNUAL INSPECTION REPORT FOR VIRGINIA REGULATED IMPOUNDING STRUCTURES

Reference: Impounding Structures Regulations, 4VAC 50-20-10 et seq., including 4VAC 50-20-105, Virginia Soil and Water Conservation Board

Owner's Information

Name of Dam: Kingspoint Pond Dam
Inventory Number: N/A
Owner's Name: Dr. Hoay T. Tan, Trustee
Location-County/City: James City County
Contact Person (if different from above): Mr. A. John Tan
Owner's Address: 415N 2nd Street, Unit 244, San Jose, CA 95112
Hazard Classification:
Name of reservoir: Kingspoint Pond
Purpose of reservoir: Amenity, Stormwater Management
Telephone No.: (Residential) (Business)
Other means of communication:

Owner's Engineer

Name of Engineering Firm and Engineer: **Stantec, Jeffrey T. Hancock, P.E.**
Professional Engineer Virginia License Number: **37017**
Mailing Address: **5209 Center Street, Williamsburg, VA 23188**

Telephone No.: (Business) **757-220-6869**

Directions: Make note of all pertinent conditions and changes since the last inspection, or, if this is the first inspection, since the filing of a design report.

Date of This Inspection **Feb. 25, 2014**
Date of Last Inspection **unknown**

1. EMBANKMENT

a. Any alteration made to the embankment? **No**

b. Erosion on embankment? **Slope failure associated with pipe separation of principal spillway, DS face of dam**

c. Settlement, misalignment or cracks in embankment? **No**

d. Seepage? If so, seepage flow rate and location (describe any turbidity and observed color within the flow): **No**

2. UPSTREAM SLOPE

a. Woody vegetation discovered? **Herbaceous vegetation, some large stumps**
b. Rodent burrows discovered? **Not observable due to herbaceous vegetation**
c. Remedial work performed? **Tree removal in recent years**

3. INTAKE STRUCTURE

a. Deterioration of concrete? **No**
b. Exposure of rebar reinforcement? **No**
c. Is there a need to repair or replace the trash rack? **No trash rack.**
d. Any problems with debris? **Some debris accumulation**
e. Was the drawdown valve operated? **No valve present**

4. ABUTMENT CONTACTS

a. Any seepage? If so, estimate the flow rate and describe the location of the seep or damp areas (describe any turbidity and observed color within the flow):

No seepage observed. Right US groin has concrete ditch installed for some road drainage.
Evidence of runoff in left DS groin, with light erosion. Right DS groin is in failure area

---

5. EARTHEN EMERGENCY SPILLWAY Not present

a. Obstructions to flow? If so, describe plans to correct:

b. Rodent burrows discovered?

c. Any deterioration in the approach or discharge channel?

---

6. CONCRETE EMERGENCY SPILLWAY Not present

a. Deterioration of concrete?

b. Exposed steel reinforcement?

c. Any leakage below concrete spillway?

d. Obstructions to flow? If so, lists plans to correct:

---

7. DOWNSTREAM SLOPE Slope failure associated with failure of outfall barrel due to pipe separation

a. Woody vegetation discovered? **Some large remaining stumps. Wood chips cover the whole face**

b. Rodent burrows discovered? **Not observable due to layer of wood chips**

c. Are seepage drains flowing? **No drains present**

d. Any seepage or wet areas? **No seepage or wet areas on embankment. Failure area shows no sign of seepage**

---

8. OUTLET PIPE Pipe Separation

a. Any water flowing outside of discharge pipe through the Impounding Structure? **no**

b. Describe any deflection or damage to the pipe: **Pipe separation approx. half way through DS slope**

---

9. STILLING BASIN Not present

a. Deterioration of concrete structures?

b. Exposure of rebar reinforcement?

c. Deterioration of the basin slopes?

d. Repairs made?

e. Any obstruction to flow?

---

10. GATES Not present

a. Gate malfunctions or repairs?

b. Corrosion or damage?

c. Were any gates operated? If so, how often and to what extreme?

---

11. RESERVOIR/WATERSHED

a. New developments upstream of dam? **No**

b. Slides or erosion of lake banks around the rim? **No**

c. General comments to include silt, algae or other influence factors: **Woody debris accumulation along shoreline and at the principal outlet structure. Algae**

---

12. INSTRUMENTS **Not present**

a. List all instruments

b. Any readings of instruments?

c. Any installation of new instruments?

13. DOWNSTREAM/HAZARD ISSUES

a. New development in downstream inundation zone? **No**

b. Note the maximum storm water discharge or peak elevation during the previous year. **Unknown**

c. Was general maintenance performed on dam? If so, when? **Tree removal in recent years**

d. List actions that need to be accomplished before the next inspection: **Repair of the pipe separation and slope failure Removal of the stumps and roots with diameter larger than 1 inch. Removal of herbaceous vegetation. Re-grading of the dam faces, re-seeding and soil amendments based on testing. Debris removal along shoreline and at inlet structure.**

14. OVERALL EVAULATION OF IMPOUNDING STRUCTURE AND APPURTENANCES

(Check one) ☐ **EXCELLENT** ☐ **GOOD** ☒ **POOR**

General Comments: The impounding structure is not well maintained. Obviously the most significant issue is the pipe separation and associated slope failure. Without repair the impounding structure is at risk for breach in the future.

Recommendations: Tree stumps and roots as well as the layer of wood chips need to be removed and a healthy stand of grass established, which is mowed at least twice a growing season.
Debris should be removed from the shoreline and around the outlet structure.
Efforts should be undertaken to obtain an Operation & Maintenance Certificate or a General Permit for the operation of this Impoundment. Preliminary calculations demonstrate that the impoundment is subject to the Dam Safety Regulations.

CERTIFICATION BY OWNER'S ENGINEER (required only when an inspection by an engineer is required)

I hereby certify that the information provided in this report has been examined by me and found to be true and correct in my professional judgment.

Signed: _____ Virginia Number: _____
Professional Engineer's Signature Print Name

This _____ day of _____ , 20 _____ .

Engineer's Virginia Seal:

CERTIFICATION BY OWNER

I hereby certify that the information provided in this report has been examined by me.

Signed: _____
Owner's Signature Print Name

This _____ day of _____ , 20 _____ . _____

Mail the executed form to the appropriate
Department of Conservation and Recreation
Division of Dam Safety and Floodplain Management
Regional Engineer

Blue Ridge Geotechnical, LLC

REPORT OF GEOTECHNICAL EXPLORATION

KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

Prepared for:

STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP

WILLIAMSBURG, VIRGINIA

Prepared by:

BLUE RIDGE GEOTECHNICAL, LLC

RICHMOND, VIRGINIA

BRG PROJECT NO. 150

REVISED MARCH 10, 2014

INTRODUCTION AND AUTHORIZATION

Blue Ridge Geotechnical, LLC (BRG) is pleased to submit this report of the geotechnical exploration program performed for the Kingspoint Dam in James City County, Virginia. This work was performed in general accordance with the proposal submitted to Stantec/**Williamsburg Environmental Group (WEG)** on January 21, 2014 and accepted on January 22, 2014.

PURPOSES AND SCOPE OF SERVICES

The purposes of our involvement on this project were to execute a subsurface exploration program, to evaluate the subsurface conditions at the site, and to prepare this report, which contains our geotechnical recommendations. The tasks that **BRG** performed are summarized below.

A. Reviewed the available geologic literature and soils maps of the area.

B. Performed two site visits (January 27, 2014 and February 4, 2014).

C. Performed two (2) Standard Penetration Test (SPT) borings and two (2) shallow hand auger borings.

D. Performed laboratory testing on selected soil samples.

E. Estimated the engineering properties of the subsurface materials within the depths explored.

F. Performed analyses in order to develop geotechnical recommendations regarding the existing dam based on the estimated soil parameters and our understanding of the project.

G. Prepared this report presenting our findings and recommendations.

Our scope of services did not include subsequent site visits, construction observation work, attendance at meetings, or any other task not explicitly identified herein or in our proposal.

PROJECT INFORMATION AND CURRENT SITE CONDITIONS

Kingspoint Dam is located within the Kingspoint subdivision in James City County, Virginia as shown on the Project Location Map (Drawing No. 1) in Appendix "A." The dam is located

northeast of 110 Overlook Drive and is generally located on the south side of the pond. From the downstream toe, the dam appears to have a maximum height of approximately 25 to 30 feet at its center and is approximately 300 feet in length. The crest (top) of the dam is approximately 20 to 25 feet wide. The dam appears to have been constructed across a natural swale; steep natural slopes were observed on both sides of the ravine. Large trees were once present on the dam, but have recently been removed (cut even with the surface of the dam). Several large stumps were observed in the dam. The crest and downstream surface of the dam is covered with what appears to be mulch or chipped wood, which is likely the remnants of the trees. The age of the dam is unknown. Additionally, it is not known if the dam was constructed of zoned material (separate core and shell zones, each consisting of different material), or whether the dam is made of a relatively homogeneous material.

The primary spillway consists of a brick riser structure that is capped with concrete located on the right side of the pond, adjacent to the dam. (Note that the terms "right" and "left" are relative to one viewing the dam in a downstream direction. In this case, the right and left sides are the southwest and northeast sides, respectively.) The downstream slope of the dam ranges between 24° and 26°, and the upstream slope (above the pond water level) ranges from 22° to 23°. The pond water level appeared to be approximately 6 to 7 feet below the crest of the dam at the time the drilling was performed, and pond water was entering the primary spillway. A portion of the top of the spillway structure appeared to be clogged with debris.

Mature trees are present in the flat area approximately 25 feet beyond the downstream toe of the dam, and the ground in this area was saturated at the time of our site visit. Rain had fallen the day prior to drilling; however, this area may remain marshy during the wet time of the year.

A large failure zone is present on the right, downstream portion of the dam. This failure is directly over the primary spillway barrel pipe. The barrel pipe, which is made of corrugated metal, is completely severed at the bottom of the failed zone. Water is flowing through the portion of pipe that extends out of the dam. The face of the failed zone (scarp) appears to be nearly vertical, and extends up to the downstream edge of the dam's crest. No seepage was observed in the vertical face of the failed zone.

GEOLOGIC CONDITIONS

According to the geologic references cited, the site is located within the Coastal Plain Physiographic Province. The site appears to be located within the Chesapeake Group ***(Tc)***, which is comprised of several formations. The material within this group can consist of fine to coarse sand, silt, clay, variably shelly and diatomaceous.

2003 Digital Representation of the 1993 Geologic Map of Virginia,
Commonwealth of Virginia, Department of Mines, Minerals and Energy,
Division of Mineral Resources

FIELD EXPLORATION PROGRAM

On January 27, 2014, two (2) hand auger borings (HA-1 and HA-2) were performed at the toe of the dam. On February 4, 2014, two (2) Standard Penetration Test (SPT) borings were performed on the crest of the dam. The boring locations are shown on the Approximate Boring Location Plan (Drawing No. 2) in Appendix "A." The borings (designated B-1 and B-2) were advanced to a depth of 40 feet below the crest of the dam. The locations of the borings were recorded in the field using a hand-held GPS unit.

The borings were performed by Ayers and Ayers, Inc. of Powhatan, Virginia and were advanced using a CME 45B drill rig mounted on an all-terrain vehicle. Hollow-stem augers having an inside diameter of 2¼ inches were used. The SPT, as defined by ASTM D 1586, involves drilling to predetermined depths using hollow-stem augers, removing the center plug, and driving a split-spoon sampler with a 140-pound hammer falling 30 inches through the hollow-stem augers. The blow counts required to drive the split-spoon sampler are recorded for three successive, 6-inch increments. The last two, 6-inch increments are added together, and this value is referred to as the N-value for that particular sample. The N-value can be used to estimate the relative density of the soil (for granular soils), or the consistency (for fine-grained soils), and can be used to estimate geotechnical engineering properties. A manual hammer was used during the SPT work. Upon completion, all borings were filled and sealed with a grout consisting of a mixture of extra high yield bentonite and cement.

HAND AUGER RESULTS

The results of the hand auger borings are summarized in the table below:

Hand Auger Location	Material Encountered	Groundwater Depth	Termination Depth	Reason for Termination
HA-1 37.24095° -76.70018°	0-2': Very moist, brown, lean CLAY with sand, large stick at 2' 2'-3.4': Very moist, dark gray, silty fine to medium SAND	2.6'	3.4'	Refusal
HA-2 37.24102° -76.70008°	0-2.75': Moist to very moist, red brown to yellow brown lean CLAY with sand	2.5'	2.75'	Below water table

USDA SOIL MAP

The USDA Soil Map of this area was reviewed. A copy of this map is provided in Appendix C (Drawing No. 3). The predominant soil unit indicated was **Unit 15F** (Emporia complex, 25% to 50% slopes). The parent material is indicated to be marine deposits. Appendix C contains additional information obtained from the USDA website.

LABORATORY TESTING PROGRAM

The soil samples obtained during drilling operations were visually classified in general accordance with ASTM D 2487 (Standard Test Method for Classification of Soils for Engineering Purposes) and ASTM D 2488 (Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)). This system is also known as the Unified Soil Classification System (USCS) and was used to develop the soil descriptions presented on the logs. The logs and supplemental information regarding the USCS procedure are provided in Appendix "B."

Selected soil samples were sent to GeoTesting Express in Acton, Massachusetts for laboratory testing. Water Content determinations (ASTM D 2216), Atterberg Limits (ASTM D 4318), and Grain-size Analyses (ASTM D 422) were performed. Detailed laboratory results are included in Appendix "D" of this report and summarized below.

Location	Depth (ft.)	Water Content (%)	Liquid Limit (%)	Plasticity Index (%)	Fines Content (%)	USCS
B-1	2.0-3.5	16.2	49	28	70.6	CL
B-1	9.0-10.5	22.0	37	18	75.0	CL
B-1	14.0-15.5	17.6	25	11	61.7	CL
B-2	7.0-8.5	19.9	32	16	70.3	CL

SUBSURFACE CONDITIONS

Soil Stratigraphy

Three general soil units were encountered during our subsurface exploration program:

Unit "A": Surficial Materials
Unit "B": Fill (Dam Embankment)
Unit "C": Alluvium/Marine Sediments

Unit "A" surficial materials consisted of approximately 1 to 2 inches of mulch (chipped trees). This unit was encountered in all borings locations.

Unit "B" fill soils that make up the dam embankment consist primarily of lean CLAY with sand. Occasional organic matter and wood fragments were encountered in this unit. This unit, which was encountered in borings B-1 and B-2, extends to a depth of approximately 23 feet below the crest of the dam. The Standard Penetration Test N-values ranged from 2 to 17 blows per foot (bpf), with an average value of approximately 8 bpf, which represents a "medium stiff" consistency for the cohesive soils.

Unit "C" alluvial/marine soils were encountered in all borings and consist lean CLAY (CL) with sand and clayey SAND (SC). The N-values in this unit range from 3 to 12 with an average of 6.

A detailed description of the soils encountered at each boring is presented on the boring logs provided in Appendix "B." Although the delineations between these units, as well as the delineations between the various soil strata within each unit, are depicted as a solid line on the boring logs, the transition between strata may be gradual or abrupt. BRG will retain the soil samples for 60 days, unless it is requested that they be kept for a longer period of time.

Groundwater/Seepage Line Observations

The groundwater (seepage line) was encountered at the depths/elevations shown in the table below.

