JOINT PERMIT APPLICATION

Chickahominy Riverfront Park Raw Water Intake and Water Treatment Facility

James City Service Authority

Date: June 2016

CDM Smith

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STANDARD JOINT PERMIT APPLICATION

United States Army Corps of Engineers (USACE) - Norfolk District
803 Front Street, ATTN: CENAO-WR-R
Norfolk, Virginia 23510-1096
Phone: (757) 201-7652, Fax: (757) 201-7678
Website: http://www.nao.usace.army.mil/Missions/Regulatory.aspx

Virginia Marine Resources Commission (VMRC)
Habitat Management Division
2600 Washington Avenue, 3rd Floor
Newport News, Virginia 23607-0756
Phone: (757) 247-2200, Fax: (757) 247-8062
Website: http://www.mrc.virginia.gov/hmac/hmoverview.shtm

Virginia Department of Environmental Quality (DEQ)
Virginia Water Protection Program
Post Office Box 1105
Richmond, Virginia 23218
Phone: (804) 698-4000, Fax: (804) 698-4000
Websites: http://www.deq.virginia.gov/
http://www.deq.virginia.gov/Locations.aspx

The following instructions and information are designed to assist you in applying for permits from Federal, State, and Local regulatory agencies for work in waters and/or wetlands within the Commonwealth of Virginia. The intent is to provide general information on the permit process, not to act as a complete legal and technical reference.

JOINT PERMIT APPLICATION PROCESS

The Joint Permit Application (JPA) process and Standard JPA form are used by the United States Army Corps of Engineers (USACE), the Virginia Marine Resources Commission (VMRC), the Virginia Department of Environmental Quality (DEQ), and the Local Wetlands Boards (LWB) for permitting purposes involving water, wetlands, and dune/beach resources, including, but not limited to, *major* water supply and water withdrawals projects (as defined in DEQ Regulation 9 VAC 25-210).

The Tidewater Joint Permit Application form may be used for most commercial and noncommercial projects in **tidal waters, tidal wetlands, and coastal primary sand dunes and beaches in Virginia** that require the review and/or authorization by local wetlands boards, the Virginia Marine Resources Commission, the Department of Environmental Quality, and/or the U. S. Army Corps of Engineers. The Tidewater JPA may be downloaded from the same web page on which the Standard JPA is located: http://www.nao.usace.army.mil/Missions/Regulatory/JPA.aspx . *If using the Tidewater JPA, follow the instructions provided with that form.* Note that the Tidewater JPA form is not intended for noncommercial, riparian shellfish aquaculture projects (i.e., "oyster gardening"); the form for these types of projects may be obtained from http://www.mrc.virginia.gov/forms/abbrjpa.pdf or from the VMRC office.

The Standard JPA should not be used for *minor* water supply or water withdrawal projects, defined in DEQ Regulation 9 VAC 25-210 as a surface water withdrawal of less than 90 million gallons per month (mgm), unless filling or flooding of wetlands and streams occurs or if alteration of stream flow occurs. The application form for minor water supply or water withdrawals can be obtained from DEQ's web site. In the case where fill, flooding, or alteration of flow occurs, please use the Standard JPA.

Please note that some health departments and local agencies, such as local building officials and erosion and sediment control authorities, do not use the Joint Permit Application process or forms and may have different informational requirements. The applicant is responsible for contacting these agencies for information regarding those permitting requirements.

REGULATORY AUTHORITIES OF PARTICIPATING AGENCIES:
The USACE regulates activities in waters of the United States, including wetlands, under Section 404 of the Clean Water Act (33 U.S.C. §1344), Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. §403), and Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 (33 U.S.C. §1413).

The VMRC regulates activities on State-owned submerged lands, tidal wetlands, and dunes/beaches under Code of Virginia Title 28.2, Chapters 12, 13, and 14.

The DEQ regulates activities in state waters and wetlands under Section 401 of the Clean Water Act (33 U.S.C. §1341), under State Water Control Law (Code of Virginia Title 62.1), and Virginia Administrative Code Regulations 9VAC25-210 et seq., 9VAC25-660 et seq., 9VAC25-670 et seq., 9VAC25-680 et seq., and 9VAC25-690 et seq.

The LWBs regulate activities in tidal wetlands and dunes/beaches under Code of Virginia Title 28.2, Chapters 13 and 14.

LOCAL WETLANDS BOARD CONTACT INFORMATION:

Links to LWB information on the Web can be found at http://ccrm.vims.edu/permits_web/guidance/local_wetlands_boards.html.

USACE FIELD OFFICE INFORMATION AND DEQ REGIONAL OFFICE INFORMATION:
Answers to technical questions and detailed information about specific aspects of the various permit programs may be obtained from the USACE field office in your project area (please refer to the Contact Information on the Regulatory webpage at: http://www.nao.usace.army.mil/Missions/Regulatory.aspx or call 757-201-7652), or from the DEQ regional office in your project area (please refer to http://www.deq.virginia.gov/Locations.aspx or call 804-698-4000). Applicants may also seek assistance with completing the informational requirements and/or submittals from private consulting and/or engineering firms for hire.

CHESAPEAKE BAY PRESERVATION ACT INFORMATION: Development within the 84 Counties, Cities, and Towns of "Tidewater Virginia" (as defined in §62.1-44.15:68 of the Code of Virginia) is subject to the requirements of the Chesapeake Bay Preservation Act. If your project is located in a Bay Act locality and will involve land disturbance or removal of vegetation within a designated Resource Protection Area (RPA), these actions will require approval from your local government and completion of Appendix C. The individual localities, not the DEQ, USACE, or Local Wetlands Boards, are responsible for enforcing Bay Act requirements and, therefore, local permits for land disturbance are not issued through this JPA process. Each Tidewater locality has adopted a program based on the Chesapeake Bay Preservation Act and the *Chesapeake Bay Preservation Area Designation & Management Regulations.*

The Act and regulations recognize local government responsibility for land use decisions and are designed to establish a framework for compliance without dictating precisely what local programs must look like. The regulations address nonpoint source pollution by identifying and protecting certain lands called Chesapeake Bay Preservation Areas. The requirements of the Bay Act may, however, affect the ultimate design and construction of projects. In order to ensure that these requirements are considered early in the permitting process, and to avoid unnecessary and costly delays, applicants should contact their local government as early in the process as possible. Individual localities may request information regarding existing vegetation within the RPA as well as a description and site drawings of any proposed land disturbance or vegetation clearing. Locality staff charged with ensuring compliance with the Bay Act will then evaluate project proposals and advise their Local Wetlands Boards of applicable Bay Act issues.

To determine if your project is located in a Bay Act locality (see map on page 31 or *http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay/ChesapeakeBayPreservationAct/LocalGovernmentOrdinances.aspx)*, learn more about Bay Act requirements, or find local government contacts, please visit the Virginia Department of Environmental Quality at *http://www.deq.virginia.gov/Programs/Water/ChesapeakeBay/ChesapeakeBayPreservationAct.aspx*.

HOW TO APPLY

Sections A through D below provide a general list of information and drawings that are required, depending on the type of project being proposed. Prepare all required drawings or sketches as detailed in the lists provided in Appendix D (Drawings) and according to the sample drawings provided in Appendix D.

Application materials should be submitted to VMRC:

1. ***If by mail or courier, use the address on page 1.***
2. ***If by electronic mail, address the package to: JPA.permits@mrc.virginia.gov . The application must be provided in the .pdf format.***

A. APPLICATIONS FOR PROJECTS INVOLVING IMPACTS TO *TIDAL* WATERS, WETLANDS, AND DUNES/BEACHES (INCLUDING SHORELINE STABILIZATION, PIERS, MARINAS, BEACH NOURISHMENT, BOATHOUSES, BOAT LIFTS, BREAKWATERS, AQUACULTURE ACTIVITIES, DREDGING, ETC.) SHOULD INCLUDE THE FOLLOWING:

- All *applicable* portions of Sections 1 through 28 of the JPA, including necessary attachments, information required for projects located in CBPA localities as required in Appendix C (a map of CBPA localities can be found on page 31).
- Adjacent Property Owner's Acknowledgement Forms[(1)], as detailed in Appendix A.
- For projects with impacts to greater than 1 acre of wetlands, a functional values assessment[(3)].
- A set of 8 ½ x 11 inch drawings. If you can not include all of your project site on one page at a scale no smaller than 1" = 200', you **must** submit a set of 8 ½ x 11 inch match-line drawings **and** a set of large-sized drawings at a scale no smaller than 1"= 200'. If oversized drawings are used, attach **five** copies of the oversized drawings to your application.
- In order for projects requiring LWB authorization to be considered complete, applications must include the following information (per Virginia Code 28.2-1302):

> *"The permit application shall include the following: the name and address of the applicant; a detailed description of the proposed activities; a map, drawn to an appropriate and uniform scale, showing the area of wetlands directly affected, the location of the proposed work thereon, the area of existing and proposed fill and excavation, the location, width, depth and length of any proposed channel and disposal area, and the location of all existing and proposed structures, sewage collection and treatment facilities, utility installations, roadways, and other related appurtenances of facilities, including those on the adjacent uplands; a description of the type of equipment to be used and the means of access to the activity site; the names and addresses of record of adjacent land and known claimants of water rights in or adjacent to the wetland of whom the applicant has notice; an estimate of cost; the primary purpose of the project; and secondary purpose of the proposed project; a complete description of measures to be taken during and after alteration to reduce detrimental offsite effects; the completion date of the proposed work, project, or structure; and such additional materials and documentation as the wetlands board may require."*

B. APPLICATIONS FOR PROJECTS THAT ARE SUBJECT TO CURRENT STATE PROGRAM GENERAL PERMIT (SPGP) AND INVOLVE IMPACTS TO NONTIDAL WATERS AND/OR WETLANDS:

Programmatic general permits may be issued in situations where a state, regional, or local authority has a regulatory program in place that provides a similar level of review as the U.S. Army Corps of Engineers (Corps). In such cases, the programmatic general permit avoids unnecessary duplication of effort by providing Corps authorization for certain activities provided they obtain the necessary state, regional, or local authorizations. Details may be found at http://www.nao.usace.army.mil/Missions/Regulatory/RBregional.aspx .

The following activities will be considered for coverage under the current State Program General Permit:

- RESIDENTIAL, COMMERCIAL, AND INSTITUTIONAL DEVELOPMENT (DEVELOPMENT) ACTIVITIES (including attendant features) that involve the discharge of dredged or fill material causing the loss of not more than one acre of nontidal wetlands or waters, or the loss of not more than 2,000 linear feet of streams, unless otherwise excluded.
- LINEAR TRANSPORTATION (TRANSPORTATION) ACTIVITIES (including construction, expansion, modification, or improvement) that involve the discharge of dredged or fill material associated with the linear transportation projects not causing the loss of more than 1/3 acre of nontidal waters of the United States, including wetlands, unless otherwise excluded.

- Mark the "SPGP" checkbox on page 7 of this application.
- All *applicable* portions of Sections 1 through 28 of the JPA, including necessary attachments.
- A conceptual compensatory mitigation plan[(2)] for 1) Development projects that impact greater than 1/10 of an acre of wetlands and open waters, or greater than 300 linear feet of stream bed, or 2) Transportation projects that impact any wetlands or open water, or greater than 300 linear feet of stream bed.
- A copy of the Corps' confirmed waters and wetlands delineation (including data sheets)
- All information required for projects located in CBPA localities as required in Appendix C (a map of CBPA localities can be found on page 31).
- A copy of the FEMA flood insurance rate map or FEMA-approved local floodplain map for the project site (not applicable to <0.1 acre and < 300 linear feet projects by either Corps or DEQ).
- A set of 8 ½ x 11 inch drawings. If you can not include all of your project site on one page at a scale no smaller than 1" = 200', you **must** submit a set of 8 ½ x 11 inch match-line drawings **and** a set of large-sized drawings at a scale no smaller than 1"= 200'. If oversized drawings are used, attach **five** copies of the oversized drawings to your application.

C. APPLICATIONS FOR OTHER PROJECTS THAT INVOLVE IMPACTS TO NONTIDAL WATERS AND/OR WETLANDS:

- All *applicable* portions of Sections 1 through 28 of the JPA, including necessary attachments.
- A conceptual compensatory mitigation plan[(2)].
- A copy of the Corps' confirmed waters and wetlands delineation (including data sheets).
- All information required for projects located in CBPA localities as required in Appendix C (a map of CBPA localities can be found on page 31), and a copy of the FEMA flood insurance rate map or FEMA-approved local floodplain map for the project site.
- For projects with impacts to greater than 1 acre of wetlands, a functional values assessment[(3)].
- A set of 8 ½ x 11 inch drawings. If you can not include all of your project site on one page at a scale no smaller than 1" = 200', you **must** submit a set of 8 ½ x 11 inch match-line drawings **and** a set of large-sized drawings at a scale no smaller than 1"= 200'. If oversized drawings are used, attach **five** copies of the oversized drawings to your application.

D. WHEN USING THE JPA FORM AS A PRE-CONSTRUCTION NOTIFICATION (PCN) FOR A USACE NATIONWIDE PERMIT:

- Mark the "PCN" checkbox on page 7 of this application. If you fail to mark this box, the PCN will be deemed incomplete and the USACE 45-day time clock will not start.
- All *applicable* portions of Sections 1 through 28 of the JPA, including necessary attachments and all information required for projects located in CBPA localities as required in Appendix C (a map of CBPA localities can be found on page 31)
- A set of 8 ½ x 11 inch drawings. If you can not include all of your project site on one page at a scale no smaller than 1" = 200', you **must** submit a set of 8 ½ x 11 inch match-line drawings **and** a set of large-sized drawings at a scale no smaller than 1"= 200'. If oversized drawings are used, attach **five** copies of the oversized drawings to your application.

WHAT HAPPENS NEXT

Upon receipt of an application, VMRC will assign a permit application number to the JPA and will then distribute a copy of the application and any original plan copies submitted to the other regulatory agencies that are involved in the JPA process. All agencies will conduct separate but concurrent reviews of your project. Please be aware that each agency must issue a separate permit (or a notification that no permit is required). Therefore, make sure that you have received all necessary authorizations, or documentation that no permit is required, from each agency prior to beginning the proposed work.

During the JPA review process, site inspections may be necessary to evaluate a proposed project. Failure to allow an authorized representative of a regulatory agency to enter the property, or to take photographs of conditions at the project site, may result in either the withdrawal of your permit application or denial of a permit.

For certain Federal and State permit applications, a public notice is published in a newspaper having circulation in the project area, is mailed to adjacent property owners, and/or is posted on the agency's Web page. The public may comment on the project during a

designated comment period, which varies from agency to agency. Some agencies accept comments upon receipt of the application or during the permit review process, while others only accept comments on draft permits. Comments are evaluated and a decision is made whether to revise a draft permit, issue a final permit, issue a final permit with special conditions, or to deny a permit. When applicable, the project will be heard by the appropriate LWB after a notice of public hearing has been advertised for at least once a week for two consecutive weeks in a local newspaper. VMRC will conduct the hearings for the localities that do not have a wetlands board. You may be responsible for bearing the costs for advertisement of public notices.

Public hearings are held by VMRC at their regularly scheduled monthly commission meetings under the following situations: Protested applications for VMRC permits which can not be resolved; projects costing over $50,000 involving encroachment over State-owned subaqueous land; and all projects affecting tidal wetlands and dunes/beaches in localities without a LWB. All interested parties will be officially notified regarding the date and time of the hearing and Commission meeting procedures. The Commission will usually make a decision on the project at the meeting unless a decision for continuance is made. If a proposed project is approved, a permit or similar agency correspondence is sent to the applicant. In some cases, notarized signatures, as well as processing fees and royalties, are required before the permit is validated. If the project is denied, the applicant will be notified in writing.

Permits or permit authorizations from some agencies may be provided via electronic mail. If the applicant wishes to receive their permit via electronic mail, please include an e-mail address at the requested place in the application.

PERMIT APPLICATION FEES

Do not send any permit application fees in with the JPA**,** since VMRC is not responsible for accounting for permit application fees required by other agencies. Fees are subject to change. Please consult agency Websites or contact agencies directly for current fee information.

- USACE: Permit application fees are required for USACE Individual (Standard) permits. A USACE project manager will contact you regarding the proper fee and submittal requirements.
- DEQ: Permit application fees required by DEQ for VWP permits are provided on DEQ's Website at http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/Permits.aspx or on the Commonwealth of Virginia's Website at http://leg1.state.va.us/000/reg/TOC09025.HTM#C0020. A DEQ project manager will contact you regarding the proper fee and submittal requirements after receiving your application package. After being contacted by the DEQ, mail the permit application fee and the Permit Application Fee Form to the address listed on the form. Please make sure that the applicant name and facility (project) name are the same as those reported in your JPA.
- VMRC: Permit fees are $25.00 for projects costing $10,000 or less and $100 for projects costing more than $10,000. Royalties may also be required for some projects. The proper fee and any required royalty is paid at the time of permit issuance by VMRC. VMRC staff will send the permittee a letter notifying him/her of the proper fees and submittal requirements.
- LWB: Permit fees vary. Contact the LWB in your locality or reference locality Websites for fee information and submittal requirements. Contact information for LWB may be found at http://ccrm.vims.edu/permits_web/guidance/local_wetlands_boards.html.

WETLANDS & WATERS DELINEATIONS

Wetlands/waters delineations must be performed using the 1987 Corps of Engineers Wetland Delineation Manual and applicable Regional Supplement to the Corps of Engineers Wetlands Delineation Manual (Atlantic and Gulf Coastal Plain Region (Version 2.0) or Eastern Mountains and Peidmont Region (Version 2.0)) .Contact the appropriate USACE District office or field office to obtain a delineation confirmation by referencing the Contact Information on the Regulatory webpage at: http://www.nao.usace.army.mil/Missions/Regulatory.aspx or call the Regulatory of the Day (ROD) at 757-201-7652.

INFORMATION REGARDING THREATENED OR ENDANGERED SPECIES

In order to find preliminary information regarding federal or state threatened or endangered species on your project site, you may contact the following agencies:

United States Fish and Wildlife Service
6669 Short Lane
Gloucester, Virginia 23061
Voice: (804) 693-6694
Fax: (804) 693-9032
http://virginiafieldoffice.fws.gov/

Project Review Coordinator
Virginia Department of Conservation and Recreation
Natural Heritage Division
217 Governor Street
Richmond, Virginia 23219
Voice: (804) 786-7951
Fax: (804) 371-2674
http://www.dcr.virginia.gov/natural_heritage/index.shtml

Virginia Department of Game and Inland Fisheries
Environmental Services Section
4010 West Broad Street
Richmond, Virginia 23230-1104
(804) 367-1000
http://www.dgif.virginia.gov/wildlife/

INFORMATION REGARDING FEMA-MAPPED FLOODPLAINS

You may obtain "Online Hazard Maps" for FEMA-mapped floodplains by visiting https://hazards.fema.gov/femaportal/wps/portal . Local governments also keep paper copies of FEMA maps on hand.

FOOTNOTES:

(1) Adjacent Property Owner Notification: When determining whether to grant or deny any permit for the use of state-owned submerged lands, the VMRC must consider, among other things, effects of a proposed project on adjacent or nearby properties. Discussing the proposed project with these property owners can be done on your own using the forms in Appendix A of this package. LWB must also consider the effects on adjacent properties and notify adjoining property owners of the required public hearings for all applications. The completed forms will assist VMRC and LWB in processing the application. The forms in Appendix A may be photocopied if more copies are needed.

(2) Conceptual mitigation plans, when required, should include all information stipulated by DEQ Regulations 9 VAC 25-210-80 and 9 VAC 25-210-116, or 9 VAC 25-[660-690]-50, -60, and -70, whichever is applicable to your project. Regulations may be obtained from DEQ's web site at http://www.deq.virginia.gov/Programs/Water/WetlandsStreams.aspx.

Information on wetland and stream mitigation is available at http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/Mitigation.aspx. The final compensatory mitigation plan will be *required prior to commencement of impacts to waters and/or wetlands* on your project site. If no mitigation is planned, submit a detailed statement explaining the reason(s) for no mitigation.

(3) A functions and values assessment consists of a narrative description of the existing functions and values of the wetlands and waters being impacted, the impact that the project will have on these functions and values, and information on the following: surrounding land uses and cover types; nutrient, sediment, and pollutant trapping; flood control and flood storage capacity; erosion control and shoreline stabilization; groundwater recharge and discharge; aquatic and wildlife habitat; and unique or critical habitats. Functional values may also include: water quality, floodflow desynchronization, nutrient import or export, stormwater retention or detention, recreation, education, aesthetics, or other beneficial uses. Also include the assessment methodology that was used.

(4) Wetland and waters boundary delineation map: For DEQ application purposes, this applies to all projects impacting more than 1/10 acre wetlands or open waters, or more than 300 linear feet of stream bed, and may apply in areas under a deed restriction or protective instrument, regardless of the amount of impacts. The information to be submitted includes the wetlands data sheets; the location of impacted and non-impacted wetlands, streams, open water, and the approximate limits of Chesapeake Bay Resource Protection Areas (RPAs); wetland types, noted according to their Cowardin classification or similar terminology; and a copy of the USACE delineation confirmation, or other correspondence from the USACE indicating their approval of the wetland and waters boundaries. If a Corps confirmation is not available at the time of application, it must be submitted as soon as it becomes available during the DEQ permit review.

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PLEASE PRINT OR TYPE ALL ANSWERS. If a question does not apply to your project, please print N/A (not applicable) in the space provided. ***If additional space is needed, attach extra 8 ½ x 11 inch sheets of paper.***

CHECK ONE, if applicable:	Pre-Construction Notification (PCN) ☐ (*For Nationwide Permits ONLY*)	SPGP ☐

1. PROJECT LOCATION INFORMATION
(Attach a copy of a detailed map, such as a USGS topographic map or street map showing the site location and project boundary, so that it may be located for inspection. Include an arrow indicating the north direction.)

Street Address	City/County/Zipcode
1350 John Tyler Highway	Williamsburg/James City County/23185
Subdivision	Lot/Block/Parcel #
Acreage Lots - Powhatan	Parcel # 3430100002

Name of water body(ies) within project boundaries and drainage area (acres or square miles)
Chickahominy River, Drainage Area = 454 square miles; Gordon Creek, Drainage Area = 13.8 square miles

Tributary(ies) to: Chickahominy River
Basin: James River Subbasin: Lower James River
(*Example: Basin: James River Subbasin: Middle James River*)

Special Standards (based on DEQ Water Quality Standards 9VAC25-260 et seq.): _____

Project type (check one)
_____ Single user (private, non-commercial, residential)
__×__ Multi-user (community, commercial, industrial, government)

Latitude and longitude at center of project site: 37° - 15' - 59.2" / 76° - 52' - 13.1"

USGS topographic map name: Norge, Virginia

8- digit USGS Hydrologic Unit Code (HUC) for your project site (See http://cfpub.epa.gov/surf/locate/index.cfm): 02080206
If known, indicate the 10-digit and 12-digit USGS HUCs (see *http://dswcapps.dcr.virginia.gov/htdocs/maps/HUExplorer.htm* :
0208020606 020802060605

Name of your project (*Example: Water Creek driveway crossing*) Chickahominy Riverfront Raw Water Supply & Treatment Plant

Is there an access road to the project? ✕ Yes __ No. If yes, check all that apply: ✕ public __ private __ improved __ unimproved

Provide driving directions to your site, giving distances from the best and nearest visible landmarks or major intersections:
From I-64, take exit 242A onto VA-199W toward Williamsburg/Jamestown. After 6 miles, turn left onto VA-5W. Continue on VA-5W for 8 miles. Chickahominy Riverfront Park will be on the right before crossing the James River.

Does your project site cross boundaries of two or more localities (i.e. cities/counties/towns)? __ Yes ✕ No
If so, name those localities:

FOR AGENCY USE ONLY	
	Notes:
JPA#	

2. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR INFORMATION

The applicant(s) is/are the legal entity to which the permit may be issued. The applicant(s) can either be the property owner(s) or the person/people/company(ies) that intend(s) to undertake the activity. The agent is the person or company that is representing the applicant(s). If a company, please use the company name that is registered with the State Corporation Commission (SCC), or indicate no registration with the SCC.

Applicant(s) (For a company, use SCC-registered name) James City Service Authority (JCSA)			Agent (if applicable) (For a company, use SCC-registered name) Matt Petty/CDM Smith		
Mailing address 119 Tewning Road			Mailing address 3201 Jermantown Road, Suite 400		
City Williamsburg	State VA	Zip Code 23188	City Fairfax	State VA	Zip Code 22030
Phone number w/area code (757) 259-5453	Fax		Phone number w/area code 703-691-6467	Fax 703-267-6083	
Mobile/pager	E-mail doug.powell@jamescitycountyva.gov		Mobile/pager	E-mail pettyme@cdmsmith.com	
State Corporation Commission ID number (if applicable)			State Corporation Commission ID number (if applicable)		

Certain permits or permit authorizations may be provided via electronic mail. If the applicant wishes to receive their permit via electronic mail, please provide an e-mail address here: _____

Property owner(s), if different from applicant (For a company, use SCC-registered name) James City County			Contractor, if known (For a company, use SCC-registered name)		
Mailing address 101-D Mounts Bay Road			Mailing address		
City Williamsburg	State VA	Zip code 23185	City	State	Zip code
Phone number w/area code 757-253-6603	Fax		Phone number w/area code	Fax	
Mobile/pager	E-mail Bryan.Hill@jamescitycountyva.gov		Mobile/pager	E-mail	
State Corporation Commission ID number (if applicable)			State Corporation Commission ID number (if applicable)		

3. PROVIDE A DESCRIPTION OF THE PROJECT, PROJECT PRIMARY AND SECONDARY PURPOSES, PROJECT NEED, INTENDED USE, AND ALTERNATIVES CONSIDERED (Attach additional sheets if necessary)

- The purpose must include any new development or expansion of an existing land use and/or proposed future use of residual land
- Describe the physical alteration of surface waters
- Include a description of alternatives considered to avoid or minimize impacts to surface waters, including wetlands, to the maximum extent practicable. Include factors such as, but not limited to, alternative construction technologies, alternative project layout and design, alternative locations, local land use regulations, and existing infrastructure
- For utility crossings, include both alternative routes and alternative construction methodologies considered
- For major surface water withdrawals, public surface water supply withdrawals, or projects that will alter in-stream flows, include the water supply issues that form the basis of the proposed project.

Response provided in Attachment A.

3. PROVIDE A DESCRIPTION OF THE PROJECT (Continued)

Date of proposed commencement of work (MM/DD/YYYY) June 30, 2021	Date of proposed completion of work (MM/DD/YYYY) January 2025
Are you submitting this application at the direction of any State, local, or Federal agency? X Yes _____No	Has any work commenced or has any portion of the project for which you are seeking a permit been completed? _____ Yes X No

If you answered "yes" to either question above, give details stating when the work was completed and/or when it commenced, who performed the work, and which agency (if any) directed you to submit this application. In addition, you will need to clearly differentiate between completed work and proposed work on your project drawings.

The project has not been constructed and is in the planning stage. DEQ Office of Water Supply recommended that JCSA submit the application.

Are you aware of any unresolved violations of environmental law or litigation involving the property? _____Yes X No
(If yes, please explain)

4. PREVIOUS SITE VISITS AND/OR PERMITS RELATED TO THE PROPOSED WORK (Include all Federal, State, and Local pre-application coordination or previous permits)

Agency	Activity	Permit/Project number, and explanation of non-reporting Nationwide permits previously used	Action taken ** and Date of Action	If denied, give reason for denial
USACE	Jurisdictional Determination		Submitted (3/7/16); Under Review	

** Issued, denied, site visit

5. PROJECT COSTS

Approximate cost of the entire project, including materials and labor: $ 128,000,000

Approximate cost of only the portion of the project affecting State waters (below mean low water in tidal areas and below ordinary high water mark in nontidal areas): $ $15,000,000

6. PUBLIC NOTIFICATION (Attach additional sheets if necessary)

- Complete information for all property owners adjacent to the project site and across the waterway, if the waterway is less than 500 feet in width. If your project is located within a cove, you will need to provide names and mailing addresses for all property owners within the cove.
- If you own the adjacent lot, provide the requested information for the first adjacent parcel beyond your property line.

Property owner's name	Mailing address	City	State	Zip code
Scholley, Peggy & Beckerdite, Luke	1668 John Tyler Highway	Williamsburg	VA	23185
Ambs, Loran D Trustee & Joanna G. Tru	1666 John Tyler Highway	Williamsburg	VA	23185
Claybank Landing LLC	1409 John Tyler Highway	Williamsburg	VA	23185
Bell, Baxter I Jr. Trustee	327 Mill Neck Road	Williamsburg	VA	23185
Hofmeyer, Eugene J & Ruth M of the Ho	1409 John Tyler Highway	Williamsburg	VA	23185

Name of newspaper having general circulation in the area of the project: Virginia Gazette

Address and phone number (including area code) of newspaper 216 Ironbound Rd Williamsburg, VA 23188-2618; phone (757)-220-1736

Have adjacent property owners been notified with forms in Appendix A? _____Yes _X_No (attach copies of distributed forms)

7. THREATENED AND ENDANGERED SPECIES INFORMATION

Please provide any information concerning the potential for your project to impact state and/or federally threatened and endangered species (listed or proposed). Attach correspondence from agencies and/or reference materials that address potential impacts, such as database search results or your Corps' waters and wetlands delineation confirmation. Contact information for the Virginia Department of Game and Inland Fisheries and the Virginia Department of Conservation and Recreation, Division of Natural Heritage can be found on page 4 of this package.

REFER TO ATTACHMENT B

8. HISTORIC RESOURCES INFORMATION

Note: Historic properties include but are not limited to archeological sites, battlefields, Civil War earthworks, graveyards, buildings, bridges, canals, etc. Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. **REFER TO ATTACHMENT C**

Are any historic properties located within or adjacent to the project site? _X_ Yes ____ No _____ Uncertain
If Yes, please provide a map showing the location of the historic property within or adjacent to the project site.

Are there any buildings or structures 50 years old or older located on the project site? ____ Yes _X_ No _____ Uncertain
If Yes, please provide a map showing the location of these buildings or structures on the project site.

Is your project located within a historic district? ____ Yes _X_ No ____ Uncertain
If Yes, please indicate which district: _____

8. HISTORIC RESOURCES INFORMATION (Continued)

Has a survey to locate archeological sites and/or historic structures been carried out on the property?
___ Yes _X_ No ___ Uncertain

If Yes, please provide the following information: Date of Survey: _____

Name of firm: _____

Is there a report on file with the Virginia Department of Historic Resources? ____ Yes _X_ No ___Uncertain

Title of Cultural Resources Management (CRM) report: _____

Was any historic property located? ____ Yes ____ No __ Uncertain

9. WETLANDS, WATERS, AND DUNES/BEACHES IMPACT INFORMATION

Report each impact site in a separate column. If needed, attach additional sheets using a similar table format. Please ensure that the associated project drawings clearly depict the location and footprint of each numbered impact site. For dredging, mining, and excavating projects, use Section 18.

	Impact site number 1	Impact site number 2	Impact site number 3
Impact description (use all that apply): F=fill EX=excavation S=Structure T=tidal NT=non-tidal TE=temporary PE=permanent PR=perennial IN=intermittent SB=subaqueous bottom DB=dune/beach IS=hydrologically isolated V=vegetated NV=non-vegetated MC=Mechanized Clearing of PFO (*Example: F, NT, PE, V)*	**REFER TO ATTACHMENT D**		
Wetland/waters impact area (square feet)			
Dune/beach impact area (square feet)			
Stream dimensions at impact site (length and average width in linear feet, and area in square feet)			
Volume of fill below Mean High Water or Ordinary High Water (cubic yards)			
Cowardin classification of impacted wetland/water or geomorphological classification of stream *Example wetland: PFO;* *Example stream: wide; bank eroding; braided channel;* *Example stream: 'C' channel*			
Average stream flow at site (flow rate under normal rainfall conditions in cubic feet per second)			
Contributing drainage area (acres or square miles)			

9. WETLANDS/WATERS IMPACT INFORMATION (Continued)

DEQ classification of impacted resource(s): Estuarine Class II Non-tidal waters Class III Mountainous zone waters Class IV Stockable trout waters Class V Natural trout waters Class VI Wetlands Class VII			

For DEQ permitting purposes, also submit as part of this section a wetland and waters boundary delineation map[4] – see the Footnotes section in the form instructions. REFER TO ATTACHMENT D

For DEQ permitting purposes, also submit as part of this section a written disclosure of all wetlands, open water, or streams that are located within the proposed project or compensation areas that are also under a deed restriction, conservation easement, restrictive covenant, or other land-use protective instrument.

10. APPLICANT, AGENT, OWNER, AND CONTRACTOR CERTIFICATIONS

If the Applicant(s), Agent(s), Owner(s), or Contractor(s) is/are a company, please use the company name(s) that is/are registered with the State Corporation Commission (SCC).

READ ALL OF THE FOLLOWING CAREFULLY BEFORE SIGNING

PRIVACY ACT STATEMENT: The Department of the Army permit program is authorized by Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and Section 103 of the Marine Protection Research and Sanctuaries Act of 1972. These laws require that individuals obtain permits that authorize structures and work in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters prior to undertaking the activity. Information provided in the Joint Permit Application will be used in the permit review process and is a matter of public record once the application is filed. Disclosure of the requested information is voluntary, but it may not be possible to evaluate the permit application or to issue a permit if the information requested is not provided.

CERTIFICATION: I am hereby applying for permits typically issued by the DEQ, VMRC, U.S. Army Corps of Engineers, and/or Local Wetlands Boards for the activities I have described herein. I agree to allow the duly authorized representatives of any regulatory or advisory agency to enter upon the premises of the project site at reasonable times to inspect and photograph site conditions, both in reviewing a proposal to issue a permit and after permit issuance to determine compliance with the permit.

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

Is/Are the Applicant(s) and Owner(s) the same? ___ Yes _×_ No

Applicant's name & title (printed or typed) James City Service Authority (Doug Powell/General Manager)	Second applicant's name & title, if applicable (printed or typed)
Applicant's signature	Second applicant's signature
Date	Date
(Required for VMRC permit actions only) Property owner's name, if different from Applicant James City County (Bryan Hill/County Administrator)	*(Required for VMRC permit actions only)* Second property owner's name, if applicable
Owner's signature, if different from Applicant	Second owner's signature
Date	Date

10. APPLICANT, AGENT, OWNER, AND CONTRACTOR CERTIFICATIONS (Continued)

If the Applicant(s), Agent(s), Owner(s), or Contractor(s) is/are a company, please use the company name(s) that is/are registered with the State Corporation Commission (SCC).

CERTIFICATION OF AUTHORIZATION TO ALLOW AGENT(S) TO ACT ON APPLICANT'S(S') BEHALF (IF APPLICABLE)

I (we), Doug Powell (JCSA) (and) _____ ,
APPLICANT'S NAME(S) – *complete the second blank if more than one Applicant*

hereby certify that I (we) have authorized CDM Smith, Inc. (and) _____
AGENT'S NAME(S) – *complete the second blank if more than one Agent*

to act on my (our) behalf and take all actions necessary to the processing, issuance, and acceptance of this permit and any and all standard and special conditions attached. I (we) hereby certify that the information submitted in this application is true and accurate to the best of my (our) knowledge.

Applicant's signature	Second applicant's signature, if applicable
Date	Date
Agent's signature and title	Second agent's signature and title, if applicable
Date	Date

CONTRACTOR ACKNOWLEDGEMENT (IF APPLICABLE)

I (we), _____ (and) _____ ,
APPLICANT'S NAME(S) – *complete the second blank if more than one Applicant*

have contracted _____ (and) _____
CONTRACTOR'S NAME(S) – *complete the second blank if more than one Contractor*

to perform the work described in this Joint Permit Application, signed and dated _____.

I (we) will read and abide by all conditions as set forth in all Federal, State, and Local permits as required for this project. I (we) understand that failure to follow the conditions of the permits may constitute a violation of applicable Federal, State, and Local statutes and that we will be liable for any civil and/or criminal penalties imposed by these statutes.

In addition, I (we) agree to make available a copy of any permit to any regulatory representative visiting the project site to ensure permit compliance. If I (we) fail to provide the applicable permit upon request, I (we) understand that the representative will have the option of stopping our operation until it has been determined that we have a properly signed and executed permit and are in full compliance with all of the terms and conditions.

Contractor's name or name of firm (printed/typed)	Contractor's or firm's mailing address	
Contractor's signature and title	Contractor's license number	Date
Applicant's signature	Second applicant's signature, if applicable	
Date	Date	

END OF GENERAL INFORMATION

The following sections are activity-specific. Fill out only the sections that apply to your particular project.

11. PRIVATE PIERS, MARGINAL WHARVES, AND UNCOVERED BOAT LIFTS

*If you plan to construct a private, residential pier, you **may** qualify to work in a non-reporting capacity under the Norfolk District Corps of Engineers' Regional Permit 17 (RP-17).*

A copy of RP-17 can be obtained by calling (757) 201-7652 or by visiting the Corps' Website at: http://www.nao.usace.army.mil/Missions/Regulatory/RBregional.aspx . A copy of the RP-17 Certificate of Compliance is found in Appendix B of this application package. You should only sign and attach this form to the application if you have completely read and understood the terms and conditions of RP-17. **Although no further written authorization will be required from the Corps, you may require a permit from the Virginia Marine Resources Commission and/or your local wetlands board. Please submit this application as instructed in order to obtain all required state and local permits.**

In cases where the proposed pier will encroach beyond one fourth the waterway width (as determined by measuring mean high water to mean high water or ordinary high water mark to ordinary high water mark), the following information must be included before the application will be considered complete. For an application to be considered complete:

1. The Corps **MAY** require depth sounding across the waterway at increments designated by the Corps project manager. Typically 10-foot increments on waterways less than 200 feet wide and 20-foot increments on waterways greater than 200 feet wide with the date and time the measurements were taken and how they were taken (e.g., tape, range finder, etc.).
2. The applicant **MUST** provide a justification as to purpose if the proposed work would extend a pier greater than one-fourth of the distance across the open water measured from mean high water or the channelward edge of the wetlands.
3. The applicant **MUST** provide justification if the proposed work would involve the construction of a pier greater than five feet wide or less than four feet above any wetland substrate.