Boring	**Groundwater Measurements** (Depth)		
	During Drilling	Upon completion (through hollow-stem auger)	Upon completion (through uncased borehole)
B-1	Not observed	Not observed	33 ft.
B-2	22 ft.*	Not observed	36 ft.
HA-1	3.4	N/A	N/A
HA-2	2.75	N/A	N/A

*possibly perched

Long-term water level (seepage line) measurements using piezometers were not obtained. Unless long-term water measurements are made over a long period of time, it is difficult to know precisely where the water surface (seepage line) is located. The water may not simply be the point at which the soil samples have a "wet" appearance. The actual phreatic surface may be lower than the point at which "wet" soils are encountered. This is due to the presence of a saturated capillary fringe zone above the actual water level, especially common in fine-grained soils. Additionally, the soil augers typically alter the sides of the borehole (smear the sidewalls of the hole), which inhibits groundwater recharge, resulting in possible erroneous readings when taken immediately upon completion of the boring. In some cases, the groundwater that is encountered during drilling is not a static phreatic surface, but rather is under artesian pressure. Alternatively, subsurface water may be "perched" on top of an impervious stratum. Seasonal fluctuations and extended periods of drought or rain can also significantly affect the water levels.

OVERALL CONDITION OF DAM

Based on observations made at the time of our site visits, except for the large failed area, the condition of the dam generally appears satisfactory. No signs of localized slope failure or excessive seepage were noted on the downstream slope face, nor on the portion of the upstream face that is visible above pond level. The ground surface near the toe of the dam and beyond was wet; however, this appears to be the result of recent heavy rain and snowfall. The Standard Penetration Test N-values tended to be lower in boring B-2 than in boring B-1, possibly indicating that the dam may contain localized zones of weaker material. However, the dam appears to have been in place and stable for a relatively long period of time.

The dam appears capable of supporting a proposed driveway that will provide access to the property on the east side of the pond from Overlook Drive. Prior to driveway construction, the wood chips should be removed, and the subgrade thoroughly proofrolled with a fully loaded, tandem-axle dump truck to identify any soft or weak areas. All areas that pump or rut during proofrolling operations should be improved based on field conditions. This driveway appears to be the sole access point for this property, as the pond and the Colonial National Historic Parkway border the property on the west and east sides, respectively. However, if possible, it would be prudent to incorporate a secondary ingress/egress route (possible from the north) that can be used in case of an emergency.

It is recommended that the stumps and large roots present in the dam be removed and replaced with compacted structural fill as described later in this report. Roots larger than approximately one inch in diameter should be removed; however, this work should be performed as carefully as possible. It would be preferable to leave isolated roots in place rather than to damage the dam by attempting to remove roots that extend deep into the embankment. As a guide, excavations performed for the purpose of stump and root removal should be limited to a depth of approximately 3 feet.

CAUSE OF FAILURE

It is difficult to determine whether the leak in the CMP cause the failure of the downstream slope of the dam, or whether the failure resulted in the pipe becoming severed. Additionally, it is not known what impact, if any, that overtopping may have played in the failure. It seems likely that the pipe began to leak at some point, which ultimately resulted the failure of the dam.

When a buried pipe leaks, it will saturate the soil, which can significantly reduce the shear strength of the soil. Additionally, the soil that surrounds the pipe can progressively enter the pipe, which can create loss of ground, eventually resulting in a large-scale failure.

RECOMMENDATIONS

Although the failed zone of the dam is large and a significant portion of the dam has been removed, no apparent seepage was noted in the shear face of the scarp. This seems to indicate that the dam is still able to function in spite of the failure. Based on our borings, the material with which the dam was constructed (at least in the center of the dam) appears to be predominantly clay. Clay has a low permeability, which is good for controlling seepage.

The following corrective measures are recommended:

1. Evaluate the condition of the primary spillway, the riser pipe and the CMP barrel. This can be accomplished with video camera that can be fed both from the top, extending down the riser pipe, and up the CMP barrel from the severed portion. For best results, this work will likely have to be performed when the pond level is low, so that water is not flowing within the pipe. The camera can used to determine if the pipe is corroded, severed at any joints, or otherwise compromised. One sign of a potential future problem might be if there is an area where soil appears to be entering the pipe.

2. Once it is confirmed that the portions of the riser and barrel that remain in the dam are sound, the failed material at the toe of the dam can be removed. As this area is currently being inundated with water exiting the barrel, this work should be performed when the pond level is below the primary spillway. Alternatively, the water should be collected at the current discharge point and piped downstream, until the water can be conveyed within a new extended barrel.

3. Soft, weak soil that is currently present at the base of the failed area should be carefully removed, and the subgrade evaluated. A limited portion of the soft material can probably remain; however, this must be determined in the field. If some soft soils must remain, it may be necessary to utilize a bridge lift of large stone (e.g., VDOT No. 2 stone). It is imperative that this material be completely wrapped in geosynthetic fabric for separation. It will also be important that this excavation not undermine the existing dam in any way.

4. Extend the barrel and construct a proper outfall. The lower half of the barrel should be supported on a cradle of concrete or flowable fill, as it is not possible to compact around the lower portion of the pipe.

5. Replace the failed portion of the dam using compacted soil fill as described below.

COMPACTED FILL

Compacted fill for the dam should consist of lean CLAY with sand (CL), sandy CLAY (CL/CH), or clayey SAND (SC), providing the fines content is at least 35%. The fill should be free of organics, root matter, debris and all other deleterious material and should be placed in thin horizontal layers having a maximum loose lift thickness of 8 inches. Compacted fill placed in close proximity to the barrel extension should be placed in 4-inch loose lifts and compacted with hand tampers.

The fill should be compacted to a minimum density of 95% of the maximum dry density based on the Standard Proctor compaction test (ASTM D 698). The water content (moisture content) at the time of compaction should be within (-1) percentage point to (+3) percentage points of the optimum water content based on the Standard Proctor. Otherwise, wetting or drying the material may be necessary prior to compaction. Fill should not be placed on ground that is saturated, frozen or snow-covered.

In many cases, a soil cannot be properly compacted due to excessive moisture. If scarification and aeration is not practical, the use of lime or some other admixture can be considered to help facilitate earthwork operations.

It is typically recommended that all fill lifts be benched into existing slopes a minimum of 4 to 6 feet horizontal to help prevent the development of a smooth failure plane between the compacted fill and the existing ground (existing dam embankment). However, this must be weighed against the effect that cutting into the existing dam will have. Using a detailed survey of the failed area, it will be necessary to develop a series of steps into the existing dam that accomplish this goal while also limiting the impact to the dam.

UTILITY CONSTRUCTION

It is understood that the placement of water and sewer lines are being considered across the dam. In order to reduce the risk that the dam will be harmed by localized inundation, it will be imperative that measures be taken to keep these lines from leaking or rupturing during their service life, especially at the joints.

CONSTRUCTION INSPECTION AND SAFETY

It is strongly recommended that a qualified inspector monitor all aspects of earthwork construction, especially fill placement and moisture-density (compaction) testing. A full-time inspector can often help identify earthwork problems so they can be quickly corrected.

It is imperative that all OSHA regulations be followed. This work will be performed at the base of steep slope, and the safety of those working in this area must be maintained. It may be necessary for the contractor to utilize temporary shoring to ensure the safety of the construction crew.

LIMITATIONS

This report has been prepared specifically for Stantec/Williamsburg Environmental Group, or their authorized representatives, for the proposed Kingspoint Dam in James City County, Virginia.

The recommendations contained herein are based on the information obtained during our subsurface exploration program and our understanding of the project. If the details of this project differ from those described herein, or if any details of this project change after the date of this report, we should be contacted. Our recommendations may have to be amended as a result of the project modifications.

It is important to realize that subsurface conditions can vary (sometimes significantly) from those encountered during the subsurface exploration program. If, during construction operations, site conditions appear different than those described herein, we should be contacted. Again, our recommendations may have to be amended as a result of the conditions revealed during construction.

The report should be made available to other designers involved with the project, as well as perspective contractors bidding on the project. However, it should be known that this report is "for information only" and should not be considered part of the Contract Documents. This report was intended to provide recommendations for design only. The recommendations contained herein represent our opinions and interpretations; no other warranty, explicit or implicit, is made.

ACKNOWLEDGEMENT

We appreciate the opportunity to serve as your geotechnical engineering consultant on this project. If you have any questions, please do not hesitate to contact us at 804/357-4157 or BlueRidgeGeotech@comcast.net.

Respectfully Submitted,
Blue Ridge Geotechnical, LLC

J. Michael Hall, P.E.
Geotechnical Engineer/Founder

REFERENCES

Commonwealth of Virginia, Department of Mines, Minerals and Energy, Division of Mineral Resources, Publication 174, *Digital Representation of the 1993 Geologic Map of Virginia, Expanded Explanation*, 2003

USDA Soil Survey Maps (www.websoilsurvey.nrcs.usda.gov)

Army Corp of Engineers Engineering Manual (EM 1110-2-1901), September 30, 1986

APPENDICES

- Appendix A (Figures)
  - Project Location Map (Drawing No. 1)
  - Approximate Boring Location Plan (Drawing No. 2)

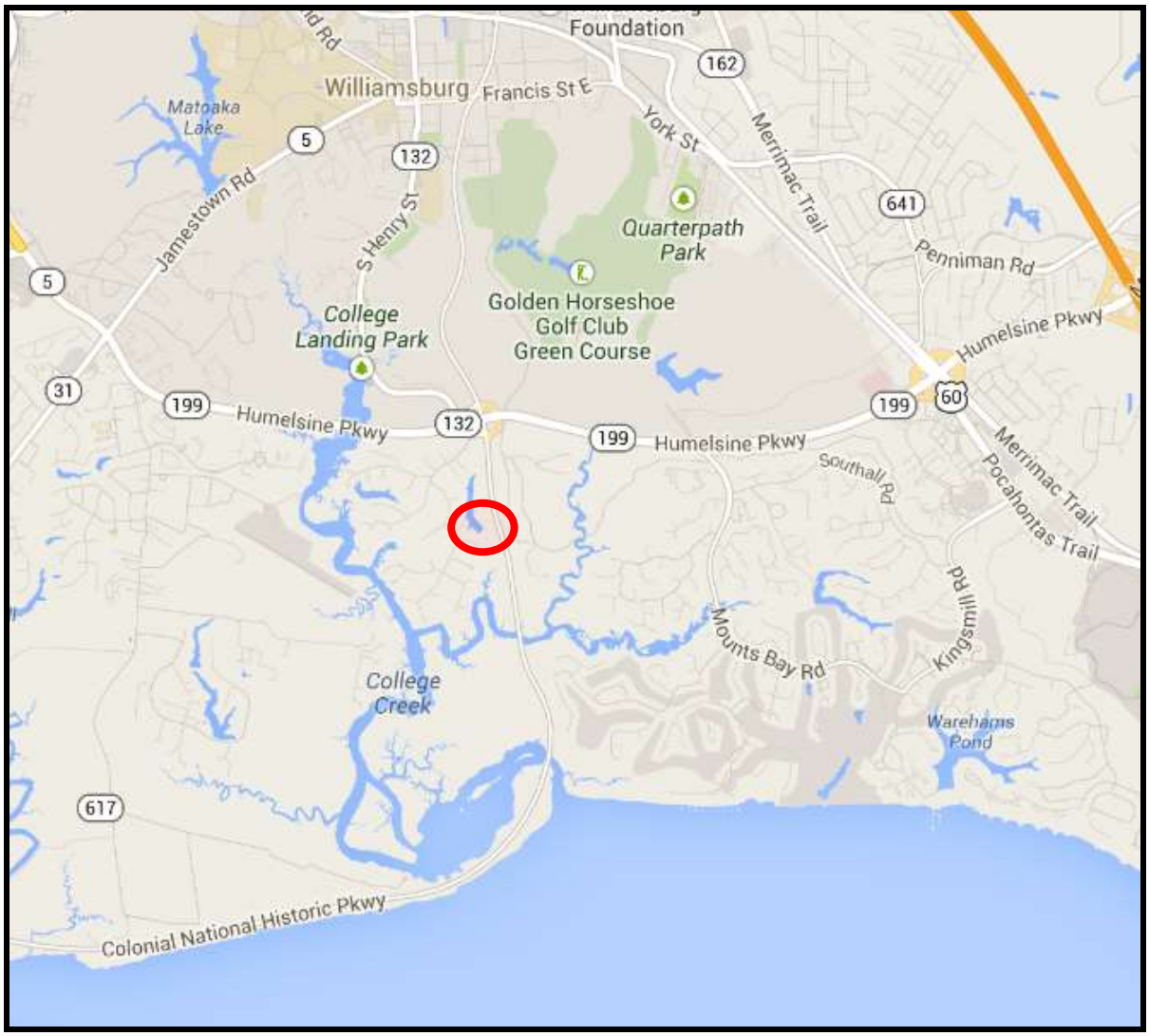
- Appendix B (Boring Logs)
  - Boring Logs B-1 and B-2
  - Boring Log Interpretation (2 pages)

- Appendix C (USDA Soil Map Data)
  - USDA Soils Map (Drawing No. 3)
  - Map Unit Description – (15F) Emporia Complex, 25% to 50% slopes
  - Engineering Properties (9 pages)
  - Physical Properties (8 pages)
  - Particle Size and Coarse Fragments (5 pages)

- Appendix D (Laboratory Test Results) (9 pages)

APPENDIX "A"

FIGURES



** Map obtained from Virginia.gov website*

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STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP
WILLIAMSBURG, VIRGINIA

PROJECT LOCATION MAP

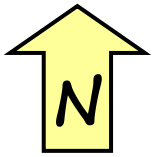
KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

BRG NO. 150
FEBRUARY 2014
DRAWN BY: JMH *
SCALE: N/A

DRAWING NO. 1

** Adapted itouchmap.com*



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APPROXIMATE BORING LOCATION PLAN

KINGSPOINT DAM

JAMES CITY COUNTY, VIRGINIA

BRG NO. 150
FEBRUARY 2014
DRAWN BY: JMH *
SCALE: AS NOTED

DRAWING NO. 2

APPENDIX "B"

BORING LOGS

Blue Ridge Geotechnical, LLC

Boring Log

B-1 (Sht. 1 of 2)

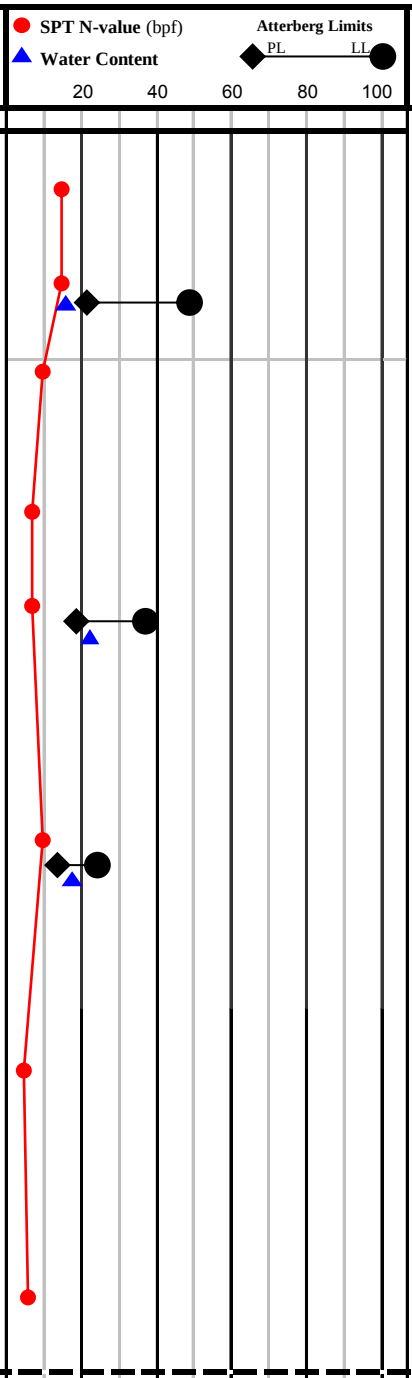
Project: ***Kingspoint Dam***
James City County, Virginia

BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unknown
Boring Location: N 37.24099° W -76.70048°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value
	Moist, stiff, red brown, brown and gray, lean **CLAY** with sand, trace organic matter (occasional sticks, roots) *(Fill)*	(F)		0.0	6	6	9	15
				1.5				
				2.0	6	7	8	15
				3.5				
	Moist, stiff, yellow brown and orange brown, lean **CLAY** with sand, trace organic matter (occasional sticks, roots)	(F)		4.0	7	6	4	10
				5.5				
	Below 7': Medium stiff consistency			7.0	4	3	5	8
				8.5				
	Below 9': Tan and gray color			9.0	4	4	4	8
				10.5				
	Below 14': Stiff consistency			14.0	4	5	5	10
				15.5				
	Below 19': Medium Stiff consistency, orange brown and brown color *(Fill)*			19.0	3	2	3	5
				20.5				
				23.0				
	Very moist, medium stiff, brown, fine sandy lean **CLAY**, trace organics, trace shell *(Alluvial/Marine)*	(CL)		24.0	3	3	3	6
				25.5				
				27.0				



Remarks

~2 inches mulch on surface

Water:
-Not encountered during drilling
-Not encountered upon completion (through HSA) - 33 ft. (through uncased borehole)

Cave-in: 37 ft.

2.0'-3.5':
LL=49 PI=28
FC=70.6%
w_c=16.2%

9.0'-10.5':
LL=37 PI=18
FC=75.0%
w_c=22.0%

14.0'-15.5':
LL=25 PI=11
FC=61.7%
w_c=17.6%

Continued on Sheet 2

Blue Ridge Geotechnical, LLC

Boring Log

B-1 (Sht. 2 of 2)

Project: *Kingspoint Dam*
James City County, Virginia

BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unkknown
Boring Location: N 37.24099° W -76.70048°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value	SPT N-value (bpf) / Water Content / Atterberg Limits (PL–LL) 20 40 60 80 100	Remarks
	Continued from Sheet 1			27.0						
				28.0						
	Very moist, medium stiff, brown and gray, fine to medium sandy **CLAY** *(Alluvial/Marine)*	(CL)		29.0	1	2	3	5		
				30.5						
				32.0						
	Very moist, medium stiff, brown and gray, fat **CLAY** with fine sand *(Alluvial/Marine)*	(CH)		34.0	2	3	3	6		
				35.5						
				36.0						
	Very moist, medium dense, tan and gray, clayey fine to medium **SAND** *(Alluvial/Marine)*	(SC)		38.5	4	5	7	12		
				40.0						
	Boring Terminated at 40.0 ft.									

Blue Ridge Geotechnical, LLC

Boring Log

B-2 (Sht. 1 of 2)

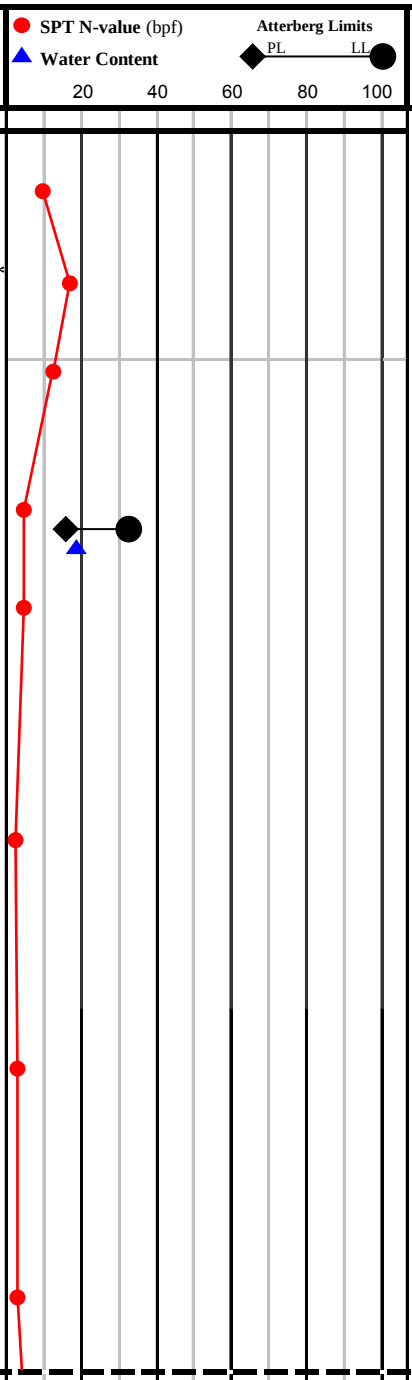
Project: *Kingspoint Dam*
James City County, Virginia

BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unknown
Boring Location: N 37.24113° W -76.70025°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value
	Moist to very moist, stiff, red brown, tan and gray, lean **CLAY** with sand, trace organic matter (occasional sticks, roots)	(F)		0.0	2	4	6	10
				1.5				
	Below 2': "Moist"			2.0	3	6	11	17*
				3.5				
				4.0	6	6	6	12
				5.5				
	(Fill)			7.0	1	2	3	5
				8.5				
	Very moist, medium stiff, gray and brown, lean **CLAY** with sand, isolated zones of sand *(Fill)*	(F)		9.0	3	3	2	5
				10.5				
	Very moist, soft, gray and red brown (mot.), lean **CLAY,** with sand *(Fill)*	(F)		12.0				
				14.0	1	1	1	2
				15.5				
	Very moist, soft, gray and brown, sandy lean **CLAY,** trace organics *(Fill)*	(F)		17.0				
				19.0	1	1	2	3
				20.5				
	Very moist, soft, brown, fine sandy lean **CLAY**, trace organics *(Alluvial/Marine)*	(CL)		23.0				
				24.0	1	2	1	3
				25.5				
				27.0				



Remarks

~1 inches mulch on surface

* Spoon driven through large stick

Water:
-Apparent perched water at approx. 22 ft.
-Not encountered upon completion (through HSA) - 36 ft. (through uncased borehole)

Cave-in: 37 ft.

7.0'-8.5':
LL=32 PI=16
FC=70.3%
w_c=19.9%

Continued on Sheet 2

Blue Ridge Geotechnical, LLC

Boring Log

B-2 (Sht. 2 of 2)

Project: *Kingspoint Dam*
James City County, Virginia

BRG Project No.: 150

Client: Stantec

Drilling Contractor: Ayers and Ayers, Inc.
Drilling Method/Equip: HSA, 2-1/4" I.D., CME 45B ATV Rig
Hammer Type: *Manual*
Drill Date: *2/4/14*
GS EL.: Unkknown
Boring Location: N 37.24113° W -76.70025°

Elev. (ft.)	Material Description	USCS	Sample	Depth (ft.)	Blows 6"	Blows 6"	Blows 6"	N-value	SPT N-value (bpf) / Water Content / Atterberg Limits (PL–LL) 20 40 60 80 100	Remarks
	Continued from Sheet 1			27.0						
				28.0						
	Very moist, medium stiff, brown and gray, lean **CLAY,** with sand *(Alluvial/Marine)*	(CL)		29.0	1	3	2	5		
				30.5						
				32.0						
	Very moist, medium stiff, brown and gray, sandy lean **CLAY** *(Alluvial/Marine)*	(CL)		34.0	2	3	3	6		
				35.5						
				36.0						
	Very moist, stiff, dark gray, fine sandy **CLAY** *(Marine)*	(CL/ CH)		38.5	2	4	5	9		
				40.0						
	Boring Terminated at 40.0 ft.									

Boring Log Interpretation

The convention used to describe the soil strata on the boring logs is described below. This procedure in general accordance with ASTM D 2487 and ASTM D 2488. The soil descriptions typically follow this format:

"Moisture, Relative Density/Consistency, Color, Secondary component, PRIMARY COMPONENT, minor components and additional comments"

Moisture:
"Dry" – Absence of moisture
"Moist" – Damp, but no visible water
"Wet" – Visible water within sample.

Relative Density/Consistency:

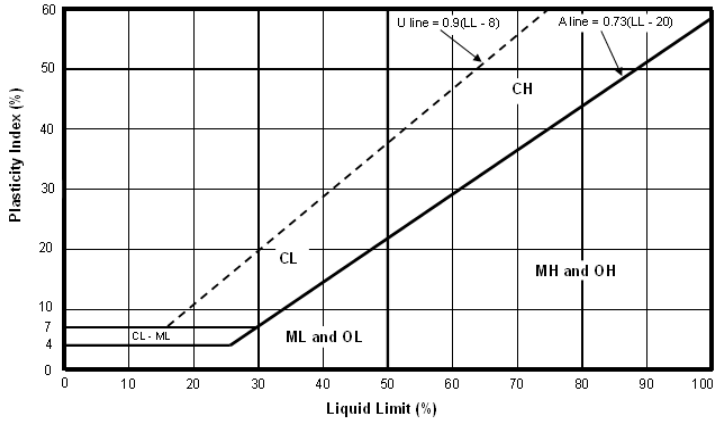
Relative Density is used to describe soils that are predominantly Coarse-Grained (Sands and Gravels).
Consistency is used to describe soils that are predominantly Fine-Grained (Silts and Clays).
Relative Density/Consistency descriptions are based on the SPT N-values as follows:

Relative Density		Consistency	
	SPT N-value		SPT N-value
Very Loose	0 – 4	Very Soft	0 – 1
Loose	5 – 10	Soft	2 – 4
Medium Dense	11 – 30	Medium Stiff	5 – 8
Dense	31 – 50	Stiff	9 – 15
Very Dense	> 50	Very Stiff	16 – 30
		Hard	> 30

Primary and Secondary Components:

Soil Type in Terms of Sieve Size	
Boulder	< 12 inches
Cobble	3 – 12 inches
Gravel (coarse)	¾" – 3 inches
Gravel (fine)	#4 – ¾"
Sand (coarse)	#10 – #4
Sand (medium)	#40 – #10
Sand (fine)	#200 – #40
Silt	< #200
Clay	< #200

Coarse-grained soils can be classified based on their grain-size distribution (gradation curves). Fine-grained soils are classified according to their plasticity, which can be determined using performance tests (e.g., Atterberg Limits plotted on the Plasticity chart shown below).



Boring Log Interpretation (con't)

USCS (Unified Soil Classification System) Group Symbols:

USCS Group Symbols are two letter designations.

The first letter represents the primary constituent (all soil types). The second letter represents the secondary constituent (in the case of predominantly coarse-grained soils) or the second letter represents the plasticity (in the case of predominantly fine-grained soils):

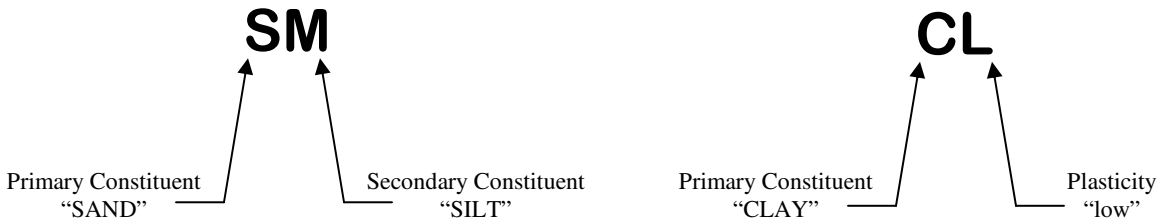
First Letter (Primary Constituent)

G = Gravel
S = Sand
M =Silt
C = Clay

Second Letter (Secondary Constituent or Plasticity)

Coarse-Grained Soils	Fine-Grained Soils
M = Silt	H = High Plasticity
C = Clay	L = Low Plasticity

For example,



Description: "silty SAND"

Description: "lean CLAY"

Minor Components:

According to ASTM D 2488, the terms used to describe to describe the minor components are based on estimations of the quantity of that component within the sample as follows:

Term	Estimated Quantity (by weight)
"trace"	< 5%
"few"	5 – 10 %
"little"	15 – 25%
"some"	30 – 45%

Miscellaneous Terms:

PP – Pocket Penetrometer
FC – Fines Content (quantity of silt and clay)
w_c – Water Content
LL – Liquid Limit
PL – Plastic Limit
PI – Plasticity Index
Mot. – Mottled appearance

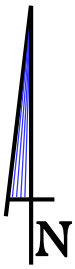
APPENDIX "C"

USDA SOIL MAP DATA

*Map obtained from websoilsurvey.nrcs.usda.gov

Primary Soil Unit:

Map Unit Symbol	Map Unit Name	Typical Profile
15F	Emporia complex, 25 to 50% slopes	0-13": Fine sandy loam 13"-58": Loam 58"-75": Sandy clay loam



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STANTEC/WILLIAMSBURG ENVIRONMENTAL GROUP
WILLIAMSBURG, VIRGINIA

USDA SOILS MAP

KINGSPOINT DAM
JAMES CITY COUNTY, VIRGINIA

BRG No. 150
February 2014
Drawn by: JMH *
Scale: As noted

DRAWING NO. 3

James City and York Counties and the City of Williamsburg, Virginia

15F—Emporia complex, 25 to 50 percent slopes

Map Unit Setting

Elevation: 20 to 150 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 165 to 193 days

Map Unit Composition

Emporia and similar soils: 75 percent
Minor components: 5 percent

Description of Emporia

Setting

Landform: Marine terraces
Landform position (three-dimensional): Riser
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Marine deposits

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: About 36 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 8.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 13 inches: Fine sandy loam
13 to 58 inches: Loam
58 to 75 inches: Sandy clay loam

Minor Components

Johnston

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash.