Number of vessels to be moored at the pier or wharf: _____

In the spaces provided below, give the type (i.e. sail, power, skiff, etc.), size, and registration number of the vessel(s) to be moored

TYPE	LENGTH	WIDTH	DRAFT	REGISTRATION #

NOT APPLICABLE

12. BOATHOUSES, GAZEBOS, COVERED BOAT LIFTS, AND OTHER ROOFED STRUCTURES OVER WATERWAYS

No. of vessels to be moored at the proposed structure: _____

Will the sides of the structure be enclosed? _____Yes _____No
Area covered by the roof structure _____ square feet

In the spaces provided below, give the type (i.e. sail, power, skiff, etc.), size, and registration number of the vessel(s) to be moored

TYPE	LENGTH	WIDTH	DRAFT	REGISTRATION #

NOT APPLICABLE

13. MARINAS AND COMMERCIAL, GOVERNMENTAL, AND COMMUNITY PIERS

Have you obtained the Virginia Department of Health's approval for sanitary facilities? _____Yes _____No
You will need to obtain this authorization or a variance before a VMRC permit will be issued.

Will petroleum products or other hazardous materials be stored or handled at the facility? _____Yes _____No
If your answer is yes, please attach your spill contingency plan.

Will the facility be equipped to offload sewage from boats? _____Yes _____No

EXISTING: wet slips: _____ dry storage: _____

PROPOSED: wet slips: _____ dry storage: _____

NOT APPLICABLE

14. FREE STANDING MOORING PILES, OSPREY NESTING POLES, MOORING BUOYS, AND DOLPHINS (not associated with piers)

Number of vessels to be moored: _____

Type and number of mooring(s) proposed:_____
_____

In the spaces provided below, give the type (i.e. sail, power, skiff, etc.), size, and registration number of the vessel(s) to be moored

TYPE	LENGTH	WIDTH	DRAFT	REGISTRATION #

Give the name and complete mailing address(es) of the owner(s) of the vessel(s) if not owned by applicant (attach extra sheets if needed):

Do you plan to reach the mooring from your own upland property? _____Yes _____No
If "no," explain how you intend to access the mooring.

NOT APPLICABLE

15. BOAT RAMPS

Will excavation be required to construct the boat ramp? _____Yes _____No

If "yes," will any of the excavation occur below the plane of the ordinary high water mark/mean high water line or in wetlands?
_____Yes _____No
If "yes," you will need to fill out Section 18 for this excavation. Where will you dispose of the excavated material?

What type of design and materials will be used to construct the ramp (open pile design with salt treated lumber, concrete slab on gravel bedding, etc.)?

Location of nearest public boat ramp

Driving distance to that public ramp

_____miles

Will other structures be constructed concurrent with the boat ramp installation? _____Yes _____No
If "yes," please fill out the appropriate sections of this application associated with those other activities.

NOT APPLICABLE

16. TIDAL/NONTIDAL SHORELINE STABILIZATION STRUCTURES (INCLUDING BULKHEADS AND ASSOCIATED BACKFILL, RIPRAP REVETMENTS AND ASSOCIATED BACKFILL, MARSH TOE STABILIZATION, GROINS, JETTIES, AND BREAKWATERS, ETC.)

Is any portion of the project maintenance or replacement of an existing and currently serviceable structure? _____Yes _____No
If yes, give length of existing structure: _____ linear feet

If your maintenance project entails replacement of a bulkhead is it possible to construct the replacement bulkhead within 2 feet channelward of the existing bulkhead? _____Yes _____No If no, please explain below.

NOT APPLICABLE

16. TIDAL/NONTIDAL SHORELINE STABILIZATION STRUCTURES (Continued)

Length of proposed structure, including returns: _____linear feet

Average channelward encroachment of the structure from Mean high water/ordinary high water mark: _____ feet Mean low water: _____feet	*Maximum* channelward encroachment of the structure from Mean high water/ordinary high water mark: _____ feet Mean low water: _____feet
Maximum channelward encroachment form the back edge of the Dune _____feet	*Maximum* channelward encroachment from the back edge of the Beach _____feet

Describe the type of construction including all materials to be used (including all fittings):

NOT APPLICABLE

Will filter cloth be used? ____Yes ____No

What is the source of the backfill material? _____

What is the composition of the backfill material? _____

If rock is to be used, give the average volume of material to be used for every linear foot of construction: _____cubic yards
What is the volume of material to be placed below the plane of ordinary high water mark/mean high water? _____cubic yards

For projects involving stone:
Average weight of core material (bottom layers): _____pounds per stone (Class_____)
Average weight of armor material (top layers): _____pounds per stone (Class_____)

Are there similar shoreline stabilization structures in the vicinity of your project site? _____Yes _____No
If so, describe the type(s) and location(s) of the structure(s):

If you are building a groin or jetty, will the channelward end of the structure be marked to show a hazard to navigation? _____Yes _____No	Has your project been reviewed by the Shoreline Erosion Advisory Service (SEAS)? _____Yes _____No If yes, please attach a copy of their comments.

17. BEACH NOURISHMENT

Source of material: _____	Volume of material: _____cubic yards
Composition of material (percentage sand, silt, clay):	Mode of transportation of material to the project site (truck, pipeline, etc.):

Describe the type(s) of vegetation proposed for stabilization and the proposed planting plan, including schedule, spacing, monitoring, etc. Attach additional sheets if necessary.

NOT APPLICABLE

18. DREDGING, MINING, AND EXCAVATING

FILL OUT THE FOLLOWING TABLE FOR DREDGING PROJECTS

	NEW dredging				MAINTENANCE dredging			
	Hydraulic		Mechanical (clamshell, dragline, etc.)		Hydraulic		Mechanical (clamshell, dragline, etc.)	
	Cubic yards	Square feet	Cubic yards	Square feet	Cubic yards	Square feet	Cubic yards	Square feet
Vegetated wetlands								
Nonvegetated wetlands								
Subaqueous land			92,260	6,590				
Totals								

Is this a one-time dredging event? _X_Yes _____ No If "no", how many dredging cycles are anticipated: _____
(____ initial cycle in cu. yds.) (_____ subsequent cycles in cu. yds.)

Composition of material (percentage sand, silt, clay, rock):
Provide documentation (i.e. laboratory results or analytical reports) that *dredged* material from on-site areas is free of toxics. If not free of toxics, provide documentation of proper disposal (i.e. bill of lading from commercial supplier or disposal site).

Dredged material is expected to be free of toxics. Geotechnical and soil composition investigations are to be completed. If dredged material is not free of toxics, it will be disposed of at a properly-licensed facility or landfill.

Please include a dredged material management plan that includes specifics on how the dredged material will be handled and retained to prevent its entry into surface waters or wetlands. If on-site dewatering is proposed, please include plan view and cross section drawings of the dewatering area and associated outfall.
A cofferdam will be put into place to dewater the intake and associated raw water piping construction area. Sediment controls (e.g. silt curtain) will be installed. On-site dewatering is proposed; however, dewatering facilities are still to be designed and located.

Will the dredged material be used for any commercial purpose or beneficial use? _____Yes __X__No
If yes, please explain:

If this is a maintenance dredging project, what was the date that the dredging was last performed? _____
Permit number of original permit: _____ *(It is important that you attach a copy of the original permit.)*

For mining projects: On separate sheets of paper, explain the operation plans, including: 1) the frequency (i.e., every six weeks, for example), duration (i.e., April through September), and volume (in cubic yards) to be removed per operation; 2) the temporary storage and handling methods of mined material, including the dimensions of the containment berm used for upland disposal of dredged material and the need (or no need) for a liner or impermeable material to prevent the leaching of any identified contaminants into ground water; 3) how equipment will access the mine site; and 4) verification that dredging: a) will not occur in water body segments that are currently on the effective Section 303(d) Total Maximum Daily Load (TMDL) priority list or that have an approved TMDL; b) will not exacerbate any impairment; and c) will be consistent with any waste load allocation/limit/conditions imposed by an approved TMDL.
Have you applied for a permit from the Virginia Department of Mines, Minerals and Energy? _____Yes _____No

Contributing drainage area: ____454____square miles

Average stream flow at site (flow rate under normal rainfall conditions): _____(Tidal)_____cfs

See Attachment E

19. FILL (not associated with backfilled shoreline structures) AND OTHER STRUCTURES (other than piers and boathouses) IN WETLANDS OR WATERS, OR ON DUNES/BEACHES

Source and composition of fill material (percentage sand, silt, clay, rock): ~~Fill will be obtained from local, clean sources and will be composed of debris-free materials (sand/clay/rock) required for load bearing as determined by geotechnical investigations.~~

Provide documentation (i.e. laboratory results or analytical reports) that *fill* material from *off-site* locations is free of toxics. If not free of toxics, provide documentation of proper disposal (i.e. bill of lading from commercial supplier or disposal site). Documentation is not necessary for fill material obtained from on-site areas.

Explain the purpose of the filling activity and the type of structure to be constructed over the filled area (if any):

Area will need to be filled for the construction of the water treatment facility.

Describe any structure that will be placed in wetlands/waters or on a beach dune and its purpose:

Water treatment facility (impacting wetlands and intermittent stream) and raw water intake (impacting Chickahominy River) will be used to treat water withdrawn from the Chickahominy River to provide potable water for James City County.

Will the structure be placed on pilings? _ × _ Yes _ _ No The water treatment facility and raw water intake may be on pilings.	Total area occupied by any structure. _377,534____ Square Feet 374,400 sf = water treatment facility 3,134 sf = raw water intake
How far will the structure be placed channelward from the back edge of the dune? _____feet **Not Applicable**	How far will the structure be placed channelward from the back edge of the beach? _____feet **Not Applicable**

20. NONTIDAL STREAM CHANNEL MODIFICATIONS FOR RESTORATION OR ENHANCMENT, or TEMPORARY OR PERMANENT RELOCATIONS

If proposed activities are being conducted for the purposes of compensatory mitigation, please attach separate sheets of paper providing all information required by the most recent version of the stream assessment methodology approved by the Norfolk District of the U.S. Army Corps of Engineers and the Virginia Department of Environmental Quality, in lieu of completing the questions below. Required information outlined by the methodology can be found at:
http://www.nao.usace.army.mil/Missions/Regulatory/UnifiedStreamMethodology.aspx *or*
http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/Mitigation.aspx.

Has the stream restoration project been designed by a local, state, or federal agency? _ _ Yes _×_ No. If yes, please include the name of the agency here: _____.

Is the agency also providing funding for this project? _____ Yes _×_ No

Linear feet of stream impact: _____640_____

Contributing drainage area: _____15____acres *or* _____square miles

Existing average stream flow at site (flow rate under normal rainfall conditions): _Intermittent <10_cfs	Proposed average stream flow at site after modifications (flow rate under normal rainfall conditions): _< 10_cfs

Explain, in detail, the method to be used to stabilize the banks:

A portion of an intermittent stream will be relocated to accommodate the water treatment facility. The existing channel is only slightly entrenched and banks are stable. The relocated channel will be stabilized using soft engineering techniques to not only preserve the bank and prevent erosion, but to promote the natural aesthetic the park desires and provide habitat for wildlife. Potential soft engineering stabilization techniques include live stakes, live fascines, brush mattresses, fiber/coir rolls, and/or jute logs.

Explain the composition of the existing stream bed (percent cobble, rock, sand, etc.):

The existing stream bed is made up largely of silts and fine sands. Rocky substrates, largely gravels and small cobbles, are present, but in very small quantities.

Silt - 70%
Sand - 25%
Gravel - 5%
Cobble - < 1%

20. NONTIDAL STREAM CHANNEL MODIFICATIONS (Continued)

Will low-flow channels be maintained in the modified stream channel? _ _Yes _ × _No.
Describe how:

The existing stream is an intermittent, dredged drainage channel that receives most of its flow from a man-made depression near the park entrance and storm sewers upstream. Because of its existing intermittent hydrology, the modified stream channel will not maintain low flow conditions.

Will any structure(s) be placed in the stream to create riffles, pools, meanders, etc.? _____Yes _ × _No
If yes, please explain:

The existing stream is an intermittent, dredged drainage channel with no little sinuosity and channel diversity (i.e. riffles/runs/pools). Channel relocation has yet to be designed, but due to the small size of the channel and limited flow, in-stream structures are not warranted.

21. UTILITY CROSSINGS

Type of crossing: _ _overhead _____trenched _____directionally-drilled

Method of clearing corridor of vegetation (check all that apply): __ __ mechanized land clearing that disturbs the soil surface
_____ cutting vegetation above the soil surface

Describe the materials to be used in the installation of the utility line (including gravel bedding for trenched installations, bentonite slurries used during direction-drilling, etc.) and a sequence of events to detail how the installation will be accomplished (including methods used for in-stream and dry crossings).

For overhead crossings over navigable waterways (including all tidal waterways), please indicate the height of other overhead crossings or bridges over the waterway relative to mean high water, mean low water or ordinary high water mark:

NOT APPLICABLE

Nominal system voltage, if project involves power lines: _____

Will there be an excess of excavated material? _ _Yes _____No
If so, describe the method that will be undertaken to dispose of, and transport, the material to its permanent disposal location and give that location:

Will any excess material be stockpiled in wetlands? _____Yes _ _No
If so, will the stockpiled material be placed on filter fabric or some other type of impervious surface? _____Yes _____No

21. UTILITY CROSSINGS (Continued)

Will permanent access roads be placed through wetlands/streams? ____Yes _____No
If yes, will the roads be _____at grade or _____above grade (check one)?

Will the utility line through wetland/waters be continuously maintained (e.g. via mowing or herbicide)? ____Yes _____No

If maintained, what is the maximum width? _____feet

NOT APPLICABLE

22. ROAD CROSSINGS

Have you conducted hydraulic studies to verify the adequacy of the culverts? _____Yes _____No
If so, please attach a copy of the hydraulic study/report.
Virginia Department of Transportation (VDOT) standards require that the backwater for a 100 year storm not exceed 1 foot for all road, culvert, and bridge projects within FEMA-designated floodplains.

Will the culverts be countersunk below the stream bottom? _____Yes _ _No. If no, explain: _____
_____

If the project entails a bridged crossing and there are similar crossings that are what is the distance above mean high water, mean low water, or ordinary high water mark of those similar structures? _____feet above _____
For all bridges proposed over navigable waterways (including all tidal water bodies), you will be required to contact the U.S. Coast Guard to determine if a permit is required of their agency.

On separate sheets of paper, describe the materials to be used, the method of construction (including the use of cofferdams), and the sequence of construction events. Include cross sections and profile plans of the culvert crossings including wing walls or rip rap.

NOT APPLICABLE

23. PRIVATE AND COMMERCIAL AQUACULTURE ACTIVITIES

Please review VMRC regulations related to aquaculture activities if you are completing this section. An abbreviated application is available for certain private oyster gardening activities by a riparian owner. Also, separate information is required by the VMRC Fisheries Management Division for the review of commercial projects that may qualify for the Virginia Marine Resources Commission General Permit #4 FOR TEMPORARY PROTECTIVE ENCLOSURES FOR SHELLFISH. The VMRC aquaculture regulations can be found on the agency web page at: http://www.mrc.state.va.us/regulations/regindex.shtm.
Please see regulations 4 VAC 20-335-10 et seq., 4 VAC 20-336-10 et seq., and 4 VAC 20-1130-10 et seq.

Briefly describe your proposed aquaculture activity from the time of acquisition (seed, fingerlings, etc.) to time of harvest, and indicate which species you intend to culture. Attach additional sheets if needed.

Source of the animals/plants that you want to culture: _____
_____
Note: VMRC Regulation 4VAC 20-754 et seq. "Pertaining to the Importation of Fish, Shellfish or Crustacea" sets forth the requirements for importing organisms from out of state.

Describe below the number, type, and dimensions of the structures that will be used (e.g., 4' x 2' x 18" floats, 3' x 3' x 1' bottom cages, etc.) and the overall dimensions of the area to be occupied by the aquaculture structures (e.g., two 40-foot by 10-foot bottom plots).

NOT APPLICABLE

23. PRIVATE AND COMMERCIAL AQUACULTURE ACTIVITIES (Continued)

Will the structures be affixed to an existing structure? _ _Yes _ __No
If so, describe the attachment below.

NOT APPLICABLE

Will the structures be located on leased oyster planting ground? _____Yes _____No
If so, give the following information: _____lease number _____plat file number

24. IMPOUNDMENTS, DAMS, AND STORMWATER MANAGEMENT FACILITIES

If the impoundment or dam is a component of a water withdrawal project, also complete Sections 26 through 28.

Will the proposed impoundment, dam, or stormwater management facility be used for agricultural purposes (e.g., in the operation of a farm)? For DEQ permitting purposes, a farm is considered to be a property or operation that produces goods for market.
___ Yes ___ No

What type of materials will be used in the construction (earth, concrete, rock, etc.)? _____

What is the source of these materials? _____

Provide the dimensions of proposed impoundment, dam, or stormwater management facility, including the height and width of all structures.

Storage capacity* of impoundment: _____acre-feet *should be given for the normal pool of recreational or farm ponds, or design pool for stormwater management ponds or reservoirs (the elevation the pond will be at for the design storm, e.g., 10-year, 24-hour storm)	Surface area** of impoundment: _____acres **should be given for the normal pool of recreational or farm ponds, or design pool for stormwater management ponds or reservoirs (the elevation the pond will be at for the design storm, e.g., 10-year, 24-hour storm)

Is the proposed project excluded from the Virginia Dam Safety Regulations? ___ Yes ___ No ___ Uncertain

If not excluded, does your proposed project comply with the Virginia Dam Safety Regulations? ___ Yes ___ No ___ Uncertain

Does the proposed design include a vegetation management area per §10.1-609.2? ___ Yes ___ No ___ Uncertain

If your answer to these questions is no or uncertain, you should contact the Virginia Department of Conservation and Recreation's Dam Safety Program at (804) 371-6095 or reference the regulations on the Web at http://www.dcr.virginia.gov/dam_safety_and_floodplains/index.shtml

NOT APPLICABLE

For stormwater management facilities:
Design storm event: _____year storm
Retention time: _____hours
Current average flow: _____cfs
Proposed peak outflow for the design storm provided above: _____cfs

Has the facility been designed as an Enhanced Extended Detention Basin or an Extended Detention Basin in accordance with the Minimum Standard 3.07 of the Virginia Stormwater Management Handbook, Volume I (published by the Virginia Department of Conservation and Recreation, 1999), or in accordance with the latest version of this handbook? _____Yes _____No

Will the impoundment structure be designed to pass a minimum flow at all times? _____Yes _____No
If so, please give the minimum rate of flow: _____cfs

What is the drainage area upstream of the proposed impoundment? _____square miles

How much of your proposed impoundment structure will be located on the stream bed? _____square feet

What is the area of vegetated wetlands that will be excavated and/or backflooded by the impoundment? _____ square feet

What is the *area and length* of streambed that will be excavated and/or backflooded by the impoundment? _____ square feet
_____ linear feet

Are fish ladders being proposed to accommodate the passage of fish? _____Yes _____No

25. OUTFALLS NOT ASSOCIATED WITH PROPOSED WATER WITHDRAWAL ACTIVITIES

Type and size of pipe(s): _____

Daily rate of discharge: _____mgd

If the discharge will be thermally-altered, provide the maximum temperature: _____

Contributing drainage area: _____square miles

Average daily stream flow at site:_____cfs

NOT APPLICABLE

Have you received a Virginia Discharge Elimination System (VPDES) permit for the proposed project? ___ Yes ___ No.
If yes, please provide the VPDES permit number: _____.
If no, is there a permit action pending? ___ Yes ___ No. If pending, what is the facility name? _____.

The following sections are typically related to surface water withdrawal activities; Federal Energy Regulatory Commission license projects; or impacts likely to require instream flow limits. Examples of such projects include, but are not limited to, reservoirs, irrigation projects, power generation facilities, and public water supply facilities that may or may not have associated features, such as dams, intake pipes, outfall structures, berms, etc.

If completing these sections, enter "N/A" in any section that does not apply to the project.

26. INTAKES, OUTFALLS, AND WATER CONTROL STRUCTURES (INCLUDING ALL PROPOSED WATER WITHDRAWAL ACTIVITIES)

For intakes:

Type and size of pipe(s): 3, 36" dia w/7' dia. screens
Type and size of pump(s): to be determined in design
Daily rate of withdrawal: 18 mgd
Velocity of withdrawal: 0.25 fps
Screen mesh size: _____inches / 1 mm
If other sizing units, please specify:_____
Contributing drainage area at withdrawal point(s): 454 square miles
Average daily stream flow at withdrawal point(s): (Tidal) cfs
Average annual stream flow at withdrawal point(s): (Tidal) cfs
Latitude and longitude of withdrawal point(s) (degrees, minutes, seconds): 37°16'5"/-76°52'38"

For outfalls:

Type and size of pipe(s): _____
Daily rate of discharge: _____mgd
If the discharge will be thermally-altered, provide the maximum temperature: _____
Contributing drainage area at discharge point(s): _____square miles
Average daily stream flow at discharge point(s):_____cfs
Latitude and longitude of discharge point(s) (degrees, minutes, seconds): _____

Outfall will be designed and permitted as Phase 2 of the project

For intakes and dams, use the table below to provide the median monthly stream flows in cubic feet per second (cfs) at the water intake or dam site (not at the stream gage; if there is not a gage at the intake or dam site, you will need to interpolate flows to the intake or dam site based upon the most closely related watershed in which there is an operational stream gage monitored by the United States Geologic Survey (USGS)). Median flow is the value at which half of the measurements are above and half of the measurements are below. Median is also sometimes referred to as the '50% exceedence flow'. The median flow generally must be calculated from USGS historical data. Please do not provide *mean (average)* flow.

Month	Median flow (cfs)	Month	Median flow (cfs)
January		July	
February		August	
March			
April		October	
May		November	
June		December	

TIDAL FLOW - NOT APPLICABLE (REFER TO ATTACHMENT E)

26. INTAKES, OUTFALLS, AND WATER CONTROL STRUCTURES (Continued)

For interbasin transfer of water resources proposed from either the Chowan River, New River, Potomac River, Roanoke River, Big Sandy River, or Tennessee River basins to another river basin, provide the following information: **NOT APPLICABLE**

For the destination location (discharge point) of the transfer:

8- digit USGS Hydrologic Unit Code (HUC) (See http://cfpub.epa.gov/surf/locate/index.cfm): _____

If known, indicate the 10-digit and 12-digit USGS HUCs (see http://dswcapps.dcr.virginia.gov/htdocs/maps/HUExplorer.htm:

_____ _____

Latitude and Longitude: _____- _____- _____/ _____- _____- _____

Describe the stream flow gages used, the type of calculations used (such as drainage area correction factors), and the period of record that was used to calculate the median flows provided in the table above. Generally, the period of record should span a minimum of 30 years.

Refer to Attachment E, Chickahominy River Flow Determination Memorandum.
Stream flow gages: USGS 02042500 (Chickahominy River @ Providence Forge, January 1942-present) and NOAA Station ID 8638610 (Sewell's Point; gage in service since 1927)
Average streamflows were estimated by applying linear scaling to the USGS data. Tidal prism method was used to determine tidal flux using the NOAA data.

Provide any available historical low-flows at the intake or dam site.

No data available.

Describe how the proposed withdrawal at the intake or dam site will impact stream flows in terms of rates, volumes, frequency, etc. (i.e. percent of the flow to be withdrawn, percent of withdrawal returned to the original source, etc.).

Average streamflow without Newport News Waterworks (NNWW) withdrawal at Walker's Dam is estimated to be 480 cfs and 415 cfs if NNWW withdrawal is 65.4 cfs (42.2 mgd) based on max day withdrawal from 1997 to 2015 provided by DEQ. Tidal influx is estimated to be 35,301 cfs. Withdrawal of 27.9 cfs (18 mgd) constitutes approximately 0.08% of the average streamflow with the tidal influx. Approximately 4 mgd will be returned downstream of the withdrawal point on a different site as concentrate discharge from the WTF; the location of the concentrate discharge will be determined based on salinity modeling results.

Describe how the withdrawal of water will vary over time. For example, will the withdrawal vary by the time of year, by the time of day, or by the time of week? Examples of projects that should describe variable withdrawals include, but are not limited to: power plant cooling withdrawals that increase and decrease seasonally; golf course irrigation; municipal water supply; nurseries; ski resorts that use water for snowmaking; and resorts with weekend or seasonal variations.

Refer to Attachment F for description and graphical illustration of demand variation.

Provide the amount of water that will be lost due to consumptive use. For the purpose of this application, consumptive use means the withdrawal of surface waters without recycling of said waters to their source or basin of origin. Examples of consumptive uses are water that is evaporated in cooling towers or by other means in power plants; irrigation water (all types); residential water use that takes place outside of the home; and residential water use both inside and outside of homes for residences served by septic systems. Projects that propose a transfer of water from one river basin to another and/or localities that sell water to other jurisdictions, should document the portion of the withdrawal that is not returned to the originating watershed.

Proposed monthly consumptive volume: 8 mgdx30 days=240 million gallons

Attach a map showing the location of the withdrawal and the location of the return of flow.

The location of the withdrawal is shown in Appendix D, Figures D-1, D-1a, and D-2. The location of the return of flow will be on a different site downstream of the intake and will be determined based on salinity modeling results. concentrate brine discharge will be returned downstream of the intake location. The project will be implemented in two phases; the design and permitting for the return flow (including outfall and transmission line) will occur as part of Phase 2 of the project and is not included as part of this application.

26. INTAKES, OUTFALLS, AND WATER CONTROL STRUCTURES (Continued)

For withdrawals proposed on an impoundment, provide a description of flow or release control structures. Include type of structure, size, capacity, and the mechanism used to control release. Provide a description of available water storage facilities. Include the volume, depth, normal pool elevation, unusable storage volume and dimensions. If applicable, stage-storage relationship at the impounding structure and volume or rate of withdrawals from the storage facility.

Not applicable

For withdrawals proposed on an impoundment, provide a description of flow or release control structures. Include type of structure, size, capacity, and the mechanism used to control release.

Not applicable

27. WATER WITHDRAWAL USE, NEED, AND ALTERNATIVES

Describe the proposed use of the water withdrawal.

The water withdrawn will primarily be used to provide potable water supply for residents of James City County. The water will also be used in the reverse-osmosis process necessary to treat the raw water to meet drinking water standards for potable use; the concentrate brine discharge will be returned downstream of the intake location. The project will be implemented in two phases; the design and permitting for the return flow (including outfall and transmission line) will occur as part of Phase 2 of the project and is not included as part of this application.

Provide the following information at the water intake or dam site. Specify the units of measurement (i.e. million gallons per day, gallons per minute, cubic feet per second, etc.).

Proposed maximum instantaneous withdrawal 18 mgd (12,500 gpm)

Proposed average daily withdrawal 12 mgd

Proposed maximum daily withdrawal 18 million gallons

Proposed maximum monthly withdrawal 1.33 x 12 mgd avg x 31 days = 494,760,000 gallons

Proposed maximum annual withdrawal 12 mgd x 366 days = 4,392 million gallons

Describe how the above withdrawals were calculated, including the relevant assumptions made in that calculation and the documentation or resources used to support the calculations, such as population projections, population growth rates, per-capita use, new uses, changes to service areas, and if applicable, evapotranspiration data and irrigation data.

Based on the 2009-2014 historical growth of 412 water connections per year, neighborhood buildout data, and growth trends resulting from local environmental and economic conditions, projected average day and maximum day (peak day) demand are estimated to be 8.9 and 13.3 mgd, respectively by 2050. JCSA has a permitted annual groundwater withdrawal of 8.8 mgd and monthly maximum withdrawal of 11.8 mgd. Approximately 0.96 mgd of the withdrawal is water used for the treatment processes at the Five Forks water treatment facility. DEQ is planning to reduce JCSA's permitted groundwater withdrawal; a reduction to 4 mgd annual average has been proposed, but has not been finalized. A 4-mgd reduction would result in a finished water deficit of 8.2 mgd by 2050. Should aggressive population growth occur as estimated in the Hampton Roads Regional Water Supply Plan, the projected maximum day demand is 21 mgd by 2050, resulting in a deficit of 11 mgd based on the existing permitted withdrawal and 15.8 mgd if the permitted withdrawal is reduced to 4 mgd. This project is based on an initial finished water treatment plant capacity of 8 mgd with a buildout capacity of 12 mgd. The withdrawal requirement for a 12-mgd reverse osmosis treatment facility is 17.17 mgd which was rounded up to 18 mgd. Additional information is provided in Attachment A, Water Supply Study, Sections 3 and 9.

27. WATER WITTHDRAWAL USE, NEED AND ALTERNATIVES (Continued)

For major surface water withdrawals, public water supply withdrawals, and projects that will alter instream flows, provide information to establish the local water supply need:

Existing supply sources, yields, and demands: Groundwater; Existing DEQ permitted annual withdrawal = 3,222,269,520 gal.(8.83 mgd) & monthly withdrawal = 364,798,000 gallons (11.8 mgd); yr 2015 peak day demand = 7.23 mgd (historical max (yr 2010) = 9.17 mgd)

Peak day withdrawal: Yr 2015 = 8,092,952 million gallons; historical max, 7/7/2010 = 10,024,567 million gallons)

Average daily withdrawal: Yr 2015= 5.39 mgd; historical highest average daily withdrawal (yr 2010) = 5.72 mgd

Safe yield: DEQ existing permitted annual withdrawal = 3,222,269,520 gal & monthly withdrawal = 364,798,000 gallons

Lowest daily flow of record: Not applicable - groundwater source

Types of water uses:
Potable water, water treatment plant process water

Existing water conservation measures and drought response plan, including what conditions trigger implementation:
Response is provided in Attachment G.

Projected demands over a minimum 30-year planning period:
Yr 2050, Average day = 8.89 mgd, Maximum Day = 13.33 mgd

Projected demands in local or regional water supply plan (9 VAC 25-780 et seq.) or demand for the project service area, if that is smaller in area:
Yr 2050, Average day demand = 8.89 mgd, Maximum day (peak day) demand = 13.33 mgd

Statistical population (growth) trends: 412 connections per year (1009 people/yr) i.e. slightly less than 2 percent per year

Projected demands by use type: 35% commercial/industrial, 65% residential

Projected demands without water conservation measures: Unknown

Projected demands with long-term water conservation measures: Yr 2050 average day=8.89 mgd; max day=13.33 mgd

For surface water withdrawals other than public water supply, provide information or documentation that demonstrates alternate sources of water are available for the proposed project during times of reduced instream flow.

Not Applicable - Public Water Supply

Provide information from the water supply plan that covers the area in which the proposed water withdrawal project is located. Include information from the plan that pertains to projected demand, analysis of alternatives, and water conservation measures. Discuss any discrepancies between the water supply plan and the proposed project. For projects that propose a transfer of water resources from the Chowan River, New River, Potomac River, Roanoke River, Big Sandy River, or Tennessee River basins to another river basin, information should be provided from the water supply plans for both the source and receiving basins.

Response is provided in Attachment H.

Provide an alternatives analysis for the proposed water withdrawal project, including the required range of alternatives to be analyzed; a narrative outlining the opportunities and status of regional efforts undertaken; and the criteria used to evaluate each alternative. The analysis must address all of the criteria contained in 9 VAC 25-210-115 C 2 and 9 VAC 25-210-115 C 3.

Response is provided in Attachment I.

27. WATER WITTHDRAWAL USE, NEED AND ALTERNATIVES (Continued)

Describe any existing, flow-dependent beneficial uses along the affected stream reach. Include both instream and offstream uses. Describe the stream flow necessary to protect existing beneficial uses, how the proposed withdrawal will impact existing beneficial uses, and any measures proposed to mitigate any adverse impacts that may arise. For projects that propose a transfer of water resources from the Chowan River, New River, Potomac River, Roanoke River, Big Sandy River, or Tennessee River basins to another river basin, this analysis should include both the source and receiving basins. For the purposes of this application, beneficial instream uses include, but are not limited to: the protection of fish and wildlife habitat; maintenance of waste assimilation; recreation; navigation; and cultural and aesthetic values. Offstream beneficial uses include, but are not limited to: domestic (including public water supply); agriculture; electric power generation; commercial; and industrial.

Response is provided in Attachment K.

Describe the aquatic life known to be present along the affected stream reach. Describe aquatic life that may be impacted by the proposed water withdrawal. Include the species' habitat requirements. For projects that propose a transfer of water resources from either the Chowan River, New River, Potomac River, Roanoke River, Big Sandy River, or Tennessee River basins to another river basin, this analysis should include both the source and receiving basins.

The project area is located in a tidal freshwater river system. These areas are in the uppermost part of the estuarine zone where there is a tidal influence bringing saltwater into a larger volume of freshwater. Typically, the salt concentrations in freshwater are less than 0.5 parts per trillion, but will have larger concentrations depending on the tidal flow, or low river discharge. These tidal freshwater beds are home to many floating and submerged plants that provide breeding and foraging habitat for insects, crustaceans, amphibians, birds, and fish. More details on aquatic life are provided in Attachment L.

28. PUBLIC COMMENTS/ISSUES FOR MAJOR WATER WITHDRAWALS OR INTERBASIN TRANSFERS

For new or expanded major surface water supply projects, use separate sheets of paper to summarize the steps taken to seek public input per 9 VAC 25-210-75, and identify the issues raised during the public information process. **REFER TO ATTACHMENT M**

For interbasin transfer of water resources proposed from either the Chowan River, New River, Potomac River, Roanoke River, Big Sandy River, or Tennessee River basins to another river basin, if public input was not required per 9 VAC 25-210-75, summarize on separate sheets of paper any coordination and/or notice provided to the public, local/state government, and interested parties in the affected river basins and identify any issues raised.

APPENDIX A

Adjacent Property Owner's Acknowledgement Form

I, _____, own land next to/ across the water from/ in the same cove
(print adjacent property owner's name)

as the land of _____ .
(print applicant's name)

I have reviewed the applicant's project drawings dated _____ to be submitted for all
(date of drawings)

necessary Federal, State, and Local permits.

_____ I have no comment regarding the proposal

_____ I do not object to the proposal

_____ I object to the proposal

The applicant has agreed to contact me for additional comments if the proposal changes prior to construction of the project.

(Before signing this form, please be sure that you have checked the appropriate option above)

_____
Adjacent property owner's signature

_____
Date

NOTE: IF YOU OBJECT TO THE PROPOSAL, THE REASON(S) YOU OPPOSE THE PROJECT MUST BE SUBMITTED TO VMRC IN WRITING. AN OBJECTION WILL NOT NECESSARILY RESULT IN A DENIAL OF A PERMIT FOR THE PROPOSED WORK. HOWEVER, VALID COMPLAINTS WILL BE GIVEN FULL CONSIDERATION DURING THE PERMIT REVIEW PROCESS.

APPENDIX A

Adjacent Property Owner's Acknowledgement Form

I, _____, own land next to/ across the water from/ in the same cove
(print adjacent property owner's name)

as the land of _____ .
(print applicant's name)

I have reviewed the applicant's project drawings dated _____ to be submitted for all
(date of drawings)

necessary Federal, State, and Local permits.

_____ I have no comment regarding the proposal

_____ I do not object to the proposal

_____ I object to the proposal

The applicant has agreed to contact me for additional comments if the proposal changes prior to construction of the project.

(Before signing this form, please be sure that you have checked the appropriate option above)

_____
Adjacent property owner's signature

_____
Date

NOTE: IF YOU OBJECT TO THE PROPOSAL, THE REASON(S) YOU OPPOSE THE PROJECT MUST BE SUBMITTED TO VMRC IN WRITING. AN OBJECTION WILL NOT NECESSARILY RESULT IN A DENIAL OF A PERMIT FOR THE PROPOSED WORK. HOWEVER, VALID COMPLAINTS WILL BE GIVEN FULL CONSIDERATION DURING THE PERMIT REVIEW PROCESS.

U.S. Army Corps
Of Engineers
Norfolk District

Regional Permit 17 Certificate of Compliance Form

Please obtain and read a copy of the 13-RP-17 prior to completion of this form. Copies can be obtained by contacting the U.S. Army Corps of Engineers Regulatory Branch (Corps) at (757) 201-7652 or on our website at: http://www.nao.usace.army.mil/Missions/Regulatory/RBregional.aspx .

YES☐ NO☐ Is the proposed pier for private use ONLY?

YES☐ NO☐ Does the proposed pier extend LESS than ¼ the width of the waterway as measured from MHW to MHW or OHW to OHW (including channelward wetlands) based on the narrowest distance across the waterway regardless of the orientation of the proposed pier (MHW = mean high water line; OHW = ordinary high water line)?

YES☐ NO☐ Does the proposed pier and/or mooring structure(s) extend LESS than 300 feet from the mean high water line or ordinary high water line?

YES☐ NO☐ N/A☐ If the proposed structure crosses wetland vegetation, is it of an open-pile design that has a maximum width of five (5) feet and a minimum height of four (4) feet between the decking and the wetland substrate?

YES☐ NO☐ N/A☐ If the proposed pier is to include an attached open-sided roof designed to provide shelter, is the cumulative roof square footage less than 700 square feet?

YES☐ NO☐ N/A☐ Is the total number of boat slips on the property less than or equal to two boat slips?

YES☐ NO☐ Have you confirmed that the proposed construction will not take place in one of the reaches which serve as habitat for federally threatened and endangered species, Federal Navigation Channels, and/or does not meet any of the requirements listed in the "V. NOTIFICATION REQUIREMENTS #1-7" section of this permit?

YES☐ NO☐ N/A☐ If the proposed work is in portions of any waterways listed in Special Condition 6, have you obtained an easement to cross government property from the Army Corps of Engineers Real Estate Office?

IF YOU HAVE ANSWERED "NO" TO ANY OF THE QUESTIONS ABOVE, THE REGIONAL PERMIT 17 WILL NOT APPLY AND YOU WILL NEED TO SUBMIT A JOINT PERMIT APPLICATION AND OBTAIN A SEPARATE PERMIT FROM THE CORPS BEFORE COMMENCING CONSTRUCTION.

IF YOU HAVE ANSWERED "YES" (OR "N/A", WHERE APPLICABLE) TO ALL OF THE QUESTIONS ABOVE, YOU ARE IN COMPLIANCE WITH THE REGIONAL PERMIT 17. PLEASE SIGN BELOW, ATTACH, AND SUBMIT WITH YOUR COMPLETED JOINT PERMIT APPLICATION. THIS SIGNED CERTIFICATE SERVES AS YOUR LETTER OF AUTHORIZATION FROM THE CORPS. YOU WILL NOT RECEIVE ANY OTHER WRITTEN AUTHORIZATION FROM THE CORPS. HOWEVER, YOU MAY NOT PROCEED WITH CONSTRUCTION UNTIL YOU HAVE OBTAINED ALL OTHER NECESSARY STATE AND LOCAL PERMITS.

I CERTIFY THAT I HAVE READ AND UNDERSTAND ALL CONDITIONS OF THE REGIONAL PERMIT 17 (13-RP-17), DATED AUGUST 14 2013, ISSUED BY THE US ARMY CORPS OF ENGINEERS, NORFOLK DISTRICT REGULATORY BRANCH (CENAO-WR-R), NORFOLK, VIRGINIA.