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
4—Beaches														
Beaches	70		0-60	Coarse sand, sand, fine sand	SP	A-1, A-3	0	0	80-100	78-100	39-80	4-35	7-9	NP
8B—Caroline fine sandy loam, 2 to 6 percent slopes														
Caroline	85	C	0-13	Loam, sandy loam, fine sandy loam	CL, CL-ML	A-4	0	0	90-100	85-100	85-100	50-90	20-30	4-10
			13-47	Clay loam, clay, sandy clay loam, sandy clay	CH, CL	A-7	0	0	90-100	85-100	80-100	35-95	25-61	7-27
			47-72	Clay loam, clay, fine sandy loam, sandy clay	CH, CL, SC, SC-SM, ML	A-4, A-6, A-7	0	0	90-100	85-100	60-100	30-95	20-61	4-27
10B—Craven fine sandy loam, 2 to 6 percent slopes														
Craven	80	D	0-9	Fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	58-100	29-90	13-31	NP-10
			9-53	Clay, silty clay, silty clay loam, clay loam, sandy clay loam, sandy clay	CL, CH	A-7	0	0	100	98-100	83-100	44-95	34-61	12-27
			53-80	Sandy clay loam, sandy loam, loamy sand	SC, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	49-100	14-55	12-38	NP-14

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
10C—Craven fine sandy loam, 6 to 10 percent slopes														
Craven	80	D	0-9	Fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	58-100	29-90	13-31	NP-10
			9-53	Clay, silty clay, silty clay loam, clay loam, sandy clay loam, sandy clay	CL, CH	A-7	0	0	100	98-100	83-100	44-95	34-61	12-27
			53-80	Sandy clay loam, sandy loam, loamy sand	SC, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	49-100	14-55	12-38	NP-14
11C—Craven-Uchee complex, 6 to 10 percent slopes														
Craven	35	D	0-9	Fine sandy loam, silt loam, loam	CL, ML, SC, SM	A-4	0	0	100	98-100	58-100	29-90	13-31	NP-10
			9-53	Clay, silty clay, silty clay loam, clay loam, sandy clay loam, sandy clay	CL, CH	A-7	0	0	100	98-100	83-100	44-95	34-61	12-27
			53-80	Sandy clay loam, sandy loam, loamy sand	SC, SC-SM, SM	A-2, A-4, A-6	0	0	100	98-100	49-100	14-55	12-38	NP-14
Uchee	35	B	0-24	Loamy fine sand, sand, loamy sand	SM	A-1-b, A-2	0	0	80-100	78-100	40-70	15-30	10-16	NP-2
			24-56	Sandy loam, sandy clay loam, clay, sandy clay	SC, SC-SM	A-2, A-4, A-6	0	0	80-100	78-100	46-100	23-95	14-52	1-22
			56-65	Sandy loam, sandy clay loam, sandy clay	CL, SC	A-2-6, A-6, A-7	0	0	80-100	78-100	46-95	23-60	18-43	3-17

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
14B—Emporia fine sandy loam, 2 to 6 percent slopes														
Emporia	80	B	0-13	Fine sandy loam, loam, sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-4, A-6	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Clay loam, sandy clay loam, loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14
15D—Emporia complex, 10 to 15 percent slopes														
Emporia	75	B	0-13	Sandy loam, loam, fine sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-6, A-4	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Clay loam, sandy clay loam, loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
15F—Emporia complex, 25 to 50 percent slopes														
Emporia	75	B	0-13	Sandy loam, loam, fine sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-4, A-6	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Loam, sandy loam, clay loam, sandy clay loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14
17—Johnston complex														
Johnston	75	A/D	0-34	Silty clay loam, silt loam, loam, fine sandy loam	CL-ML, ML, OL	A-4, A-6	0	0	100	100	70-100	40-95	13-38	NP-14
			34-60	Sandy clay loam, sandy loam, sand, fine sandy loam	SC, SM	A-2, A-4	0	0	100	100	50-90	5-55	7-34	NP-12
18B—Kempsville fine sandy loam, 2 to 6 percent slopes														
Kempsville	80	A	0-14	Fine sandy loam, sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-3	90-100	85-100	51-85	26-55	12-20	NP-4
			14-55	Sandy loam, fine sandy loam, loam, sandy clay loam	SC-SM, CL, ML, SC, SM	A-2, A-4	0	0-3	90-100	85-100	51-90	26-55	18-38	3-14
			55-68	Loamy sand, fine sand, loamy fine sand, sandy loam, fine sandy loam, sandy clay loam	SM, ML	A-2	0	0-8	85-100	80-100	40-95	12-60	9-25	NP-7

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes														
Kempsville	50	A	0-14	Fine sandy loam, sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0-3	90-100	85-100	51-85	26-55	12-20	NP-4
			14-55	Sandy loam, fine sandy loam, loam, sandy clay loam	SC-SM, CL, ML, SC, SM	A-2, A-4	0	0-3	90-100	85-100	51-90	26-55	18-38	3-14
			55-68	Loamy sand, fine sand, loamy fine sand, sandy loam, fine sandy loam, sandy clay loam	SM, ML	A-2	0	0-8	85-100	80-100	40-95	12-60	9-25	NP-7
Emporia	30	B	0-13	Sandy loam, loam, fine sandy loam	ML, SM	A-4	0	0-5	95-100	93-100	55-95	27-75	13-23	NP-6
			13-58	Sandy clay loam, sandy loam, clay loam, fine sandy loam, loam	CL, SC	A-4, A-6	0	0-3	95-100	93-100	55-100	27-80	23-38	6-14
			58-75	Clay loam, sandy clay loam, loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-8	95-100	93-100	55-100	27-80	23-38	6-14
21—Levy silty clay														
Levy	85	C/D	0-18	Silty clay	ML, CH, CL	A-6, A-7	0	0	100	100	95-100	90-95	38-61	14-27
			18-80	Silty clay, clay, silty clay loam	ML, CH, CL	A-6, A-7	0	0	100	100	95-100	85-95	38-61	14-27

Engineering Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*Pct*	*Pct*					*Pct*	
29B—Slagle fine sandy loam, 2 to 6 percent slopes														
Slagle	80	C	0-9	Fine sandy loam, sandy loam, loam	SC-SM, SM	A-2, A-4	0	0-3	95-100	90-100	54-95	27-75	14-23	1-6
			9-25	Sandy clay loam, loam, clay loam	ML, CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-3	95-100	90-100	72-100	32-80	18-43	3-17
			25-60	Sandy clay loam, loam, clay loam, clay, sandy clay, sandy loam, loamy sand	ML, CL, SC	A-4, A-6, A-7	0	0-3	95-100	90-100	45-100	14-95	10-52	NP-22
31B—Suffolk fine sandy loam, 2 to 6 percent slopes														
Suffolk	80	B	0-14	Sandy loam, fine sandy loam	CL-ML, ML, SC-SM, SM	A-2, A-4	0	0	98-100	98-100	58-85	29-55	14-23	1-6
			14-40	Sandy clay loam, sandy loam, fine sandy loam	CL, SC	A-4, A-2, A-6	0	0	98-100	98-100	58-90	29-55	16-38	2-14
			40-64	Fine sandy loam, sandy loam, fine sand, sand, loamy fine sand, loamy sand	SC-SM, SM, SP	A-1, A-2, A-3, A-4	0	0	98-100	98-100	30-80	3-50	8-25	NP-7

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
4—Beaches														
Beaches	0-60	-99-	- 2-	0- 0- 2	1.35-1.85	141.00	0.03-0.05	0.0-2.9	0.0-0.1				1	220
8B—Caroline fine sandy loam, 2 to 6 percent slopes														
Caroline	0-13	-58-	-25-	15-18- 25	1.35-1.45	4.00-14.00	0.16-0.22	0.0-2.9	0.5-1.0	.32	.32	5	3	86
	13-47	-40-	-20-	20-40- 60	1.40-1.50	0.01-4.00	0.13-0.20	3.0-5.9	0.0	.24	.24			
	47-72	-35-	-20-	15-45- 60	1.40-1.55	0.01-4.00	0.11-0.17	3.0-5.9	0.0	.20	.20			
10B—Craven fine sandy loam, 2 to 6 percent slopes														
Craven	0-9	-69-	-15-	7-17- 27	1.30-1.45	1.40-14.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-53	-23-	-29-	30-48- 60	1.30-1.45	0.42-1.40	0.12-0.15	3.0-5.9	0.0	.24	.24			
	53-80	-57-	-18-	5-25- 35	1.35-1.60	1.40-42.00	0.08-0.14	0.0-2.9	0.0	.20	.20			
10C—Craven fine sandy loam, 6 to 10 percent slopes														
Craven	0-9	-69-	-15-	7-17- 27	1.30-1.45	1.40-14.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-53	-23-	-29-	30-48- 60	1.30-1.45	0.42-1.40	0.12-0.15	3.0-5.9	0.0	.24	.24			
	53-80	-57-	-18-	5-25- 35	1.35-1.60	1.40-42.00	0.08-0.14	0.0-2.9	0.0	.20	.20			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
11C—Craven-Uchee complex, 6 to 10 percent slopes														
Craven	0-9	-69-	-15-	7-17- 27	1.30-1.45	1.40-14.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-53	-23-	-29-	30-48- 60	1.30-1.45	0.42-1.40	0.12-0.15	3.0-5.9	0.0	.24	.24			
	53-80	-57-	-18-	5-25- 35	1.35-1.60	1.40-42.00	0.08-0.14	0.0-2.9	0.0	.20	.20			
Uchee	0-24	-77-	-16-	3- 7- 10	1.30-1.70	42.00-141.00	0.05-0.10	0.0-2.9	0.3-3.0	.28	.28	5	2	134
	24-56	-57-	-18-	8-25- 50	1.40-1.60	4.00-14.00	0.10-0.15	0.0-2.9	0.0	.24	.24			
	56-65	-65-	-17-	12-18- 40	1.40-1.60	1.40-14.00	0.10-0.16	3.0-5.9	0.0	.24	.24			
14B—Emporia fine sandy loam, 2 to 6 percent slopes														
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			
15D—Emporia complex, 10 to 15 percent slopes														
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
15F—Emporia complex, 25 to 50 percent slopes														
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			
17—Johnston complex														
Johnston	0-34	-31-	-57-	7-13- 35	1.30-1.55	14.00-42.00	0.20-0.26	0.0-2.9	3.0-8.0	.37	.37	5	5	56
	34-60	-52-	-36-	0-13- 30	1.45-1.65	42.00-141.00	0.06-0.12	0.0-2.9	0.0	.37	.37			
18B—Kempsville fine sandy loam, 2 to 6 percent slopes														
Kempsville	0-14	-69-	-22-	5-10- 15	1.30-1.40	14.00-42.00	0.08-0.14	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	14-55	-57-	-18-	12-25- 35	1.30-1.45	14.00-42.00	0.12-0.18	0.0-2.9	0.0	.20	.20			
	55-68	-71-	-17-	2-12- 20	1.35-1.65	4.00-14.00	0.12-0.18	0.0-2.9	0.0	.28	.28			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes														
Kempsville	0-14	-69-	-22-	5-10- 15	1.30-1.40	14.00-42.00	0.08-0.14	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	14-55	-57-	-18-	12-25- 35	1.30-1.45	14.00-42.00	0.12-0.18	0.0-2.9	0.0	.20	.20			
	55-68	-71-	-17-	2-12- 20	1.35-1.65	4.00-14.00	0.12-0.18	0.0-2.9	0.0	.28	.28			
Emporia	0-13	-71-	-17-	7-13- 18	1.30-1.40	14.00-42.00	0.10-0.17	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	13-58	-45-	-29-	18-27- 35	1.35-1.60	0.42-14.00	0.10-0.18	3.0-5.9	0.0	.32	.32			
	58-75	-56-	-18-	18-27- 35	1.30-1.50	4.00-14.00	0.12-0.20	0.0-2.9	0.0	.24	.24			
21—Levy silty clay														
Levy	0-18	- 6-	-47-	35-48- 60	0.50-1.10	0.42-1.40	0.16-0.22	6.0-8.9	5.0-10.0	.24	.24	5	8	0
	18-80	- 6-	-47-	35-48- 60	0.50-1.10	0.42-1.40	0.16-0.22	6.0-8.9	1.0-3.0	.28	.28			
29B—Slagle fine sandy loam, 2 to 6 percent slopes														
Slagle	0-9	-71-	-17-	8-13- 18	1.30-1.45	14.00-42.00	0.10-0.14	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	9-25	-34-	-37-	12-30- 40	1.30-1.45	4.00-14.00	0.10-0.18	0.0-2.9	0.0	.32	.32			
	25-60	-34-	-37-	3-30- 50	1.35-1.60	0.01-4.00	0.12-0.18	3.0-5.9	0.0	.32	.32			

Physical Soil Properties–James City and York Counties and the City of Williamsburg, Virginia														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
31B—Suffolk fine sandy loam, 2 to 6 percent slopes														
Suffolk	0-14	-69-	-16-	10-15- 18	1.35-1.45	14.00-42.00	0.10-0.16	0.0-2.9	0.5-2.0	.24	.24	5	3	86
	14-40	-57-	-18-	10-25- 35	1.40-1.50	4.00-14.00	0.10-0.15	0.0-2.9	0.0	.24	.24			
	40-64	-71-	-17-	1-12- 20	1.40-1.50	14.00-141.00	0.04-0.10	0.0-2.9	0.0	.24	.24			
W—Water														
Water	—	—	—	—	—	—	—	—	—					

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

Particle Size and Coarse Fragments

This table shows estimates of particle size distribution and coarse fragment content of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Total fragments is the content of fragments of rock and other materials larger than 2 millimeters in diameter on volumetric basis of the whole soil.

Fragments 2-74 mm refers to the content of coarse fragments in the 2 to 74 millimeter size fraction.

Fragments 75-249 mm refers to the content of coarse fragments in teh 75 to 249 millimeter size fraction.

Fragments 250-599 mm refers to the content of coarse fragments in the 250 to 599 millimeter size fraction.

Fragments >=600 mm refers to the content of coarse fragments in the greater than or equal to 600 millimeter size fraction.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Particle Size and Coarse Fragments

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
4—Beaches										
Beaches	H1	0-60	-99-	- 2-	0- 0- 2	7	7	—	—	—
8B—Caroline fine sandy loam, 2 to 6 percent slopes										
Caroline	H1	0-13	-58-	-25-	15-18- 25	0	0	—	—	—
	H2	13-47	-40-	-20-	20-40- 60	0	0	—	—	—
	H3	47-72	-35-	-20-	15-45- 60	0	0	—	—	—
10B—Craven fine sandy loam, 2 to 6 percent slopes										
Craven	H1	0-9	-69-	-15-	7-17- 27	0	0	—	—	—
	H2	9-53	-23-	-29-	30-48- 60	0	0	—	—	—
	H3	53-80	-57-	-18-	5-25- 35	0	0	—	—	—
10C—Craven fine sandy loam, 6 to 10 percent slopes										
Craven	H1	0-9	-69-	-15-	7-17- 27	0	0	—	—	—
	H2	9-53	-23-	-29-	30-48- 60	0	0	—	—	—
	H3	53-80	-57-	-18-	5-25- 35	0	0	—	—	—

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
11C—Craven-Uchee complex, 6 to 10 percent slopes										
Craven	H1	0-9	-69-	-15-	7-17- 27	0	0	—	—	—
	H2	9-53	-23-	-29-	30-48- 60	0	0	—	—	—
	H3	53-80	-57-	-18-	5-25- 35	0	0	—	—	—
Uchee	H1	0-24	-77-	-16-	3- 7- 10	0	0	—	—	—
	H2	24-56	-57-	-18-	8-25- 50	0	0	—	—	—
	H3	56-65	-65-	-17-	12-18- 40	0	0	—	—	—
14B—Emporia fine sandy loam, 2 to 6 percent slopes										
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—
15D—Emporia complex, 10 to 15 percent slopes										
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—
15F—Emporia complex, 25 to 50 percent slopes										
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
17—Johnston complex										
Johnston	H1	0-34	-31-	-57-	7-13- 35	—	—	—	—	—
	H2	34-60	-52-	-36-	0-13- 30	—	—	—	—	—
18B—Kempsville fine sandy loam, 2 to 6 percent slopes										
Kempsville	H1	0-14	-69-	-22-	5-10- 15	0	0	0	—	—
	H2	14-55	-57-	-18-	12-25- 35	0	0	0	—	—
	H3	55-68	-71-	-17-	2-12- 20	0	0	0	—	—
19B—Kempsville-Emporia fine sandy loams, 2 to 6 percent slopes										
Kempsville	H1	0-14	-69-	-22-	5-10- 15	0	0	0	—	—
	H2	14-55	-57-	-18-	12-25- 35	0	0	0	—	—
	H3	55-68	-71-	-17-	2-12- 20	0	0	0	—	—
Emporia	H1	0-13	-71-	-17-	7-13- 18	0	0	0	—	—
	H2	13-58	-45-	-29-	18-27- 35	0	0	0	—	—
	H3	58-75	-56-	-18-	18-27- 35	0	0	0	—	—
21—Levy silty clay										
Levy	H1	0-18	- 6-	-47-	35-48- 60	—	—	—	—	—
	H2	18-80	- 6-	-47-	35-48- 60	—	—	—	—	—