_____
Signature of Property Owner(s) or Agent

Date 59.2"

Proposed work to be located at:

_____

_____

_____

REVISED: March 2014

APPENDIX C

Chesapeake Bay Preservation Act Information

Please answer the following questions to determine if your project is subject to the requirements of the Bay Act Regulations:

1. Is your project located within Tidewater Virginia? ____Yes ____No (See map on next page) - If the answer is "no", the Bay Act requirements do not apply; if "yes", then please continue to question #2.

2. Please indicate if the project proposes to impact any of the following Resource Protection Area (RPA) features:

   ____ Tidal wetlands,

   ____ Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow,

   ____ Tidal shores,

   ____ Other lands considered by the local government to meet the provisions of subsection A of § 9VAC 25-830-80 and to be necessary to protect the quality of state waters (contact the local government for specific information),

   ____ A buffer area not less than 100 feet in width located adjacent to and landward of the components listed above, and along both sides of any water body with perennial flow.

If the answer to question #1 was "yes" and any of the features listed under question #2 will be impacted, compliance with the Chesapeake Bay Preservation Area Designation and Management Regulations is required. **The Chesapeake Bay Preservation Area Designation and Management Regulations** are enforced through locally adopted ordinances based on the Chesapeake Bay Preservation Act (CBPA) program. Compliance with state and local CBPA requirements mandates the submission of a ***Water Quality Impact Assessment (WQIA)*** for the review and approval of the local government. Contact the appropriate local government office to determine if a WQIA is required for the proposed activity(ies).

The individual localities, not the DEQ, USACE, or the Local Wetlands Boards, are responsible for enforcing the CBPA requirements and, therefore, local permits for land disturbance are not issued through this JPA process. **Approval of this wetlands permit does not constitute compliance with the CBPA regulations nor does it guarantee that the local government will issue land-disturbing permits for this project**.

Notes for all projects in RPAs

Development, construction, land disturbance, or placement of fill within the RPA features listed above *requires a review from the locality and may require an exception or variance from the local Bay Act program or zoning ordinance*. Please contact the appropriate local government to determine the types of development or land uses that are permitted within RPAs.

Pursuant to § 9VAC 25-830-110, *on-site delineation of the RPA is required for all projects in CBPAs*. Because USGS maps are not always indicative of actual "in-field" conditions, they may not be used to determine the site-specific boundaries of the RPA.

Notes for shoreline erosion control projects in RPAs

Re-establishment of woody vegetation in the buffer may be required to mitigate for the removal or disturbance of buffer vegetation associated with your proposed project. Please contact the local government to determine the mitigation requirements for impacts to the 100-foot RPA buffer.

Pursuant to § 9VAC 25-830-140.5.a(4), § 9VAC 25-830-140.1, and § 9VAC 25-830-130 of the Virginia Administrative Code, the locality will use the information provided in this Appendix and in the project drawings, along with other information in this permit application and a WQIA, to make a determination that:

1. Any proposed shoreline erosion control measure is necessary and consistent with the nature of the erosion occurring on the site, and the measures have employed the "best available technical advice"
2. Indigenous vegetation will be preserved to the maximum extent practicable
3. Proposed land disturbance has been minimized
4. Appropriate mitigation plantings will provide the required water quality functions of the buffer (§ 9VAC 25-830-140.3)
5. The project is consistent with the locality's comprehensive plan
6. Access to the project will be provided with the minimum disturbance necessary.

TIDEWATER VIRGINIA

REVISED: March 2014

APPENDIX D

APPENDIX D – Drawings

On the following pages, you will find sample drawings in plan and cross-sectional view that demonstrate the general format necessary for drawings. You should make sure to consult the detailed lists below to ensure that your drawings contain all of the necessary information. Failure to include all necessary information on your drawings may mean that your application is not considered complete by one or more agencies.

All projects will require the submittal of plan view and cross-sectional view drawings. These drawings should be drawn to a scale no smaller than 1 inch = 200 feet. The number of sets of drawings to be submitted is detailed in the HOW TO APPLY section starting on page 2 of this package. Drawings can be computer-generated or hand-drawn. Please be advised that some Local Wetlands Boards (LWB) require you to have a licensed engineer certify the drawings. You should contact your LWB to determine their specific requirements.

Plan view *drawings should contain the following general informational items:*

- Name of project
- North arrow
- Scale
- Waterway name, if designated
- Existing contours
- Proposed contours (if available)
- Width of waterway from the mean high water level to the mean high water level (tidal areas), or the ordinary high water mark to the ordinary high water mark (nontidal areas)
- Direction of flood and ebb (tidal areas), and/or direction of flow in nontidal areas (if applicable)
- Mean low water level and mean high water level (tidal areas), or ordinary high water mark (nontidal areas)
- Landward limit of the dune or beach at the site

AND Plan view *drawings should also contain the following specific informational items* ***if they apply to the project****:*

Resource Impact/Protection-Specific Items:

- Limits: of existing wetlands, open water, or streams, including submerged aquatic vegetation (SAV); of proposed impact areas, such as fill areas (square feet or acres) or dredge areas; of Chesapeake Bay Preservation Act Resource Protection Area(s) (RPA), including the 100-foot buffer; of proposed clearing within the RPA buffer
- Location and type of existing vegetation within the 100-foot RPA buffer; location of proposed wetland planting areas (as restoration for temporary impacts or mitigation for permanent impacts); locations of existing and proposed stream channel(s), including all proposed riffle/pool complexes, bars, and bank stabilization structures; location of proposed riprap scour protection
- Historic/cultural resources
- Threatened/Endangered resources

Structure/Project-Specific Items:

- Existing and proposed structures, labeled as ‘existing’ and ‘proposed’, and their dimensions. These items may include pier(s), including L-heads, T-heads, platforms, and/or decks; roof(s) on roofed structures located over waterways, including boathouses; gasoline storage tanks and/or structures for collecting and handling hazardous material, including settling tanks for travel lift washdown water, paint chips, etc.; return walls; tie-ins to existing bulkhead(s) or riprap; utility line easement(s); utility line/road right(s)-of-way; aerial transmission line structure(s), including towers, poles, platforms, etc.; onsite or offsite dredged material disposal areas, including location of all berms, spillways, erosion and sediment control measures, outfall pipes, and aprons; temporary stockpiles of excavated material; temporary construction access facilities; risers and/or emergency spillways, labeled with their proposed invert elevations; design pool/normal pool for stormwater management ponds/impoundments/reservoirs; intakes and/or outfalls, including splash aprons, relative to mean high water, mean low water, or ordinary high water mark(s); anchoring devices and weights (mooring buoys), including the total swing radius
- Channelward encroachment of proposed structure(s) from mean high water and mean low water, or from ordinary high water mark
- For piers that cover ¼ or more of the waterway width: depth soundings, taken at the mean low water level (tidal areas) or the ordinary high water mark (nontidal areas)
- Distance(s) between structure(s) (piers, boathouses, catwalks, etc.) and mooring pile(s)
- Minimum distance between dredge cut and vegetated wetlands
- Latitude and longitude of all mooring structures, in degrees, minutes, and seconds
- End points and turning points along proposed bulkhead(s), labeled as such
- For bulkheads, measurements from each end point and each turning point along proposed bulkhead(s) to two fixed points of reference (labeled as such)
- Structure or method used to contain fill (hay bales, silt fences, etc.)
- Dimensions of impoundment, dam, or stormwater management facility and area of any vegetative management areas

Cross-section view *drawings should contain the following General Informational items:*

- Name of project
- North arrow
- Scale
- Waterway name
- Mean low water and mean high water lines (tidal areas), and/or ordinary high water mark (nontidal areas)
- Direction of flood and ebb (tidal areas), and/or direction of flow in nontidal areas (if applicable)
- Existing contours of the bottom (depths relative to mean low water or ordinary high water mark) and the bank itself
- Existing contours of the dune or beach

AND Cross-section view *drawings should also contain the following specific informational items* ***if they apply to the project****:*

Resource impact/protection-specific Items:

- Riprap scour protection
- Proposed wetland planting areas, relative to mean high water and mean low water (tidal areas), or ordinary high water mark (nontidal areas)
- Depth of buried toe of riprap or marsh toe stabilization
- Base width, top width, and slope of stone/concrete stabilization structures

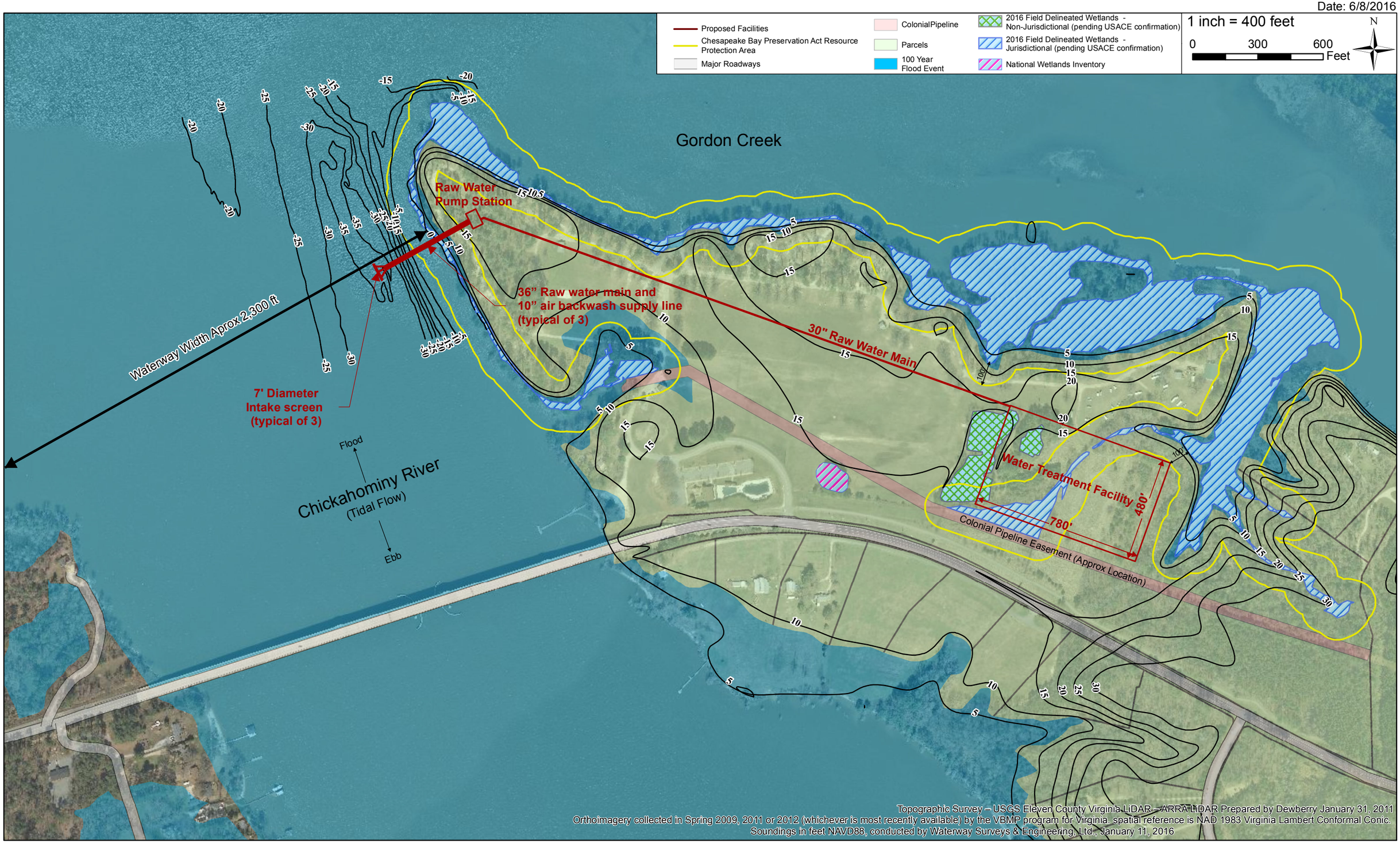
Structure/Project-Specific Items:

- Existing and proposed structures, labeled as ‘existing’ and ‘proposed’, and their dimensions. These items may include fill areas, labeled with square footage(s) or acreage(s) over vegetated wetlands and subaqueous bottom; berms, spillways, erosion and sediment control measures, outfall pipes, and aprons at onsite or offsite dredged material disposal area(s); bank grades; deadmen, sheeting, knee braces, etc., as used in the construction of bulkheads; filter cloth; weep holes; intakes and/or outfalls, including splash aprons, relative to mean high water, mean low water, or ordinary high water mark; risers and/or emergency spillways; low-flow channels; culverts, including their proposed invert elevations and diameters; anchoring systems for aquaculture structures; type of chain used to secure mooring buoys to subaqueous bottom
- For dredge projects, proposed contours of the bottom (depth relative to mean low water or ordinary water level)
- Bottom width of proposed dredge cut, projected side slope of cut, and estimated top width of cut
- Ponding depth of onsite or offsite dredged material disposal area
- Minimum distance between pier decking and vegetated wetland substrate (a.k.a. the “mud line”)
- Water depth below mean low water at the end of proposed boat ramps
- Depth of penetration of pilings and/or sheeting (bulkheads)
- Elevation of any proposed fill (including backfill)
- Structure or method used to contain fill (hay bales, silt fences, etc.)
- Design pool/normal pool elevation for stormwater management facilities/impoundments/reservoirs
- Vertical distance from the water surface (relative to mean high water or ordinary high water mark) for all aerial crossings (bridges or overhead utility lines) over navigable water bodies
- Depth below bottom of water body for submarine utility crossings
- Dimensions of impoundment, dam, or stormwater management facility through a cross-section of the structure(s); bottom elevation(s) of basin created; depth of pool; and depth(s) to structure(s) on the bottom.

APPENDIX D

Drawings

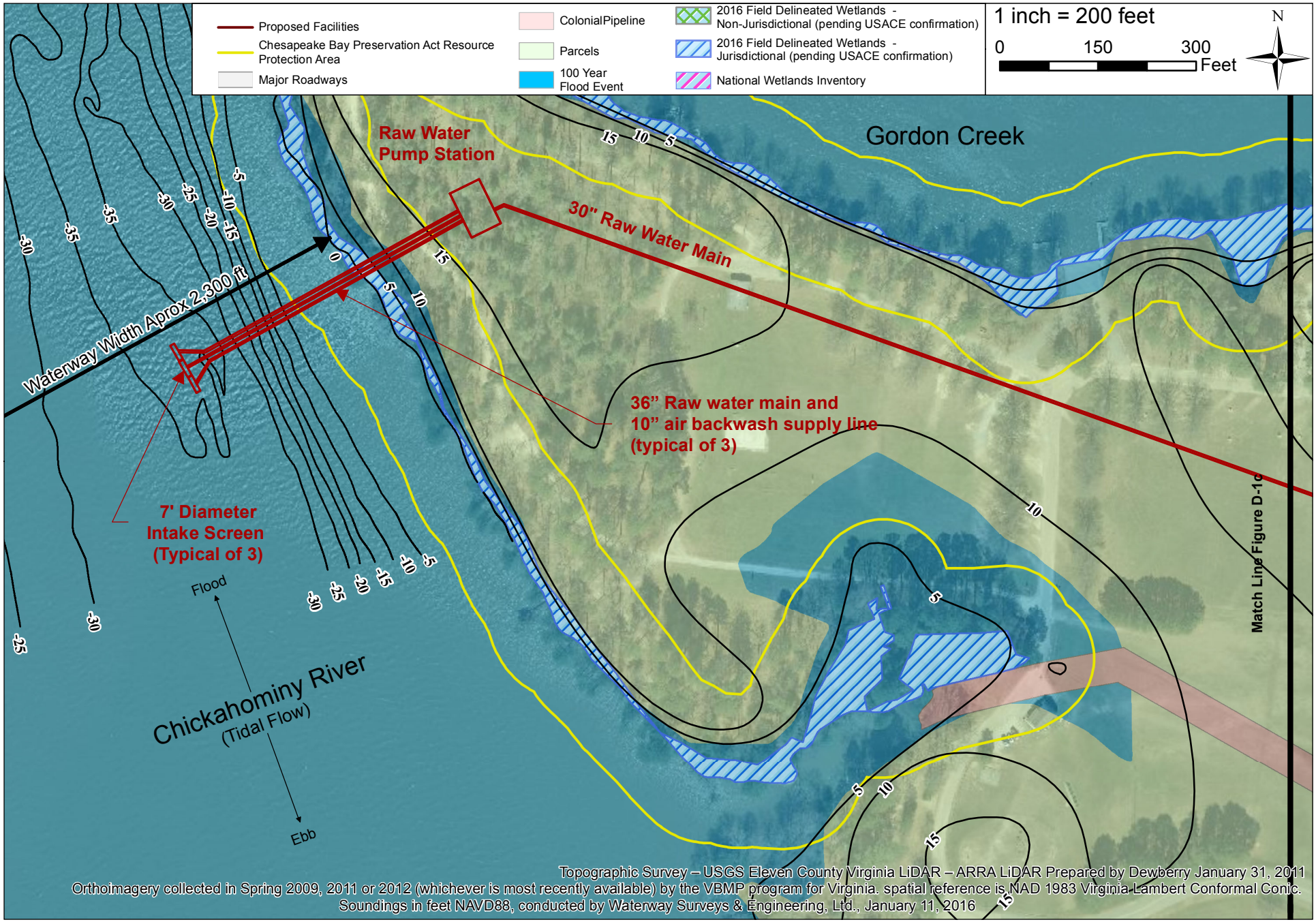
Date: 6/8/2016



CDM Smith

Figure D-1a
Chickahominy Riverfront Park Water Treatment Facility
Conceptual Site Plan

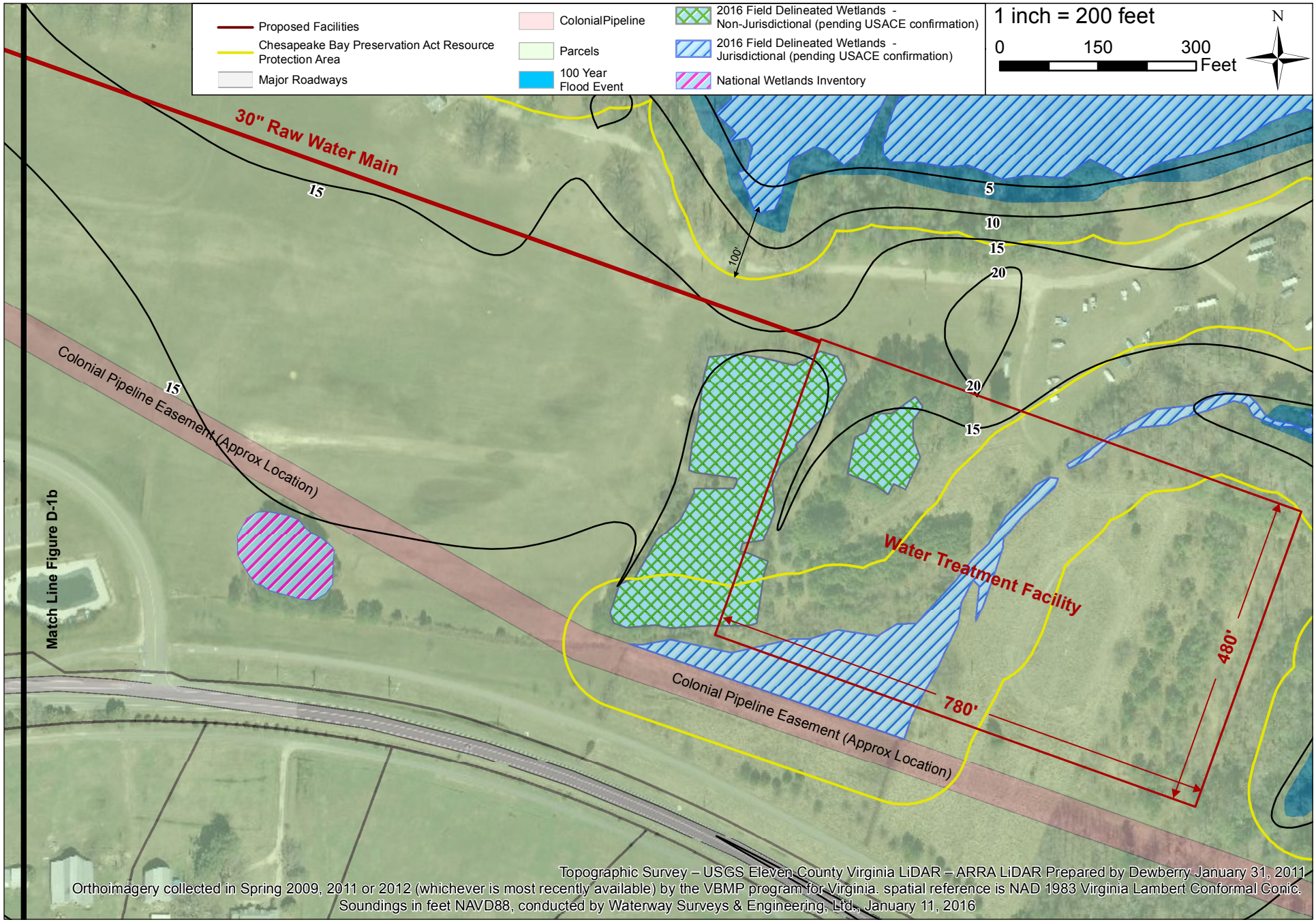
Date: 6/8/2016



CDM Smith

Figure D-1b
Chickahominy Riverfront Park Water Treatment Facility
Conceptual Site Plan

Date: 6/8/2016



CDM Smith

Figure D-1c
Chickahominy Riverfront Park Water Treatment Facility
Conceptual Site Plan

Date: 6/8/2016

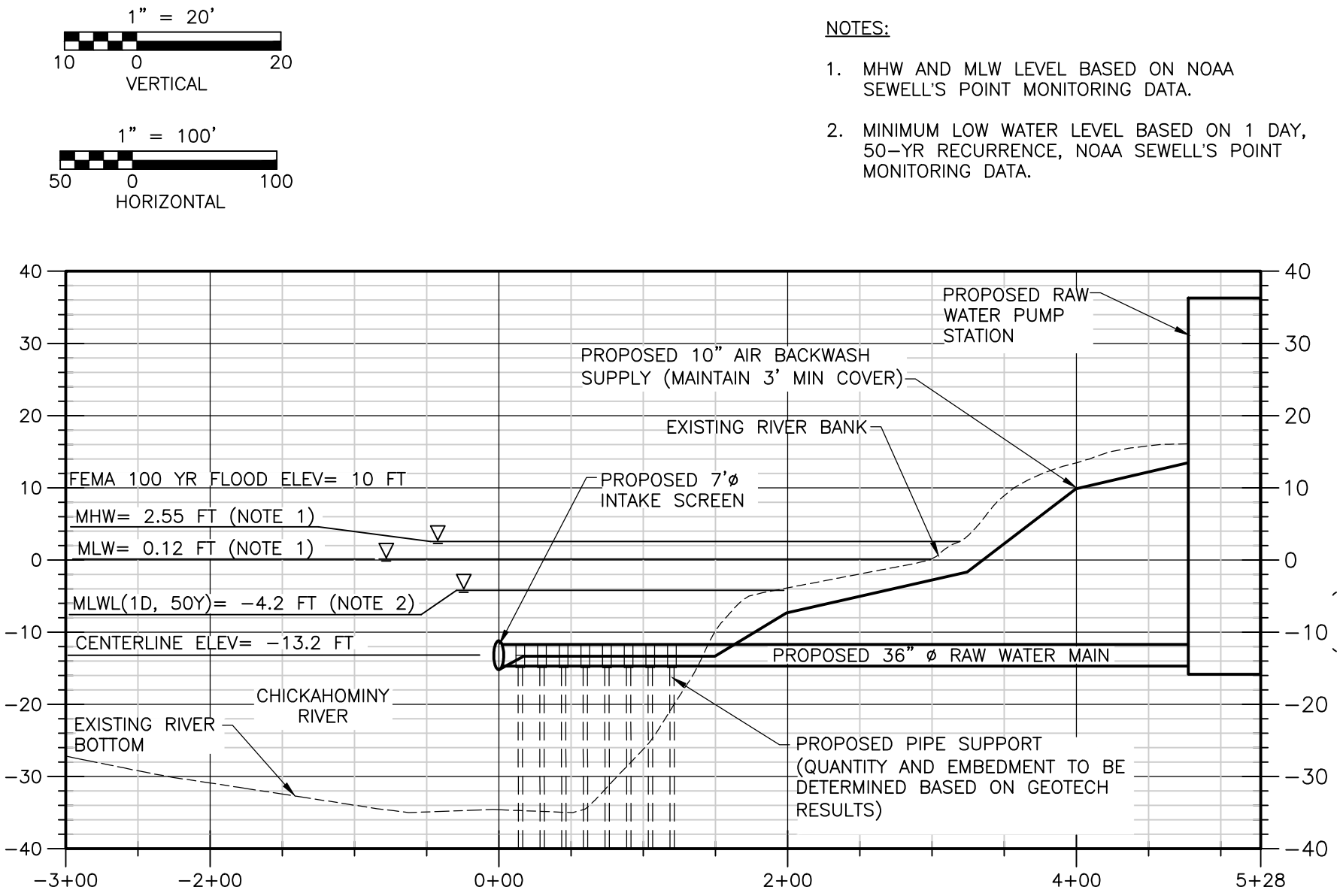


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Figure D-2
Chickahominy Riverfront Park
Raw Water Intake Profile

ATTACHMENT A

Project Description and Water Supply Study

Water Supply Study		Applicable Sections		
		JPA		
Section No.		**Item 3**	**Item 26**	**Item 27**
1	Introduction	✓		
2	Existing DEQ Groundwater and VDH Operations Permits	✓		
3	Water Supply Needs	✓	✓	✓
4	Newport News Waterworks Water Purchase Agreement			
5	Ware Creek Reservoir	✓		✓
6	King William Reservoir	✓		✓
7	York River	✓		✓
8	James River	✓		✓
9	Chickahominy River	✓	✓	✓
10	Groundwater Sources	✓		✓
11	Permit and Approval Requirements	✓		✓
12	Evaluation Results of Potential Alternatives	✓		✓

Project Description

Purpose and Need

JCSA relies solely on groundwater as its primary water supply source. DEQ intends to reduce the amount of groundwater that JCSA can withdraw due to declining groundwater levels, advancing saltwater intrusion, and land subsidence in the Eastern Virginia Groundwater Management Area. DEQ proposes to reduce JCSA's permitted annual withdrawal amount from 8.83 million gallons per day (mgd) to 3.8 to 4.0 mgd; DEQ has not finalized the reduction amount nor the date when the reduction would be implemented. If DEQ reduces the permitted annual withdrawal to 4.0 mgd, JCSA will have an immediate deficit in their water supply. The 2015 average day withdrawal was 5.39 mgd with a peak day withdrawal of 8.09 mgd. The 2015 average day demand was 4.72 mgd with a peak day demand of 7.23 mgd. The difference between the demand and the water withdrawal is attributed to the process water used for reverse osmosis at the Five Forks Water Treatment Facility. The projected 2050 average day and peak day demands are 8.89 and 13.33 mgd, respectively. (Refer to Section 3 of the attached Water Supply Study for additional information.)

Alternatives Considered

JCSA evaluated the following potential surface water supply alternatives to meet their demands: Chickahominy River, James River, and York River. While all of these surface water supplies have brackish water with tidal influence and require reverse-osmosis treatment, Chickahominy River has the lowest estimated salinity. Chickahominy Riverfront Park which is owned by James City County was selected for this project. (Additional information on the alternatives analysis is provided in Attachments A and I).

Description

This project involves two phases. The first phase involves the construction of an 18- mgd raw water intake and pump station and a reverse-osmosis water treatment facility (WTF) with a finished water capacity of 8 mgd (expandable to 12 mgd) on the Chickahominy Riverfront Park property. The intake and raw water pump station are sized to accommodate a 12-mgd plant capacity to reduce the potential for future river disturbances when the plant expands. Three 36-inch diameter pipes will extend from the proposed raw water pump station approximately 480 feet into the Chickahominy River; a 7-foot diameter wedge-wire screens will be installed at the end of each pipe. Each screen will have 1 mm mesh openings and will be sized for a maximum flow-through velocity of 0.25 feet per second (fps). Each screen will include a 10-inch air burst supply line for periodic cleaning. The WTF will be located on the east side of the property to reduce archaeological impact and retain the park's recreational use.

The second phase will include design and construction of the brine concentrate discharge line and outfall on another site. The site location has not yet been determined.

Physical Alteration of Surface Waters

The raw water supply and treatment facilities described above were sited within the Chickahominy Riverfront Park according to several factors including the presence of waters/wetlands, locations of cultural resources, locations of undeveloped lands (e.g. forested areas), park aesthetics, and park current and future recreational uses. While the intake and raw water pipe directly attached to the intake had to be placed within the Chickahominy River, a

design was chosen to install the pipe perpendicular to the channel to minimize the extent of riverbed impacts. Additionally, those project elements that did not require placement within waters/wetlands, including the raw water pump station, raw water transmission main, and the WTF, were sited in disturbed upland areas to the extent practicable. Only the WTF, due largely to the size of its footprint, will result in impacts to waters/wetlands. Those impacts were minimized by orienting the WTF in such a way to reduce wetland filling to the maximum extent possible.

The installation of the raw water intake and associated raw water piping will involve physical alteration to 42,780 ft^2 of the Chickahominy River and its subaqueous lands. A cofferdam will divert river waters around the intake construction area. The intake will be installed atop footings that will be secured into the riverbed. Associated raw water piping will include three 36-inch diameter pipes that will extend from a proposed raw water pump station approximately 480 feet into the Chickahominy River; a 7-foot diameter wedge-wire screens will be installed at the end of each pipe. Raw water pipes will be installed in a trench and buried into the riverbed.

The raw water pump station and raw water transmission main will be installed in upland areas currently used as campsites, overflow parking, and recreational event fields. The raw water transmission main delivers water from the raw water pump station to the WTF.

The footprint of the WTF occupies 374,400 ft^2 and will impact portions of a man-made catch-and-release fishing pond, isolated forested wetland, intermittent stream channel, and emergent/scrub-shrub wetland. During a formal wetland delineation, conducted in February 2016, the catch-and-release fishing pond and forested wetland were determined to be hydrologically isolated and potentially non-jurisdictional. Impacts to these two areas would be 13,463 ft^2 and 10,226 ft^2, respectively (i.e. roughly 6% of the total WTF footprint). The intermittent channel, which is a maintained drainage ditch, forms the northern boundary of the emergent/scrub-shrub wetland. These areas eventually flow into freshwater tidal wetlands on the south shore of Gordon Creek. Impacts to these two areas include 640 linear feet of intermittent channel and 29,248 ft^2 of emergent/scrub-shrub wetland (i.e. roughly 8% of the total WTF footprint). The intermittent channel will likely need to be re-routed to the north, but would continue to empty into the freshwater tidal wetlands at the same confluence point.

During design, additional ways to minimize impacts to surface waters will be evaluated. For example, the locations of the individual WTF buildings and structures may be oriented in such a way to avoid wetland areas. Access roads can also be located away from surface waters, and where not possible, could cross surface waters immediately and at a right angle to minimize impacts.

FINAL DRAFT REPORT

Water Supply Study

James City Service Authority

Date: April 2015

CONFIDENTIAL

CDM Smith

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fax: 757-596-2694

April 24, 2015

Mr. Michael Vergakis, P.E.
Chief Engineer - Water
James City Service Authority
Engineering
119 Tewning Road
Williamsburg, Virginia 23188-2639

Subject: Water Supply Study – Final Draft Report

Dear Mr. Vergakis:

Enclosed are five copies of the Water Supply Study, Final Draft Report. Comments received from you and your staff on the Revised Draft Report dated February 2015 have been incorporated into this report.

This report evaluates the feasibility of potential water supply sources bordering James City County and the impact of purchasing drinking water from Newport News Waterworks under your current agreement. Based on current permitting conditions and without purchasing water from Newport News Waterworks, it appears that water demands will exceed available permitted capacity by 2020. If JCSA's groundwater withdrawal permit is reduced, the deficit could be immediate.

Thank you for the opportunity to be of service to the James City Service Authority. We look forward to assisting the James City Service Authority in further evaluation of the feasible water supply alternatives. Please contact us if you have any questions.

Very truly yours,

Philip M. Hecht, P.E., BCEE
Senior Project Manager
CDM Smith Inc.

Enclosure

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Acronyms

B	booster stain
cfs	cubic feet per second
cfu	colony-forming units
Cl_2	Chlorine
DBP	Disinfection Byproduct Rule
DCR	Virginia Department of Conservation and Recreation
deg C	degrees Celsius
DEQ	Virginia Department of Environmental Quality
EDR	Electrodialysis reversal
EIS	Environmental Impact Statement
EPA	U. S. Environmental Protection Agency
ES	elevated storage
EVGMA	Eastern Virginia Groundwater Management Area
FBRR	Filter Backwash Recycling Rule
FFWTF	Five Forks Water Treatment Facility
FY	fiscal year
g/L	grams per liter
gpcd	gallons per capita per day
gpm	gallons per minute
GWR	Groundwater Rule
HAA5	Haloacetic Acids 5
hp	horsepower
HRRWSP	Hampton Roads Regional Water Supply Plan
JCSA	James City Service Authority
JPA	Joint Permit Application
kW	kilowatt
LAA	Location Annual Average
LCR	Lead and Copper Rule
LT2	Long Term 2 Enhanced Surface Water Treatment Rule
mgd	million gallons per day
mg/L	milligrams per liter
MIF	minimum instream flow
N	Nitrogen
NNWW	Newport News Waterworks
NTU	Nephelometric Turbidity Units
O&M	Operations and Maintenance
PDA	Project Development Agreement

ppt	parts per thousand
PRV	pressure reducing valve
PSA	Primary Service Area
RAA	Running Annual Average
RO	Reverse Osmosis
rpm	revolutions per minute
RRWSG	Raw Water Regional Water Supply Group
SCADA	supervisory control and data acquisition
TCR	Total Coliform Rule
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TTHM	Total trihalomethane
USACE	U. S. Army Corps of Engineers
uS/cm	microsiemens per centimeter
USGS	United States Geological Survey
VAC	Virginia Administrative Code
VAW	Virginia American Water
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VECOS	Virginia Estuarine and Coastal Observing System
VMRC	Virginia Marine Resources Commission
VPDES	Virginia Pollution Discharge Elimination System
VSMP	Virginia Stormwater Management Program
VT	Virginia Tech
VWP	Virginia Water Protection Permit
W	Well
WTP	Water Treatment Plant

Section 1
Introduction

James City Service Authority (JCSA) is the largest public water system in Virginia that relies solely on groundwater as its primary water supply source.[1] JCSA's reliability of long-term dependence on exclusive use of groundwater is uncertain due to tighter regulatory restriction on groundwater by the Virginia Department of Environmental Quality (DEQ). DEQ regulates and permits groundwater withdrawals in the Eastern Virginia Groundwater Management Area (EVGMA) and proposes to reduce the amount of groundwater that JCSA and other permitted users are permitted to withdraw due to declining groundwater levels, advancing saltwater intrusion, and land subsidence in the EVGMA. A reduction in the permitted groundwater withdrawal will have a significant impact on JCSA's ability to provide adequate water supply to meet their existing and future water demand needs.

JCSA contracted CDM Smith to identify potential water supply options available to meet their projected water demands. The scope of work of the water supply study presented in this report consists of the following tasks:

- Determine water supply needs based on available projections.
- Review the existing groundwater permit and determine potential impacts if withdrawal is reduced.
- Review the Newport News Waterworks (NNWW) water purchase agreement and determine potential impacts for long-term purchase.
- Describe the Ware Creek Reservoir option and state the reasons why the project was abandoned.
- Describe the King William Reservoir option and state the reasons why the project was abandoned.
- Evaluate the York River as a potential water supply source.
- Evaluate the Chickahominy River as a potential water supply source.
- Evaluate the James River as a potential water supply source.
- Evaluate the feasibility of expanding the existing Five Forks water treatment facility by 20 percent.
- Provide a matrix of viable water supply options including the pros and cons for each option.

The analysis of each water supply alternative includes identification of treatment options, permit requirements/obstacles, probability of success, and financial impacts. Hydraulic modeling, safe yield

[1] http://www.jamescitycountyva.gov/bewatersmart/rebateprograms/rebatesintroduction.html (Last accessed February 10, 2015)

analyses, water quality sampling, and other field work are not included in the scope of work of this study. A water rate study is not included in the scope of work; however, planning-level cost estimates are provided for JCSA's development of potential water rates.

To present the results of the water supply study, the remainder of the report is divided into the following sections:

- Section 2 Existing DEQ Groundwater and VDH Waterworks Operation Permits
- Section 3 Water Supply Needs
- Section 4 Newport News Waterworks Water Purchase Agreement
- Section 5 Ware Creek Reservoir
- Section 6 King William Reservoir
- Section 7 York River
- Section 8 James River
- Section 9 Chickahominy River
- Section 10 Groundwater Sources
- Section 11 Permit and Approval Requirements
- Section 12 Evaluation Results of Potential Alternatives

Section 2

Existing DEQ Groundwater and VDH Waterworks Operation Permits

JCSA is authorized to provide potable water to the public through the DEQ Groundwater Withdrawal Permit and the Virginia Department of Health (VDH) Waterworks Operation Permit. The DEQ Groundwater Withdrawal Permit establishes the quantity of groundwater that JCSA is allowed to withdraw as an annual total withdrawal in gallons and as a total maximum monthly withdrawal in gallons. The VDH Waterworks Operation Permit regulates the capacity in gallons per day of the JCSA water system. A discussion of each permit and DEQ's groundwater withdrawal policy status follows.

2.1 DEQ Groundwater Withdrawal Permit

James City County is located in the Eastern Virginia Groundwater Management Area (EVGMA) as defined by the Virginia Administrative Code (9VAC25-600-20). The EVGMA was established in 1992 due to declining water levels in the aquifers. JCSA was permitted by VDH as a public water supplier prior to the establishment of the EVGMA. Regulations imposed on the EVGMA are intended to protect existing users from new or expanded withdrawals, assure continued resource viability into the future, and manage the resource comprehensively. A groundwater permit is required by DEQ for any withdrawal in the EVGMA greater than 300,000 gallons per month.

JCSA provides water service to their customers through the Central Water System and eight independent water systems. The Central Water System and independent water systems have separate DEQ Groundwater Withdrawal Permits as described below.

2.1.1 Central Water System

This study focuses on the Central Water System which serves the Primary Service Area (PSA), Governor's Land, Greensprings West, and three public schools. The following milestones describe JCSA's DEQ Groundwater Withdrawal Permit history for the Central Water System:

- **Permit effective July 1, 1998, expiration June 30, 2008** - JCSA was first permitted by DEQ to withdraw in the EVGMA for the Central Water System an annual total of 1,742,900,000 gallons which is an average of 4.8 million gallons per day (mgd) (maximum gallons per year divided by 365 days) and a monthly total of 206,675,000 gallons during the maximum month which is an average of 6.7 mgd (maximum gallons per month divided by 31 days).

- **Permit with additional wells under construction for Five Forks Water Treatment Facility (FFWTF), effective January 1, 2003, expiration December 31, 2012** - JCSA was later permitted by DEQ to withdraw up to an annual total of 3,267,000,000 gallons (8.95 mgd) and up to a maximum monthly total of 374,558,000 gallons (12.1 mgd). This permit included the wells for FFWTF as proposed for construction.

- **Modified Permit for converting FFWTF wells under construction to permanent wells, effective January 1, 2003, expiration December 31, 2012** - A modified permit was issued by DEQ to JCSA on January 3, 2005 for conversion of the wells proposed for construction at the

FFWTF to permanent wells. The modified permit retained the effective date of January 1, 2003 and the expiration date of December 31, 2012 and allowed JCSA to withdraw up to an annual total of 3,267,000,000 gallons (8.95 mgd) and a monthly total of 374,558,000 gallons (12.1 mgd).

- **Modified Permit for combining Stonehouse independent water system with Central Water System, effective January 1, 2003, expiration December 31, 2012** - A modified permit was issued by DEQ to JCSA on August 17, 2009 to merge the Stonehouse independent water system with the Central Water System. This modification retained the permit's effective date of January 1, 2003 and the expiration date of December 31, 2012. To include the Stonehouse water system in the permit, DEQ required that the 1-foot drawdown contour of the current Central Water System permit not be exceeded. The withdrawal allocations for each well had to be evaluated and withdrawal allocations redistributed. As a result, JCSA's permitted withdrawal was reduced from the combined previously permitted annual withdrawal amount of the Stonehouse independent water system and the Central Water System of 3,529,800,000 gallons (9.67 mgd) to 3,222,269,520 gallons (8.83 mgd) and the combined monthly withdrawal amount of 408,038,000 gallons (13.16 mgd) to 364,798,000 gallons per month (11.8 mgd). Thus, the total reduction of the previously DEQ permitted withdrawals was 307,530,480 gallons per year (0.84 mgd) and 43,240,000 gallons per month (1.4 mgd).

- **Permit Renewal Application submitted April 5, 2012** - In accordance with Virginia regulations (9VAC25-610-96), JCSA was required to submit a reapplication permit at least 270 days before the expiration date unless permission for a later date had been granted by the State Water Control Board. JCSA submitted a groundwater renewal permit for an annual average withdrawal of 8.4 mgd and a maximum monthly withdrawal of 11.89 mgd on April 5, 2012, within the stipulated time frame. DEQ has not issued a new permit; however, the existing expired permit is still effective. As stated in 9VAC25-610-96, "If a complete application for a new permit has been filed in a timely manner, and the board is unable, through no fault of the permittee, to issue a new permit before the expiration date of the previous permit, the permit may be administratively continued."

- **DEQ Permit Renewal Application Review Meeting** - On July 15, 2014, DEQ informed JCSA at a meeting that the 8.4 mgd requested did not meet the technical review criteria based on the new DEQ groundwater model results and would not be approved and that a target reduced permit withdrawal of 3.8 to 4.0 mgd was preferred but subject to negotiations with DEQ.

The impact of DEQ's proposed reduction in the Groundwater Withdrawal Permit on the water supply needs of the Central Water System is discussed in Section 3.

2.1.2 Independent Water Systems

The independent water systems are separate water systems owned and operated by JCSA, each with their own unique well. The independent water systems include:

- Wexford Hills and Riverview Plantation Subdivision
- Racefield Subdivision
- Glenwood Acres Subdivision

- Kings Village Subdivision
- Ware Creek Manor Subdivision
- The Retreat Subdivision
- Liberty Ridge Subdivision
- Westport Subdivision

Wexford Hills and Riverview Plantation, Racefield, Kings Village, Ware Creek Manor, and The Retreat independent water systems each has its own DEQ Groundwater Withdrawal Permit. Glenwood Acres water system does not require a DEQ Groundwater Withdrawal Permit because it withdraws less than 300,000 gallons per month.

JCSA has accepted operation of the Liberty Ridge and Westport independent water systems. VDH has not issued an Operation Permit for either system because each system serves less than 15 connections at this time. In addition, the DEQ withdrawal permit for each system is currently a draft permit in each developer's name, pending the issuance of the VDH Operation Permit, and withdrawals reaching 300,000 gallon per month.

2.2 VDH Waterworks Operation Permit

The treatment and distribution of groundwater as potable water is regulated by the VDH Waterworks Operation Permit. VAC 62.1-264 states:

> *To ensure that any ground water withdrawal permit issued for a public water supply does not impact a waterworks operation permit issued pursuant to § 32.1-172, the maximum permitted daily withdrawal shall be set by the Board at a level consistent with the requirements and conditions contained in the waterworks operation permit. This section shall not limit the authority of the Board to reduce or eliminate ground water withdrawals by a waterworks if necessary to protect human health or the environment.*

VDH calculates the operating design capacity based on the limiting water system component, i.e. the lesser of well yield, well pump capacity, booster pump capacity, storage volume, and treatment capacity. The Waterworks Operation Permit may be amended for changes in treatment processes, special operating conditions, and change in capacity.[1]

JCSA has separate VDH Waterworks Operation Permits for the Central Water System and the following independent water systems: Wexford Hills and Riverview Plantation, Racefield, Kings Village, Ware Creek Manor, The Retreat, and Glenwood Acres. Liberty Ridge and Westport are not required to have VDH Waterworks Operation Permits because they serve less than 15 connections at this time.

The Waterworks Operation Permit for JCSA issued by VDH on February 17, 2012 established an operating capacity of 9.973 mgd for the JCSA Central Water System. The Waterworks Operation Permit does not have an expiration date. The capacity in the Waterworks Operation Permit is calculated based on the limiting factor of bulk water storage capacity, booster pump capacities, and source water capacities. For JCSA's Central Water System, the limiting factor is source water. A

[1] http://www.vdh.state.va.us/ODW/PermitandDesign.htm (Last accessed February 10, 2015)

reduction in the DEQ permitted groundwater withdrawal will reduce the permitted capacity in the Waterworks Operation Permit.

This study focuses on the Central Water System. A description of the water operation facilities of the Central Water System follows.

2.2.1 Production and Treatment Facilities

The Central Water System is supplied by 19 wells that draw water from the Potomac and Chickahominy Piney Point aquifers. Five wells are located at the FFWTF and 14 wells supply water at 7 locations. Table 2-1 provides a summary of the annual withdrawal and VDH permitted capacity for the production facilities in the Central Water System. The VDH permitted capacity is affected by the DEQ permitted groundwater withdrawal, but does not correlate one-to-one with the DEQ Groundwater Withdrawal Permit. The permitted withdrawal in the DEQ Groundwater Withdrawal Permit focuses on the raw water supply which includes the brine concentrate in the treatment process while the VDH permitted capacity limits the quantity of finished water that can be fed into the distribution system.

Table 2-1 JCSA Water Production Facilities

Production Facility	DEQ Annual Withdrawal (mgd)	VDH Capacity (mgd) *	Treatment
Five Forks	5.964	5.0	Reverse osmosis, sodium hydroxide for pH adjustment, corrosion inhibitor, sodium hypochlorite for disinfection
Owens-Illinois (W-01)	0.320	0.972	Blending, sodium hypochlorite for disinfection
Stonehouse (W-25 and W-26)	0.670	0.965	Blending, sodium hypochlorite for disinfection
Ford's Colony (W-33)	0.236	0.170	Sodium hypochlorite for disinfection
Kristiansands (W-24 and W-38)	0.861	1.610	Blending, sodium hypochlorite for disinfection
The Pottery (W-4)	0.005	0.360	Sodium hypochlorite for disinfection
Canterbury Hills (W-22)	0.120	0.294	Sodium hypochlorite for disinfection
Ewell Hall (W-5) and Olde Towne Road (W-6)	0.225	0.602	Sodium hypochlorite for disinfection
TOTAL	**8.401**	**9.973**	

*As specified in VDH Waterworks Operation Permit

The FFWTF has a treatment capacity of 5 mgd and uses reverse osmosis to treat brackish groundwater from the Potomac aquifer; approximately 20 percent of the Lower Potomac aquifer water is rejected as brine concentrate in the treatment process. Water from the Middle Potomac aquifer is blended with the permeate water. The brine concentrate is discharged into the James River and regulated by DEQ through a Virginia Pollution Discharge Elimination System (VPDES) Permit. JCSA is required to monitor the following parameters in the concentrate discharge: pH, dissolved oxygen, total dissolved solids, total nitrogen, total phosphorus, nitrate, nitrite, and ammonia. The FFWTF also provides application of sodium hydroxide for pH adjustment, corrosion inhibitor, and sodium hypochlorite for disinfection.

The Owens-Illinois, Stonehouse, and Kristiansands production facilities blend higher quality water from the Chickahominy Piney Point aquifer with lower quality water from the Potomac aquifer. Sodium hypochlorite is added to the water for disinfection prior to distribution.

The Ford's Colony, The Pottery, Canterbury Hills, Ewell Hall and Olde Towne Road production facilities draw water from the Chickahominy Piney Point aquifer, apply sodium hypochlorite for disinfection, and pump the water directly into the distribution system.

2.2.2 Distribution Facilities

2.2.2.1 Stonehouse Commerce Park (ES-01)

JCSA owns and operates a 1.25-million-gallon elevated storage tank at Stonehouse Commerce Park. The tank is equipped with an altitude valve and has an operating range of 44.5 feet. The overflow is set at elevation 255 feet.

2.2.2.2 Warhill Sports Complex (ES-02)

JCSA also owns and operates a 1.25-million-gallon elevated storage tank at the Warhill Sports Complex. The tank is equipped with an altitude valve and has an operating range of 44.5 feet. The overflow is set at elevation 255 feet.

2.2.2.3 Ironbound Road Booster Facility (BS-27)

The Ironbound Road Booster Facility is located near the intersection of Monticello Avenue and Ironbound Road, east of Route 199. The Ironbound Road Booster Facility consists of two, 500,000-gallon storage tanks and a booster pump station. The booster pump station is equipped with three, 125-horsepower (hp) pumps, each rated 1,936 gallons per minute (gpm) at 166 feet total dynamic head (TDH) based on a speed of 1,750 revolutions per minute (rpm). The tanks normally operate in series, but can also operate individually when one tank is offline. The facility is equipped with a 400 kilowatt (kW) standby generator. This facility normally operates to move water from the FFWTF to northward and westward through the County. The facility can also be operated as a peaking facility where the tanks are filled during off-peak hours and allowed to pump out during peak demands.

2.2.2.4 Route 199 Booster Facility (BS-32)

The Route 199 Booster Facility is located off Route 199, approximately 1,500 feet west of Mounts Bay Road, near College Creek. The Route 199 booster facility consists of a one-million-gallon ground storage tank, booster pump station, and 15,000-gallon hydropneumatic tank. The booster pump station is equipped with two 40-hp pumps, each rated 600 gpm at 142 feet TDH, and one 100-hp pump rated at 2,000 gpm at 135 Feet TDH. The facility is equipped with a 200 kW standby generator. This facility is primarily used as a peaking facility at this time.

2.3 DEQ Policy

DEQ's groundwater withdrawal permit decisions currently focus on the 80-percent drawdown criterion. As established by 9VAC25-610-110D.3.h:

> *DEQ staff will conduct an evaluation to demonstrate that the proposed withdrawal in combination with all existing lawful withdrawals will not lower water levels, in any confined aquifer that the withdrawal impacts, below a point that represents 80% of the distance between the historical prepumping water levels in the aquifer and the top of the aquifer at the points that are halfway between the proposed withdrawal site and the predicted one foot drawdown contour based on the predicted stabilized effects of the proposed withdrawal. Ground water withdrawal permit applications which do not meet the 80% drawdown criteria will be denied.*

DEQ has also identified other goals/criteria:[2]

- Avoiding saltwater intrusion
- Avoiding land subsidence
- Preventing decline in water levels

To support their decisions, DEQ relies on a groundwater model developed by USGS to simulate withdrawal impacts and water level measurements from monitoring wells.[3] The groundwater model was funded by the Hampton Roads Planning District Commission (HRPDC). As stated in the October 21, 2014 HRPDC Water Resources News, the model indicates that the

> *total amount of withdrawals currently permitted would cause water levels to drop below the management criteria in the regulations. The water level measurements generally show declining water levels for more than a decade. However, several measurements near Franklin show a recent rebound in water levels because the paper mill reduced pumping from 33 to 9 million gallons per day between 2010 and 2012.*[2]

In the previous groundwater model used by DEQ, JCSA's withdrawal did not have a detrimental impact to the aquifer. Withdrawal permits issued since JCSA was first permitted to withdraw may have caused or exasperated the degree in which JCSA withdrawals have caused a violation of the criteria in the updated model.

2.4 Economic Impact of Permitted Groundwater Withdrawal Reduction

Kurt Stephenson of Virginia Tech, in conjunction with Abt Associates Inc., completed a report in August 2014 titled "*An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity*". The report presents the following conclusions:

- A groundwater permit withdrawal reduction would likely increase JCSA's need to purchase water from NNWW and require additional supplies by 2040. The report's delay in the need to acquire additional supplies to 2040 is based on a lower growth predicted by the Weldon Cooper Center and Hampton Roads Planning District Commission for 2040.[4]
- The FFWTF would also be a partially stranded asset. A partially stranded asset is an investment that will not be able to be put to full use. The FFWTF would be a partially stranded asset because JCSA would not be able to use the plant to its full treatment capacity even though they paid for it.

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[2]http://missionh2ovirginia.com/wp-content/uploads/2013/12/Groundwater-Mgmt-Issues-white-paper_2.2014.pdf (Last accessed February 10, 2015)

[3]http://www.hrpdc.org/news/article/october/21/2014/deq-proposes-groundwater-permit-cuts/ (Last accessed February 10, 2015)

[4]Stephenson, Kurt, and Abt Associates Inc. 2014. *An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity*.

- The ability of NNWW to provide additional supply is impacted by their permitted groundwater withdrawal. NNWW has a groundwater withdrawal permit for 7 mgd but average use from 2003 to 2012 was 1.7 mgd. The groundwater is used as a drought emergency supply. NNWW has agreements with JCSA and Williamsburg to provide 4 to 6 mgd. If NNWW's groundwater permit is reduced to 1.7 mgd, they may not have enough water to supply their own customers and maintain these agreements by 2040, assuming demands follow the lower use projections.

Section 3

Water Supply Needs

3.1 Historical Population and Water Demand

JCSA provides water service to approximately 51,700 people. Approximately 98 percent of the customers are served by the Central Water System with the remaining 2 percent served by independent water systems. Table 3-1 provides a summary of the service areas, number of connections, and estimated population. A map indicating the PSA boundary and other service areas is shown on Figure 3-1.

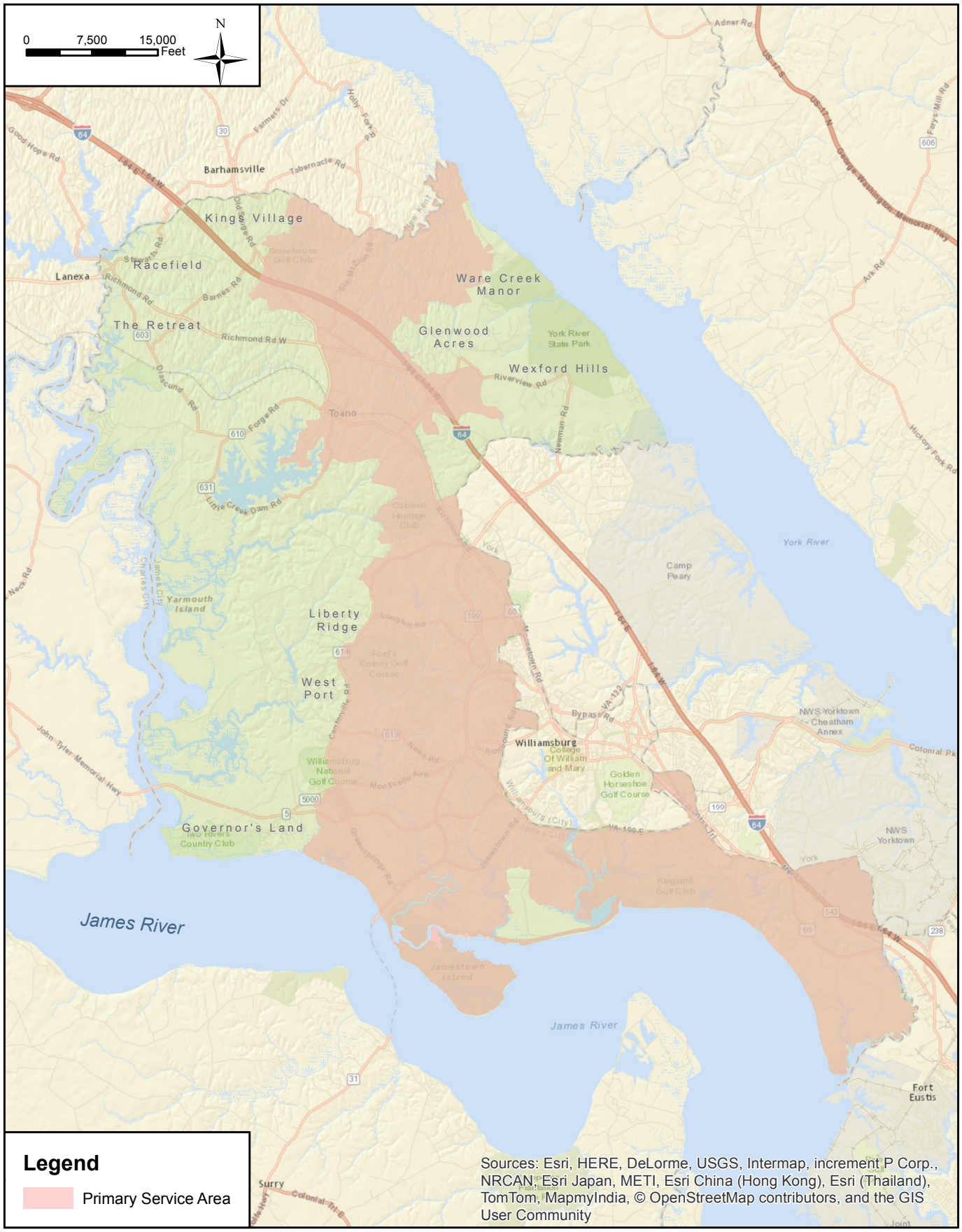
Table 3-1 JCSA Water Service Area Connections (November 2014)

Service Area	Number of Connections	Estimated Population
Central Water System		
• Primary Service Area, Governor's Land, Greensprings West	20,715	50,752
Independent Water Systems		
• Wexford Hills and Riverview Plantation Subdivision	138	341
• Racefield Subdivision	37	91
• Glenwood Acres	34	84
• Kings Village Subdivision	50	124
• Ware Creek Manor Subdivision	65	161
• The Retreat Subdivision	48	119
• Liberty Ridge Subdivision[1]	2	5
• Westport Subdivision[2]		(Under construction)

Notes:
1. Has two connections; operating under DEQ draft permit.
2. Under construction.

This study focuses on the water demands and supply needs of the Central Water System. A summary of the historical groundwater withdrawals and water demands of the Central Water System is presented in Table 3-2. The groundwater withdrawals listed in Table 3-2 reflect the amount of water pumped out of the wells and include the brine concentrate of the treatment process that is discharged into the James River. The finished water demand reflects the amount of water fed into the distribution system.

As shown in Table 3-2, JCSA experienced a slight decline in water use from 2011 through 2013. The decline may be attributed to wetter years, an increase in the number of installations of low-flow fixtures prompted by customer rebates provided by JCSA, and/or economic conditions at the time with watchful eyes on discretionary spending and the construction of privately-owned irrigation wells.



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

CDM Smith

Figure 3-1
James City County
Primary Service Area

Table 3-2 JCSA Central Water System Historical Groundwater Withdrawal and Water Demands

Year	Number of Connections	Estimated Service Area Population[a]	Average Day Groundwater Withdrawal (mgd)[b]	Peak Month Groundwater Withdrawal (mgd)[b]	Finished Water Average Day Demand (mgd)[c]	Finished Water Peak Month Demand (mgd)[c]
2002[d,g]	14,480	35,476	4.12	6.00	4.12	6.00
2003[d, g]	15,358	37,627	3.85	4.71	3.85	4.71
2004[d, g]	16,249	39,810	4.11	5.34	4.11	5.34
2005[d, e, g]	17,304	42,395	4.85	6.65	4.64	6.20
2006[d, f]	17,718	43,409	5.23	7.33	4.70	6.43
2007	18,193	44,573	5.82	7.30	5.03	6.39
2008	18,553	45,455	5.77	8.02	5.03	7.20
2009	18,829	46,131	5.33	7.29	4.67	6.47
2010	19,172	46,971	5.99	8.29	5.25	7.44
2011	19,544	47,883	5.48	7.11	4.77	6.40
2012	20,294	49,720	5.40	6.83	4.70	6.00
2013	20,325	49,796	5.25	6.51	4.55	5.73
2014	20,732	50,793	5.48	6.90	4.75	6.02

Notes:

a. Number of Connections x 2.45.
b. Water pumped out of the wells.
c. Finished water is water introduced into the distribution system.
d. 2002 through 2006 includes Stonehouse independent water system in the population and demand data.
e. 2005 was the first year of the FFWTF operation.
f. Stonehouse independent water system was combined with the Central Water System in 2006.
g. 2002 through 2005 included connection and demand data for James Terrace which is served by NNWW.

3.2 Population and Water Demand Projections

JCSA indicates that most development will occur in the PSA. The PSA was established by James City County as a growth management tool to encourage higher density development within the PSA to promote efficient use of public facilities and services such as water, sewer, roadways, schools, fire, police stations, and libraries.[1] Development outside the PSA is discouraged. JCSA's water supply plan must ensure that demands of their service area are met and continue to be met in the future.

Available population and water demand projections from the following sources were evaluated to determine JCSA's water supply needs:

- Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.*
- Stephenson, Kurt (Virginia Tech) and Abt Associates Inc. 2014. *An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity* (VT Study).
- JCSA projections based on annual increase in number of connections from Burton & Associates, *James City Service Authority Water & Sewer Rate Study Final Report* completed January 29, 2015.
- Weldon Cooper Center updated population projections released January 27, 2015.

[1] *James City County 2009 Comprehensive Plan*. November 2009. Page 125.

A discussion of the projections provided by these sources follows.

3.2.1 Hampton Roads Regional Water Supply Plan

Water demand projections developed by JCSA for the *Hampton Roads Regional Water Supply Plan* (HRRWSP) are presented in Table 3-3. The projections were estimated assuming a water usage of 106 gallons per capita per day (gpcd) based on JCSA's 2004 to 2008 historical data. The peak water demand was estimated based on a peaking factor of 1.5. JCSA indicated that the projections reflect a pre-2008 booming economy which is not indicative of the current situation.

Table 3-3 Hampton Roads Regional Water Supply Plan JCSA Water Demand Projections

Year	County Population	Estimated Public Water Service Area Population	Percentage of County Population Served	Average Water Demand (mgd)	Peak (Maximum Day) Water Demand (mgd)
2020	80,722	63,370	79%	6.7	10.1
2030	100,757	81,401	81%	8.6	12.9
2040	125,764	103,908	83%	11.0	16.5
2050	156,978	132,000	84%	14.0	21.0

Source: Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Attachment 1, Supply vs Demand 2011Final2_Jul2011.xlsx

3.2.2 VT Study

Kurt Stephenson of Virginia Tech, in conjunction with Abt Associates Inc., evaluated water projections for JCSA in their report titled "*An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity*", completed in August 2014 (VT study). The VT study provided water demand projection scenarios for each decade from 2020 through 2040 based on the following assumptions:

- HRRWSP water demand projections
- HRPDC population estimates and HRRWSP average per capita water usage
- Weldon Cooper Center population estimates and HRRWSP average per capita water usage
- HRPDC population estimates with 14 percent reduction in HRRWSP average per capita usage
- Weldon Cooper Center population estimates with 14 percent reduction in HRRWSP average per capita water usage

A summary of the population estimates is presented in Table 3-4.

Table 3-4 VT Study JCSA Average Water Demand Projections (mgd)

Year	Weldon Cooper Center Population with 2004-2008 Average Per Capita Water Usage	HRPDC Population with 2004-2008 Average Per Capita Water Usage	Weldon Cooper Center Population with 14 Percent Reduction in Average Per Capita Water Usage	HRPDC Population with 14 Percent Reduction in Average Per Capita Water Usage
2020	6.1	5.6	5.2	4.8
2030	7.9	6.5	6.8	5.6
2040	10.2	7.4	8.7	6.3

Source: Stephenson, Kurt, and Abt Associates Inc. 2014. *An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity*. Page 77, Exhibit 4-4.

The VT study indicates that the HRRWSP estimate is the most conservative water demand projection for JCSA. The Weldon Cooper Center population estimates are based on an average annual growth rate of 2.4 percent while the HRPDC population estimates are based on an average annual growth rate of 1.5 percent.[2] JCSA's 2010 average water usage exceeded the 2020 average day demand projection based on the HRPDC and Weldon Cooper Center population estimates with the 14 percent reduction in average per capita water usage, hence the 14 percent reduction appears to be unrealistic.

3.2.3 JCSA Update Based on Annual Increase in Number of Connections

JCSA has updated their water demand projections since the completion of the HRRWSP in 2011. The updated projections are presented in the *James City Service Authority Water & Sewer Rate Study Final Report* completed by Burton and Associates on January 29, 2015. The updated water demand projections were based on a review of the following information:

- Historical data for each customer class from fiscal year (FY) 2009 through FY 2014
- Neighborhood buildout data provided by the James City County Planning Division
- Reasonable growth trends discussed with JCSA staff to determine annual growth based on local environmental and economic conditions

JCSA estimates an increase of 412 connections per year which represents a growth rate slightly less than 2 percent per year.

A summary of the water demand projections is presented in Table 3-5. JCSA's projected finished water average day demands are slightly higher, but follow the same pattern as the VT study projections based on the HRPDC population estimates and HRRWSP per capita usage; the projections are lower than the HRRWSP and VT study projections based on the Weldon Cooper Center population estimates.

[2] Stephenson, Kurt,and Abt Associates Inc. 2014. An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity. Page 32.

Table 3-5 JCSA Water Demand Projections Based on Growth of 412 Connections Per Year

Year	Number of Connections	Estimated Population	Average Day Withdrawal (mgd)	Peak Month Withdrawal (mgd)	Maximum Day Withdrawal (mgd)	Finished Water Average Day Demand (mgd)	Finished Water Maximum Month Demand (mgd)	Finished Water Peak Day Demand (mgd)
2020	23,204	56,850	6.64	8.71	9.96	5.80	7.71	8.70
2022	24,028	58,869	6.88	9.02	10.32	6.01	7.98	9.01
2030	27,324	66,944	7.82	10.26	11.73	6.83	9.08	10.24
2040	31,444	77,038	9.00	11.81	13.50	7.86	10.45	11.79
2050	35,564	87,132	10.18	13.36	15.27	8.89	11.81	13.33

3.2.4 Updated Weldon Cooper Center Population Estimate

The Weldon Cooper Center released updated population estimates for Virginia on January 27, 2015.[3] A summary of the population estimates for James City County is presented in Table 3-6. The July 1, 2014 estimate for James City County was 71,140 in comparison to the April 1, 2010 census estimate of 67,009, reflecting 6.2-percent growth. The updated Weldon Cooper Center population estimates are 7 to 9 percent higher than the 2020 to 2040 population estimates for James City County in the HRRWSP. Hence, water demand projections based on the updated Weldon Cooper Center population estimates would be higher than the projections in the HRRWSP, assuming that the same percentage of the James City County population is included in the water service area.

Table 3-6 Comparison between Weldon Cooper Center Population Estimates for James City County (Released January 27, 2015) and HRRWSP Population Estimates

Year	HRRWSP Population Estimate (July 2011)[a]	Weldon Cooper Center Population Estimate (January 27, 2015)[b]	Percent Difference
2014	---	71,140	---
2020	80,722	86,142	7%
2030	100,757	109,030	8%
2040	125,764	136,736	9%

Notes:

a. Table 3-3

b. http://www.coopercenter.org/demographics/virginia-population-estimates

3.2.5 Demand Summary

Figure 3-2 provides a summary of the available average day demand projections for the JCSA Central Water System. The JCSA projections based on the growth rate of 412 connections per year appear to follow a reasonable growth pattern similar to the VT study demand projection based on the HRPDC population estimate and HRRWSP per capita usage and will be used to determine the minimum water

[3] http://www.coopercenter.org/demographics/virginia-population-estimates (Last accessed February 10, 2015)

supply needs for JCSA. The water demand projections in the HRRWSP were more conservative and will be used to determine the high end of the range of the water supply needs should aggressive growth occur.

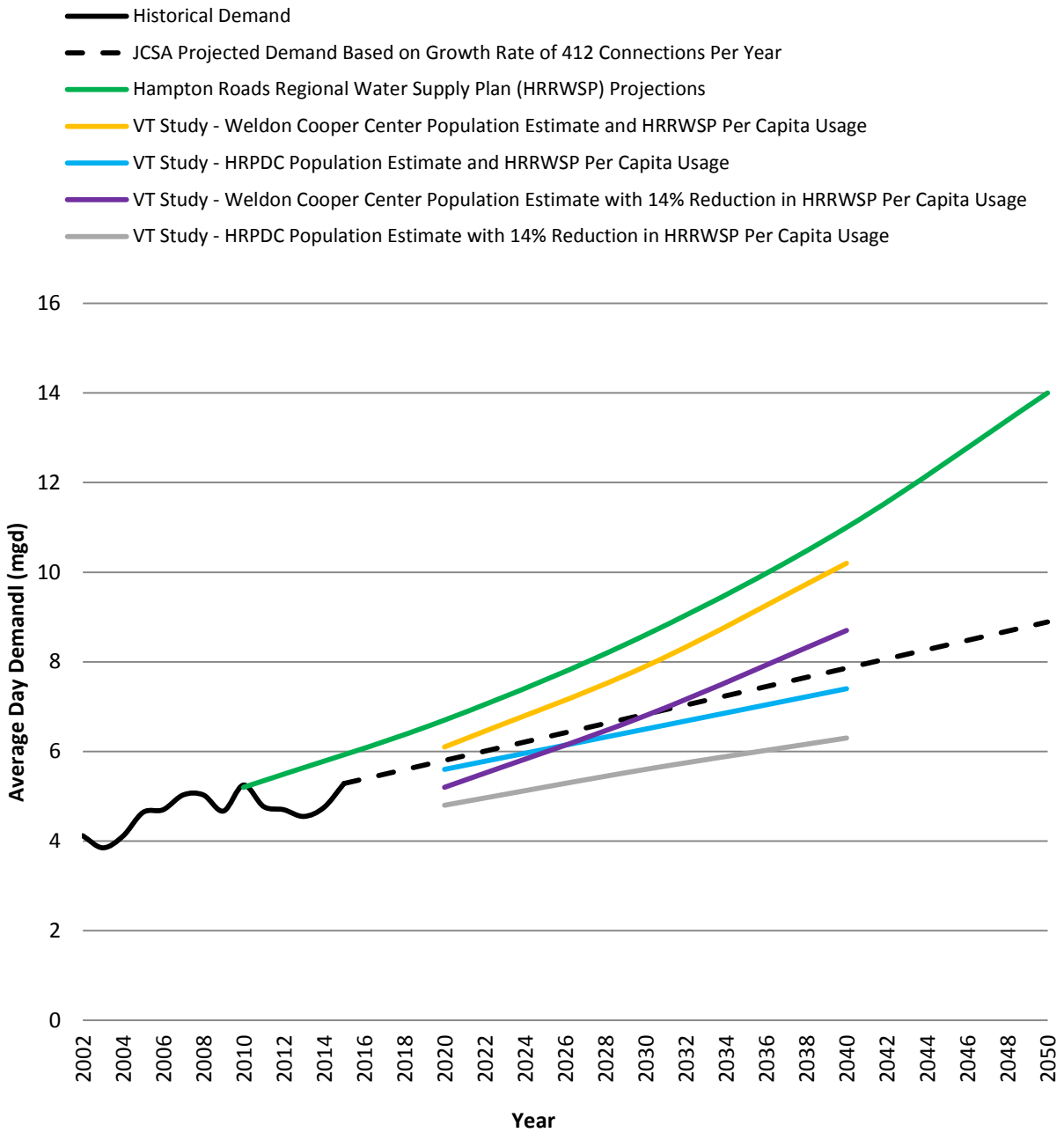


Figure 3-2
JCSA Historical and Projected Average Day Demand

3.3 Water Supply Needs

To meet their water supply needs, the capacity of JCSA's water supply and treatment facilities must satisfy 12VAC5-590-690 which requires the design capacity of the waterworks to exceed the maximum daily water demand of the system, i.e. the peak water demand (finished water peak day demand in Table 3-5). As discussed in Section 2.2, the design capacity of the waterworks is specified in the VDH Waterworks Operation Permit and is based on the limiting water system component, i.e. the lesser of well yield, well pump capacity, booster pump capacity, storage volume, and treatment capacity.

The VDH Waterworks Operation Permit is dependent on the DEQ Groundwater Withdrawal Permit for well yield, but does not correlate one-to-one with the DEQ Groundwater Withdrawal Permit. As discussed in Section 2.2.1, the DEQ Groundwater Withdrawal Permit establishes the limit for the raw water supply and includes the concentrate water in the treatment process while the VDH Waterworks Operation Permit focuses on the limit for the finished water supply, treatment, and distribution system. The current VDH permitted capacity of 9.973 mgd is based on the existing DEQ Groundwater Withdrawal Permit. If DEQ reduces the permitted groundwater withdrawal, VDH will also reduce the permitted capacity in the VDH Waterworks Operation Permit; the permitted groundwater withdrawal will be the limiting factor even if the treatment plant has the design capacity.

The impact of the DEQ permitted groundwater withdrawal on JCSA's water supply needs was evaluated for three scenarios:

- Current DEQ permitted average withdrawal of 8.8 mgd and maximum withdrawal of 11.8 mgd (refer to Section 3.3.1)
- DEQ's proposed reduction in the permitted average withdrawal to 4.0 mgd and estimated maximum withdrawal to 5.4 mgd (refer to Section 3.3.2)
- Revised DEQ permitted average withdrawal of 7.84 mgd to meet the average day demand in the 10-year DEQ permit cycle with an estimated maximum withdrawal of 10.5 mgd (refer to Section 3.3.3)

The ratio of the maximum withdrawal to the average withdrawal in the current DEQ permit was assumed for the reduced and revised DEQ maximum withdrawal permit values. A discussion of the projected water supply deficit for each scenario follows.

3.3.1 Current DEQ Groundwater Withdrawal Permit (Average = 8.8 mgd, Maximum = 11.8 mgd)

Table 3-7 provides a summary of the projected water supply deficit based on the current DEQ Groundwater Withdrawal Permit. As shown in Table 3-7, VDH's maximum day water system capacity of 9.973 mgd is inadequate to meet the projected maximum day demand by 2030 with a projected deficit of 0.3 mgd. The projected deficit was estimated based on the following calculation:

Projected 2030 Peak Day Demand – VDH Permitted Capacity = Finished Water Supply Deficit

10.24 mgd – 9.973 mgd = 0.267 (rounded to 0.3 mgd)

The projected deficit is estimated to increase to 3.4 mgd by 2050.

Table 3-7 Water Supply Deficit with Existing DEQ Permitted Groundwater Withdrawal

A	B	C	D	E	F	G	H	I	J
Year	DEQ Permitted Groundwater Withdrawal (mgd)		Concentrate Water Withdrawal as Maximum Daily (mgd)	Finished Groundwater Withdrawal as Daily Average (mgd)	Finished Groundwater as Monthly Maximum (mgd)	VDH Permitted Capacity as Maximum Day (mgd)	Average Day Demand (mgd)	Maximum Month Demand (mgd)	Peak Day Demand (mgd)
	Avg	Max							
2011	8.8	11.8	0.96	7.84	10.84	9.973	4.77	6.40	7.16
2012	8.8	11.8	0.96	7.84	10.84	9.973	4.70	6.00	7.05
2013	8.8	11.8	0.96	7.84	10.84	9.973	4.55	5.73	6.83
2014	8.8	11.8	0.96	7.84	10.84	9.973	4.75	6.02	7.13
2020	8.8	11.8	0.96	7.84	10.84	9.973	5.80	7.71	8.70
2022	8.8	11.8	0.96	7.84	10.84	9.973	6.01	7.98	9.01
2030	8.8	11.8	0.96	7.84	10.84	9.973	6.83	9.08	10.24
2040	8.8	11.8	0.96	7.84	10.84	9.973	7.86	10.45	11.79
2050	8.8	11.8	0.96	7.84	10.84	9.973	8.89	11.81	13.33

A	K	L	M	N	O	P	Q	R	S
Year	DEQ Deficit for Finished Water (mgd)		DEQ Deficit with Purchase of NNWW 2 mgd Option		DEQ Deficit with Purchase of NNWW 4 mgd Option		VDH Deficit Max (mgd)	VDH Deficit with Purchase of NNWW 2 mgd (2.85 mgd) Option Max (mgd)	VDH Deficit with Purchase of NNWW 4 mgd (5.7 mgd) Option Max (mgd)
	Avg	Max	Avg= 2.0 mgd	Max = 2.85 mgd	Avg = 4.0 mgd	Max = 5.7 mgd			
2011	---	---	---	---	---	---	---	---	---
2012	---	---	---	---	---	---	---	---	---
2013	---	---	---	---	---	---	---	---	---
2014	---	---	---	---	---	---	---	---	---
2020	---	---	---	---	---	---	---	---	---
2022	---	---	---	---	---	---	---	---	---
2030	---	---	---	---	---	---	0.3	---	---
2040	0.0	---	---	---	---	---	1.8	---	---
2050	1.0	0.9	---	---	---	---	3.4	0.5	---

Notes:

A = Proposed Year

B = DEQ permit ending 2012 as annual withdrawal based on an annual daily average of 8.8 mgd.

C = DEQ permit ending 2012 with maximum monthly withdrawal of 11.8 mgd.

D = Concentrate Water Withdrawal as a Max Daily (mgd) = maximum amount of water loss at the FFWTF due to treatment processes.