Particle Size and Coarse Fragments–James City and York Counties and the City of Williamsburg, Virginia										
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
29B—Slagle fine sandy loam, 2 to 6 percent slopes										
Slagle	H1	0-9	-71-	-17-	8-13- 18	0	0	0	—	—
	H2	9-25	-34-	-37-	12-30- 40	0	0	0	—	—
	H3	25-60	-34-	-37-	3-30- 50	0	0	0	—	—
31B—Suffolk fine sandy loam, 2 to 6 percent slopes										
Suffolk	H1	0-14	-69-	-16-	10-15- 18	0	0	—	—	—
	H2	14-40	-57-	-18-	10-25- 35	0	0	—	—	—
	H3	40-64	-71-	-17-	1-12- 20	0	0	—	—	—
W—Water										
Water	—	—	—	—	—	—	—	—	—	—

Data Source Information

Soil Survey Area: James City and York Counties and the City of Williamsburg, Virginia
Survey Area Data: Version 13, Dec 11, 2013

APPENDIX D

LABORATORY TEST RESULTS

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	---	Tested By:	jek
Sample ID:	---	Test Date:	02/13/14	Checked By:	jdt
Depth :	---	Test Id:	288530		

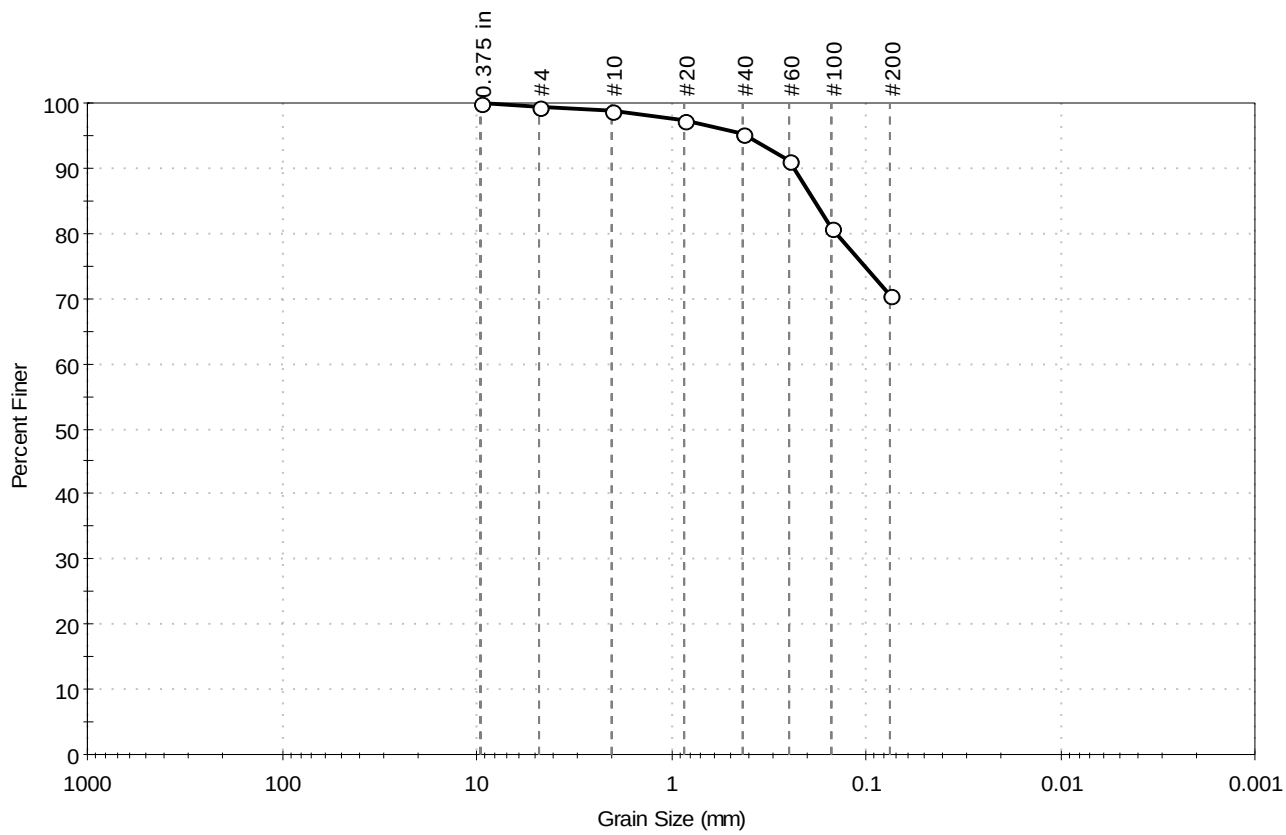
Moisture Content of Soil and Rock - ASTM D2216

Boring ID	Sample ID	Depth	Description	Moisture Content,%
---	B-1	2-3.5 ft.	Moist, yellowish brown clay with sand	16.2
---	B-1	9-10.5 ft.	Moist, yellowish brown clay with sand	22.0
---	B-1	14-15.5 ft.	Moist, yellowish brown sandy clay	17.6
---	B-2	7-8.5 ft.	Moist, yellowish brown clay with sand	19.9

Notes: Temperature of Drying : 110° Celsius

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	2-3.5 ft.	Test Id:	288523		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.5	28.9	70.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	97		
#40	0.42	95		
#60	0.25	91		
#100	0.15	81		
#200	0.075	71		

Coefficients

D_{85} = 0.1846 mm	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM lean clay with sand (CL)

AASHTO Clayey Soils (A-7-6 (19))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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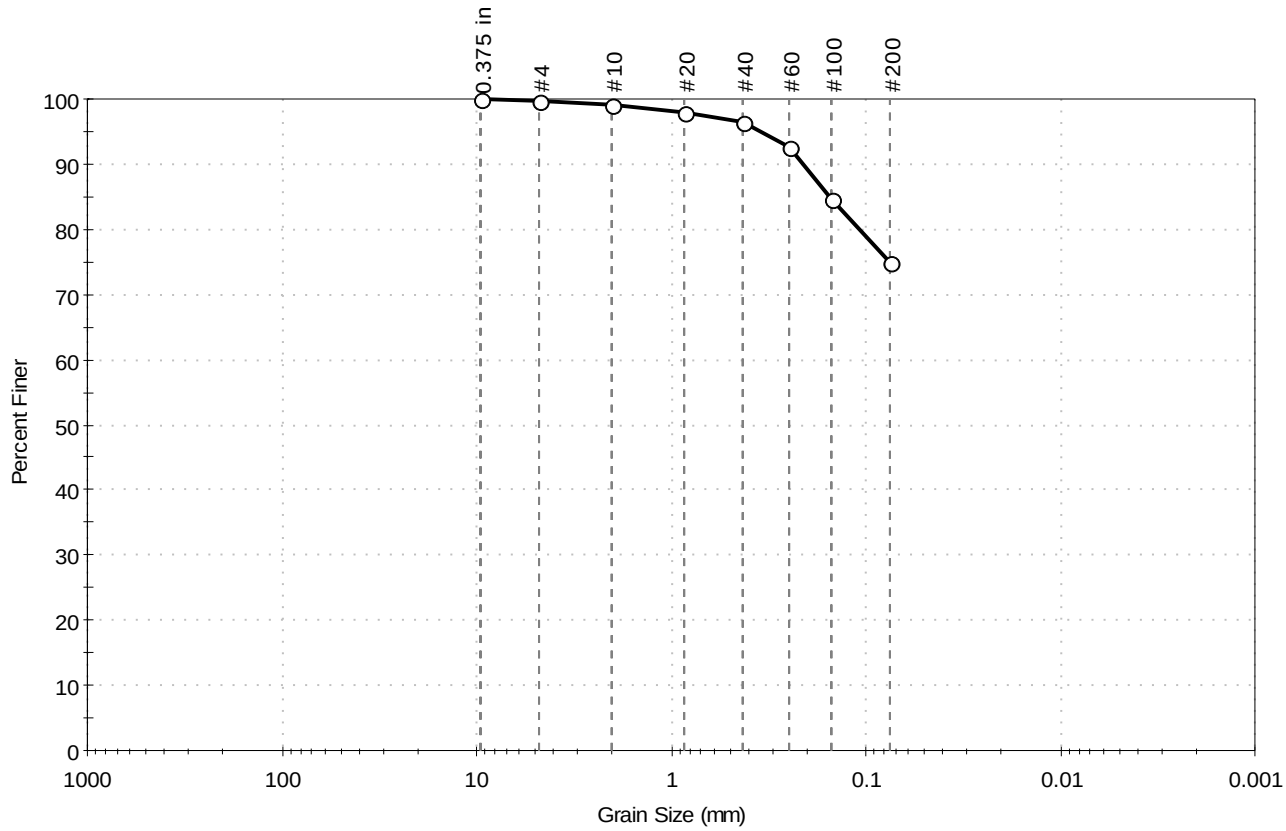
Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	9-10.5 ft.	Test Id:	288524		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.4	24.6	75.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	100		
#10	2.00	99		
#20	0.85	98		
#40	0.42	96		
#60	0.25	93		
#100	0.15	85		
#200	0.075	75		

Coefficients

D_{85} = 0.1540 mm D_{30} = N/A

D_{60} = N/A D_{15} = N/A

D_{50} = N/A D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM lean clay with sand (CL)

AASHTO Clayey Soils (A-6 (12))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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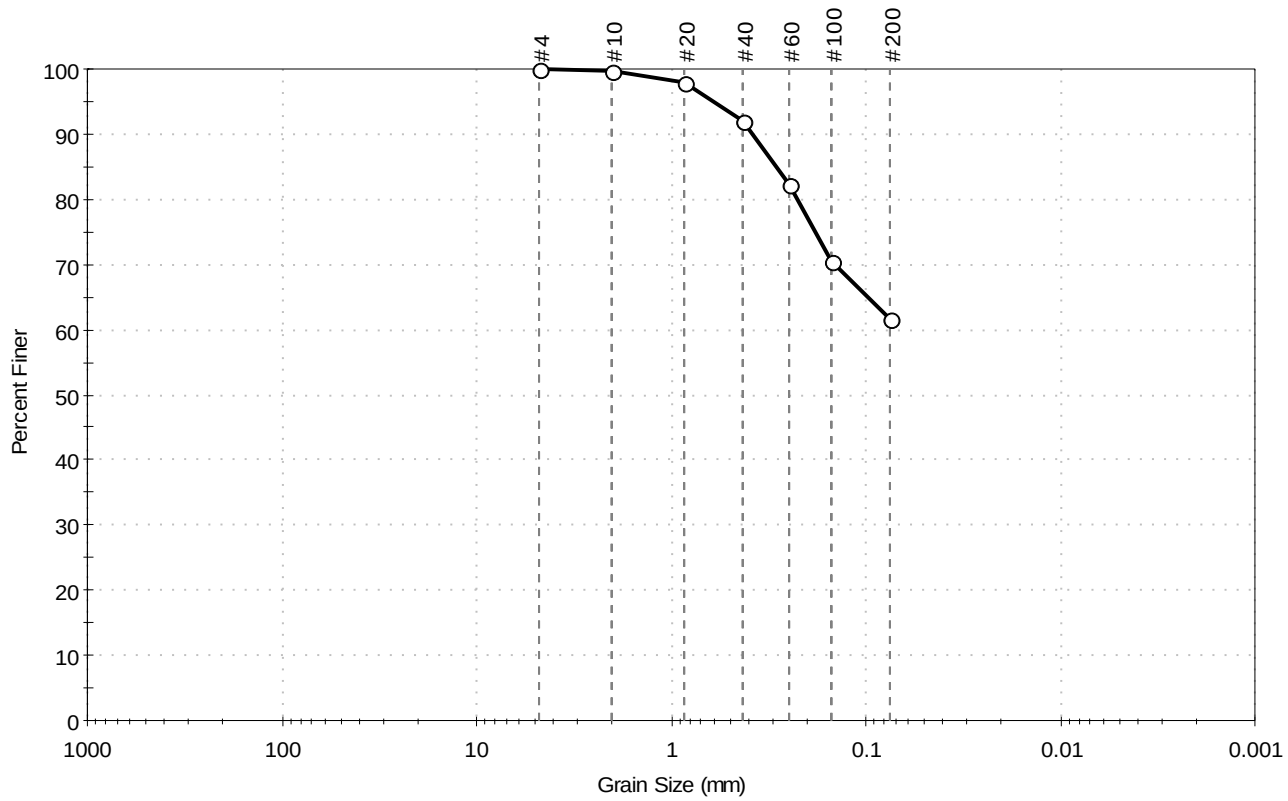
Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	14-15.5 ft.	Test Id:	288525		
Test Comment:	---				
Sample Description:	Moist, yellowish brown sandy clay				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	38.3	61.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	92		
#60	0.25	82		
#100	0.15	70		
#200	0.075	62		

Coefficients

D_{85} = 0.2875 mm D_{30} = N/A
D_{60} = N/A D_{15} = N/A
D_{50} = N/A D_{10} = N/A
C_u = N/A C_c = N/A

Classification

ASTM Sandy lean clay (CL)

AASHTO Clayey Soils (A-6 (4))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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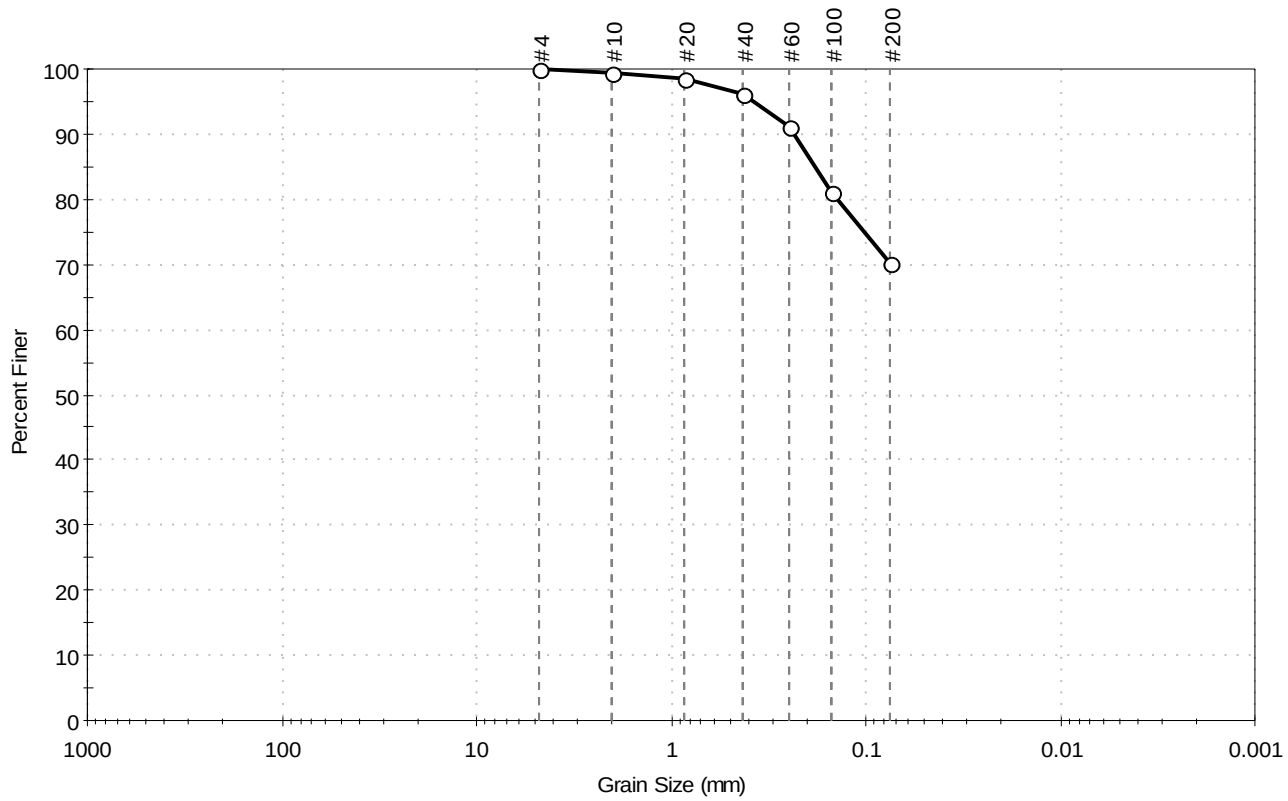
Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	jbr
Sample ID:	B-2	Test Date:	02/12/14	Checked By:	jdt
Depth :	7-8.5 ft.	Test Id:	288526		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	0.0	29.7	70.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	98		
#40	0.42	96		
#60	0.25	91		
#100	0.15	81		
#200	0.075	70		