E = Finished Groundwater Withdrawal as a Daily Average (mgd) = Current DEQ permit for groundwater withdrawal less the concentrate water as an annual daily average = Column B - Column D

F = Finished Groundwater as a Monthly Maximum (mgd) = current DEQ permit for groundwater withdrawal as a monthly maximum = Column C - Column D

G = Current VDH permitted capacity

H = Average Day Demand (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Average Day Demand by Year

I = Maximum Month (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Maximum Month Demand by Year

J = Peak Day Demand (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Peak Day Demand by Year

K = DEQ deficit during average day demand by year = Column H - Column E; No Deficit = "---".

L = DEQ deficit during maximum month by year = Column I - Column F; No Deficit = "---".

M DEQ Deficit with Purchase of NNWW 2 mgd Option (2.0 mgd as an Annual Daily Average) = Column K - 2.0: No Deficit = "---".

N = DEQ Deficit with Purchase of NNWW 2 mgd Option (2.85 mgd as a Maximum Day) = Column L - 2.85: No Deficit = "---".

O = DEQ Deficit with Purchase of NNWW 4 mgd Option (4.0 mgd as an Annual Daily Average) = Column K - 4.0: No Deficit = "---".

P = DEQ Deficit with Purchase of NNWW 4 mgd Option (5.7 mgd as a Maximum Day) = Column L - 5.7: No Deficit = "---".

Q = VDH Deficit = Projected Peak Day less VDH Permitted Capacity = Column J - Column G: No Deficit = "---".

R = VDH Deficit with Purchase of NNWW 2 mgd Option (2.85 mgd as Maximum Day) = Column Q - 2.85: No Deficit = "---".

S = VDH Deficit with Purchase of NNWW 4 mgd Option (5.7 mgd as Maximum Day) = Column Q - 5.7: No Deficit = "---".

JCSA has also entered into an agreement with Newport News to purchase supplemental water supply. Section 4 provides details of the Newport News Water Purchase Agreement. JCSA has the right to purchase an average of 4 mgd from NNWW during drought conditions and 5 mgd during non-drought conditions with a peak delivery of 5.70 mgd on a monthly average. With a supplemental peak delivery of 5.70 mgd from NNWW, the existing system is adequate to meet the projected maximum day demand through 2050. However, JCSA must make a second payment by 2019 to retain the right to purchase 4 mgd from NNWW. If JCSA does not make the second payment, JCSA's right will be reduced to an average of 2 mgd during drought conditions and 2.5 mgd during non-drought conditions with a peak delivery of 2.85 mgd. With a supplemental peak delivery of 2.85 mgd, JCSA's existing system will be inadequate to meet the projected maximum day demand by 2050 with a projected deficit of 0.5 mgd. Figure 3-3 provides a graphical representation of the impact of the Newport News Water Purchase Agreement on the water supply deficit of JCSA.

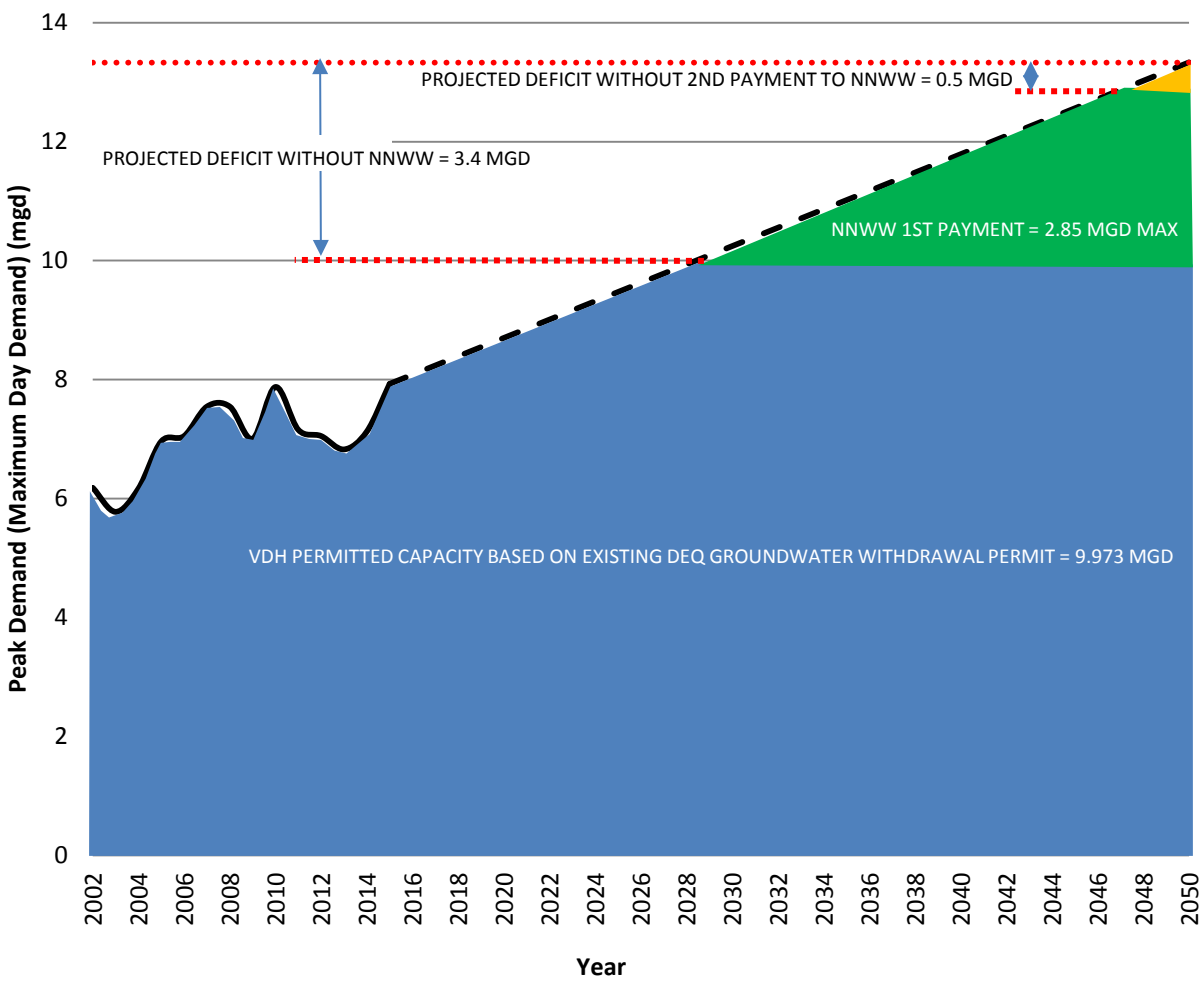


Figure 3-3
Projected Deficit with VDH Permitted Capacity Based on Existing DEQ Groundwater Withdrawal Permit

3.3.2 Reduced DEQ Groundwater Withdrawal Permit (Average = 4.0 mgd, Maximum = 5.4 mgd)

DEQ is proposing to reduce JCSA's permitted average withdrawal to 4.0 mgd. The corresponding maximum withdrawal is estimated to be 5.4 mgd based on the same ratio of the maximum withdrawal to the average withdrawal in the current DEQ Groundwater Withdrawal Permit. With this reduction, it is assumed that the VDH permitted operation capacity will be reduced by the same amount as the groundwater withdrawal reduction. The reduced VDH permitted capacity is estimated to be 5.173 mgd based on the following calculation:

Reduced VDH permitted capacity = Current permitted capacity – DEQ permit reduction
= 9.973 mgd – (8.8 mgd - 4.8 mgd)
= 5.173 mgd

Table 3-8 and Figure 3-4 provide a summary of the projected water supply deficit based on DEQ's proposed reduction. With a reduction in the DEQ permitted average withdrawal to 4.0 mgd and maximum withdrawal to 5.4 mgd, the JCSA water system is inadequate to meet its immediate needs with a deficit of 2.0 mgd, increasing to 8.2 mgd by 2050. With a supplemental peak delivery of 2.85 mgd from NNWW, JCSA's existing system will be inadequate to meet the projected maximum day demand by 2020 with a projected deficit of 0.7 mgd, increasing to 5.3 mgd by 2050. With the peak delivery of 5.70 mgd from NNWW through a second payment, a deficit of 0.9 mgd is projected by 2040, increasing to 2.5 mgd by 2050.

3.3.3 Revised DEQ Groundwater Withdrawal Permit (Average = 7.84 mgd, Maximum = 10.5 mgd)

JCSA's water supply needs were also evaluated with consideration to a revised permit withdrawal that would meet the projected demand for the 10-year duration of the DEQ Groundwater Withdrawal Permit. Since the current permit expired in 2012, it is assumed that the renewed permit will be approved for a 10-year duration and expire in 2022. To meet the projected 2022 peak day demand, a VDH permitted capacity of 9.01 mgd is required. It is assumed that the VDH permitted capacity is reduced from 9.973 to 9.01 mgd due to a reduction in the DEQ groundwater permitted withdrawal from 8.8 to 7.837 mgd (rounded to 7.84 mgd). The corresponding maximum withdrawal is estimated to be 10.5 mgd based on the same ratio of the maximum withdrawal to the average withdrawal in the current DEQ Groundwater Withdrawal Permit.

Table 3-9 and Figure 3-5 provide a summary of the projected water supply deficit based on the revised permitted average withdrawal of 7.84 mgd. With this reduction, the JCSA water system is inadequate to meet their demands prior to 2030 with a projected deficit of 1.2 mgd, increasing to 4.3 mgd by 2050. With a supplemental peak delivery of 2.85 mgd from NNWW, JCSA's existing system will be inadequate to meet the projected maximum day demand by 2050 with a projected deficit of 1.5 mgd; development of an additional water supply source or second payment to Newport News will be required.

Table 3-8 Water Supply Deficit with DEQ Proposed Groundwater Withdrawal Permit Reduction to 4.0 mgd Annual Average

A	B	C	D	E	F	G	H	I	J
Year	DEQ Permitted Groundwater Withdrawal (mgd)		Concentrate Water Withdrawal as Maximum Daily (mgd)	Finished Groundwater Withdrawal as Daily Average (mgd)	Finished Groundwater as Monthly Maximum (mgd)	VDH Permitted Capacity as Maximum Day (mgd)	Average Day Demand (mgd)	Maximum Month Demand (mgd)	Peak Day Demand (mgd)
	Avg	Max							
2011	4.0	5.4	0.5	3.5	4.9	5.173	4.77	6.40	7.16
2012	4.0	5.4	0.5	3.5	4.9	5.173	4.70	6.00	7.05
2013	4.0	5.4	0.5	3.5	4.9	5.173	4.55	5.73	6.83
2014	4.0	5.4	0.5	3.5	4.9	5.173	4.75	6.02	7.13
2020	4.0	5.4	0.5	3.5	4.9	5.173	5.80	7.71	8.70
2022	4.0	5.4	0.5	3.5	4.9	5.173	6.01	7.98	9.01
2030	4.0	5.4	0.5	3.5	4.9	5.173	6.83	9.08	10.24
2040	4.0	5.4	0.5	3.5	4.9	5.173	7.86	10.45	11.79
2050	4.0	5.4	0.5	3.5	4.9	5.173	8.89	11.81	13.33

A	K	L	M	N	O	P	Q	R	S
Year	DEQ Deficit for Finished Water (mgd)		DEQ Deficit with Purchase of NNWW 2 mgd Option		DEQ Deficit with Purchase of NNWW 4 mgd Option		VDH Deficit Max (mgd)	VDH Deficit with Purchase of NNWW 2 mgd (2.85 mgd) Option Max (mgd)	VDH Deficit with Purchase of NNWW 4 mgd (5.7 mgd) Option Max (mgd)
	Avg	Max	Avg= 2.0 mgd	Max = 2.85 mgd	Avg = 4.0 mgd	Max = 5.7 mgd			
2011	1.3	1.5	---	---	---	---	2.0	---	---
2012	1.2	1.1	---	---	---	---	1.9	---	---
2013	1.1	0.8	---	---	---	---	1.7	---	---
2014	1.3	1.1	---	---	---	---	2.0	---	---
2020	2.3	2.8	0.3	---	---	---	3.5	0.7	---
2022	2.5	3.1	0.5	0.2	---	---	3.8	1.0	---
2030	3.3	4.2	1.3	1.3	---	---	5.1	2.2	---
2040	4.4	5.6	2.4	2.7	---	---	6.6	3.8	0.9
2050	5.4	6.9	3.4	4.1	---	1.2	8.2	5.3	2.5

Notes:

A = Proposed Year

B = As proposed by DEQ for 2012 permit renewal, 3.8 mgd to 4.0 mgd for the annual daily average.

C = DEQ proposed 4.0 mgd reduction x 1.34 based on same ratio of max to average in current DEQ Groundwater Withdrawal Permit (11.8/8.8 = 1.34)

D = Concentrate Water Withdrawal as a Max Daily (mgd) = maximum amount of water loss at the FFWTF due to treatment processes.

E = Finished Groundwater Withdrawal as a Daily Average (mgd) = Current DEQ permit for groundwater withdrawal less the concentrate water as an annual daily average = Column B - Column D

F = Finished Groundwater as a Monthly Maximum (mgd) = current DEQ permit for groundwater withdrawal as a monthly maximum = Column C - Column D

G = Current VDH permitted capacity = 9.973 mgd. However, with reductions in DEQ permit the VDH permit will be reduced as well and is estimated as current VDH permit 9.973 mgd less the difference between the current DEQ permit of 8.8 less the value in Column B.

H = Average Day Demand (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Average Day Demand by Year

I = Maximum Month (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Maximum Month Demand by Year

J = Peak Day Demand (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Peak Day Demand by Year

K = DEQ deficit during average day demand by year = Column H - Column E; No Deficit = "---".

L = DEQ deficit during maximum month by year = Column I - Column F; No Deficit = "---".

M DEQ Deficit with Purchase of NNWW 2 mgd Option (2.0 mgd as an Annual Daily Average) = Column K - 2.0: No Deficit = "---".

N = DEQ Deficit with Purchase of NNWW 2 mgd Option (2.85 mgd as a Maximum Day) = Column L - 2.85: No Deficit = "---".

O = DEQ Deficit with Purchase of NNWW 4 mgd Option (4.0 mgd as an Annual Daily Average) = Column K - 4.0: No Deficit = "---".

P = DEQ Deficit with Purchase of NNWW 4 mgd Option (5.7 mgd as a Maximum Day) = Column L - 5.7: No Deficit = "---".

Q = VDH Deficit = Projected Peak Day less VDH Permitted Capacity = Column J - Column G: No Deficit = "---".

R = VDH Deficit with Purchase of NNWW 2 mgd Option (2.85 mgd as Maximum Day) = Column Q - 2.85: No Deficit = "---".

S = VDH Deficit with Purchase of NNWW 4 mgd Option (5.7 mgd as Maximum Day) = Column Q - 5.7: No Deficit = "---".

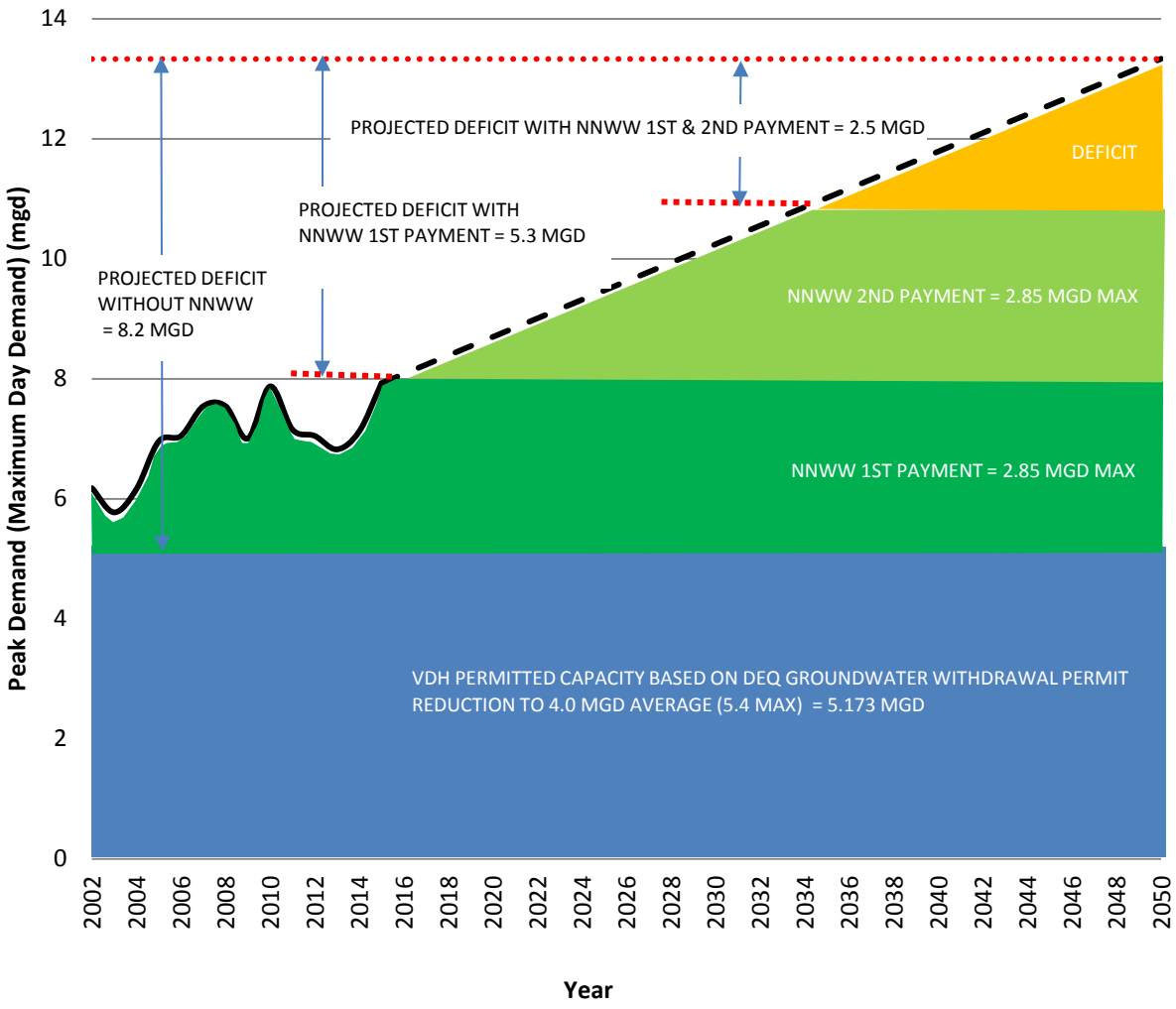


Figure 3-4
Projected Deficit with Revised VDH Permitted Capacity Based on DEQ's Proposed Groundwater Withdrawal Permit Reduction to 4.0 mgd Average (5.4 mgd Maximum)

Table 3-9 Water Supply Deficit with DEQ Revised Groundwater Withdrawal Permit of 7.84 mgd Average

A	B	C	D	E	F	G	H	I	J
Year	DEQ Permitted Groundwater Withdrawal (mgd)		Concentrate Water Withdrawal as Maximum Daily (mgd)	Finished Groundwater Withdrawal as Daily Average (mgd)	Finished Groundwater as Monthly Maximum (mgd)	VDH Permitted Capacity as Maximum Day (mgd)	Average Day Demand (mgd)	Maximum Month Demand (mgd)	Peak Day Demand (mgd)
	Avg	Max							
2011	7.84	10.5	0.96	6.88	9.54	9.01	4.77	6.40	7.16
2012	7.84	10.5	0.96	6.88	9.54	9.01	4.70	6.00	7.05
2013	7.84	10.5	0.96	6.88	9.54	9.01	4.55	5.73	6.83
2014	7.84	10.5	0.96	6.88	9.54	9.01	4.75	6.02	7.13
2020	7.84	10.5	0.96	6.88	9.54	9.01	5.80	7.71	8.70
2022	7.84	10.5	0.96	6.88	9.54	9.01	6.01	7.98	9.01
2030	7.84	10.5	0.96	6.88	9.54	9.01	6.83	9.08	10.24
2040	7.84	10.5	0.96	6.88	9.54	9.01	7.86	10.45	11.79
2050	7.84	10.5	0.96	6.88	9.54	9.01	8.89	11.81	13.33

A	K	L	M	N	O	P	Q	R	S
Year	DEQ Deficit for Finished Water (mgd)		DEQ Deficit with Purchase of NNWW 2 mgd Option		DEQ Deficit with Purchase of NNWW 4 mgd Option		VDH Deficit Max (mgd)	VDH Deficit with Purchase of NNWW 2 mgd (2.85 mgd) Option Max (mgd)	VDH Deficit with Purchase of NNWW 4 mgd (5.7 mgd) Option Max (mgd)
	Avg	Max	Avg = 2.0 mgd	Max = 2.85 mgd	Avg = 4.0 mgd	Max = 5.7 mgd			
2011	---	---	---	---	---	---	---	---	---
2012	---	---	---	---	---	---	---	---	---
2013	---	---	---	---	---	---	---	---	---
2014	---	---	---	---	---	---	---	---	---
2020	---	---	---	---	---	---	---	---	---
2022	---	---	---	---	---	---	---	---	---
2030	---	---	---	---	---	---	1.2	---	---
2040	1.0	0.9	---	---	---	---	2.8	---	---
2050	2.0	2.3	0.0	---	---	---	4.3	1.5	---

Notes:

A = Proposed Year

B = Revised permit withdrawal scenario (minimum needed to meet 2022 demand)

C = Revised permit withdrawal in Column B x 1.34 based on same ratio of max to average in current DEQ Groundwater Withdrawal Permit (11.8/8.8 = 1.34)

D = Concentrate Water Withdrawal as a Max Daily (mgd) = maximum amount of water loss at the FFWTF due to treatment processes.

E = Finished Groundwater Withdrawal as a Daily Average (mgd) = Current DEQ permit for groundwater withdrawal less the concentrate water as an annual daily average = Column B - Column D

F = Finished Groundwater as a Monthly Maximum (mgd) = current DEQ permit for groundwater withdrawal as a monthly maximum = Column C - Column D

G = Current VDH permitted capacity = 9.973 mgd. However, with reductions in DEQ permit the VDH permit will be reduced as well and is estimated as current VDH permit 9.973 mgd less the difference between the current DEQ permit of 8.8 less the value in Column B.

H = Average Day Demand (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Average Day Demand by Year

I = Maximum Month (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Maximum Month Demand by Year

J = Peak Day Demand (mgd) = Refer to Table 3-2 and Table 3-5, Finished Water Peak Day Demand by Year

K = DEQ deficit during average day demand by year = Column H - Column E; No Deficit = "---".

L = DEQ deficit during maximum month by year = Column I - Column F; No Deficit = "---".

M DEQ Deficit with Purchase of NNWW 2 mgd Option (2.0 mgd as an Annual Daily Average) = Column K - 2.0: No Deficit = "---".

N = DEQ Deficit with Purchase of NNWW 2 mgd Option (2.85 mgd as a Maximum Day) = Column L - 2.85: No Deficit = "---".

O = DEQ Deficit with Purchase of NNWW 4 mgd Option (4.0 mgd as an Annual Daily Average) = Column K - 4.0: No Deficit = "---".

P = DEQ Deficit with Purchase of NNWW 4 mgd Option (5.7 mgd as a Maximum Day) = Column L - 5.7: No Deficit = "---".

Q = VDH Deficit = Projected Peak Day less VDH Permitted Capacity = Column J - Column G: No Deficit = "---".

R = VDH Deficit with Purchase of NNWW 2 mgd Option (2.85 mgd as Maximum Day) = Column Q - 2.85: No Deficit = "---".

S = VDH Deficit with Purchase of NNWW 4 mgd Option (5.7 mgd as Maximum Day) = Column Q - 5.7: No Deficit = "---".

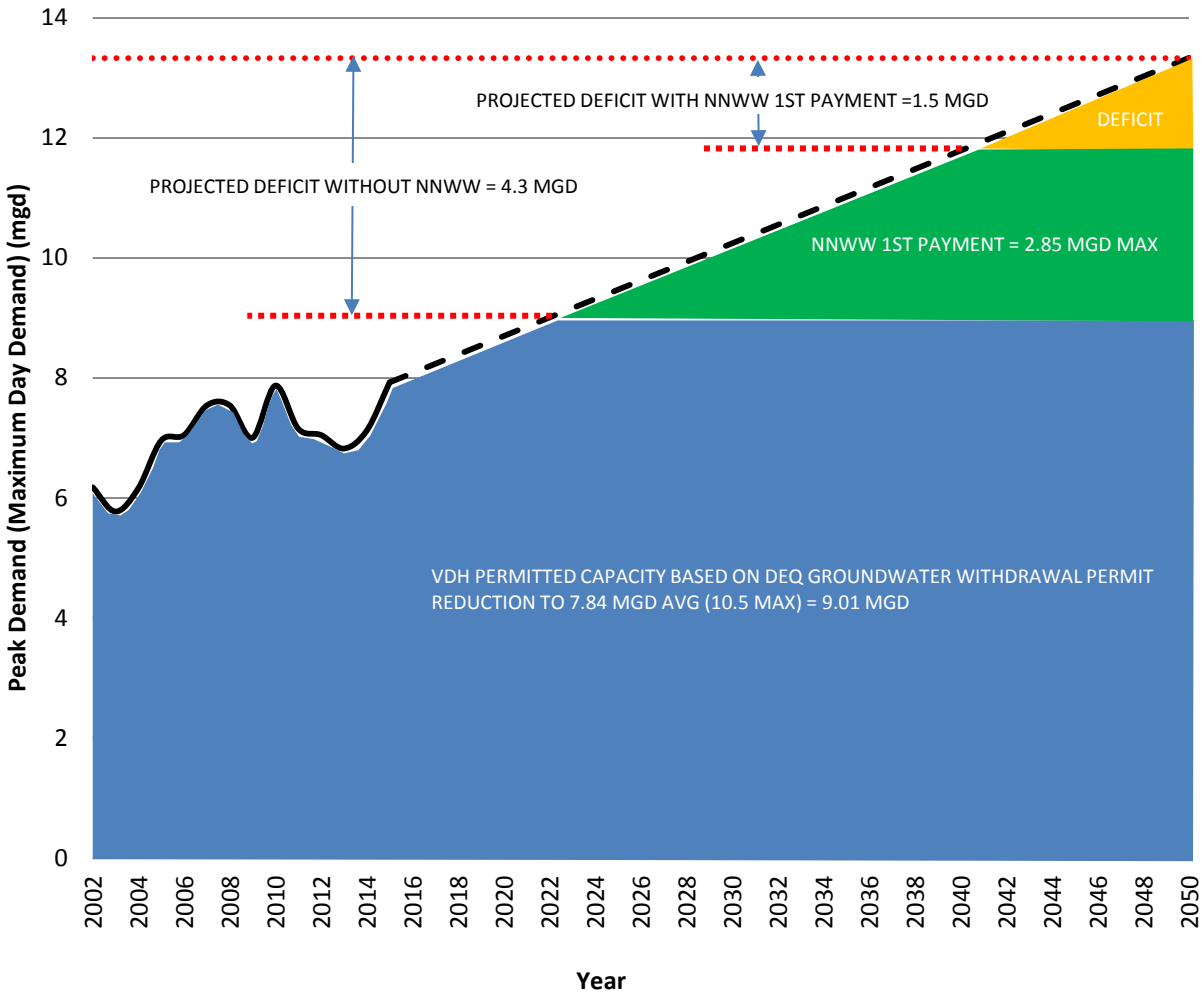


Figure 3-5
Projected Deficit with Revised VDH Permitted Capacity
Based on DEQ's Revised Groundwater Withdrawal Permit of 7.84 mgd Average (10.5 mgd Maximum)

3.3.4 Supply Needs Summary

Table 3-10 provides a summary of JCSA's water supply needs based on the DEQ Groundwater Withdrawal Permit scenarios.

Table 3-10 Water Supply Needs Summary

Description	DEQ Groundwater Withdrawal Permit		NNWW 1ST Payment	NNWW 2nd Payment	Deficit to occur by	Deficit (mgd)	Deficit by 2050
	Average (mgd)	Maximum (mgd)					
Existing DEQ Groundwater Withdrawal Permit[a]	8.8	11.8			2030	0.3	3.4
	8.8	11.8	✓		2050	0.5	0.5
	8.8	11.8	✓	✓	Beyond 2050		
DEQ Proposed Groundwater Withdrawal Permit Reduction[b]	4.0	5.4			2015	2.0	8.2
	4.0	5.4	✓		2020	0.7	5.3
	4.0	5.4	✓	✓	2040	0.9	2.5
Revised DEQ Groundwater Withdrawal Permit[c]	7.84	10.5			2030	1.2	4.3
	7.84	10.5	✓		2050	1.5	1.5
	7.84	10.5	✓	✓	Beyond 2050		

Notes:

a. Table 3-7
b. Table 3-8
c. Table 3-9

With the existing DEQ permitted groundwater withdrawal, JCSA will need additional water supply to meet their projected demands through 2050; the deficit is projected to occur prior to 2030, increasing to 3.4 mgd by 2050. If water is purchased through the first payment to Newport News, the projected deficit is 0.5 mgd by 2050. Water purchased through a second payment to Newport News is projected to meet the water supply needs through 2050.

If the DEQ permitted groundwater annual average withdrawal is reduced from 8.8 mgd to 7.84 mgd average (11.8 mgd to 10.5 mgd maximum), a water supply deficit of 1.2 mgd is projected to occur by 2030, increasing to 4.3 mgd by 2050. With the water purchased through the first payment to Newport News, a deficit of 1.5 mgd is projected by 2050. Water purchased through a second payment to Newport News is projected to meet the water supply needs through 2050.

If DEQ proceeds with their proposed groundwater permitted withdrawal reduction to 4. 0 mgd, a deficit of 2.0 mgd will be immediate, increasing to 8.2 mgd by 2050. With additional water purchased through the first payment to Newport News, a deficit of 0.7 mgd is projected by 2020, increasing to 5.3 mgd by 2050. With water purchased through a second payment to Newport News, a deficit of 0.9 mgd is projected by 2040, increasing to 2.5 mgd by 2050.

The projected deficits presented in Table 3-10 are based on the current anticipated growth trend which assumes an increase of 412 connections per year. Should aggressive growth occur as reflected in the HRRWSP, the projected deficit is estimated to be 0.1 mgd by 2020, increasing to 11 mgd by 2050. With water purchased through the first payment to Newport News, a deficit of 0.1 mgd is projected by 2030, increasing to 8.2 mgd by 2050. With the second payment to Newport News, a

deficit of 0.8 mgd is projected by 2040, increasing to 5.3 mgd by 2050. It should be noted that recent population estimates developed by the Weldon Cooper Center reflect a growth rate for James City County that is even higher than the rate assumed in the HRRWSP projections.

Figure 3-6 reflects the range in the projected deficit based on the water demand projection assumptions, DEQ permitted groundwater withdrawal, and NNWW purchase.

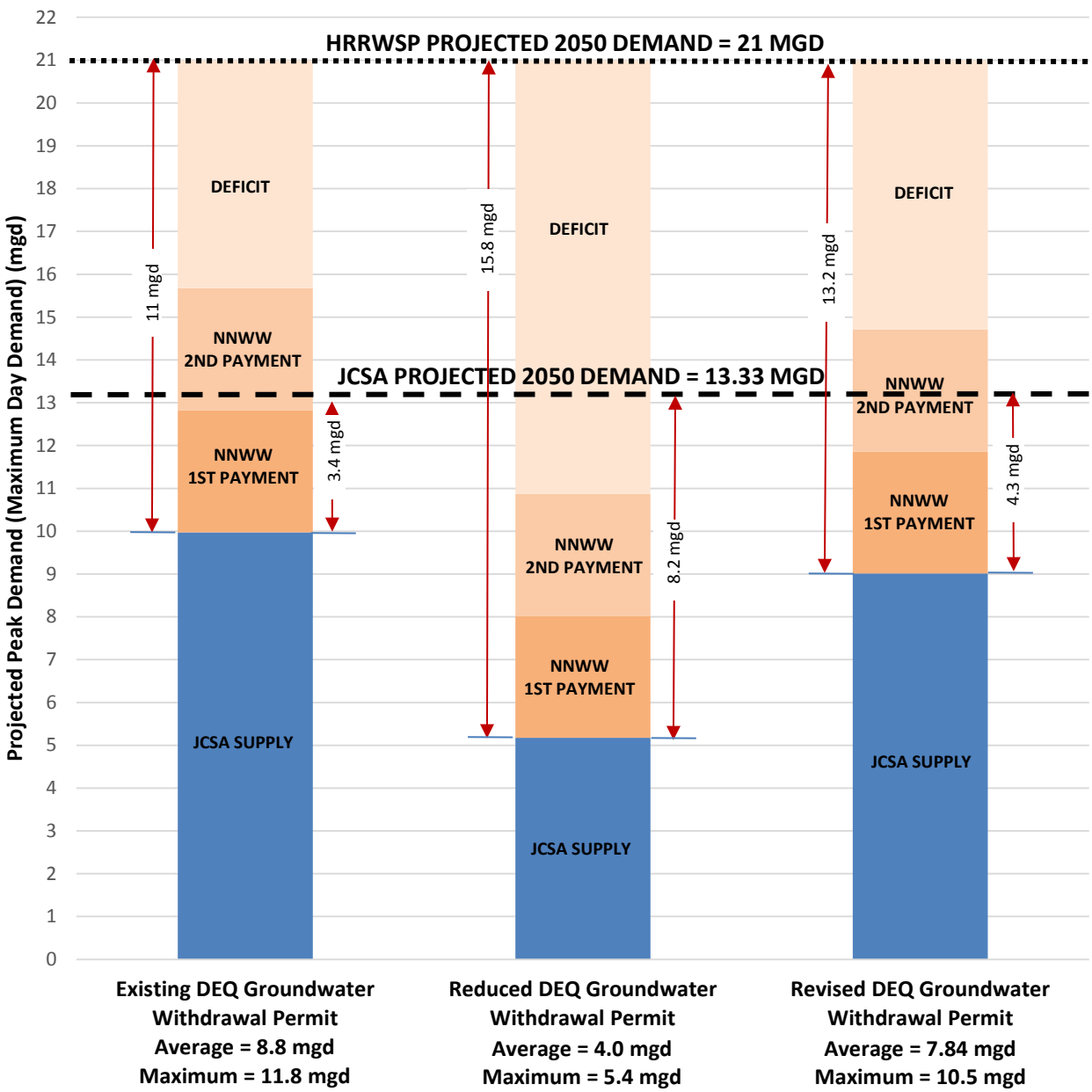


Figure 3-6
Projected 2050 Water Supply Deficit Based on Water Demand Projection, DEQ Groundwater Withdrawal Permit, and NNWW Water Purchase Assumptions

Section 4

Newport News Waterworks Water Purchase Agreement

4.1 Project Development Agreement

As a participant in the Lower Peninsula Regional Raw Water Study Group, JCSA supported Newport News in their plan to build the King William Reservoir (refer to Section 6) with the intent to purchase a 20-percent share of the safe yield, i.e. 4 mgd of the 20 mgd safe yield. JCSA recognized the existing groundwater withdrawal permit would not provide sufficient capacity to meet their water supply needs by the time the King William Reservoir would have been constructed. Newport News indicated a willingness to supplement JCSA's groundwater supply with treated water from the King William Reservoir or from an alternate source if the reservoir was not implemented. **The water from Newport News or alternate source is intended to meet long-term future demands and is not a replacement for existing groundwater withdrawals.**

As a result, on March 25, 2008, JCSA entered into a Project Development Agreement (PDA) with the City of Newport News to purchase supplemental water. The initial term of the PDA continues until January 1, 2050 at which time it will be automatically renewed for 25 years; the terms and conditions of the PDA may be modified by each party at the time of renewal. Notwithstanding the renewal clause, the PDA shall terminate upon the mutual consent of the governing bodies of the parties. A description of the terms and conditions of the PDA follows.

4.1.1 Treated Water Delivery

Under the PDA, Newport News will provide:

- Average delivery of 4 mgd during drought conditions, system failure, or emergency
- Non-drought delivery (if reservoir capacity is at or above typical drawdown cycle on Drought Tracking Chart) of 5 mgd
- Peak delivery of 5.7 mgd on a monthly average calculated on a 30-day rolling average and up to 6.5 mgd daily, provided 4 mgd is not exceeded in a calendar year or 5 mgd under non-drought conditions.

If the federal government, the Commonwealth of Virginia, or Newport News imposes water use restrictions in response to drought or other emergency conditions, JCSA will also be subject to the water use restriction. The amount of treated water provided to JCSA may be reduced in accordance with the targets specified in the *Water Conservation Management Plan, 2006 Update* prepared by NNWW. As specified in the PDA, "The amount of treated water provided to JCSA at the metered system interconnections may be reduced in accordance with Newport News's tiered reduction targets of 5 percent for Tier 2, 10 percent for Tier 3, and 15 percent for Tier 4."

4.1.2 Delivery Locations

The location of the metered interconnections for treated water delivery was to be determined jointly by Newport News and JCSA. Two potential interconnections were established:

- Route 199 at Mounts Bay Road – interconnection has been completed and is estimated to have a maximum capacity of 2.85 mgd
- Lightfoot area near the James City County/York County boundary – interconnection does not exist and potential location has not been identified.

JCSA will have to make significant water distribution piping improvements, add bulk water storage tanks, upgrade or add additional booster pumps, and add potential chemical treatment to distribute water effectively from these locations; the cost of these improvements will be solely JCSA's responsibility.

4.1.3 Payment

4.1.3.1 Safe Yield Share

To receive their safe yield share of the raw water supply, JCSA is required to pay Newport News $50 million in two installments. The first $25 million was paid in 2008 and funded through revenue bonds; the actual cost of the $25 million was $51.5 million including the debt service. The second $25 million (subject to inflation based on the Engineering News Record Building Cost Index) is due June 30, 2019. JCSA estimates the cost of the second payment of $25 million to be approximately $34 million in 2019 dollars with an actual cost of $60 million to finance. JCSA's safe yield share will be limited to 2 mgd on an annual average if the second payment is not made.

4.1.3.2 Water Treatment Costs

In addition to the safe yield share cost, JCSA must also pay a cost for water treatment and delivery to the two system interconnections. The cost of treatment was $0.70 per 1,000 gallons of water in 2008 and has risen to $1.22 per 1,000 gallons of water in 2014. The cost basis is referenced in Section 3.2.2 of the PDA. Newport News determines the treated water cost each year based on the average operating cost for treatment including labor, chemicals, power, and equipment associated with the delivery of raw water to the treatment plant, water treatment, and delivery to the metered connections. JCSA will be billed monthly for the metered consumption.

JCSA will be required to pay a penalty of 1.5 times the consumption rate that Newport News charges its retail commercial customers for treated water if JCSA exceeds the maximum delivery rate of treated water in any calendar year.

4.1.3.3 Water Distribution System Improvement Costs

Costs for NNWW water distribution improvements including water mains, storage tanks, water meters, and pump stations needed to provide treated water to JCSA at the interconnection will be shared between JCSA and Newport News based on the hydraulic capacity required for each party.

4.1.3.4 Capital Cost for Improvements

JCSA is responsible for paying 20 percent of the capital costs for improvement or replacement of water facilities necessary to comply with regulatory requirements or maintain the safe yield share or operability of the water source. Newport News is required to inform JCSA of planned capital projects and associated costs no later than September 1 annually so that JCSA can include the costs in their

upcoming budget. If JCSA does not pay the second installment for the safe yield share discussed in Section 4.1.3.1, their responsibility for the capital cost for improvements will be reduced to 10 percent.

4.1.3.5 Variable and Fixed Operation and Maintenance Costs

JCSA is responsible for paying 20 percent of the variable and fixed operation and maintenance (O&M) costs which is based on their 20-percent safe yield share of the King William Reservoir project. Variable O&M costs are annual costs incurred by Newport News for the maintenance and operation of the raw water supply, which varies based on the amount of raw water pumped and includes electricity and pump maintenance. Fixed O&M costs are annual or recurrent costs incurred by Newport News for the operation and maintenance of the water supply, regardless of whether water is delivered. Fixed O&M costs include permitting requirements, reservoir treatment, watershed maintenance and protection, fishery stocking, monitoring, and reporting. Limitations on the variable and fixed O&M costs that JCSA is required to pay with the cancellation of the King William Reservoir project is described in Section 5.1.4 of the PDA.

4.2 System Interconnection Considerations

4.2.1 Disinfection Compatibility

JCSA applies 12.5 percent sodium hypochlorite solution to disinfect groundwater sources directly connected to the distribution system and to finished water from the FFWTF. NNWW uses chloramines to disinfect finished water from their two water treatment facilities. Blending chloraminated finished water from NNWW with JCSA's chlorinated water is not recommended because of the formation of chlorinated byproducts that are ineffective disinfectants unless breakpoint is achieved and additional chlorine is then added. As a result, disinfectants used by JCSA and NNWW must be compatible. JCSA must convert its other facilities to chloramines (Option 1) or the water received from NNWW must be converted/treated to free chlorine (Option 2).

Figure 4-1 illustrates the reactions between ammonia and chlorine. The left (rising) portion of the solid black curve shows what happens when ammonia and chlorine are combined to form monochloramine at a Cl_2/N ratio up to 4.6:1. At a ratio of 4.6:1, all of the added chlorine is monochloramine, there is no free chlorine, and there is potentially some free ammonia. To completely oxidize the ammonia, 7.6 milligrams (mg) Cl_2 for each mg of ammonia (as N) needs to be added. When more than 7.6 parts of chlorine to ammonia (as N) is added, a free chlorine residual becomes measureable which is the objective of what a chorine "burn" achieves. The indication of possibly some nitrogen tri-chloride (NCl_3) in this region of the figure suggests that if pH is not properly controlled, nitrogen tri-chloride, which is an odorant and eye irritant, can form. This should not be a concern in the JCSA system; however, the groundwater should be checked for ammonia (as N) levels. In the region between 5 and 7.6, extra free chlorine leads to a loss in total chlorine residual. It is anticipated that, should JCSA go to breakpoint chlorination, there would be minimal impacts or risk to health as long as free chlorine residual is kept below 3.0 mg/L. Additional analysis is required to assess the feasibility of implementing breakpoint chlorination. It is recommended that water blending analyses be conducted to confirm that negative effects will not occur with breakpoint chlorination. Potential adverse effects include, but are not limited to Total Trihalomethanes (THMs), Haloacetic Acids (HAA5), Lead and Copper Rule, taste, odor, and color.

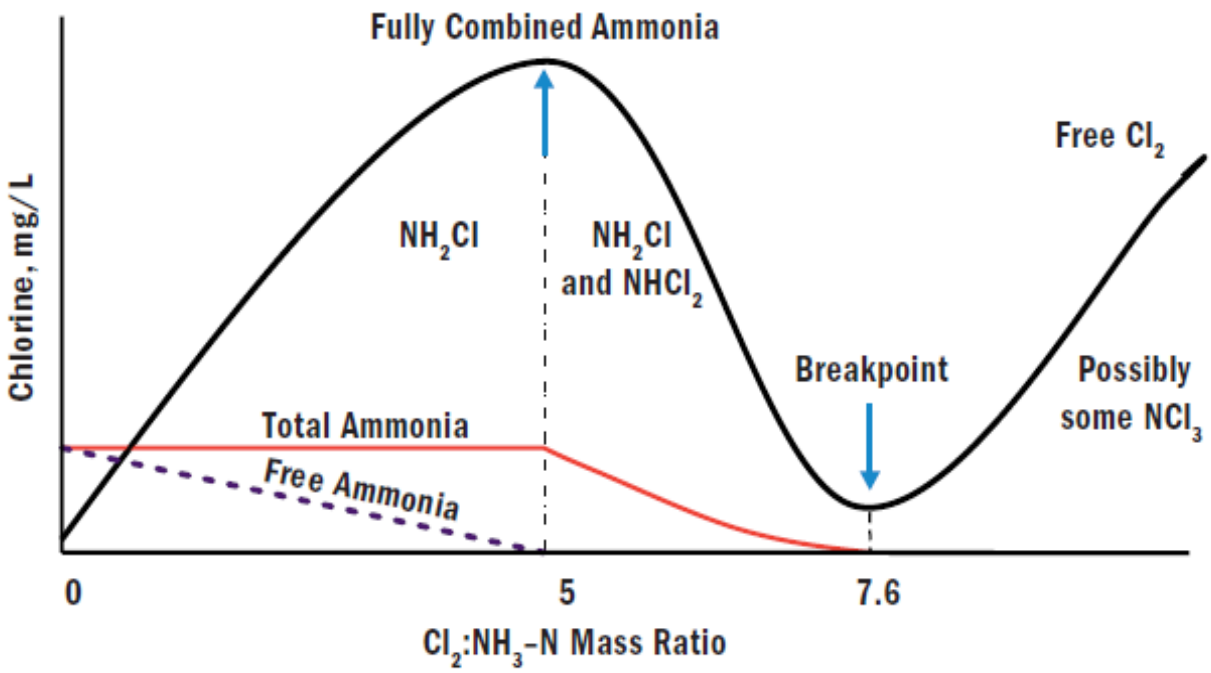


Figure 4-1
Ammonia and Chlorine Reaction
(N. Blute et al, *Opflow*, 2012)

4.2.1.1 Option 1: Converting JCSA to Chloramines

To evaluate the feasibility of converting JCSA's satellite chlorination facilities to chloramination facilities compatible with NNWW finished water, conceptual level cost estimates were developed based on the assumptions below.

Water Supply Locations

JCSA currently monitors free and total chlorine at the following water supply and well (W) locations:

- FFWTF
- Owens- Illinois (W-1)
- The Pottery (W-4)
- Ford's Colony (W-33)
- Stonehouse (W-25)
- Ewell Hall (W-5)
- Canterbury Hills (W-22)
- Kristiansand (W-38)

Ammonia analyzers will be required at these locations.

Distribution Facilities

JCSA also monitors various parameters in the distribution system at the elevated storage tank (ES), booster station (B), pressure reducing valve (PRV) locations, and at well facilities (W). The parameters monitored at each site are listed in Table 4-1.

Table 4-1 Parameters Monitored at Distribution Facilities by SCADA

Site	pH	Conductivity	Temperature	Total Chlorine	Free Chlorine
Stonehouse Commerce Park (ES-01)	✓	✓	✓	✓	✓
Warhill Sports Complex (ES-02)	✓	✓	✓	✓	✓
Ironbound Booster Station (B-27)	✓	✓	✓	✓	✓
Route 199 (B-32)	---	---	---	✓	✓
PRV-1 Below Ground Vault	---	---	✓	---	---
PRV-2 Above Ground in Building	---	---	✓	✓	✓
PRV-3 Above Ground in Building	---	---	✓	✓	✓
Olde Towne Road (W-6)	---	---	✓	✓	✓
Powhatan Secondary (W-12)	---	---	✓	✓	✓
Norge (W-24)	---	---	✓	✓	✓

The total chlorine and pH data will be used to monitor the chloramination effectiveness. Total chlorine concentrations that approach zero indicate the presence of nitrifying bacteria. The pH range impacts the effectiveness of the chlorine and ammonia. Further evaluation using jar tests is required to determine the optimum pH range and ratio of chlorine to ammonia. The addition of pH monitoring equipment at B-32, PRV-2, PRV-3, W-6, W-12, and W-24 is recommended. SCADA control panels are already available at each site for the connection of the pH monitoring equipment.

Temperature is the only parameter monitored at PRV-1; the valve is located in a below-ground vault and does not have room for additional equipment. Additional monitoring equipment is not recommended for this site.

Planning-Level Cost Estimate

The planning-level costs for conversion to chloramination are based on purchasing HACH APA 6000 ammonia and chloramine analyzers at approximately $18,000 each. If desired, the HACH comprehensive warranty can be purchased for $3,500 per analyzer. Features of the warranty include:

- Instrument start-up
- All parts, labor, and travel for on-site repairs
- Four on-site calibrations per year
- Factory recommended maintenance (including required parts)
- Unlimited technical support calls
- Free firmware updates.

The planning-level cost estimates are presented in Table 4-2 and assume the following conditions:

- The satellite facilities currently have the capability to transmit the chloramine reading data to the JCSA Supervisory Control and Data Acquisition (SCADA) system.
- A total of eight ammonia chloramine analyzers will need to be installed.
- Existing chlorine analyzers are currently in operation at each facility.
- Signals from the existing chlorine analyzers are relayed back to SCADA located at the FFWTF and at the Tewning Road Administrative Center.
- The existing chlorine feed pumps are capable of feeding sufficient chlorine to achieve breakpoint chlorination and an additional 3 mg/L for a free chlorine residual that will meet the requirements of the Ground Water Rule (refer to Section 4.2.4.1).
- Sodium hypochlorite and ammonia are a potential hazard if kept in the same place. Space is available in all existing facilities for the installation and operation of aqua ammonia addition feed and storage based on the following assumptions:
  - Walls will need to be installed at the FFWTF and W–25 to separate hypochlorite and aqua ammonia. It is estimated that this will cost approximately $30,000 per facility.
  - W-1, W-4, W-5, W- 33, W-38, and W-22 have separate buildings for sodium hypochlorite. JCSA will have to construct another building on the site for the ammonia. JCSA does not want the sodium hypochlorite and ammonia in the same space. It is estimated that the separate buildings will cost approximately $120,000 per building.
- Installation of the ammonia feed equipment (including analyzers) will be required from a contractor
- Aqua ammonia feed pumps will be required and shall be Prominent pumps or equal. The pumps are approximately $1,800 each plus installation. Two pumps will be required for each facility, one duty and one standby.
- pH monitoring equipment will be installed at B-32, W-6, W-12, W-24, PRV-2, and PRV-3.
- All appurtenances (tubing, flow meters, etc.) will be required. The selected contractor will purchase this equipment from a supplier.
- Aqua ammonia costs are not included in this estimate and will be contracted out.

Table 4-2 Planning-Level Costs for Conversion to Chloramination

Description	Planning-Level Cost Estimate ($)[2]	
Ammonia room at FFWTF and W-25	60,000	
Ammonia building at W-1, W-4, W-5, W-33, W-22, and W-38	720,000	
Ammonia equipment and installation at 8 sites[1,3,4]	310,000	
pH monitoring equipment and installation at 6 sites[5]	8,000	
Miscellaneous piping, valves, and appurtenances	100,000	
Electrical and Instrumentation	120,000	
Subtotal for Prime Contractor		1,320,000
Construction Contingency		330,000
Total Construction Cost in 2015 Dollars		1,650,000
Engineering, Legal, and Financial Fees		250,000
Total Project Cost in 2015 Dollars		1,900,000

Notes:

1. Assumes installation of one HACH APA 6000 chloramine/ammonia analyzer and two aqua ammonia feed pumps (one duty, one standby) at each site.
2. Does not include chemical cost for ammonia
3. Does not include HACH comprehensive warranty which can be purchased at $3,500 per analyzer
4. 8 sites = FFWTF, W-25, W-1, W-4, W-5, W-33, W-22, and W-38
5. 6 sites = B-32, PRV-2, PRV-3, W-6, W-12, W-24

4.2.1.2 Option 2: Converting NNWW to free Chlorine

Breakpoint chlorination to destroy ammonia should also be considered. It is assumed that JCSA would need to feed a chlorine dose of 10 mg/L to achieve a 2.4 mg/L free chlorine residual downstream of the chlorine feedpoint. If the current chemical feed equipment is capable of achieving the 10 mg/L chlorine dose at the facilities, additional chemical costs would be incurred for the additional chlorine dose. Breakpoint chlorination must be achieved prior to distribution to consumers.

JCSA should notify hospitals, dialysis centers, and, pet stores that JCSA is combining source waters that may have potential changes in water quality. It is also essential that pH be maintained at existing levels to not adversely impact other SDWA regulations such as the Lead and Copper Rule or LT2 disinfection byproduct rules. There will be some minor changes to taste and odor. Jar testing is recommended to assess potential water quality changes and disinfectant byproduct formation.

Should JCSA develop a separate surface water treatment facility and close their distribution system off from NNWW supply, then chlorination would be appropriate if the Authority chooses to do so. Otherwise, conversion to chloramination is recommended for disinfection compatibility with the NNWW water supply.

4.2.2 Infrastructure Improvements

In addition to disinfection compatibility improvements, physical infrastructure improvements by JCSA within the existing Central Water System will be required to distribute the flow from either or both of the NNWW interconnections on Route 199 at Mounts Bay Road and in the Lightfoot area near the James City County/York County boundary. It is recommended that JCSA conduct simulations on their hydraulic water model to define specific infrastructure needs. JCSA provided preliminary planning-level costs for infrastructure improvements presented in Table 4-3. Three scenarios were considered:

- Scenario A – 2 mgd from the Mounts Bay Road interconnection
- Scenario B – 2 mgd from the Mounts Bay Road interconnection and 2 mgd from the Lightfoot interconnection
- Scenario C – 4 mgd from the Lightfoot interconnection

Table 4-3 Preliminary Planning-Level Construction Costs for Infrastructure Improvements Necessary for NNWW Interconnections (dollars)

	Scenario A	Scenario B	Scenario C
Mounts Bay Road	**2 mgd**	**2 mgd**	**0**
Lightfoot	**0**	**2 mgd**	**4 mgd**
Upgrade Route 199 Booster Facility (BS-32)	2,200,000	2,200,000	
Build two interconnections similar to Mounts Bay Road interconnection	250,000	250,000	
Elevated storage tank	1,500,000	1,500,000	
One-acre property for distribution storage tank	100,000	100,000	
One-acre land at B-32	100,000	100,000	
Booster facility near Pottery	---	2,500,000	3,000,000
4-5 acres land for booster facility campus	---	1,000,000	1,000,000
JCSA's 20% share of 42,000 feet of NNWW 20 or 24-inch diameter main from Oak Avenue near Penniman Road vicinity up Mooretown Road to hospital ($275/foot)	---	2,310,000	
JCSA's 40% share of 42,000 feet of NNWW 20 or 24-inch diameter main from Oak Avenue near Penniman Road vicinity up Mooretown Road to hospital ($275/foot)	---		4,620,000
JCSA system pipeline upgrades	---	1,000,000	3,500,000
Subtotal for Prime Contractor	4,150,000	10,960,000	12,120,000
Construction Contingency	1,040,000	2,740,000	3,030,000
Total Construction Cost in 2015 Dollars	**5,190,000**	**13,700,000**	**15,150,000**
Engineering, Legal, and Financial Fees	620,000	1,640,000	1,820,000
Total Project Cost	**5,810,000**	**15,340,000**	**16,970,000**

Note: Construction cost of line items provided by JCSA, excluding disinfection compatibility improvements (Refer to Table 4-2)

4.2.3 Financial Impact Summary

A summary of the planning-level cost estimates to implement the NNWW water supply purchase is presented in Table 4-4. It should be noted that the costs presented in Table 4-4 do not include costs for the ammonia. JCSA indicated that for the Scenario A option, the NNWW water supply is intended to serve an area in the vicinity of the Mounts Bay Road interconnection that would be separate from the JCSA water system; hence, disinfection compatibility improvements would not be required for this scenario since the water from the two supplies would not mix.

Table 4-4 Summary of Planning-Level Cost Estimates for NNWW Water Supply Purchase

	Scenario A	Scenario B	Scenario C
Mounts Bay Road	**2 mgd**	**2 mgd**	**0**
Lightfoot	**0**	**2 mgd**	**4 mgd**
2nd Payment[1]	---	$60,000,000	$60,000,000
Infrastructure Improvements[2]	$5,810,000	$15,340,000	$16,970,000
Disinfection Compatibility Improvements[3]	---[4]	$ 1,900,000	$ 1,900,000
Total Project Cost	**$5,810,000**	**$77,240,000**	**$78,870,000**

Note:

1. $25 Million escalated to 2019 dollars (Projected) as $34 million plus cost of debt service.
2. Table 4-3.
3. Table 4-2 for Scenarios B and C.
4. Assumes area served by NNWW is isolated from the JCSA system.

4.2.4 Regulatory Impact

4.2.4.1 Groundwater Regulatory Requirements

Ground Water Rule

EPA published the Ground Water Rule (GWR) in the Federal Register on November 8, 2006. The purpose of the rule is to provide increased protection against microbial pathogens in public water systems that use ground water sources. EPA is particularly concerned about ground water systems that are directly under the influence of surface water and are susceptible to fecal contamination since disease-causing pathogens may be found in fecal contamination. JCSA receives its groundwater from confined aquifers which are not under the influence of surface water. JCSA still falls under the regulatory requirements of the GWR. They are not required to disinfect because of well contamination. JCSA provides the disinfections as a protection for the water in the distribution system.

The GWR applies to public water systems that are served by ground water. The rule also applies to any system that mixes surface and ground water if the ground water is added directly to the distribution system and provided to consumers without treatment.

Final Requirements:

The targeted, risk-based strategy addresses risks through an approach that relies on four major components:

- Periodic sanitary surveys of systems that require the evaluation of eight critical elements of a public water system and the identification of significant deficiencies (e.g., a well located near a leaking septic system)

- Triggered source water monitoring when a system (that does not already treat drinking water to remove 99.99 percent (4-log) of viruses) identifies a positive sample during its Total Coliform Rule monitoring and assessment monitoring (at the option of the state) targeted at high-risk systems
- Corrective action is required for any system with a significant deficiency or source water fecal contamination
- Compliance monitoring to ensure that treatment technology installed to treat drinking water reliably achieves 99.99 percent (4-log) inactivation or removal of viruses

Lead and Copper Rule

Lead and copper enter drinking water primarily through plumbing materials. Exposure to lead and copper may cause health problems ranging from stomach distress to brain damage. On June 7, 1991, EPA published a regulation to control lead and copper in drinking water. This regulation is known as the Lead and Copper Rule (also referred to as the LCR or 1991 Rule).

The treatment technique for the rule requires systems to monitor drinking water at customer taps. If lead concentrations exceed an action level of 15 ppb or copper concentrations exceed an action level of 1.3 parts per million (ppm) in more than 10 percent of customer taps sampled, the system must undertake a number of additional actions to control corrosion. If the action level for lead is exceeded, the system must also inform the public about steps they should take to protect their health and may have to replace lead service lines under their control.

JCSA would be required to return to initial monitoring levels when a new source is added, i.e. NNWW, surface water treatment plant, etc. Current monitoring is conducted every three years at half the number of original sites. Initial monitoring would require all original sites every 6 months for a year then once a year for 3 years; afterwards, monitoring would then be reduced to half the sites every 3 years if the 90th percentile is below the action level. The number of initial sites could also increase from the original number of sites due to the population growth triggers.

Long-Term Revisions to the Lead and Copper Rule

The goal for the LCR Long-Term Revisions is to improve public health protection provided by the LCR by making substantive changes based on topics that were identified in the 2004 National Review, and to streamline the rule requirements. Example categories of potential changes to the rule include:

- Sample site collection criteria and sampling procedures for lead and copper tap monitoring
- Corrosion control treatment and water quality parameter monitoring requirements
- Lead service line replacement requirements
- Schools and day care facilities
- Consecutive system requirements
- Potentially outdated requirements, rule relevancy and simplicity for systems

Stage 2 Disinfectants/Disinfection Byproduct Rule (Stage 2 DBP Rule)

Pathogens, such as *Giardia*, are often found in source water, and can cause gastrointestinal illness (e.g., diarrhea, vomiting, and cramps) and other health risks. In many cases, water needs to be disinfected to inactivate (or kill) these microbial pathogens. However, disinfectants like chlorine can react with naturally-occurring materials in the water to form byproducts such as:

- Trihalomethanes (THMs)
- Haloacetic acids (HAAs)
- Chlorite
- Bromate

These byproducts, if consumed in excess of EPA's standard over many years, may lead to increased health risks. EPA has developed the Stage 2 DBP rule to protect public health by limiting exposure to these disinfectant byproducts.

One of the primary changes in the rule is the switch from Running Annual Averaging (RAA) where all samples collected are averaged over a 12-month period to a Location Annual Average (LAA) where individual sites are chosen and averaged over a 12-month period. Also, the compliance LAA levels for Total Trihalomethane (TTHM) and Haloacetic Acids 5 (HAA5) have been lowered.

Total Coliform Rule

There are a variety of bacteria, parasites, and viruses that can potentially cause health problems if humans ingest them in drinking water. Testing water for each of these potential pathogens (disease causing agents) would be difficult and expensive. Instead, water quality and public health workers measure coliform levels. The presence of any coliforms in drinking water suggests that there may be a pathway for pathogens and/or fecal contamination to enter the drinking water distribution system (pipes, storage facilities, etc.).

Total coliforms are a group of closely related bacteria that are (with few exceptions) not harmful to humans. Because total coliforms are common inhabitants of ambient water and may be injured by environmental stresses (e.g., lack of nutrients) and water treatment (e.g., chlorine disinfection) in a manner similar to many pathogens, EPA considers them a useful indicator of these pathogens. Health problems associated with these pathogens include diarrhea, cramps, nausea, and vomiting. Together, these symptoms comprise a general category known as gastroenteritis. Gastroenteritis is not usually serious for a healthy person, but it can lead to more serious problems for people with weakened immune systems, such as the very young, elderly, or immuno-compromised.

For drinking water, total coliforms are used to determine the adequacy of water treatment and the integrity of the distribution system. The absence of total coliforms in the distribution system minimizes the likelihood that fecal pathogens are present. Thus, total coliforms are used to determine the vulnerability of a system to fecal contamination.

To comply with the monthly MCL for total coliforms, JCSA must not find coliforms in more than five percent of the samples they take each month to meet EPA's standards. If more than five percent of the samples contain coliforms, JCSA operators must report this violation to VDH and the public. If a sample tests positive for total coliforms, JCSA must collect a set of repeat samples located within five or fewer sampling sites adjacent to the location of the routine positive sample within 24 hours. When

a routine or repeat sample tests positive for total coliforms, it must also be analyzed for fecal coliforms or E. coli, which are types of coliform bacteria that are directly associated with fresh feces. A positive result for fecal coliforms or E. coli can signify an acute MCL violation, which necessitates rapid VDH and public notification because it represents a direct health risk. Often, an acute violation due to the presence of fecal coliform or E. coli will result in a "boil water" notice.

4.2.4.2 Surface Water Regulatory Requirements

The LCR, TCR, and the Stage 2 DBP Rule requirements for treated surface water are the same as those presented in the Groundwater Regulatory Requirements section. Should JCSA wish to evaluate treating surface water in the future, the following rules will apply:

Filter Backwash Recycling Rule

In May 2001, EPA released a rule governing the process of recycling waste water generated by the backwashing of drinking water filters. The Filter Backwash Recycling Rule (FBRR) is required by the Safe Drinking Water Act as one method of reducing the risks posed to consumers by microbial contaminants that may be present in public drinking water supplies.

Long Term 2 Enhanced Surface Water Treatment Rule (LT2)

Pathogens, such as *Giardia* and *Cryptosporidium*, are often found in water, and can cause gastrointestinal illness (e.g., diarrhea, vomiting, and cramps) and other health risks. In many cases, this water needs to be disinfected through the use of additives such as chlorine to inactivate (or kill) microbial pathogens.

Cryptosporidium is a significant concern in drinking water because it contaminates surface waters used as drinking water sources, it is resistant to chlorine and other disinfectants, and it has caused waterborne disease outbreaks. Consuming water with *Cryptosporidium* can cause gastrointestinal illness, which may be severe in people with weakened immune systems (e.g., infants and the elderly) and sometimes fatal in people with severely compromised immune systems (e.g., cancer and AIDS patients).

The purpose of the LT2 rule is to reduce disease incidence associated with *Cryptosporidium* and other pathogenic microorganisms in drinking water. The rule applies to all public water systems that use surface water or ground water that are under the direct influence of surface water. The rule will bolster existing regulations and provide a higher level of protection of the drinking water supply by:

- Targeting additional *Cryptosporidium* treatment requirements to higher risk systems
- Requiring provisions to reduce risks from uncovered finished water storage facilities
- Providing provisions to ensure that systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts

Should JCSA purchase untreated water from NNWW or develop its own surface water source, these regulations will all need to be considered in the design phase of the surface water treatment facility and will impact the selection of the proper equipment. Additional water quality monitoring will be required based on the surface water regulatory requirements and should be added to JCSA's budget for a new surface water supply source.

Section 5

Ware Creek Reservoir

JCSA identified the Ware Creek Reservoir as a water supply option in the 1980s. A description of the Ware Creek Reservoir project and the reasons why it was not considered a viable option is provided in this section. The information is based on a review of the following sources:

- Final Determination of the U.S. Environmental Protection Agency's Assistant Administrator for Water Pursuant to Section 404(c) of the Clean Water Act Concerning the Proposed Ware Creek Water Supply Impoundment, James City County, Virginia. (http://water.epa.gov/lawsregs/guidance/wetlands/upload/WareCreekFD.pdf (Last accessed February 10, 2015)
- http://www.epa.gov/owow/wetlands/pdf/Ware_Creek_Summary.pdf (Last accessed February 10, 2015)

5.1 Description

The Ware Creek Reservoir project was a proposed impoundment along the James City County/New Kent County border. The Ware Creek Reservoir project involved the construction of an earthen dam on a northwest-southeast axis across Ware Creek, approximately 1,000 feet downstream from its confluence with France Swamp and 4.72 miles upstream of the Ware Creek confluence with York River. The dam would have been 1,450 feet long with a crest width of 40 feet, base width of 300 feet, and crest elevation +48 feet mean sea level. The reservoir would have had a surface area of 1,217 acres, an average water depth of 16 feet, and a volume of 6,355 million gallons at a normal pool elevation of +35 feet mean sea level. The Ware Creek Reservoir's safe yield was estimated to be 9.4 mgd. The average stream flow at the dam was estimated to be 12.3 mgd (19.2 cubic feet per second(cfs)) with a maximum flow of 12,485 cfs.

The majority of the Ware Creek drainage basin would have been located upstream of the proposed dam location, and at inception was undeveloped, and characterized by upland areas with hardwood and mixed pine-hardwood trees. Since the 1980s, the area has seen an increase in development within the proposed watershed. The wetland environment would have been relatively undisturbed, supporting a diverse wildlife population. There were sightings of three significant bird species in the vicinity of the Ware Creek wetland area: Southern Bald Eagles, Great Blue Herons, and Black Duck. The Southern Bald Eagle was not known to nest in the area; however, there were anecdotal references to its sighting. The species prefers open water environment and is likely to limit its activities to portions of the watershed that provide suitable habitat. The Great Blue Heron has a rookery in France Swamp and has low tolerance for human disturbance. The Black Duck has experienced decline in population due to habitat loss.

Construction of the Ware Creek Reservoir would have inundated 425 acres of waters of the United States (381 acres vegetated with scrub-shrub, herbaceous or forested wetland and 44 acres of open water less than two meters deep) and 792 acres of primarily forested upland. The project would have eliminated over 38 percent of the vegetated wetland communities in the Ware Creek watershed. The destruction of the wetlands could have had an adverse impact on the wildlife.

Ware Creek discharges into a tidal brackish section of the York River and experiences fluctuations in salinity. The National Marine Fisheries Service indicated that Ware Creek is suitable for spawning of anadromous fish species. The water supply withdrawal would have reduced the stream flow downstream of the dam from 12.4 to 3.3 mgd. The reduction would have affected the downstream wetland communities and nutrient transport capabilities of the ecology.

James City County developed a mitigation plan to offset the adverse impacts of the project. The proposed mitigation plan included:

- Wetland creation and wetland and upland preservation in the Ware Creek/York River watershed
- Creation of nesting habitat as mitigation for an existing Great Blue Heron rookery in the Ware Creek watershed
- Wetland creation and breaching on an existing dam in Yarmouth Creek to reconnect wetlands and reestablish anadromous fish access in the James River watershed
- Extensive preservation of wetlands and uplands in Yarmouth and Powhatan Creeks in the James River watershed.

The Recommended Determination indicated that "in all probability, James City County's is the most comprehensive mitigation plan put forth to date in this region."[1] Although EPA commended James City County for their effort, EPA concluded in the Final Determination issued on July 10, 1989 that "the proposed mitigation plan would not adequately offset the anticipated adverse impacts to wildlife" and that "there are practicable, less environmentally damaging alternatives to satisfy James City County's projected water supply needs." The use of groundwater from the lower aquifer was identified as a viable source which resulted in the construction of the FFWTF.

5.2 Reasons for Abandonment

5.2.1 Local Water Supply Source

In September 1989, James City County filed a complaint in U.S. District Court to vacate EPA's Final Determination issued on July 10, 1989. The District Court granted the relief to James City County based on the finding that the County had no practicable water supply alternative available. On March 1, 1991, the U. S. Army Corps of Engineers issued a Section 404 permit to James City County for the Ware Creek Reservoir construction.

EPA appealed the Corps of Engineers' permit approval. On January 29, 1992, the Court of Appeals reversed the District Court's decision and remanded the case to EPA. The Court requested EPA to determine if the adverse environmental impacts justify the restriction for site development even if there were no other practicable water supply alternatives for the County. On March 27, 1992, the Court reaffirmed EPA's 1989 determination and withdrew the Section 404 permit.

[1] Final Determination of the U.S. Environmental Protection Agency's Assistant Administrator for Water Pursuant to Section 404(c) of the Clean Water Act Concerning the Proposed Ware Creek Water Supply Impoundment, James City County, Virginia. Page 44.

James City County filed suit for review of the Remand Determination and the District Court supported the County. EPA appealed the decision and filed with the Fourth Circuit to reverse the District Court's decision. On December 23, 1993, the Fourth Circuit upheld the 1989 Final Determination.

James City County filed for a rehearing in banc of the case and was denied on March 25, 1994. On June 22, 1994, the County filed a Writ of Certiorari for the U.S. Supreme Court to hear the case, but was denied certiorari on October 3, 1994. As a result, the County abandoned their consideration of the Ware Creek Reservoir as a local water supply source.

5.2.2 Regional Water Supply Source

Ware Creek Reservoir was reconsidered as a potential water supply for the Regional Raw Water Study Group (RRWSG). The RRWSG formed in 1987 to evaluate water supply needs of the Lower Peninsula area of southeast Virginia and to develop a plan for a regional water supply. James City County is part of the RRWSG and would receive water from the Ware Creek Reservoir. The Ware Creek Reservoir was evaluated in conjunction with the King William Reservoir project which is discussed in Section 6.

Ware Creek Reservoir was considered with pumpovers from the Pamunkey, Mattaponi, Chickahominy, and/or James rivers. The RRWSG considered Ware Creek Reservoir as the least favorable of the reservoir alternatives (including King William and Black Creek) for similar reasons identified in the local supply final determination, as well as the following:

- Largest reduction in streamflow levels below a proposed dam site
- Large impact on hydrologic and salinity regimes of wetlands below a proposed dam site
- Questionable long-term water quality due to intense development in the Stonehouse community
- Negative impact on the largest and most diverse area of wetlands and largest population of Great Blue Heron
- Ten percent reduction in treated water safe yield benefit compared to King William Reservoir
- Largest impact on number of existing roadways

The Ware Creek Reservoir was eliminated from further evaluation as a regional water supply source for James City County and other members of the RRWSG.

Section 6

King William Reservoir

The King William Reservoir was identified as a potential regional water supply source for the RRWSG in the 1980s. JCSA had planned on purchasing 4 mgd of the King William Reservoir's safe yield to meet their future water supply needs. A description of the King William Reservoir project and why it was abandoned is provided in this section. The information is based on a review of the following sources:

- Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*.
- http://www.virginiaplaces.org/watersheds/kwreservoir.html (Last accessed February 10, 2015)

6.1 Description

The King William Reservoir would have involved the construction of a 78-foot high, 1,700-foot long dam across Cohoke Creek, approximately 3.5 miles upstream of the Cohoke Millpond dam and 0.2 miles downstream of the Route 626 crossing in King William County. The reservoir would have encompassed a 1,526-acre surface area with a volume of 12.2 billion gallons at a normal pool elevation of +96 feet mean sea level.

The King William Reservoir project also involved a pumpover from Mattaponi River since Cohoke Creek did not have sufficient flow for the reservoir. The raw water intake structure and pump station would be located on the Mattaponi River at Scotland Landing, upstream of the fresh/brackish water boundary. Water would have be pumped to the King William Reservoir through 1.5 miles of 54-inch diameter pipe.

Construction of the King William Reservoir would have inundated 403 acres of waters of the United States and potentially affected two threatened plant species, the sensitive joint-vetch and the small whorled pogonia, which may be present. The Mattaponi tribe indicated that a secret sacred site would be destroyed by the reservoir. Fisheries on the Mattaponi River may also be threatened.

A $31 million wetland mitigation plan was prepared to offset the adverse impacts of the project. The Virginia Marine Resources Commission permit allowing the intake to be constructed was approved in 2004. The U.S. Army Corps of Engineers (USACE) approved the permit to construct the reservoir in 2005.

6.2 Reasons for Abandonment

Since its inception, the King William Reservoir project had undergone controversial, regulatory approvals. The USACE's approval of the Section 404 permit in 2005 was challenged by The Alliance to Save the Mattaponi River, the Chesapeake Bay Foundation, the Sierra Club, and the Southern Environmental Law Center. On March 31, 2009, the Federal District Court rejected the USACE's 2005 approval of the Section 404 permit. On April 30, 2009, the USACE directed Newport News to stop work on the project. The project managers indicated that there was a risk that the DEQ and Virginia

Marine Resources Commission permits would expire and that the USACE would not issue a new Section 404 permit. Newport News abandoned the King William Reservoir project on September 22, 2009.

Section 7

York River

The York River flows along the northeast boundary of James City County. The York River has a drainage basin that encompasses 2,626 square miles; the headwaters begin in Orange County and flows southeasterly into Chesapeake Bay.[1]

An investigation of the York River as a potential water supply source for JCSA was conducted based on information from the following sources:

- Buchart Horn, Inc. and Watek Engineering. 2005. *A Brief Feasibility Study, Use of the York or James River for Future Water Supply*.
- Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.*
- Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*.
- Rice, Karen C., Mark R. Bennett, and Jian Shen. USGS Open File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.*
- U.S. Environmental Protection Agency. 2014. STORET.
- Virginia Department of Environmental Quality. 2013. *Status of Virginia's Water Resources, A Report on Virginia's Water Resources Management Activities.*
- Virginia Institute of Marine Sciences, Virginia Estuarine and Coastal Observing System (VECOS) (http://web2.vims.edu/vecos/StationDetail.aspx?param=YRK006.77&program=CMON)

7.1 Existing Withdrawals

The Yorktown Fossil Power Plant, which is located in York County, uses water from the York River for cooling water.[2] The Virginia Water Protection Permit established a 2007 use estimate of 817 mgd. DEQ reported an average withdrawal of 691 mgd with a 2012 withdrawal of 531 mgd.[3] Most of the water is returned to the York River.

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[1] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 3-5.

[2] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 1-9.

[3] Virginia Department of Environmental Quality. 2013. *Status of Virginia's Water Resources, A Report on Virginia's Water Resources Management Activities*.

7.2 Existing VPDES Discharges

There were no VPDES permitted facilities identified in the section of the York River that flows along the James City County boundary.[4] Approximately 10 miles upstream from York River State Park, there are two VPDES discharges into the Pamunkey River that feed into the York River at West Point: a pulp mill owned by Rocktenn CP LLC - West Point (VPDES Permit No. VA0003115) and the Hampton Roads Sanitary District (HRSD) West Point sewage treatment plant (VPDES Permit No. VA0075434).[5] The VPDES discharge locations are shown on Figure 7-1.

7.3 Previous Studies

7.3.1 Lower Virginia Peninsula Regional Raw Water Supply Plan EIS

The York River was evaluated as a potential water supply source in the Lower Virginia Peninsula Regional Water Supply Plan EIS. The raw water intake structure and pump station were proposed to be located in James City County, midway between Sycamore Landing and York River State Park, approximately 23 miles upstream from the mouth of the York River. The conceptualized facility included an 85-mgd raw water intake and a 44-mgd RO plant located near Williamsburg's Waller Mill water treatment plant in York County. A 41-mgd capacity concentrate disposal pipeline from the RO plant to the York River with an outfall located near HRSD's York River sewage treatment plant were also proposed.

The proposed pretreatment process included screening, conventional sedimentation and filtration, and chemical addition for scale control and pH adjustment. The pretreated water would flow into an RO unit. Chlorine for disinfection, chemical conditioning for corrosion control, and degassing would be applied to the permeate. The feed water was assumed to have a maximum total dissolved solids (TDS) content of 23,500 mg/L. With a water recovery rate of 52 percent and a TDS rejection rate of 99 percent, a maximum TDS level of 46,500 mg/L was estimated for the concentrate stream.

As stated in the EIS, the York River was considered technologically and economically infeasible at the time as a regional water supply source due to raw water quality variability, particularly fluctuating salinity levels, and treatment control concerns. However, since the time that the EIS was completed in 1997, technological advancements have occurred that allow RO systems to cope better with fluctuations in salinity levels and makes RO technology a more viable option for treating the York River today. These technological advancements include improvements in RO membrane performance including dramatic improvements in RO membrane rejection and the rated permeate production per RO element. In addition, new low energy and ultra-low energy membranes have been developed which help bridge the performance gap between brackish water and seawater RO membranes. These membranes are suited better for treating tidally influenced water sources such as the York, James, and Chickahominy rivers. Variable frequency drives are more reliable and are used more extensively today than at the time the EIS was published. Variable frequency drives provide much greater flexibility in adjusting the flow rate and operating pressure of the high pressure RO pumps in order to reliably maintain the design capacity and required product quality under fluctuating conditions of feed water TDS and temperature. More efficient energy recovery devices have also been developed which help to significantly reduce the cost of RO treatment.