Coefficients

D_{85} = 0.1817 mm	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM lean clay with sand (CL)

AASHTO Clayey Soils (A-6 (9))

Sample / Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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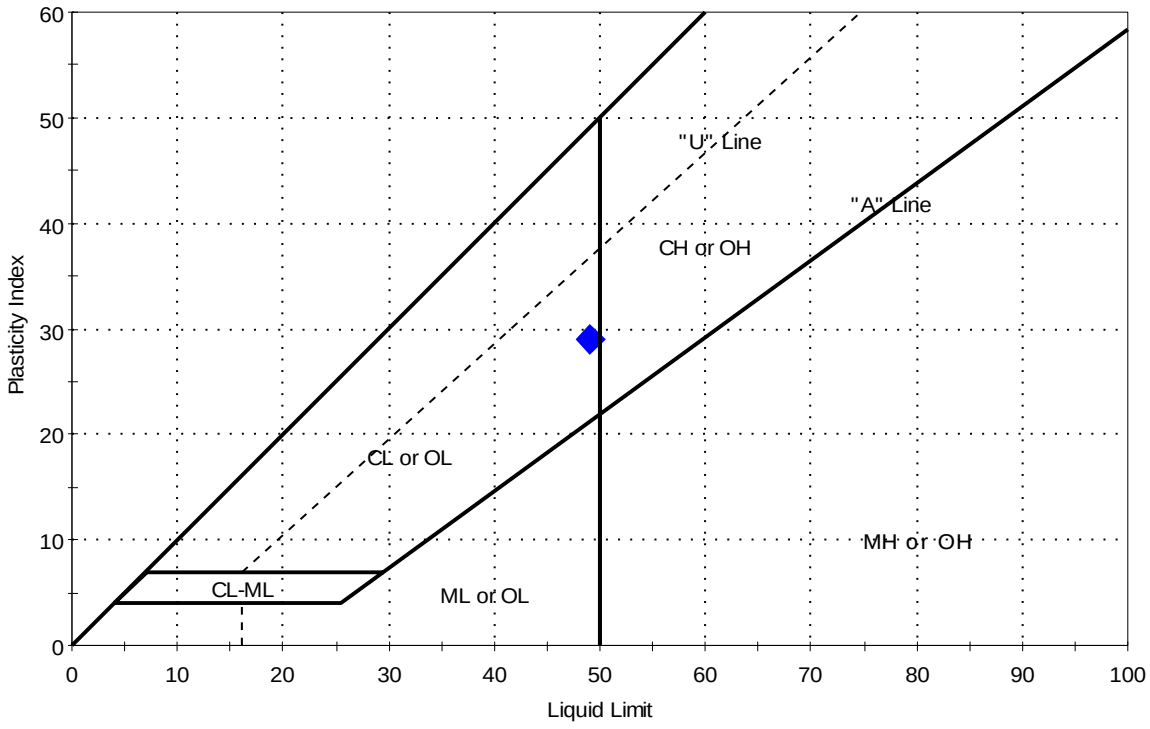
Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	2-3.5 ft.	Test Id:	288519		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-1	---	2-3.5 ft.	16	49	21	28	0	lean clay with sand (CL)

Sample Prepared using the WET method

5% Retained on #40 Sieve

Dry Strength: VERY HIGH

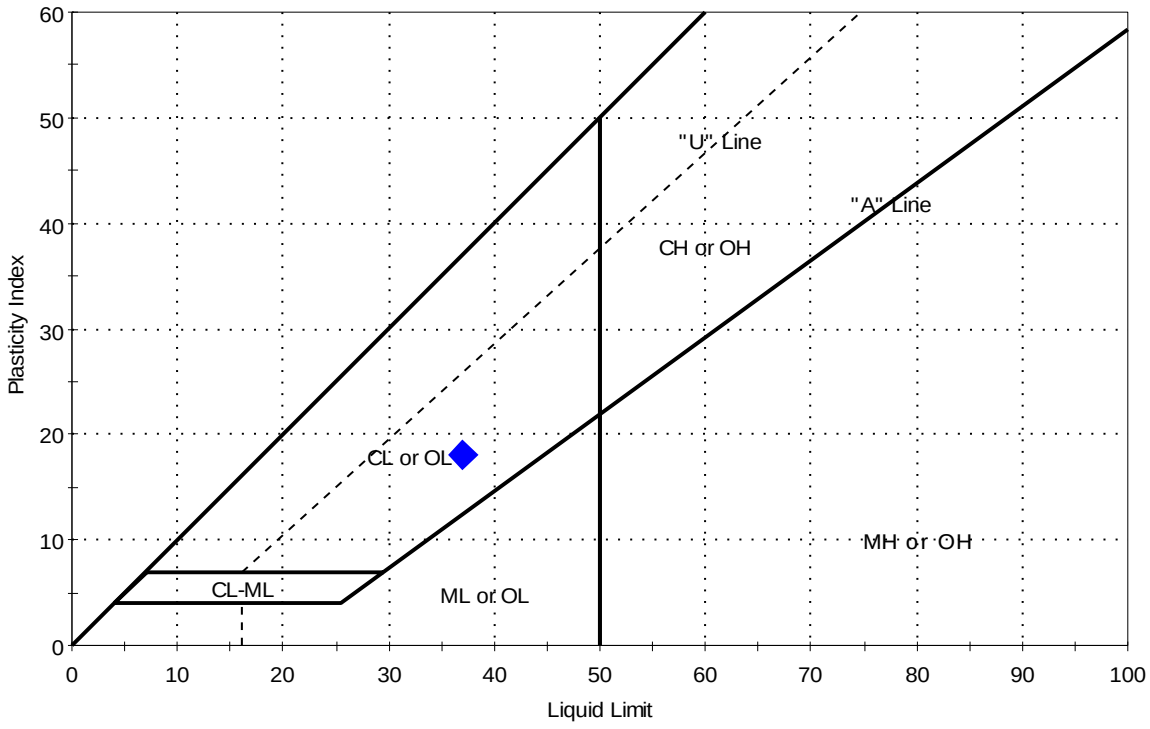
Dilatancy: SLOW

Toughness: LOW

printed 2/13/2014 8:26:42 AM

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	9-10.5 ft.	Test Id:	288520		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-1	---	9-10.5 ft.	22	37	19	18	0	lean clay with sand (CL)

Sample Prepared using the WET method

4% Retained on #40 Sieve

Dry Strength: VERY HIGH

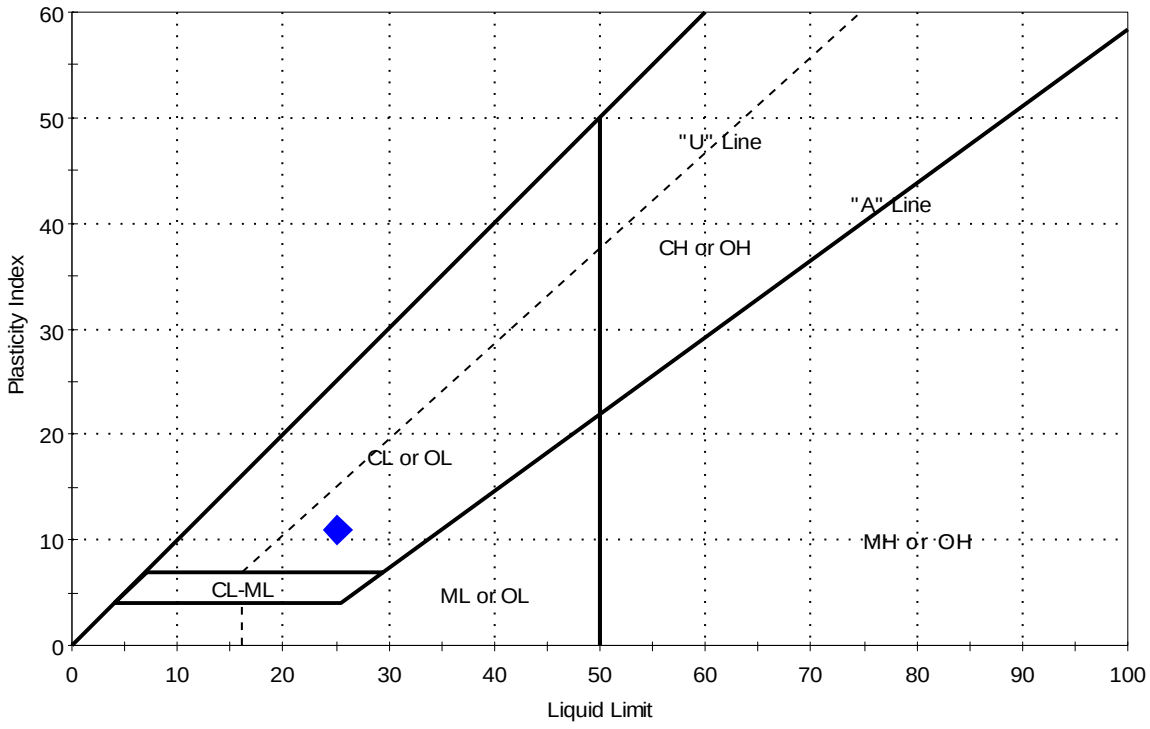
Dilatancy: SLOW

Toughness: LOW

printed 2/13/2014 8:26:43 AM

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-1	Test Date:	02/12/14	Checked By:	jdt
Depth :	14-15.5 ft.	Test Id:	288521		
Test Comment:	---				
Sample Description:	Moist, yellowish brown sandy clay				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-1	---	14-15.5 ft.	18	25	14	11	0	Sandy lean clay (CL)

Sample Prepared using the WET method

8% Retained on #40 Sieve

Dry Strength: VERY HIGH

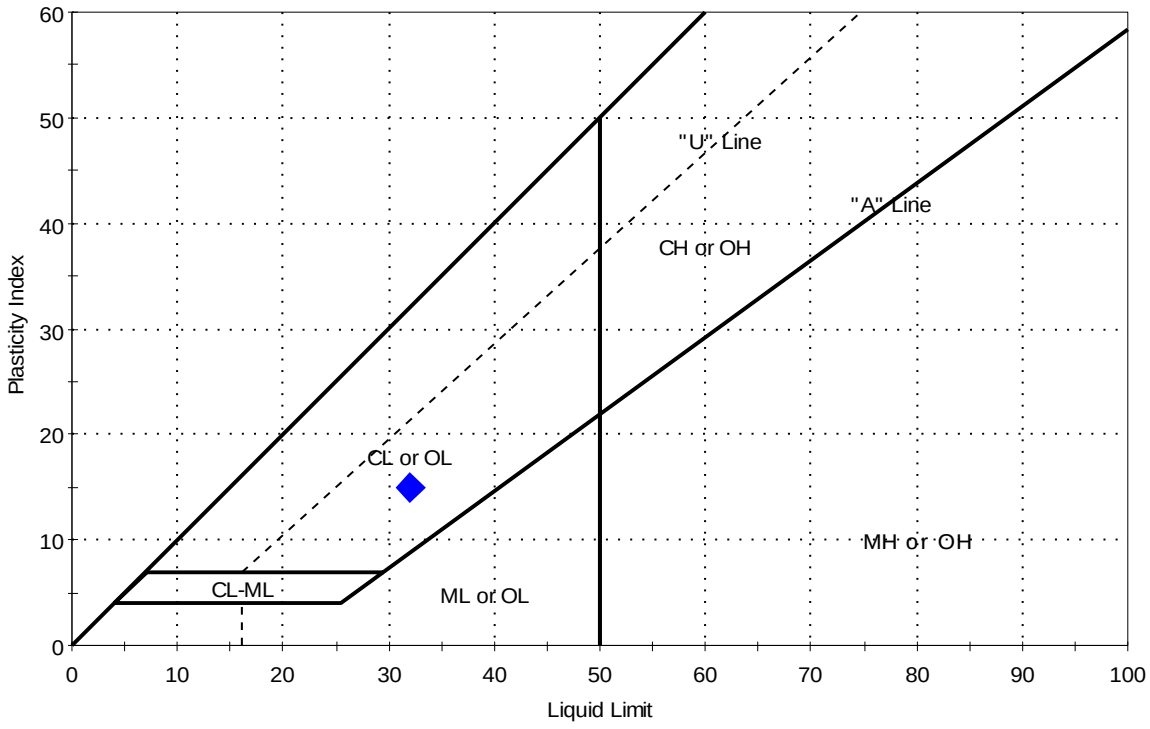
Dilatancy: SLOW

Toughness: LOW

printed 2/13/2014 8:26:43 AM

Client:	Blue Ridge Geotechnical, LLC				
Project:	Kingspoint Dam				
Location:	Petersburg, VA			Project No:	GTX-301446
Boring ID:	---	Sample Type:	bag	Tested By:	cam
Sample ID:	B-2	Test Date:	02/12/14	Checked By:	jdt
Depth :	7-8.5 ft.	Test Id:	288522		
Test Comment:	---				
Sample Description:	Moist, yellowish brown clay with sand				
Sample Comment:	---				

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content, %	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	B-2	---	7-8.5 ft.	20	32	16	16	0	lean clay with sand (CL)

Sample Prepared using the WET method

4% Retained on #40 Sieve

Dry Strength: VERY HIGH

Dilatancy: SLOW

Toughness: LOW

printed 2/13/2014 8:26:44 AM

BANDER SMITH LLC
DAM REPAIR, INSPECTION, CONSTRUCTION

Kingspoint Dam Repair

Budget Estimate & Scope of Work

BANDER SMITH, LLC ~ P.O. BOX 7188 ~ RICHMOND, VA 23221
PHONE: (804) 212-2898 ~ FAX (804) 545-0812 ~ WWW.BANDERSMITH.COM

Table of Contents

Table of Contents 2

Dam Repair Budget Estimate 4

Technical Management 5

Task No. 1 –Formal Site Inspection & Design 5

Task No. 2 – Mobilization, E& S, and Water Control/Diversion 5

Task No.3 – Existing Structure Removal & Embankment Preparation 6

Task No. 4 – Slipline 6

Task No. 5 – Restore Embankment 15

Task No. 6 – Demobilization, Clean-up 15

Project Schedule & Submittals 16

Statement of Qualifications 17

Company Background 17

Licensing & Insurance 17

Bander Smith, LLC - Team Personnel 19

Cameron J. Smith – Project Manager 19

Austen C. Bander – Project Superintendent 19

Paul L. Wood – Project Superintendent & Lead Diver 19

February 27, 2014

Sent via email to chris.kuhn@stantec.com

Chris Kuhn
WEG, now Stantec

Subject: Kingspoint Dam Repair Budget Estimate

Dear Mr. Kuhn,

Bander Smith, LLC is pleased to offer the following budget estimate for the repair to Kingspoint Dam. Bander Smith, LLC is a specialty contracting firm that focuses solely on dam repair and inspection. Our services draw from all facets of the construction industry but we apply those skills to the specific requirements of dam and marine construction.