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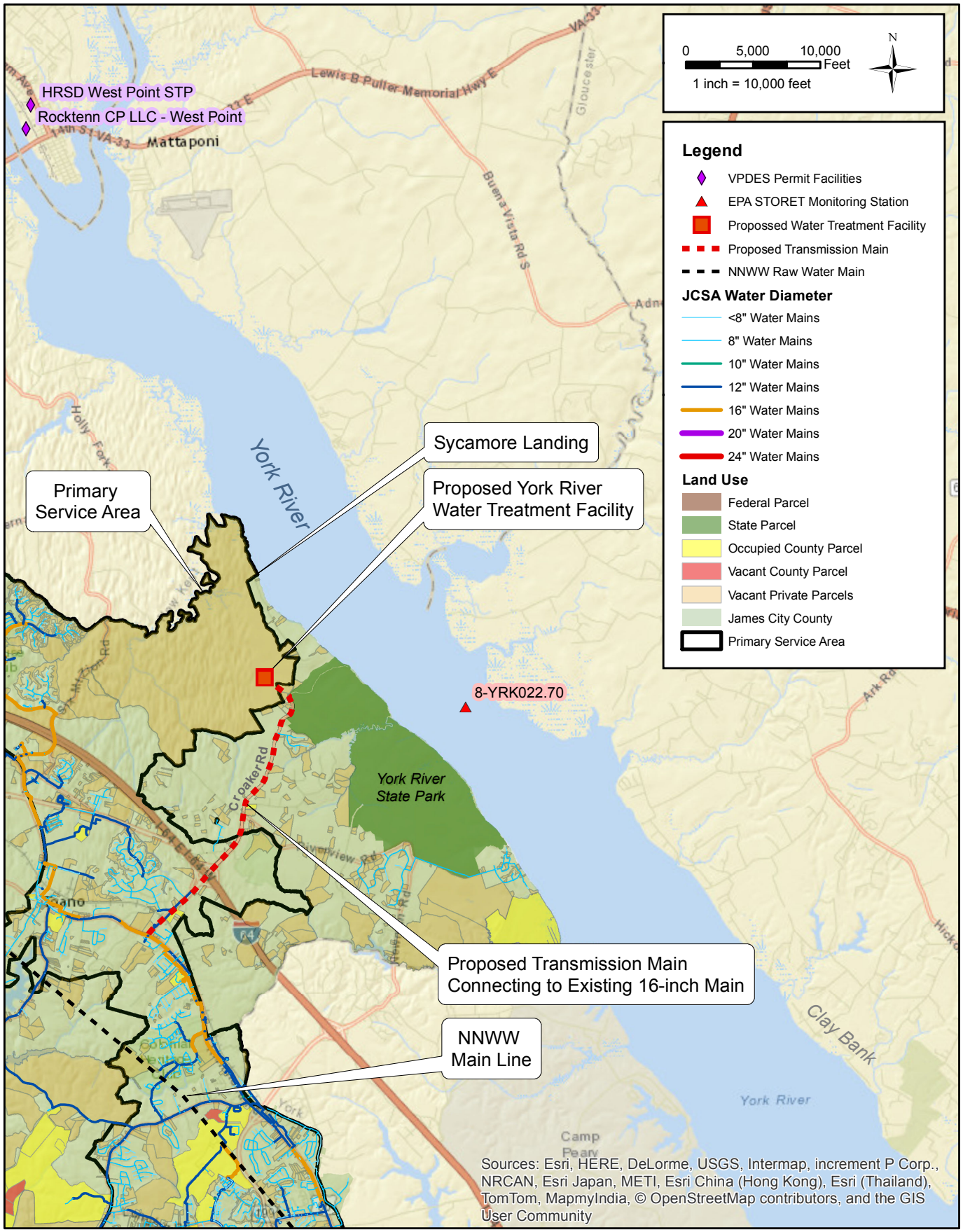
[4] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Map 3-15.

[5] http://watersgeo.epa.gov/mwm/(Last accessed November 13, 2014)



CDM Smith

Figure 7-1
York River
Potential Water Supply Source

7.3.2 Brief Feasibility Study for JCSA Future Water Supply (2005)

A brief feasibility study of the York River as a future water supply for JCSA was completed in November 2005 by Buchart Horn, Inc. and Watek Engineering Corporation. The study considered the use of the York River as a water source for the northern portion of the County with an 8-mgd water treatment facility constructed in the Croaker Road area. Raw water quality was based on data collected from DEQ Water Quality Monitoring Station 8-YRK022.70.

York River was characterized as essentially fresh water with salinity increasing with depth. Salinity ranged from 4.7 to 16.6 g/L (4.7 to 16.6 parts per thousand (ppt)) with an average of 12.3 g/L (12.3 ppt). A maximum salinity of 16.6 ppt correlates to a TDS of approximately 16,600 mg/L which is considerably lower than the TDS of 23,500 mg/L reported in the EIS; the discrepancy between the TDS and salinity in the Buchart Horn Watek Engineering Corporation study appears questionable.

A multi-port intake was suggested to provide flexibility. Riverbank filtration was also proposed as an option to improve raw water quality, reduce pretreatment costs, and potentially simplify the permitting process by not directly impacting the waterway. Reverse osmosis was recommended for desalination. A recovery of 55 percent was assumed.

The study recommended a pretreatment process consisting of coagulation/flocculation, sedimentation followed by microfiltration, and reverse osmosis. The conceptual-level construction cost estimate for the treatment facility was $59 million and included 8 million gallons of distribution storage. The conceptual-level operating cost estimate was $3.20 per 1,000 gallons of water produced.

7.4 Evaluation of Treatment Options

7.4.1 Water Quality Evaluation

For the purpose of this study, the location of a raw water intake in the York River close to Croaker Road was assumed. Water quality data from the following sources were reviewed to determine treatment requirements:

- U.S. Environmental Protection Agency. 2014. STORET.
- Rice, Karen C., Mark R. Bennett, and Jian Shen. USGS Open File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.*
- Virginia Institute of Marine Sciences, Virginia Estuarine and Coastal Observing System (VECOS) website

Table 7-1 presents a summary of the water quality data from DEQ Water Quality Monitoring Station 8-YRK022.70. Intermittent sampling was conducted at this station from March 15, 2005 to December 5, 2013.

Table 7-1 DEQ Water Monitoring Station 8-YRK022.70 Available Data (2005-2013)

Parameter	Units	Minimum	Maximum	Average	Number of Samples
Ammonia as N	mg/L	0.024	0.163	0.076	8
Carbon	mg/L	0.997	4.55	2.439	8
Dissolved oxygen (DO)	mg/L	9.26	9.76	9.46	6
Enterococcus	cfu/100ml	25	25	25	4
Fecal Coliform	cfu/100ml	25	25	25	4
Fixed suspended solids	mg/L	14	143	58	8
Inorganic nitrogen (nitrate and nitrite) as N	mg/L	0.077	0.245	0.127	8
Nitrate as N	mg/L	0.042	0.245	0.116	8
Nitrite as N	mg/L	0.002	0.038	0.011	8
Nitrogen as N	mg/L	0.081	0.556	0.378	16
pH		7.48	7.82	7.70	16
Phosphorus as P	mg/L	0.002	0.053	0.022	16
Phosphorus, Particulate Organic as P	mg/L	0.0189	0.1508	0.0771	8
Salinity	Ppt	7.21	16.8	14.6	16
Silica	mg/L	2.8	5.4	4.4	4
Specific conductance	uS/cm	12570	27488	24089	16
Temperature, water	deg C	8.29	11.77	9.37	16
Total suspended solids (TSS)	mg/L	19	163	69	8
Total volatile solids	mg/L	4	20	11	8
Turbidity	NTU	8.9	85	37	8

Source: U.S. Environmental Protection Agency. 2014. STORET database.

Units: mg/L = milligrams per liter
cfu = colony-forming unit
deg C = degree Celsius
ppt = parts per thousand
uS/cm = Microsiemens Per Centimeter
NTU = nephelometric turbidity unit

The USGS Open-File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay,* provides salinity data at the head of the York estuary from 1998 to 2008. A summary of the salinity data from the USGS report is presented in Table 7-2. The highest salinity observed during this period was 14.5 ppt in January 2002. The report also provides information on the 31-day mean salinity along the York River for October 2002 (a dry-year scenario) based on the distance upstream of the river mouth. The 31-day mean salinity was estimated to be 13.1 ppt at the head of the river and 14.5 ppt at the proposed intake location. The maximum salinity of 14.5 ppt at the head of the river is approximately 10 percent higher than the 31-day mean salinity of 13.1 ppt. Hence, for the purposes of this study, the maximum salinity at the York River intake was estimated to be 16 ppt, i.e. 10 percent higher than the 31-day mean salinity of 14.5 ppt. The estimated maximum salinity of 16 ppt compares well with the maximum salinity of 16.8 ppt reported in Table 7-1 for DEQ Water Quality Monitoring Station 8-YRK022.70.

Table 7-2 USGS York River Salinity Data

Parameter	Head of the York River	Proposed WTF Site
Maximum Salinity – January 2002 based on 1998 to 2008 data	14.5 ppt[a]	16.0 ppt[d]
31-Day Mean Salinity – October 2002	13.1 ppt[b]	14.5 ppt[c]

Source: Rice, Karen C., Mark R. Bennett, and Jian Shen. USGS Open File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.* Parameters estimate basis with reference to figures in the USGS report:

a. Figure 10
b. Figure 14
c. Figure 14 with WTF intake estimated to be 43 km (27 mi) from mouth of the river
d. Estimated assuming same percent relationship of maximum to 31-day mean salinity as head of the York River.

The Virginia Institute of Marine Sciences, VECOS database provides the following average values for 2005 for monitoring station TSK:

- Salinity = 10 ppt
- Temperature = 16.7 degrees Celsius (62 degrees Fahrenheit)
- Turbidity = 58 NTU

The VECOS salinity of 10 ppt is lower than the average salinity of 14.6 ppt for DEQ Water Quality Monitoring Station 8-YRK022.70. The VECOS temperature of 16.7 degrees Celsius is higher than the DEQ average of 9.37 degrees Celsius. Likewise, the turbidity of 58 NTU is higher than the DEQ average of 11 NTU. It should be noted, however, that the DEQ average is based on a limited number of samples (8 to 16 samples), while the VECOS TSK station has been continuously collecting data at 15 minute intervals since 1995. For this reason, the VECOS data has been used to establish the design criteria for the York River site.

Please note that while salinity values are typically reported in ppt, TDS and ionic concentrations are usually reported in mg/L or ppm (parts per million). For clean water that does not have high concentrations of dissolved organics, TDS values in mg/L or ppm should be approximately equal to salinity values in ppt times one thousand.

7.4.2 Recommended Treatment

Based on the water quality evaluation, RO treatment is recommended for the York River to reduce the level of TDS from values ranging up to 16,800 mg/L to drinking water quality levels with TDS of less than 350 mg/L as JCSA's established water quality goal.[6] While others have evaluated RO treatment for the York and James rivers and concluded that this technology would not be cost effective, RO membrane technology has improved significantly over the past 10 to 20 years. Salt passage through seawater RO membranes has decreased by over 50 percent in the past 10 years. In addition, new low energy and ultra-low energy membranes have been developed in the last 10 years that can reduce power consumption by 17.5 percent and 29 percent, respectively, versus conventional seawater RO

[6] American Membrane Technology Association. 2006. *New Facilities Solutions.* "Five Forks RO plant in Virginia after 1 year of successful operation". Table 1. Page 5. [http://www.amtaorg.com/wp-content/uploads/AMTA_Summer06.pdf (Last accessed February 12, 2015)]

membranes. For this reason, a re-evaluation of RO technology for these applications is considered to be warranted.

The proposed treatment schematic for the York River is shown on Figures 7-2 and 7-3. In the proposed scheme, water from the York River would be drawn through wedge wire screens into a raw water pump basin. The intake screens will remove suspended particles greater than a few millimeters in size and prevent the impingement or entrainment of fish and other water fauna.

To remove the relatively high levels of suspended solids and turbidity ahead of the RO system, a robust pretreatment system consisting of coagulation, flocculation and sedimentation followed by either microfiltration (MF) or ultrafiltration (UF) is recommended. In addition to the removal of suspended solids, the MF/UF system will also provide an effective barrier for the removal of water borne pathogens such as *Giardia lamblia*, *Cryptosporidium*, and viruses. Low turbidity feed water from the MF/UF system will be fed to the suction side of the high pressure pumps for the RO system.

The high pressure RO pumps will pressurize the feed water to overcome the osmotic pressure of the feed stream and allow the RO system to extract high purity water from the salt water feed. The operating pressure required by the membranes will increase or decrease in proportion to the salinity and temperature of the feed water. As shown on Figure 7-3, at the average operating condition of 10,000 mg/L of feed and 17 degrees Celsius (63 degrees Fahrenheit), the feed water to the RO membranes will be pressurized to approximately 330 pounds per square inch (psi). At this operating pressure, the RO membranes allow fresh water to flow through the membranes while the majority of the dissolved salts are rejected. As a result, the RO membranes separate the salty river water into a higher purity stream (70 percent of flow) and a more concentrated stream (30 percent of flow). In this manner, the RO process essentially converts a portion of brackish water into a high purity drinking water stream (permeate) and returns the unused portion (concentrate) back to the river. The high purity permeate from the RO system will be passivated through the addition of carbon dioxide and hydrated lime and receive final disinfection in chlorine contact basins prior to storage and distribution. Concentrate from the process will be returned to the river.

Collocating the desalination plant with a power plant or industrial plant that uses once-thru cooling water and discharges reject heat can be cost-effective in terms of reducing energy requirements for the desalination plant as a result of temperature extremes. Direct heating of the feed water to increase temperature to lower operating pressure would probably not be cost-effective.

Pretreatment solids may be discharged back to the river depending on the VPDES discharge limits. As shown on the process flow drawings, a sludge thickener was included for removal of pretreatment solids with supernatent recycle back to the head of the plant. Chlorine can be dosed intermittently at the intake pump station to prevent growth of organisms in the raw water pipelines, pretreatment basins, and MF/UF treatment trains. Chlorine can be neutralized with sodium bisulfite on an assured basis following pretreatment (upstream of the cartridge filters at the RO treatment facility) to ensure that any residual chlorine is removed upstream of the RO membranes and prior to the return of the concentrate to the estuary. Redundant chlorine residual analyzers can be provided to alarm and to shut down the membrane trains in the event that a chlorine residual is detected.

In the RO process, the concentration of salts in the remaining salt water stream or concentrate stream increases as high purity drinking water is removed from the salt water. In this situation, certain salts such as calcium carbonate, calcium sulfate, barium sulfate, strontium sulfate, or silica could become supersaturated near the membrane surface. These supersaturated salts could precipitate and form

scale, which is similar to deposits sometimes found in water heaters or water mains. Scale formation is avoided through a combination of adjusting feed water pH, the addition of antiscalant chemical, and the proper selection of the RO system recovery. The scaling potential of the feed water to the RO system is often the limiting factor in determining the system recovery for the RO system.

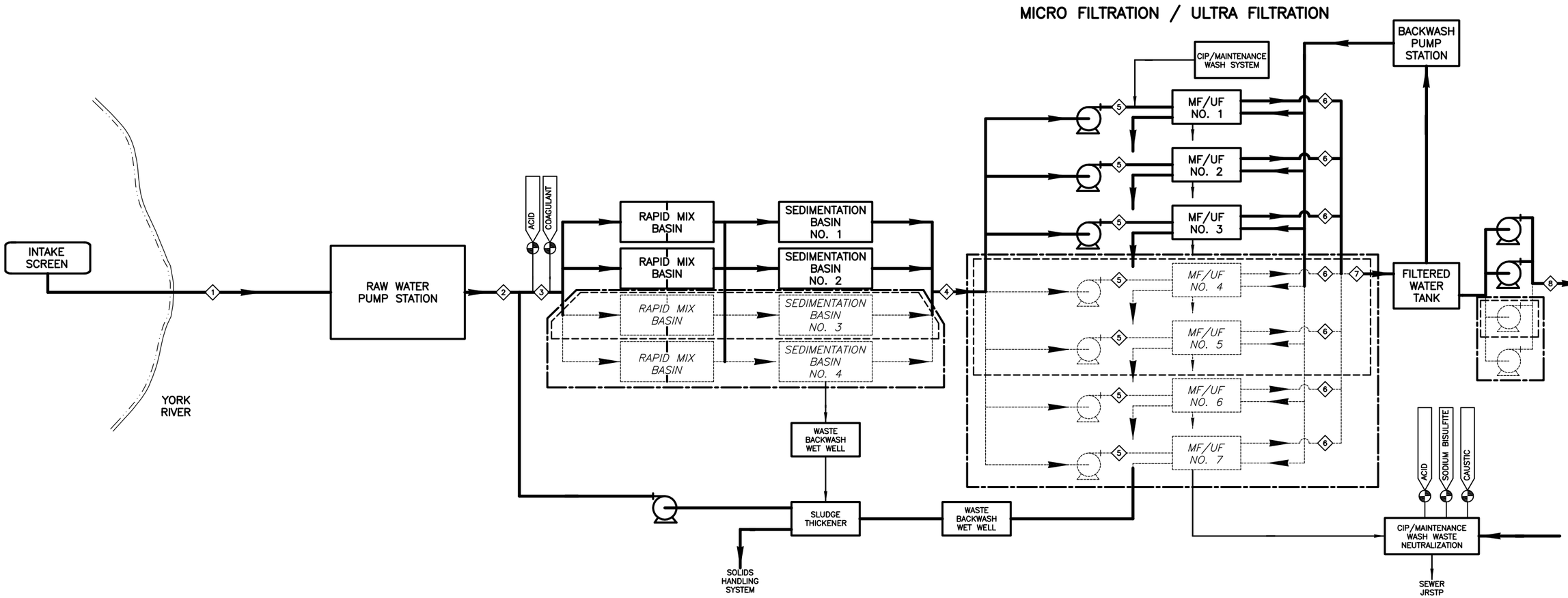
Unfortunately, the raw water data bases that were reviewed to determine the design basis for the RO system did not include sufficient data for the primary ions that are used to determine the scaling potential for an RO system. In this case, the RO system recoveries were selected based on membrane performance parameters including operating pressure, permeate quality, lead element flux, minimum required concentrate flow, etc. If RO is shown to be a cost-effective alternative water supply, it is recommended that a more rigorous analysis of membrane scaling potential and the impact on system recovery be performed.

The RO concentrate needs to be discharged to tidal waters with relatively high salinity levels. Since the RO concentrate consists of natural substances found in the water supply, the only treatment typically required prior to discharge is an air injection system to raise the dissolved oxygen to an acceptable level. However, the actual limits on the discharge concentrations may require dilution and/or diffusers and a mixing zone to stay below the discharge limits.

The required capacity for the treatment facility is highly dependent on the DEQ permitted groundwater withdrawal, the water demand projection, and the amount of water purchased from NNWW. For the purposes of this study, 4-, 8-, and 12-mgd plant capacities were considered. To meet the projected maximum day demand with the existing DEQ Groundwater Withdrawal Permit or revised permit average withdrawal of 7.84 mgd (refer to Tables 3-6 and 3-8), a 4-mgd treatment facility is required prior to 2030 to supplement JCSA's existing water supply without the initial purchase of 2 mgd from NNWW. If DEQ reduces the permitted average groundwater withdrawal to 4 mgd, an 8-mgd facility will be required to meet the 2050 projected demand (refer to Table 3-7). With the initial purchase of 2 mgd from NNWW, a 4-mgd treatment facility would be required prior to 2020 if the Groundwater Withdrawal Permit is reduced to 4.0 mgd. With the existing DEQ Groundwater Withdrawal Permit, the facility will need to be expanded to 12 mgd by 2050 if aggressive growth occurs as reflected in the HRRWSP and additional water is not purchased from NNWW.

The concept for the equipment configuration for the base 4-mgd plant and for expansion to 8-mgd or 12-mgd capacity in the future is shown on the Figures 7-2 and 7-3. This approach assumes that JCSA will want "n+1" redundancy on major process equipment. For the RO units, this translates to three RO units with a production capacity of 2 mgd each. Two units would normally be in operation for full capacity with the third unit serving as an installed standby unit. As shown on Figure 7-3 for the 8-mgd expansion case, two additional 2-mgd units (units 4 and 5) would be added with four units in operation for full capacity with one unit standby. For the 12-mgd capacity, two additional units would be installed above the five units provided for the 8-mgd plant. In this case, six units would be in operation for full production with one standby unit.

A similar expansion strategy could be employed for the MF/UF systems. The capacity of the MF/UF systems are typically five to ten percent higher than the required feed flow to the RO units to account for additional water requirements for backwashing, chemically enhanced backwashes, and maintenance washes.



PROCESS DATA

	1	2	3	4	5	6	7	8
FLOWS:								
Phase 1 MGD	6.13	6.13	6.13	6.01	3.01	2.86	5.71	5.71
Build-out MGD	18.4	18.4	18.4	18	3.01	2.86	17.14	17.14
CONSTITUENTS:								
TDS, Avg. mg/L	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
TDS, Max. mg/L	16,820	16,820	16,820	16,820	16,820	16,820	16,820	16,820
TSS, Avg. mg/L	58	58	58	12	12	0.5	0.5	0.5
TSS, Max. mg/L								
PRESSURES:								
Avg. psi	atm	45	atm	atm	15	4	4	45
Max. psi	atm	45	atm	atm	35	4	4	45

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis

12 - STREAM NUMBER

LEGEND:

---- 8 MGD

—·— 12 MGD

pw:\\dacpwapp1:PW_XM1\Documents\103518\106170\03 Reports and Studies\09 CADD Figures and Graphics\FIG 7-2.dwg
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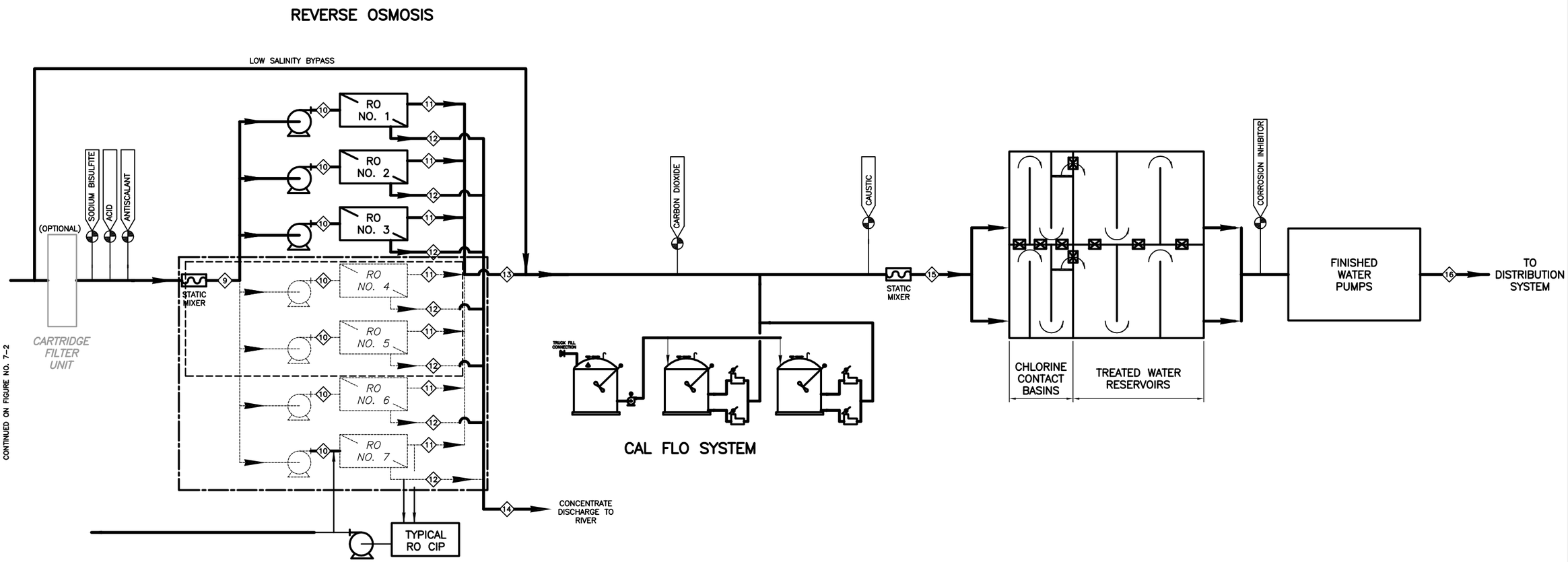
Figure No. 7-2
James City Service Authority
York River Process Flow Diagram I - Clarification and MF/UF



PROCESS DATA

	9	10	11	12	13	14	15	16
FLOWS:								
Phase 1 MGD	5.71	2.86	2.0	0.86	4.0	1.71	4.0	4.0
Build-out MGD	17.14	2.80	2.0	0.86	12.0	5.14	12.0	12.0
CONSTITUENTS:								
TDS, Avg. mg/L	10,000	10,000	100	33,140	100	33,140	<200	<200
TDS, Max. mg/L	16,820	16,820	274	55,835	340	55,835	<450	<450
TSS, Avg. mg/L								
TSS, Max. mg/L	0.5	0.5	-	3	-	3	-	-
PRESSURES:								
Avg. psi	30	329	10	465	15	10	8	50
Max. psi	30	599	10	879	15	10	8	50

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis
1 AT MAX TDS MIN TEMP
2 AT MAX TDS MAX TEMP
12 - STREAM NUMBER

LEGEND:
- - - - 8 MGD
— - — 12 MGD

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Figure No. 7-3
James City Service Authority
York River Process Flow Diagram **II** - Desal & Post-Treatment

pw:\\dacpwapp1:PW_XM1\Documents\103518\106170\03 Reports and Studies\09 CADD Figures and Graphics\FIG 7-3.dwg
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For the rapid mix and sedimentation basins, the proposed configuration includes two, 100-percent units with one unit capable of treating the required feed flow to two MF/UF units. In this case, if one flocculation/sedimentation train needs to be removed from service, one flocculation/sedimentation train could still provide sufficient flow to the MF/UF units to maintain rated capacity.

There are several potential options for permeate stabilization including carbon dioxide in combination with hydrated lime systems, lime saturators or calcite contactors. A Cal-Flo hydrated lime system is shown on the process flow drawing because it typically is more compact and easier to operate than the other two systems. The concept shown on the drawing would include a storage tank with transfer pump for the base 4-mgd system. This system would also have sufficient capacity for the 8-mgd system without requiring any additional equipment. For expansion to 12 mgd, a second dosing tank would be provided.

Passivated water following carbon dioxide and lime addition is split and flows into two chlorine contact basins. Each chlorine contact basin is configured with three contact channels arranged in series in a serpentine configuration. Finished water from each chlorine contact chamber flows into a treated water reservoir. Depending on the level of redundancy required, the chlorine contact basins and the finished water reservoirs could be arranged in several different configurations. For example, if a standby unit is required for each major process component, then the initial 4-mgd capacity plant could be provided with two chlorine contact basins and two reservoirs as shown in Figure 7-3 with each sized for a 4-mgd capacity plant. In this case, if a chlorine contact chamber or reservoir needs to be taken out of service, the other contact chamber or reservoir could still accommodate full plant capacity. Sizing of the reservoir basins assumes that approximately one million gallons of storage capacity would be provided for a 4-mgd facility. For a plant expansion to 8 mgd, one additional chlorine contact chamber and reservoir could be added to provide the installed standby capacity. For the 12-mgd facility, a total of four chlorine contact basins and reservoirs sized for the 4-mgd capacity case would be provided to cover the design and standby capacity.

The design of the RO system for the York River location, and for the James and Chickahominy River locations (refer to Sections 8 and 9) as well, falls in a range that is generally between brackish and seawater RO designs. Brackish RO membranes typically operate at maximum operating pressures in the range of 400 to 500 psi although the membranes are nominally pressure-rated to 600 psi. Depending on the system recovery and operating temperature range, brackish RO membranes typically treat brackish water up to a concentration of 8,000 to 10,000 mg/L. For high feed water concentrations and higher operating pressures, seawater RO membranes are typically employed.

There are three general categories for seawater RO membranes: higher rejection, low energy, and ultra-low energy. Higher rejection membranes are typically used if the plant owner prefers lower chloride or sodium concentrations than required by federal or state drinking water requirements or if low concentrations of trace constituents such as boron or bromide are required. For feed water with TDS lower than a "typical" seawater concentration of 35,000 mg/L, low energy and ultra-low energy membranes can be used to meet product quality goals at lower power consumption.

For the York River design concept with a maximum feed water salinity of 16.8 ppt, which is almost 50 percent the salt concentration of seawater, a hybrid RO membrane system design consisting of low energy and ultra-low energy consumption seawater RO (SWRO) membranes was developed. This hybrid membrane design will use the higher rejecting low energy membrane to provide sufficiently high salt rejection to produce a product water stream with less than 350 mg/L TDS from 16,800 mg/L

feed water at the maximum operating temperature of 28 degrees Celsius, while using the ultra-low energy membranes to provide power savings when operating at the highest operating pressure on 16,800 mg/L feed water at 2 degrees Celsius. At these conditions, the projected feed pressure to the RO system would increase to approximately 600 psi as compared to the 330 psi pressure required for the average feed water conditions of 10,000 mg/L and 17 degrees Celsius.
Since the average feed TDS of 10,000 mg/L is more in the brackish RO (BWRO) TDS range than in the seawater RO range, a two-stage reverse osmosis system operating at 70 percent recovery was proposed. Because of the relatively high recovery, two stage design, and high operating pressure, a turbocharger type energy recovery system is used to recover residual pressure energy from the concentrate stream. The turbocharger recovers pressure energy from the second-stage concentrate leaving the RO process and transfers this energy to the feed to the second-stage of the RO system. For the maximum operating pressure case, the turbocharger will recover pressure energy from the second-stage concentrate stream which will enter the turbine side of the turbocharger at 879 psi and exit at 15 psi to the pump side of the turbocharger which will boost the pressure of the concentrate leaving the first stage of the RO unit from 589 psi and feed it to the second-stage membranes at 893 psi. Without the energy recovery from the turbocharger, the feed pressure to the first stage and overall power consumption of the RO units would be approximately 20 percent higher.

7.5 Physical Infrastructure Impacts

Based on a review of the James City County GIS parcel data base, vacant property appears to be available for the York River water treatment facility northwest of the York River State Park. To feed into the existing water system, it is assumed that approximately 24,000 feet of 36-inch diameter main will be required from an 8-mgd water treatment facility to the existing 16-inch diameter main on Richmond Road. The capacity of the 36-inch diameter would also be adequate for a 12-mgd facility. Additional infrastructure improvements may also be required within the existing system to transmit the flow to the demand centroid. It is recommended that JCSA conduct simulations on their hydraulic water model to define the infrastructure needs for the York River water treatment plant to be hydraulically effective for their system.

7.6 Financial Impacts

Planning-level cost estimates for the York River water treatment facility are presented in Table 7-3. The planning-level cost estimate includes costs to purchase a 7-acre property off Croaker Road. The planning-level cost estimate includes a cost to install a transmission main to connect the WTF to the existing system, but does not include costs for infrastructure improvements necessary to distribute the flow in the system. Planning-level cost estimates were developed for 4-, 8-, and 12-mgd plant capacities. For all capacities, the raw water intake facility, raw water transmission main, and finished water transmission main were assumed to be constructed for the ultimate capacity of 12 mgd.

Annual O&M costs were also developed for an 8-mgd facility. The O&M cost is presented in Table 7-4 and includes costs associated with chemical usage, energy consumption, membrane replacement, sludge disposal, plant waste and concentrate disposal, labor, equipment costs, and repairs. The O&M costs were based on unit costs provided by JCSA for chemical purchase, power, and staffing and planning-level cost estimating guidance provided in the *Desalting Handbook for Planners*.[7]

[7] Watson, Ian C., O.J. Morin, Jr., and Lisa Henthorne. 2003. *Desalting Handbook for Planners*. U. S. Department of the Interior Bureau of Reclamation, Desalination and Water Purification Research and Development Program Report No. 72.

Table 7-3 Planning-Level Cost Estimate for York River WTF (dollars)

Description	4-mgd Capacity		8-mgd Capacity		12-mgd Capacity	
Intake Facilities						
Intake	14,390,000		14,390,000		14,390,000	
Intake Pump Station	2,140,000		3,210,000		4,170,000	
Raw Water Pipeline	2,610,000		2,610,000		2,610,000	
Instrumentation – Intake Pump Station	610,000		920,000		1,180,000	
Electrical – Intake Pump Station	430,000		650,000		830,000	
Subtotal for Prime Contractor		20,180,000		21,780,000		23,180,000
Construction Contingency		5,050,000		5,450,000		5,800,000
Intake Facilities		25,230,000		27,230,000		28,980,000
Water Treatment Plant						
Yard Piping	1,980,000		2,210,000		2,460,000	
Site	4,770,000		5,680,000		6,590,000	
Pretreatment Basins	2,550,000		3,820,000		5,090,000	
Chemical Systems	3,600,000		4,190,000		4,780,000	
Administration Building	3,060,000		3,060,000		3,060,000	
Process Building	16,790,000		26,710,000		36,630,000	
CCT/Finished Water Storage	1,360,000		1,360,000		1,360,000	
Finished Water Pump Station	2,390,000		3,310,000		4,010,000	
Sludge Processing	1,020,000		1,520,000		2,020,000	
Instrumentation – WTP	1,370,000		1,520,000		1,680,000	
Electrical – WTP	4,900,000		5,830,000		6,770,000	
Concentrate Discharge Main	1,280,000		1,280,000		1,280,000	
Subtotal for Prime Contractor		45,070,000		60,490,000		75,730,000
Construction Contingency		11,270,000		15,120,000		18,930,000
Water Treatment Plant		56,340,000		75,610,000		94,660,000
Transmission Main						
Approximately 24,000 feet of 36-inch diameter main	12,000,000		12,000,000		12,000,000	
Subtotal for Prime Contractor		12,000,000		12,000,000		12,000,000
Construction Contingency		3,000,000		3,000,000		3,000,000
Transmission Main		15,000,000		15,000,000		15,000,000
Total Construction Cost in 2015 dollars	**96,570,000**		**117,840,000**		**138,640,000**	
Engineering, Legal, and Financial Fees	14,490,000		17,680,000		20,800,000	
Pilot Testing	500,000		500,000		500,000	
Permitting	500,000		500,000		500,000	
Land Acquisition (7 acres at $175,000/acre)	1,230,000		1,230,000		1,230,000	
Total Project Costs in 2015 dollars	**$113,290,000**		**$137,750,000**		**$161,670,000**	
Total Project Costs in 2015 dollars per million gallons treated	**$28,322,500**		**$17,218,750**		**$13,472,500**	

Notes:

1. All costs expressed in 2015 dollars.
2. Existing distribution system should be evaluated to determine if the flow will require additional infrastructure improvements.

Table 7-4 Planning-Level O&M Cost Estimate for 8-mgd York River WTF

Description	Annual O&M Cost $
Chemical Usage	1,310,000
Energy Consumption	1,670,000
Sludge Disposal	210,000
Labor	640,000
Equipment Maintenance/Repairs, annualized	1,490,000
Subtotal	5,320,000
Contingency	530,000
Total O&M Cost	5,850,000
	$ 2.00/1000 gal

Note: All costs expressed in 2015 dollars.

7.7 Potential Environmental Concerns

Implementation of the York River water supply and treatment facility may cause the following potential environmental concerns:

- Impact to the 12-mile section of the York River from Almondsville to Plum Point designated as having hydrologic significance described as a "unique segment of sparsely developed, high order tidal river" as listed in the National Park Service, National Rivers Inventory.[8]

- Impact to the York River shellfish management area defined by the Virginia Marine Resources Commission as "public grounds located inshore of a line beginning at the entrance to the Virginia Institute of Marine Science boat basin at Gloucester Point, running Northwesterly to Buoy #30, thence Northwesterly to Buoy #32, thence Northwesterly to Buoy #34, then Northwesterly to Pages Rock Buoy, thence Northwesterly and ending at Clay Bank Wharf.[9]

Other potential environmental concerns that CDM Smith has experienced on RO treatment projects include impingement and entrainment of fish eggs and fish larvae and the impact of the concentrate disposal.

These potential environmental concerns may impact the ability to obtain permits and approval requirements that are identified in Section 11.

[8] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan*. Page 3-21.

[9] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan*. Page 3-15.

Section 8

James River

The James River flows along the southern boundary of James City County. The James River is the largest river in Virginia, flowing from the Alleghany Mountains southeasterly to Chesapeake Bay at Hampton Roads. The James River Basin encompasses approximately 10,200 square miles.[1] The watershed is divided into three sections: the Upper James (from Alleghany County to Lynchburg), the Middle James (from Lynchburg to the fall line in Richmond), and the Lower James (from the fall line in Richmond to Chesapeake Bay).[2] The Lower James has brackish water influenced by tidal effects.

An investigation of the James River as a potential water supply source for JCSA was conducted based on a review of information from the following sources:

- Buchart Horn, Inc. and Watek Engineering. 2005. *A Brief Feasibility Study, Use of the York or James River for Future Water Supply*.
- Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.*
- Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*.
- Rice, Karen C., Mark R. Bennett, and Jian Shen. USGS Open File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.*
- Rice, Karen C., Bo Hong, and Jian Shen. 2012. "Assessment of salinity intrusion in the James and Chickahominy Rivers as a result of simulated sea-level rise in Chesapeake Bay, East Coast, USA". *Journal of Environmental Management*. Pages 61-69.
- U.S. Environmental Protection Agency. 2014. STORET.
- Virginia Department of Environmental Quality. 2013. *Status of Virginia's Water Resources, A Report on Virginia's Water Resources Management Activities.*

8.1 Existing Withdrawals

8.1.1 Public Water Supplies

Upstream of the tidal section, the James River serves as the primary water supply source for the City of Richmond and Henrico County. The Richmond water treatment plant is designed to produce up to 132 mgd.[3] The Henrico County water treatment facility has a design capacity of 55 mgd and is being

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[1] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 3-3.

[2] http://www.jamesriverassociation.org/the-james-river/about-the-james (Last accessed February 10, 2015)

[3] http://www.richmondgov.com/PublicUtilities/WaterQualityReports.aspx (Last accessed February 10, 2015)

upgraded to 80 mgd. The City of Lynchburg also withdraws water from the James River during periods of high demand.