We have included in this package a brief description of the work to be performed and information on our company. The estimates are based on information and pictures provided to us via email on Tuesday, February 25th, 2014.

I agree with your repair methodology outlined in your most recent email. The primary spillway outfall pipe should be evaluated with a pipe crawler system to confirm whether a slipline is possible and to accurately size the new liner pipe. The riser should also be inspected by a confined space entry penetration or the use of a drop camera system depending on the access. Once the site conditions are determined and a slipline is feasible, the outfall pipe should be rehabilitated and the downstream slope re-established. The root balls can be removed and re-compacted in conjunction with the spillway work.

The estimate provided is meant to assist the dam owner and/or future dam owner(s) with potential repairs costs. Until a formal site evaluate is made, several assumptions were made such as the size of the CMP outfall and construction access down to the dam.

Thank you for the opportunity to submit this package and please do not hesitate to contact us if you have any questions or concerns.

Sincerely,

Cameron J. Smith
Owner
Bander Smith, LLC
P.O. Box 7188
Richmond, VA 23221
cameron@bandersmith.com

Dam Repair Budget Estimate

Bander Smith, LLC proposes to rehabilitate the dam as outlined in tasks (found under the technical management section, in two phases:

1. **Phase 1 – Formal Site Evaluation (Task 1) - $2,200.00 (FIRM PROPOSAL)**

   This task will allow Bander Smith, LLC to evaluate the site in more detail and determine the feasibility of the a slipline. The evaluation will not be reflective of a formal engineered design or analysis and does not include the use of divers.

2. **Phase 2 – Primary Spillway Rehabilitation (Tasks 2 - 6) – $85,000.00 - $100,000.00**

   These phases will result in a fully function primary spillway system. All required permitting will be obtained before construction and is NOT included in this estimate.

Technical Management

All work will be performed by Bander Smith, LLC crews with proper insurance for dam work and experience in multiplel primary spillway rehabilitation projects. This proposal does not include any permits.

Task No. 1 –Formal Site Inspection & Design

Before any work is completed on site, the entire primary spillway will be evaluated. Important factors to determine are

1. Is a slipline is feasible
2. The condition and ID of the existing CMP
3. The size of the new HDPE liner
4. The condition of the riser and transition to new HDPE liner.

A pipe crawler system will be inserted into the outfall pipe starting on the downstream end. The water entering the riser should be controlled or completed during a period of dry weather. Water flowing into the primary spillway hampers the visual inspection. A permit confined space entry should be completed into the riser tower to determine the connection of the new outfall pipe liner into the riser. The riser should also be inspected for leaks and general stability. A brick riser structure is fairly uncommon.

Task No. 2 – Mobilization, E& S, and Water Control/Diversion

Access will be required for large equipment and concrete. Bander Smith assumes a significant amount of work will NOT be needed.

Depending on the amount of disturbance, an Erosion & Sediment control sediment plan may be required with the county. In which case, the parameters of that plan should be implemented. Regardless, E&S methods will be installed downstream to collect any muddy discharge that occurs during construction. Silt fence and straw bales will be installed where necessary.

Flows entering the pond will be accessed during initial construction. The lake will be need to be lowered several feet to provide adequate storage capacity while the slipline is being completed. Once the new liner is installed and any repairs made to the riser are finished, flows can be diverted back through the new primary spillway and discharged downstream. Pumps will be available if necessary.

Task No.3 – Existing Structure Removal & Embankment Preparation

The existing failed corrugated metal outfall pipe will be removed to stable CMP. Care needs to be taken when working around the failed embankment and a trench box may be required.

The eroded and un-compacted soils will be removed and the slopes cut back slightly. Ideally, 45 degree cuts are recommended to properly compact new soils into the existing earthen embankment. However, some concessions may need to be made due the proximity of the open cut in the embankment to the impoundment. The geotechnical report indicates good quality clay through the core of the dam which will help with the new/old soil cohesion when compacted.

The foundation conditions will need to be evaluated on site once all debris is removed.

Task No. 4 – Slipline

HDPE Pipe:

The most commonly used thermoplastic for sliplining is smooth walled HDPE pipe. HDPE pipe used for sliplining should meet the requirements of ASTM D 2447, D 3035, and F 714. The service life for HDPE pipe is 50- to 100-year service life.

HDPE pipe is very smooth. While the insertion of a new HDPE slipliner results in a smaller flow area, the reduced friction of the water passing through the slipliner results in only minimal losses of hydraulic capacity, if any. Typically, a new, smaller diameter HDPE slipliner has a hydraulic capacity equal to or greater than the original conduit. For example, the Manning's "n" value for smooth walled HDPE pipe is 0.009, compared to 0.010 for steel, 0.013 for concrete, and 0.022 for CMP.

Bander Smith, LLC proposes to line the existing CMP outfall with either an 18 inch DR26 or DR21 HDPE pipe. From the pictures, the existing CMP appears to be 24 inches. The pipe dimensions can be found in the chart below.

HDPE IRON PIPE SIZE (I.P.S.) PRESSURE PIPE

ANSI/NSF-61, 14 LISTED

PE 3408/3608		DR 21 (80 psi)			DR 26 (64 psi)			DR 32.5 (50 psi)		
PIPE SIZE	AVG. O.D.	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT	MIN. T.	AVG. I.D.	WEIGHT LB/FT
3	3.500	0.167	3.146	0.77	0.135	3.214	0.63	0.108	3.271	0.50
4	4.500	0.214	4.046	1.26	0.173	4.133	1.03	0.138	4.207	0.83
5⅜	5.375	0.256	4.832	1.80	0.207	4.936	1.47	0.165	5.025	1.18
5	5.563	0.265	5.001	1.93	0.214	5.109	1.57	0.171	5.200	1.27
6	6.625	0.315	5.957	2.73	0.255	6.084	2.23	0.204	6.193	1.80
7	7.125	0.339	6.406	3.16	0.274	6.544	2.58	0.219	6.661	2.08
8	8.625	0.411	7.754	4.64	0.332	7.921	3.79	0.265	8.063	3.05
10	10.750	0.512	9.665	7.21	0.413	9.874	5.87	0.331	10.048	4.75
12	12.750	0.607	11.463	10.13	0.490	11.711	8.26	0.392	11.919	6.67
14	14.000	0.667	12.586	12.22	0.538	12.859	9.96	0.431	13.086	8.05
16	16.000	0.762	14.385	15.96	0.615	14.696	13.01	0.492	14.957	10.50
18	18.000	0.857	16.183	20.20	0.692	16.533	16.47	0.554	16.826	13.30
20	20.000	0.952	17.982	24.93	0.769	18.370	20.34	0.615	18.696	16.41
22	22.000	1.048	19.778	30.18	0.846	20.206	24.61	0.677	20.565	19.86
24	24.000	1.143	21.577	35.19	0.923	22.043	29.30	0.738	22.435	23.62
26	26.000	1.238	23.375	42.14	1.000	23.880	34.39	0.800	24.304	27.74
28	28.000	1.333	25.174	48.86	1.077	25.717	39.88	0.862	26.173	32.19
30	30.000	1.429	26.971	56.12	1.154	27.554	45.79	0.923	28.043	36.93
32	32.000	1.542	28.730	63.84	1.231	29.390	52.10	0.985	29.912	42.04
34	34.000	1.619	30.568	72.06	1.308	31.227	58.81	1.046	31.782	47.43
36	36.000	1.714	32.366	80.78	1.385	33.064	65.94	1.108	33.651	53.20
42	42.000	2.000	37.760	109.97	1.615	38.576	89.71	1.292	39.261	72.37
48	48.000	2.286	43.154	143.65	1.846	44.086	117.18	1.477	44.869	94.56
54	54.000	2.571	48.549	181.75	2.077	49.597	148.33	1.662	50.477	119.70
63	63.000	3.000	56.640	247.42	2.423	57.863	201.88	1.938	58.891	162.84

* For custom DR, perforated pipe, please contact JM Eagle™ PE sales at (800) 621-4404 for availability.
* All dimensions are in inches unless noted otherwise.

I.D. : Inside Diameter
O.D. : Outside Diameter
T. : Wall Thickness

ISCO HDPE Product Catalog

Important Standards for High Density Polyethylene (HDPE) Pipe

Standards important for HDPE pipe relate to the resin the pipe is made from and the standards related to manufacturing sizes and tolerances. The American Society of Testing Materials (ASTM) standard for resin from which the pipe is made is **ASTM D 3350-05**, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials. This standard defines the physical properties of the resin that the pipe is made from.

Pipe dimensions and manufacturing requirements:

ASTM F 714-05 Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter. This standard is used for most large diameter HDPE pipe (4" to 63") applications other than gas pipe.

ASTM D 2513-05 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings. Polyethylene pipe and other plastic for natural gas distribution are described in great detail in this standard.

ASTM D 3035-03a Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. Most HDPE water tubing (1/2 inch to 3") is made to the dimensions in this standard. While pipe sizes up to 24" are provided, very little large diameter pipe is made to this standard.

Intallation Standards:

ASTM D 2321-05 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

ASTM D 2774-04 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings

ASTM F 585-94 Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

American Water Works Association Standards

ANSI/AWWA C 901-2005 Polyethylene Pressure Pipe and Tubing, .5 in (13 mm) Through 3 in. (76 mm) for Water Services

ANSI/AWWA C 906-2006 Polyethylene Pipe and Fittings, 4 in (100 mm) Through 63 In (1,575 mm) for Water Distribution

Pipe Joining Standards:

ASTM F 2620 – Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings

ASTM D 2657 – Standard Practice of Heat Fusion Joining of Polyolefin Pipe and Fittings

ASTM F 1290 – Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

Fitting Standards

ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM F 1055 Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing

HDPE Pipe

1-800-345-ISCO

www.isco-pipe.com

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HDPE Pipe

Specifications for HDPE Pipe

The physical properties of high-density polyethylene pipe are described using ASTM D 3350-05, "Standard Specification for Polyethylene Plastic Pipe and Fittings Materials". Recently this standard was changed. The two key areas changed are, density and slow crack growth. In the 05 version, the cell classifications for density were increased from four cells to seven cells defining the density ranges for various resins.

New high performance bimodal resins, PE 4710 resins, have higher PENT test values. Slow crack grow properties can now be defined using eight cells.

As of December 2006, most HDPE pipe is made from resin with a cell classification of PE 345464C. The pipe is labeled as PE3408/3608. The physical properties for PE 345464C are:

PROPERTY VALUE		SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation		PPI / ASTM		PE3408
Material Designation		PPI / ASTM		PE 3408/3608
Cell Classification		ASTM D 3350		345464C
Density	(3)	ASTM D 1505	g/cm3	0.941-943
Melt Index	(4)	ASTM D 1238	gm/ 10 min	0.05 -.11
Flexural Modulus	(5)	ASTM D 790	psi	110,000 to 140,000
Tensile Strength	(4)	ASTM D 638	psi	3,200
Slow Crack Growth				
ESCR		ASTM D 1693	hours in 100% igepal	>5,000
PENT	(6)	ASTM F 1473	hours	>100
HDB @ 73 deg F	(4)	ASTM D 2837	psi	1,600
UV Stabilizer	(C)	ASTM D 1603	%C	2 to 2.5%

The density provided is without carbon black. Typical HDPE pipe has a density of .958 to .967 with carbon black.

Types of Polyethylene Pipe

All polyethylene (PE) is not the same. In ASTM D 3350-05, low density PE is defined as having a density range of 0.919 to 0.925 g/cc; medium density has a range of 0.926 to 0.940 g/cc and high density is defined with a range from 0.941 to 0.955. All densities are without carbon black.

Density influences key properties in polyethylene materials. As the density increases, the tensile strength increases; also chemical resistance increases.

Medium density PE resins have been used for gas distribution. This original selection was made based on superior slow crack growth properties of medium density resins. Medium density pipe is designated as PE 2406 and PE 2708.

Today new bimodal resins are being used in gas distribution because of higher pressure ratings plus superior slow crack growth. These resins are designated PE 3408, PE 3608, PE 3708, PE 3710 and PE 4710.

1-800-345-ISCO

www.isco-pipe.com

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Existing spillway preparation:

The existing CMP spillway will be flushed with water and all dirt and debris removed. Spacers will be installed on the new 18 inch HDPE pipe every 10 to 15 feet. Flotation of the liner is a concern when a liner is to be grouted. The spacers will be staggered and spaced out to allow grout to fill the entire annular space around the pipe.

HDPE Joints:

Bander Smith, LLC anticipates joining the new spillway pipe using heat fusion. The primary spillway at Kingspoint dam may only require one joint. The HDPE will be delivered to the site in either 40 or 50 foot sections. Heat fusion (ASTM D 2657) is a widely used and industry-accepted method for joining sections of smooth solid walled HDPE pipe. This method produces a joint that is watertight and is as strong as or stronger than the HDPE pipe material itself. The use of fusion machine operators who are skilled, knowledgeable, and certified by the manufacturer will produce a good quality joint

Heat fusion creates a continuous joint-free pipe of nearly constant outside diameter. Because the HDPE slipliner joint does not take up a large part of the original conduit, a larger inside diameter slipliner can be used.

Bulkhead & Thrust Block:

Bulkheads will be installed on the upstream and downstream side of the outfall pipe. The bulkhead will consist of anti-shrink concrete packed approximately 2 to 3 feet into the annular space between the old and new pipes. Vent ports will be installed on the bottom, middle, and top of the bulkhead to insure a complete grouting has occurred. A 2 inch diameter steel injection port will be installed at the top of the downstream bulkhead. Once all vent ports have passed grout and closed, the grouting operation is complete.

Figure 1 – Typical Grout injection port and vent ports

Grouting:

Careful grouting of the annular space between the existing conduit and the HDPE slipliner is essential. This can be a complex process, requiring the experience of a qualified contractor. The HDPE slipliner is typically designed to withstand all internal and external loadings independently from exterior conditions. A lightweight, low density grout containing no aggregate will ensure the best result. Usually the material used is a Fine grout ("flowable fill") amended with Tetraguard AS20 (anti-shrink) & super plasticizer. Depending on the conditions, additional admixtures may be required to obtain desired performance such as cellular grout.

ALLIED concrete company

MIX DESIGN	BC010					DATE:	1/15/13				SPECIFICATION REFERENCE	
CALCULATION	Non-shrink grout											
PROJECT USE:	pipe annulus fill with Intraplast N					MIX VERIFICATION:					Specification #	0031 33 73
						Mix experience: none/ supplier provided mix						
						Mix is in compliance with ACI 301, Sect. 4.2.3.3c,"Required					28 daystrength:	
PROJECT	Ragged Mountain Dam					average Compressive strength" when using Sect. 4.2.3.4b					1-entrained air content:	no added air
CONTRACTOR	Thalle					"Trial Mixtures" to establish mixture proportions.(ACI 211.1)					2-water/cement ratio:	<0.50
				5%							3-Minimum cement content:	
MATERIAL	AMOUNT	DIVISOR	ABS VOL	TR.BTCH	MATERIAL	SUPPLIER/SPEC.					4-Pozzolan/% of total cem.:	<33%
CEMENT(type I/II)	500	196.6	2.54	25	CEMENT	LEHIGH/UNION BRIDGE, MD/ASTM C150					5-Slump: (before/after HRWR):	
KOMPONENT (type K)	0	196.6	0.00	0	TYPE K	CTS CEMENT/Type K / Cypress,Calif.					before	<6"
FLY ASH	250	151.6	1.65	13	FLY ASH	BORAL /CHESAPEAKE, VA / C618					after	
ENT. AIR	3.00%	0.0	0.81		MB-AE90	MSTR BLDRS/ASTM C260					6-special additives:	
C.AGG.(#8)	0	176.0	0.00	0	C.AGG(57)	MARTIN MARIETTA/RED HILL,VA/ASTM C33					add Intraplast N at site: 7.5#/yard	
F.AGG.(#2)	0	169.7	0.00	0	F.AGG(#1)	AYLETT S & G/AYLETT, VA/ASTM C33						
WATER(GAL)	41.25		5.51	2	CITY	POTABLE						
WATER(LBS)	343.6125				F.AGG(#2)	VULCAN/ "A"SAND/STAUNTON,VA/ASTM C33					Mix design logic/back-up	supplier provided mix
MOR.FRAC.	27.00	TOTAL	10.51		MFG.SAND	MARTIN MARIETTA/C'VILLE					1-curve:	no
					LTWTA	SOLITE/CASCADE PLANT/ASTM C330					2-experience(30 breaks)	no
		REMAINING										
W.C. RATIO	*0.46*	VOLUME	16.49								3-special:	
(specification:	*<0.5*					ACI Table 4.2.1-Exposure categories and classes						
						F0 no exposure						
FINE AGG.(#1)	2696	163.5	16.49	135								
	2696		16.49									
						SPECIFIC GRAVITY INFO 1/12					REVIEW COMMENTS:	
		TOTAL FOR			STONE	2.82 (3/4" NOMINAL)						
		SAND PLUG	27.00	1	SAND	2.62 (F.M. =2.8)						
					SAND(#2)	2.72						
		OVER/UND	0.00		STALITE	1.51						
					8PGRVL	2.62						
TOTAL WT/YD	3790			189		ABSORPTION					NOTES:	
					STONE*	0.50% (8p & #57)						
UNIT WEIGHT	140.35	(@3% air)			SAND*	0.4%						
					STALITE	8.0%						
	#/cu ft.	air			*stone & sand meet ASTM C33							
						DESIGN SLUMP = 4"-6"						
						F.ASH/CEM :						
						33%						
ADMIXTURES	oz/100	total oz/yard										
AIR ENTR.	0	0.00		0	AIR-ENT/MB-AE 90/BASF/ASTM C 260							
LRWR(322n)	0	0.00		0	LRWR/POZZILITH 322N/BASF/ASTM C 494							
ACCEL./NC	0	0.00		0	ACC/NC 534/BASF/ASTM C 494							
RETARDER	0	0.00		0	RETARD/961 R/BASF/ASTM C 494							
HRWR(PLAST)	0	0.00		0	HRWR/GLENIUM 7500/BASF/ASTM C 494							
FIBER(Micro)	0	0			MasterFiber F70/BASF/ASTM C 1116							
FIBER(Macro)	0	0			MasterFiber MAC100/BASF/ASTM C 1116							
INTEGRAL WATERPRF	0	0.00			RHEOMAC 300D/BASF/Modified DIN 1048/ASTM 1585							
SHRINKAGE COMP.	1%	7.5#/yd			S.I.K.A.Corp/Intraplast N/New Jersey							
CORROSION INHIB	0	0.00			RHEOCRETE CNI/BASF/C494 type S						1000 Harris Street	
INTEGRAL COLOR	0	0.00			RHEOCOLOR L/BASF/ASTM C 979						Charlottesville, Virginia 22903	
											(ph)434-296-7181	
											(fx) 434-296-3200	
											www.alliedconcrete.com	

ALLIED CONCRETE CO.

Construction

Intraplast-N®

Expanding / Fluidifying Grouting Aid

Description

Intraplast-N is a balanced blend of expanding, fluidifying, and water-reducing agents for portland-cement grouts. It produces a slow, controlled expansion prior to the grout hardening.

Applications

- Machinery base plates.
- Pre-packed aggregate cavities.
- Rock fissures and bolting.

Benefits

- High fluidity - Intraplast-N grout is extremely fluid, workable, non-settling, and cohesive.
- Versatile - use Intraplast-N with all types of grout incorporating Type I, II, or III cement, with or without pozzolanic materials or fly ash, and with or without fine aggregate.
- Controlled, gaseous expansion occurs before initial set and forces the grout into close contact with the surrounding surfaces.

Packaging

50 lb. multi-wall bag.

Typical Data *Material and curing conditions @ 73°F (23°C) and 50% R.H.*

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

Shelf Life	6 months in original, unopened bags.
Storage Conditions	Store dry at 40-95°F
Color	Gray powder
Dosage	Add 1% by weight of cementitious material, (portland-cement and, if used, fly ash)

How to Use

Forming

Where areas to be grouted require forming, forms should be tight and well fitted. When using Intraplast-N grout, expansion of the grout should be restrained in order to produce the highest possible density, bond, and strength. Top forms should be used where there are open areas. Unformed, exposed grout placements will have substantially lower physical characteristics.

Mixing

a) Water should be added to the mixer first, followed by portland-cement, fly ash, admixture, and sand as required.

b) Mixing should be of such duration as to obtain a uniform, thoroughly blended grout, without excessive temperature increase.

c) No water should be added to the grout to increase any flowability which has been lost by delayed use of grout.

d) It is essential that the water content of the grout be kept as low as possible. The water content should generally be less than 5.25 gal./100 lb. of cementitious material.

Sika®

Construction

Product	Size of Openings: 1/4 in. or less		Larger than 1/4 in.	
Cement[1]	2 parts	1 part	2 parts	1 part
Fly Ash[2]	1 part	none	1 part	none
Sand[3]	none	none	3 parts	1 part
Water[4]	4-5	4-5	4½-5½	4½-5½
Intraplast-N[5]	1%	1%	1%	1%

[1] ASTM C-150; [2] ASTM C-350; [3] 100% passing an 8-mesh sieve;
[4] Gallons per 100 lb. cementitious material; [5] By weight of cementitious material.

Water requirements will typically be lower than that of a non-Intraplast-N mix of equal fluidity.

Application

All pumps and hose fittings should be absolutely watertight to prevent loss of water and subsequent clogging. Be sure your batches are so limited in size that placement can be completed within one hour so that as much of the expanding action as possible occurs after the grout is placed.

Typical mix designs

The following typical mix designs serve only as a basis for trial mixes. Actual mix design must be tested prior to use. Proportions are by weight, unless noted.

Limitations

- Design mixes should always be tested to verify satisfactory performance, specifically as it relates to strength, bleed, flow and segregation. The use of this admixture will alter physical properties.
- Not recommended as a non-shrink admixture for conventionally placed concrete.

Caution

Irritant

Skin and eye irritant. Avoid contact. Dust may cause respiratory tract irritation. Avoid breathing dust. Use only with adequate ventilation. Use of safety goggles and chemical resistant gloves is recommended. If PELs are exceeded, an appropriate, properly fitted NIOSH approved respirator is required. Remove contaminated clothing.

First Aid

In case of skin contact, wash thoroughly with soap and water. For eye contact, flush immediately with plenty of water for at least 15 minutes, and contact a physician. For respiratory problems, remove person to fresh air.

Clean Up

In case of spillage, scoop or vacuum into appropriate container, and dispose of in accordance with current, applicable local, state, and federal regulations. Keep container tightly closed and in an upright position to prevent spillage and leakage.

Maintenance:

No maintenance is typically required for the HDPE sliplined conduit, unless the conduit requires some type of cleaning. Periodic operation of the conduit usually is sufficient to flush sediments through the system. HDPE pipe is smooth and generally resists the adherence of sediment deposits.

Task No. 5 – Restore Embankment

The new liner will need a pipe cradle installed along its path to the plunge pool. It is recommended to install a filter drain around the outfall pipe as well. This would be fairly easy to complete since the downstream embankment is already open. The filter drain would consists of a combination of a sand and stone filter media with geotextile and 4 inch PVC pipe to collect the water.

Bander Smith, LLC will backfill and compact around the new outfall pipe to match the existing grade.

Several tree roots were noted in the geotechnical report. The root balls will be removed, backfilled, and compacted.

Task No. 6 – Demobilization, Clean-up

All denuded areas will be repaired, seeded, and straw placed. Once all vegetation is established, we will remove any E&S that is in place. All equipment will be removed and the access road returned to near pre-existing conditions.

Project Schedule & Submittals

Below is a general work schedule for the project

1. Bander Smith, LLC Pipe Inspection
2. Engineer Evaluation and Design
3. Owner Approval
    a. Financing Established
    b. Proposal Review and Approval
4. Contract Executed
5. Notice to Proceed Issued
6. Material Procurement
7. Construction

We respectively request the contract time be at least 60 days from the Notice to Proceed. We anticipate approximately 4 weeks of material procurement and fabrication. Installation on site should take an estimated 20 days with the majority of the work/disturbance occurring over 15 days.

This type of work, especially when working in a live watercourse, is heavily weather dependent.

Shop drawings will be submitted for each major item and owner approved before installation.

Statement of Qualifications

Company Background

Bander Smith, LLC was formed in 2009 to address the ageing dam infrastructure in Virginia and the surrounding states. Dams have unique challenges and Bander Smith meets them with an in-depth knowledge of the techniques, laws, regulations, and safety concerns related to work on impounding structures.

Our team has over 15 years of experience in the dam repair industry. Bander Smith, LLC is owned & operated by Cameron Smith and Austen Bander. We are located centrally in the Commonwealth of Virginia with our main office in Richmond, VA.

****Dams introduce variables to ordinary construction activities and the dynamics of a dam must be understood before safe, proper repairs are made.*

Licensing & Insurance

We are a licensed Class A Contractor in Virginia (License No. 2705129060). We are also a DMBE certified SWAM vendor. License Number 679769.

We have commercial general liability insurance that specifically includes coverage for projects on dams, which, unfortunately, many firms working on dams do not have. This is very important for the client who is ultimately responsible if the contractor is under insured.

BANDE-1 OP ID: CW

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 07/03/2013

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
Premier Insurance Agency Ltd
13321-I Midlothian Turnpike
Midlothian, VA 23113
Premier Insurance Agency, Ltd

Phone: 804-794-8000
Fax: 804-794-9077

CONTACT NAME:
PHONE (A/C, No, Ext): FAX (A/C, No):
E-MAIL ADDRESS:

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Gemini Insurance Company	
INSURER B : AmGuard Insurance Co.	
INSURER C : Harleysville Insurance Company	23582
INSURER D :	
INSURER E :	
INSURER F :	

INSURED
Bander-Smith, LLC
Austen Bander
PO Box 7188
Richmond, VA 23221

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY PRO-JECT LOC			VIGP014317	07/28/2012	07/28/2013	EACH OCCURRENCE	$ 1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 50,000
							MED EXP (Any one person)	$ 5,000
							PERSONAL & ADV INJURY	$ 1,000,000
							GENERAL AGGREGATE	$ 2,000,000
							PRODUCTS - COMP/OP AGG	$ 2,000,000
								$
C	AUTOMOBILE LIABILITY ANY AUTO ALL OWNED AUTOS X SCHEDULED AUTOS HIRED AUTOS NON-OWNED AUTOS			BA00000072471H	10/11/2012	10/11/2013	COMBINED SINGLE LIMIT (Ea accident)	$ 1,000,000
							BODILY INJURY (Per person)	$
							BODILY INJURY (Per accident)	$
							PROPERTY DAMAGE (Per accident)	$
								$
	UMBRELLA LIAB OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $						EACH OCCURRENCE	$
							AGGREGATE	$
								$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y / N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below		N / A	R2WC361064	10/17/2012	10/17/2013	X WC STATU-TORY LIMITS OTH-ER	
							E.L. EACH ACCIDENT	$ 100,000
							E.L. DISEASE - EA EMPLOYEE	$ 100,000
							E.L. DISEASE - POLICY LIMIT	$ 500,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)
Addison Evans Water Treatment Plan, Chesterfield County, VA

CERTIFICATE HOLDER

SAMP000

Sample **********
****
****

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE
Premier Insurance Agency, Ltd

Bander Smith, LLC - Team Personnel

Key personnel for Bander Smith, LLC that will be on site for the inspection

Cameron J. Smith – Project Manager

Cameron Smith is a founding partner of Bander Smith, LLC and Project Manager. Mr. Smith graduated from Virginia Tech in 2004 with a degree in building construction and a minor in Real Estate. Prior to the formation of Bander Smith, LLC, Cameron Smith had over 8 years experience in the dam repair and inspection industry, working his way up to Project Manager and Vice President before pursing his own firm.

He has completed over 200 dam repair and inspection projects across the eastern half of the United States. He holds a current VA contractor's license as well as a private pilot license. He is also trained and certified in confined space entry.

Austen C. Bander – Project Superintendent

Austen Bander is a founding partner of Bander Smith, LLC and Project Superintendent. Mr. Bander graduated from Randolph-Macon College in 2004 with a degree in Physics and a minor in Astrophysics and Spanish. Prior to the formation of Bander Smith, Austen Bander had 6 years of experience in the dam repair and inspection industry.

Mr. Bander is currently designated an Engineer-in-Training in Virginia and actively pursuing a Professional Engineer's License.

Paul L. Wood – Project Superintendent & Lead Diver

Mr. Wood has over twenty five years of diving inspection and construction experience. During his 10 year career in the U.S. Navy, Mr. Wood conducted over 1,000 dives. After being honorably discharged from the Navy, Mr. Wood was employed by various commercial dive contractors, prior to starting his own company to provide diving inspection and related work. Mr. Wood is experienced in all aspects of diving operations, including air diving, mixed gas diving, SCUBA, surface air supplied and hyperbaric chamber operations. Mr. Wood has performed underwater inspections on all types of construction including wood, steel and concrete for bridges, piers, bulkheads, and wharfs. Mr. Wood is experienced in dealing with hazardous conditions including low visibility, confined space, high current, low temperature, and altitude diving.

Education & Certification:

- Association of Diving Contractors – Surface Air Diving Supervisor (#8112)
- National Highway Institute – Safety Inspection of In-Service Bridges (#13055) / 2004
- Int'L Association of Nitrox & Technical Diving (2001)
- Advance Rescue Diver (1996)
- Dive Control Specialist (1990)
- U.S. Navy 2nd Class Dive School / 1989 / Honor Graduate
- U.S. Navy Explosive Ordinance Disposal School / 1985 / Honor Graduate
- U.S. Navy SCUBA Dive School / 1984