Virginia American Water (VAW) is the water service provider for the City of Hopewell. The VAW water treatment plant in Hopewell withdraws water from the Appomatox River, approximately 1.5 miles upstream of its confluence with the James River. VAW indicated that the intake withdraws water from both rivers due to the tidal influence in this section. The plant has a capacity of 36 mgd, with 18 mgd approved by VDH for potable use and 18 mgd for nonpotable use.[4]

8.1.2 Commercial/Industrial Uses

A summary of existing commercial/industrial withdrawals from the James River is presented in Table 8-1.

Table 8-1 James River Commercial/Industrial Withdrawals[a]

User	Location	2008-2012 Average Withdrawal (mgd)	2012 Withdrawal (mgd)
James River Correctional Center	Goochland County – Beaverdam Creek	0.73	0.64
Honeywell International, Inc.	Hopewell	108.81	110.58
Dupont E. E. DeNemours & Co.	Spruance Plant, Chesterfield County	28.67	30.75
Dominion Generation	Surry Nuclear Plant[b]	1946.5	1938.2
Dominion Generation	Chesterfield Power Station	830.3	681.9
Dominion Generation	Bremo Bluff Power Plant, Fluvanna County	110.0	76.1

Notes:

a. Source: Virginia Department of Environmental Quality. 2013. *Status of Virginia's Water Resources, A Report on Virginia's Water Resources Management Activities*.

b. Water is used for cooling water purposes with most of the water discharged back into the James River.

8.2 Existing VPDES Discharges

A summary of VPDES permitted discharges into the James River between the Chickahominy River confluence and Newport News is presented in Table 8-2 and identified on Figure 8-1.

Table 8-2 VPDES Permitted Discharges to the James River between Chickahominy River and Newport News

Discharger	Location	VPDES Permit No.
BASF Corporation - Williamsburg	James City County	VA0003654
Colonial Pipeline Company - Yorktown	James City County	VA0051870
Colonial Pipeline Surry	Surry	VA0085481
Dominion Yorktown	York County	VA0004103
Grays Creek Marina and Restaurant	Surry	VA0091308
HRSD - Williamsburg STP	James City County	VA0081302
JCSA – FFWTF	Ferry stop at Jamestown	VA0091111

Source: Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan*. Table 3-15 and Map 3-19.

[4] Virginia American Water. 2012. *City of Hopewell Demand Side Management Plan*.

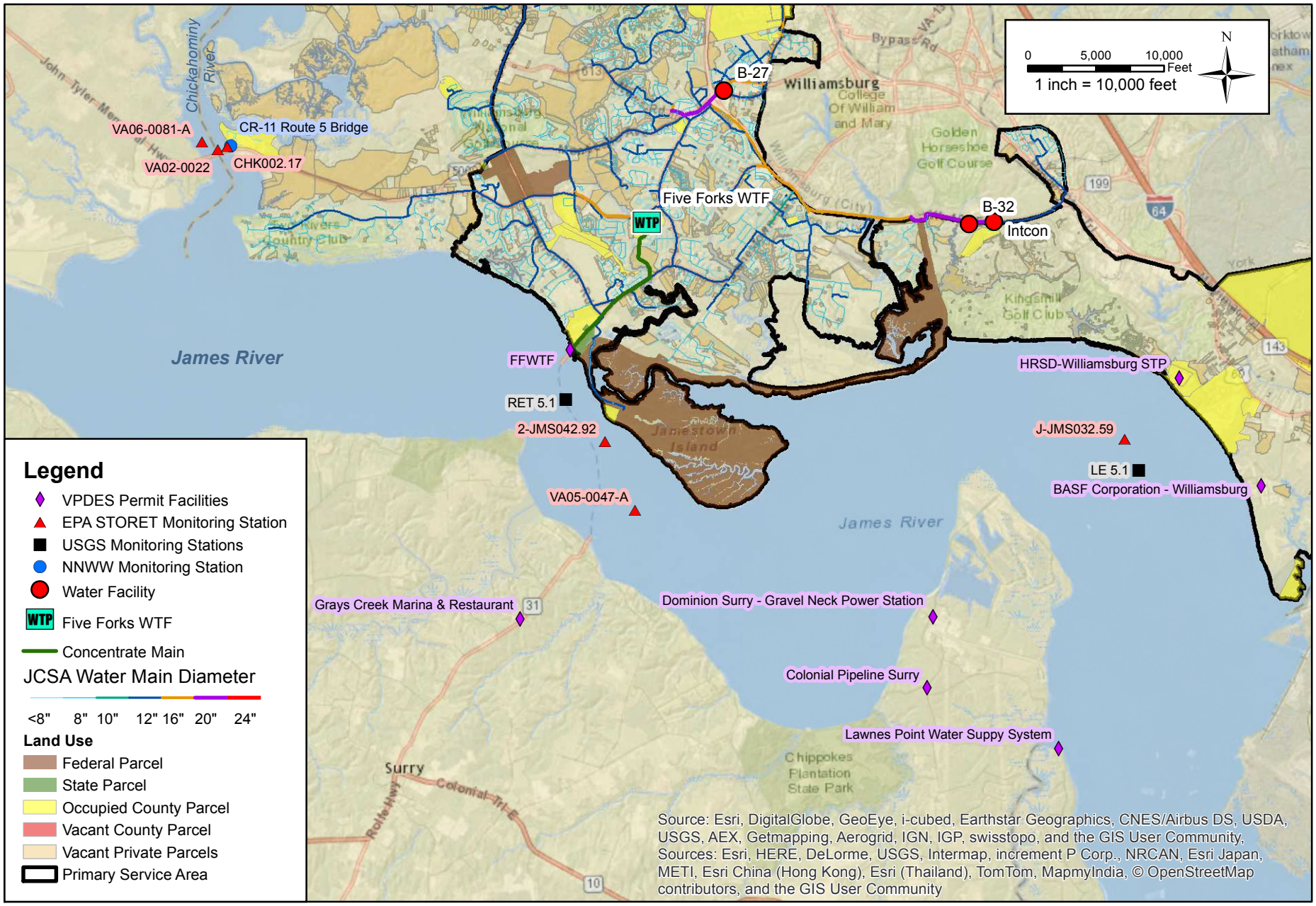

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Figure 8-1
James River
Water Quality Monitoring Stations and VPDES Locations

8.3 Previous Studies

8.3.1 Lower Virginia Peninsula Regional Raw Water Supply Plan EIS

The James River was evaluated as a potential water supply source in the Lower Virginia Peninsula Regional Water Supply Plan EIS. Various alternatives were considered:

- Pumping from a new James River 40-mgd intake in Chesterfield County above Bosher's Dam to headwaters of Diascund Creek Reservoir and then pumping to Little Creek Reservoir (EIS Alternative No. 6)
- Pumping from a new 40-mgd James River intake in Henrico County near Hatcher Island to Diascund Creek Reservoir and then pumping to Little Creek Reservoir (EIS Alternative No. 9)
- Pumping from a new 75-mgd James River intake in Chesterfield County to Diascund Creek Reservoir and then pumping to Ware Creek Reservoir (EIS Alternative No. 12)
- Pumping from a new 75-mgd James River intake in Chesterfield County to Black Creek Reservoir (EIS Alternative No. 14)
- Pumping from a new 70-mgd James River intake in James City County to desalination plant near Waller Mill Reservoir (EIS Alternative No. 24)

A discussion of the alternatives with respect to the proposed intake location follows.

8.3.1.1 Proposed James River Intake in Chesterfield County above Bosher's Dam and in Henrico County near Hatcher Island (EIS Alternative Nos. 6, 9, 12, and 14)

The proposed intake locations on the James River in Chesterfield County above Bosher's Dam and in Henrico County near Hatcher Island involve withdrawals from localities that are not part of the Lower Peninsula regional water supply area and, therefore, would not be benefitting from the withdrawal. The EIS indicated that the Richmond area localities acting through the Richmond Regional Planning District Commission opposed Lower Peninsula withdrawals from the James River above Richmond. Under local and consent laws and provisions in Virginia law, "the governing body (City Council or County Board of Supervisors) of a host locality must grant land use approvals and consents for another locality's development of public water supply facilities within its borders". The EIS also noted that competition for James River water between the City of Richmond and Henrico County could also delay efforts to pursue withdrawals. In addition, VDH expressed strong opposition to withdrawals from the James River between Richmond and Hopewell for public water supply; the EIS did not explicitly state the reasons for the opposition.[5] Alternatives associated with James River withdrawals in Chesterfield County and Henrico County were considered unavailable and impracticable at the time.

8.3.1.2 Proposed James River Intake in James City County (EIS Alternative No. 24)

A 70-mgd raw water intake structure in the James River and pump station was proposed approximately 3,000 feet upstream of Jamestown Ferry Landing. The raw water would be transported through 9 miles of dual 36-inch diameter mains to a 44-mgd RO facility located near Waller Mill Reservoir. The raw water and treatment facility capacities assumed a recovery rate of 60 percent and 10 percent RO module bypass. The concentrate would be discharged back into the James

[5] Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*. Page 3-60.

River through 20 miles of 36-inch diameter pipeline. A treated water safe yield benefit of 30 mgd was estimated for this alternative, assuming no minimum instream flow (MIF) requirement.

Construction of a 60-mgd raw water intake in the James River and pump station was also considered at Sturgeon Point in Charles City County. The raw water would be transported through 21.5 miles of dual 36-inch diameter pipe to a 44-mgd electrodialysis reversal (EDR) desalting facility. The concentrate would be discharged through 20 miles of 24-inch diameter main. The raw water and treatment capacities assume a recovery rate of 75 percent. A treated water safe yield of 30 mgd was estimated for this alternative, assuming no MIF requirement.

The EIS indicates that the proposed Jamestown intake would be located at the lower end of the turbidity maximum zone of the Lower James River estuary. The turbidity maximum zone has widely fluctuating salinity levels.

The presence of kepone in the James River was identified as a potential concern; the pesticide was discharged into the river in the early 1970s and trapped in the bottom sediments of this segment of the river. The impact of the construction of the intake and channel dredging has unknown effects. At the time, VDH had strong opposition to the use of the James River below Hopewell as a public water supply source.

As stated in the EIS, the James River was considered technologically and economically infeasible as a regional water supply source due to raw water quality variability, particularly fluctuating salinity levels, and treatment control concerns that questioned reliability. However, since the time that the EIS was completed in 1997, technological advancements have occurred that allow RO systems to cope better with fluctuations in salinity levels and make RO technology a more viable option for treating the James River today.

8.3.2 Brief Feasibility Study for JCSA Future Water Supply (2005)

A brief feasibility study of the James River as a future water supply for JCSA was completed in November 2005 by Buchart Horn, Inc. and Watek Engineering Corporation. JCSA indicated that the study focused on the York River due to potential issues associated with the James River that included shore space availability for an intake, hydraulic issues to move the water through the system, potential negative perception of the discharge of the Dominion Surry Nuclear Power Plant and the HRSD Williamsburg sewage treatment plant, and fluctuating raw water quality.

8.4 Evaluation of Treatment Options

8.4.1 Water Quality Evaluation

Figure 8-1 identifies the location of the FFWTF concentrate main that discharges into the James River. For the purpose of this study, it is assumed that the proposed raw water intake would be located off the County-owned property west of the concentrate discharge main shown on Figure 8-1. Water quality data from the following sources were reviewed to determine treatment requirements:

- U.S. Environmental Protection Agency. 2014. STORET.
- Rice, Karen C., Mark R. Bennett, and Jian Shen. USGS Open File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.*

- Rice, Karen C., Bo Hong, and Jian Shen. 2012. "Assessment of salinity intrusion in the James and Chickahominy Rivers as a result of simulated sea-level rise in Chesapeake Bay, East Coast, USA". *Journal of Environmental Management*. Pages 61-69.

Based on a review of the EPA STORET database, DEQ Water Quality Monitoring Station 2-JMS042.92 on the James River at Swann Point was identified as the closest monitoring point. Intermittent sampling was conducted at this station from March 15, 2005 to December 5, 2013. A summary of the available pertinent water quality data is provided in Appendix A. Water quality data from DEQ Monitoring Station 2-JMS032.59 which is located further downstream at Red Buoy M36 on the James River and data from EPA monitoring station VA05-0047-A is also included in Appendix A for comparative purposes. The locations of these monitoring points are shown on Figure 8-1.

USGS Open-File Report 2011-1191, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay,* provides salinity data for the James River. The closest water quality monitoring station to the proposed James River intake is RET5.1 which is 62.8 km (39 mi) upstream of the mouth of the river. The salinity data provided from January 1985 to August 2014 is presented in Figure 8-2; approximately two salinity data results were reported each month. The maximum salinity during this time period was 12.5 ppt, which occurred during 2002. The average salinity for the sample values was 2.5 ppt.

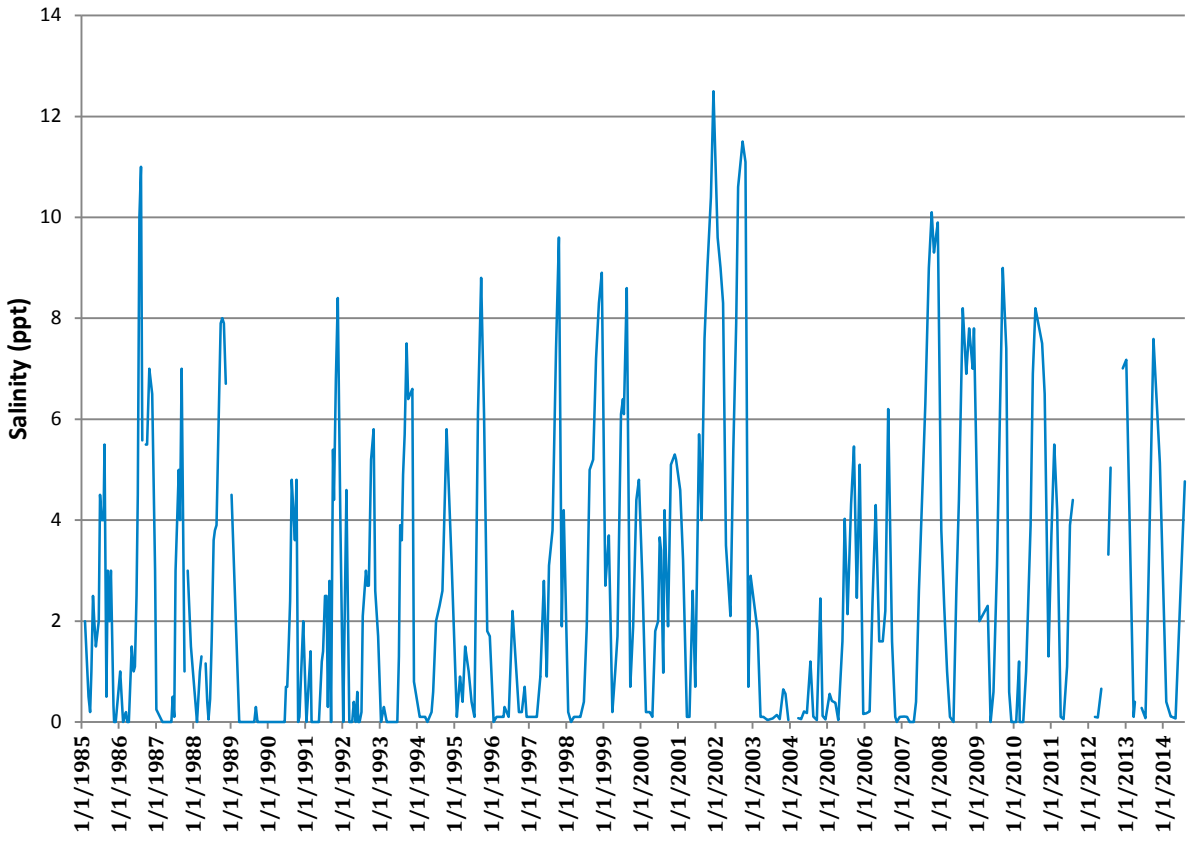

Figure 8-2
Salinity Data for USGS Water Quality Monitoring Station RET5.1

Based on data provided by K. C. Rice, et al. (2012), the maximum and average salinity at monitoring station LET5.1, approximately 48.1 km (30 mi) upstream of the mouth of the river, is estimated to be 11.9 ppt and 5.5 ppt, respectively, for 2005 which was identified as a typical year. The average salinity of LET5.1 is closer to the average salinity values reported in Appendix A for the EPA and DEQ monitoring stations than the average salinity estimated for RET5.1. For the purposes of this study, a maximum salinity of 12.5 ppt and an average salinity of 5.6 ppt were assumed for the James River intake site.

8.4.2 Recommended Treatment

Based on the water quality evaluation results, RO treatment is recommended for the James River. The proposed treatment schematic is shown on Figures 8-3 and 8-4. The capacity and treatment process requirements for the James River are similar to the capacity and treatment process discussed in Section 7.4.2 for the York River. The footprint of an 8-mgd treatment facility is estimated to require approximately 7 acres. JCSA indicated that the existing FFWTF site does not have sufficient area for the James River RO facility; adjacent property is not available. JCSA noted that available property suitable for the facility in close proximity to the river is limited since most of the area is developed or protected from development (e.g. historic preservation,); potential available property has not been identified at this time.

The existing concentrate discharge main from the FFWTF runs southeast of the plant, north of Powhatan Creek, then southward, parallel to Jamestown Road, discharging into the James River. Between the FFWTF and Jamestown Road, the concentrate discharge main is located centered on a 20-foot permanent easement. A second concentrate discharge main will also be required for the James River RO facility. The feasibility of using the existing outfall should be evaluated during design to reduce environmental impacts. It is recommended that the raw water intake be located at least 1,500 feet upstream of the concentrate discharge point.

The raw water intake may be located off the County-owned property along the James River, northwest of the Jamestown Road/Greensprings Road intersection if it is in within reasonable distance of the available property. The raw water main may be installed parallel to the concentrate main from Jamestown Road to the FFWTF if it is along the path to the available property. However, it should be noted that the Jamestown Beach area of the James River is heavily used by swimming, boating, and other water activities; this area is also shallow, ranging from 4 to 10 feet in depth for hundreds of feet off the shore depending on tidal influences.

As noted above, the treatment scheme for the James River treatment facility is basically similar to the proposed scheme for the York River; however, due to the lower maximum feed TDS of 12,500 mg/L, there are a few differences in the design concept for the RO system. For the York River option, with a maximum feed TDS of approximately 16,800 mg/L, a hybrid membrane array of low energy SWC5 and ultra-low energy SWC6 membranes is proposed. This membrane configuration was selected to achieve a finished water TDS of <350 mg/l based on the worst case design condition of 16,800 mg/l feed TDS and a temperature of 28 degrees Celsius. The 350 mg/l TDS figure was listed as a JCSA finished water quality goal in an article on the FFWTF.[6]

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[6] Movahed, Ben, "Five Forks RO plant in Virginia after 1 year of successful operation" American Membrane Technology Association. 2006. New Facilities Solutions. Table 1. Page 5. (http://www.amtaorg.com/wp-content/uploads/AMTA_Summer06.pdf (Last accessed February 12, 2015)

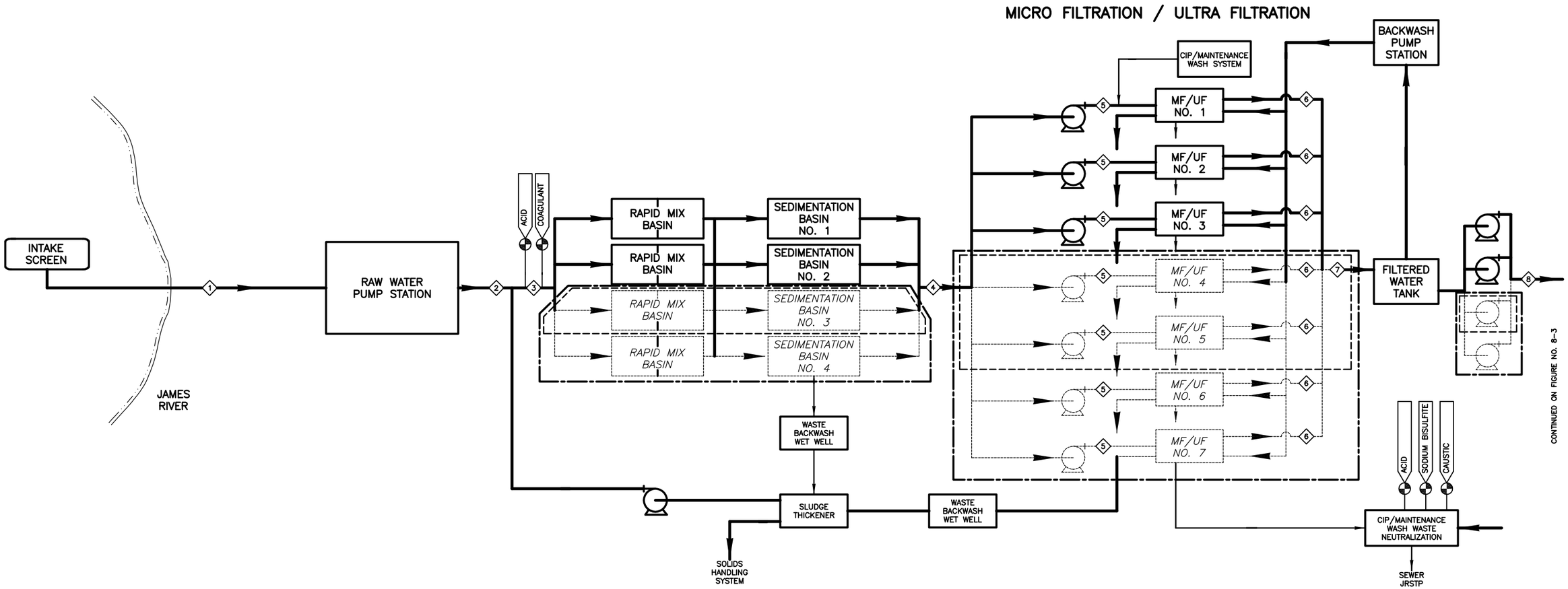
For the James River location, with a maximum feed TDS of 12,500 mg/L, an RO system consisting of all ultra-low energy SWCY membranes can be used and still achieve the JCSA finished water quality goal of 350 mg/L TDS. An all ultra-low energy membrane configuration could also be used for the York River design if a maximum finished water TDS in the range of 400 to 450 mg/L would be considered acceptable. In the York River case, since the feed TDS is over 15,000 mg/L, the operating flux (amount of permeate produced per square foot of RO membrane area) was set at 8 gallons/square foot/day (gfd), which is a typical design flux for a seawater RO plant. For the James River option with a feed TDS less than 15,000 mg/L, the design flux for the membrane system was set at 12 gfd, which is a typical operating flux for a brackish RO surface water treatment plant.

For the York River case, the membrane array for a 2-mgd RO treatment unit consists of a first stage with 60 vessels with seven RO elements per vessel and a second stage of 30 vessels with seven elements per vessel. In comparison, the James River design operating at a higher flux rate of 12 gfd only requires 40 vessels with seven elements/vessel in the first stage and 20 vessels with seven elements/vessel in the second stage.

In general, the feed pressure to produce a given RO permeate flow rate increases in proportion to the feed TDS to the RO unit. However, operating at a higher flux also tends to increase the required feed pressure to the RO unit. In comparing the maximum operating pressure for the York River RO plant of 599 psi on Figure 7-3 with the maximum operating pressure for the James River RO plant of 639 psi on Figure 8-4, operating at a higher flux rate is one of the primary factors that causes the operating pressure of the James River RO plant to be higher than the York plant even though the feed TDS for the James River plant is lower.

For the actual design of these facilities, a more rigorous evaluation would be performed to optimize system flux versus life cycle cost. In general adjusting the number of RO membranes in the system changes the operating flux and changes the balance between capital and operating costs. Increasing the number of RO membranes in a system will lower the operating flux and reduce the system operating pressure and power consumption which reduces operating costs. However, adding RO membranes to the system increases the system capital cost. Conversely, decreasing the number of membranes in the system increases the operating flux which increases the operating pressure and the system operating costs, but lowers the capital cost of the system. During the detailed design of the system an analysis can be performed to determine the optimum number of membranes and operating flux that results in the optimum balance of capital versus operating costs that would result in the lowest overall life cycle cost. In this case, it is estimated that changing operating flux from 8 gfd to 12 gfd would result in an increase in power consumption of approximately 3 percent.

Another contributing factor in increasing the feed pressure of the James River plant is the 75-percent system recovery for this plant compared to 70-percent recovery for the York River plant. The system recovery for the James River plant was increased due to the lower feed TDS. Increasing the system recovery reduces the withdrawal rate of water from the river by about 2.4 mgd for the James River versus the York River for the 12-mgd capacity facility. Similarly, operating at 75-percent recovery reduces the concentrate discharge for the James River plant by 1.14 mgd or 22 percent versus the York River plant.



PROCESS DATA

	1	2	3	4	5	6	7	8
FLOWS:								
Phase 1 MGD	5.72	5.72	5.72	5.61	2.81	2.67	5.33	5.33
Build-out MGD	17.17	17.17	17.17	16.84	2.81	2.67	16.0	16.0
CONSTITUENTS:								
TDS, Avg. mg/L	5,600	5,600	5,600	5,600	5,600	5,600	5,600	5,600
TDS, Max. mg/L	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
TSS, Avg. mg/L	58	58	58	12	12	0.5	0.5	0.5
TSS, Max. mg/L								
PRESSURES:								
Avg. psi	atm	45	atm	atm	15	4	4	45
Max. psi	atm	45	atm	atm	35	4	4	45

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis
12 - STREAM NUMBER

LEGEND:
---- 8 MGD
—-— 12 MGD

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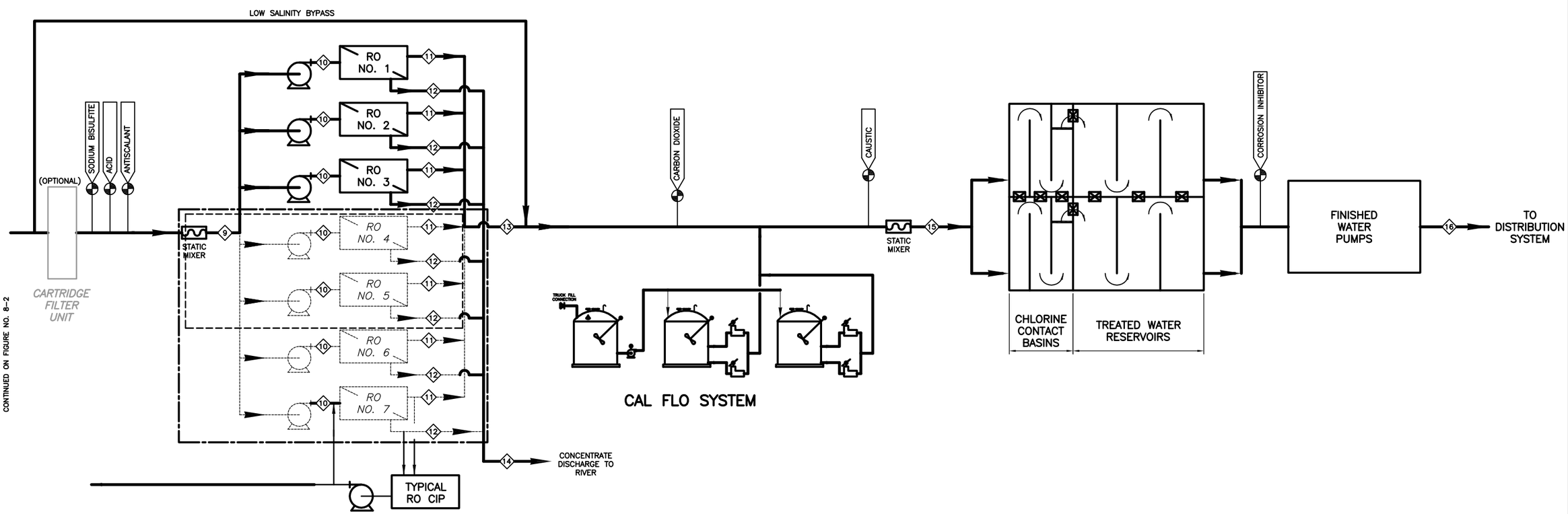
Figure No. 8-3
James City Service Authority
James River Process Flow Diagram I - Clarification and MF/UF



PROCESS DATA

	9	10	11	12	13	14	15	16
FLOWS:								
Phase 1 MGD	5.33	2.67	2.0	0.67	4.0	1.33	4.0	4.0
Build-out MGD	16.0	2.67	2.0	0.67	12.0	4.0	12.0	12.0
CONSTITUENTS:								
TDS, Avg. mg/L	5,600	5,600	52	22,280	52	22,280	<120	<120
TDS, Max. mg/L	12,500	12,520	193	49830	193	49830	<250	<250
TSS, Avg. mg/L								
TSS, Max. mg/L	0.5	0.5	-	3	-	3	-	-
PRESSURES:								
Avg. psi	30	316	10	415	15	10	8	50
Max. psi	30	639	10	903	15	10	8	50

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis
1 AT MAX TDS MIN TEMP
2 AT MAX TDS MAX TEMP
12 - STREAM NUMBER

LEGEND:
8 MGD
12 MGD

pw:\\dacpwapp1:PW_XM1\Documents\103518\106170\03 Reports and Studies\09 CADD Figures and Graphics\FIG 8-4.dwg
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Figure No. 8-4
James City Service Authority
James River Process Flow Diagram II - Desal & Post-Treatment

As a result of the higher operating flux and reduced number of RO membranes and vessels for the James River plant, the foot print of the RO units and the membrane process building will be reduced by approximately 500 to 600 square feet for a 12-mgd facility.

8.5 Physical Infrastructure Impacts

Physical infrastructure improvements within the existing water system will be required to distribute the flow from the water treatment facility site to the demand centroid. It is recommended that JCSA conduct simulations on their hydraulic water model to define the infrastructure needs once potential property has been identified.

8.6 Financial Impacts

Planning-level cost estimates for the James River water treatment facility are presented in Table 8-3. The planning-level cost estimate includes costs to purchase a 7-acre property which has not been identified by JCSA at this time. The planning-level cost estimates for infrastructure improvements necessary to transport water from the James River to the treatment facility, distribute the finished water in the system, and dispose of the concentrate are dependent on the location of the proposed water treatment facility. As an initial cursory estimate, the average cost of the raw water transmission main and concentrate discharge main estimated for the York River and Chickahominy River options was assumed for the James River alternative. For the finished water transmission main, it was assumed that the James River WTF would be located closer to a large existing transmission main and that the unit cost would be higher since it would be constructed in a developed area. The planning-level level cost estimates should be refined once potential property has been identified.

Planning-level O&M costs are presented in Table 8-4. The O&M costs were developed in a similar manner as the O&M costs for the York River discussed in Section 7.6.

8.7 Potential Environmental Concerns

Implementation of the James River water supply option may cause the following potential environmental concerns:

- Impact to tidal bald cypress forests and woodlands along James River near Swanns Point, Surry County, as identified in the Virginia Department of Conservation and Recreation, Natural Heritage Inventory (defined as "habitat of rare, threatened, or endangered plant and animal species, rate or state significant natural communities or geologic sites, and similar features of scientific interest").[7]
- Impact to the 62-mile stretch of James River from Hopewell to Mogarts Beach designated as historic. The National Rivers Inventory describes it as "one of the most significant historic, relatively undeveloped rivers in the entire northeast region. Within or adjacent to the corridor are four National Historic Register Sites and one National Historic Park."[8]

[7] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page3-14.

[8] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Table 3-9.

- Impact to the 25-mile segment of James River from 1.2 miles east of Trees Point to Lawnes Creek designated as a Scenic River by Virginia Department of Conservation and Recreation.[9]

The potential impact of the following environmental factors may also be of concern to the public:

- Presence of kepone, a pesticide that was discharged upstream in the 1970s and trapped in the bottom sediments of the river
- VPDES discharges in the vicinity of the intake
- Potential spill upstream from major highway/railway crossings such as the oil spill in Lynchburg in April 2014[10]

These potential environmental concerns may impact the ability to obtain permits and approval requirements that are identified in Section 11.

[9] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Table 3-7.

[10] http://www.wset.com/story/25397260/cleanup-begins-after-crude-oil-spills-into-james-river-in-train-derailment

Table 8-3 Planning-Level Cost Estimate for James River WTF (dollars)

Description	4-mgd Capacity		8-mgd Capacity		12-mgd Capacity	
Intake Facilities						
Intake	13,450,000		13,450,000		13,450,000	
Intake Pump Station	2,000,000		3,000,000		3,900,000	
Raw Water Pipeline[3]	2,500,000		2,500,000		2,500,000	
Instrumentation – Intake Pump Station	570,000		860,000		1,100,000	
Electrical – Intake Pump Station	400,000		610,000		780,000	
Subtotal for Prime Contractor		18,920,000		20,420,000		21,730,000
Construction Contingency		4,730,000		5,110,000		5,430,000
Intake Facilities		23,650,000		25,530,000		27,160,000
Water Treatment Plant						
Yard Piping	1,850,000		2,070,000		2,300,000	
Site	4,460,000		5,310,000		6,160,000	
Pretreatment Basins	2,380,000		3,570,000		4,760,000	
Chemical Systems	3,480,000		4,050,000		4,620,000	
Administration Building	3,060,000		3,060,000		3,060,000	
Process Building	15,480,000		24,510,000		33,540,000	
CCT/Finished Water Storage	1,270,000		1,270,000		1,270,000	
Finished Water Pump Station	2,230,000		3,310,000		4,010,000	
Sludge Processing	950,000		1,420,000		1,890,000	
Instrumentation – WTP	1,280,000		1,420,000		1,570,000	
Electrical – WTP	4,900,000		5,830,000		6,770,000	
Concentrate Discharge Main	1,300,000		1,300,000		1,300,000	
Subtotal for Prime Contractor		42,640,000		57,120,000		71,250,000
Construction Contingency		10,660,000		14,280,000		17,810,000
Water Treatment Plant		53,300,000		71,400,000		89,060,000
Transmission Main[3]						
Approximately 5,300 feet of 36-inch diameter main	5,000,000		5,000,000		5,000,000	
Subtotal for Prime Contractor		5,000,000		5,000,000		5,000,000
Construction Contingency		1,250,000		1,250,000		1,250,000
Transmission Main		6,250,000		6,250,000		6,250,000
Total Construction Cost in 2015 dollars	**83,200,000**		**103,180,000**		**122,470,000**	
Engineering, Legal, and Financial Fees	12,480,000		15,480,000		18,370,000	
Pilot Testing	500,000		500,000		500,000	
Permitting	500,000		500,000		500,000	
Land Acquisition (7 acres at $325,000/acre)	2,280,000		2,280,000		2,280,000	
Total Project Costs in 2015 dollars	**$98,960,000**		**$121,940,000**		**$144,120,000**	
Total Project Costs in 2015 dollars per million gallons treated	**$24,740,000**		**$15,242,500**		**$12,010,000**	

Notes:

1. All costs expressed in 2015 dollars.
2. Existing distribution system should be evaluated to determine if the flow will require additional infrastructure improvements.
3. Refine costs once property location has been identified.

Table 8-4 Planning-Level O&M Cost Estimate for 8-mgd James River WTF

Description	Annual O&M Cost $
Chemical Usage	1,250,000
Energy Consumption	1,580,000
Sludge Disposal	210,000
Labor	640,000
Equipment Maintenance/Repairs, annualized	1,320,000
Subtotal	5,000,000
Contingency	500,000
Total O&M Cost	5,500,000
	$1.88/1000 gallons

Note: All costs expressed in 2015 dollars.

Section 9

Chickahominy River

The Chickahominy River flows along the northwestern boundary of James City County and feeds into the James River along the southern boundary. An investigation of the Chickahominy River as a potential water supply source for JCSA was conducted based on information from the following sources:

- Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.*
- Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*.
- Rice, K.C., Bennett, M.R., and Shen, J. 2011. *Simulated changes in salinity in the York and Chickahominy Rivers from projected sea-level rise in Chesapeake Bay: U.S. Geological Survey Open-File Report 2011–1191*, 31 p.
- U.S. Environmental Protection Agency, STORET database.
- Virginia Department of Environmental Quality. 2013. *Status of Virginia's Water Resources, A Report on Virginia's Water Resources Management Activities.*

9.1 Existing Withdrawals

The Chickahominy River provides approximately 70 percent of the water supply for NNWW.[1] In 1942, Walker's Dam was constructed on the Chickahominy River to form an impoundment to supply drinking water for military personnel. The impoundment, which is known as Chickahominy Lake, was purchased by Newport News. The raw water intake is located above Walker's Dam. Water is pumped from the Chickahominy River above Walker's Dam into reservoirs: Lee Hall and/or Harwood's Mill, Little Creek, Skiffes Creek, Waller Mill or Big Bethel. NNWW also uses groundwater as a secondary source. The surface water and groundwater are treated separately and then combined prior to distribution.

The Chickahominy River intake of NNWW has a drainage area of 301 square miles and an average river flow of 180 mgd. A minimum flow of 10 cfs (6.5 mgd) must be maintained downstream of Walker's Dam.[2] NNWW maintains the 10-cfs MIF requirement by controlling the openings in the dam through SCADA.

NNWW's surface water withdrawal permit restricts pumping when the river stage at Walker's Dam is below elevation 3 feet mean sea level. NNWW indicated that the pumping restriction is tied to their Little Creek Reservoir permit; they are not allowed to pump to Little Creek Reservoir when the river is below that level. To avoid drawing high chloride water, withdrawals may also be suspended when tidal influences occur and downstream chlorides are elevated, such as during drought conditions.[3] NNWW

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[1] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 6-4.

[2] Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*. Page 2-3.

[3] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 1-6.

indicated that the withdrawal suspension is not stipulated in a permit, but is part of their operational strategy to stay within the treatment capabilities of their plant. Raw water from the Chickahominy River is sometimes blended with the reservoir waters to reduce the chloride concentration. During the 2002 drought, NNWW had to suspend withdrawal from the Chickahominy River on some occasions.

9.2 Existing VPDES Discharge

The Hideaway Sewage Treatment Plant in Mount Airy discharges into the Chickahominy River as regulated by VPDES Permit No. VA0080233.[4] The discharge location is shown on Figure 9-1.

9.3 Previous Studies

The Chickahominy River was evaluated as a potential water supply source in the Lower Virginia Water Supply Plan EIS through increased withdrawals. Three alternatives were considered:

- Increase in Chickahominy River pump station capacity from 61 to 81 mgd (EIS Alternative No. 11) - An expansion of NNWW's Walker pump station to 81 mgd was considered when pumping to Little Creek and/or Ware Creek reservoirs. The Walker pump station is located on the northern bank of the river in southeastern New Kent County. Approximately 41 mgd would be discharged 7.5 miles downstream to Little Creek Reservoir in James City County and 40 mgd would flow 1.8 miles further to Ware Creek Reservoir. Flow would only go to NNWW's terminal reservoirs if Ware Creek and Little Creek reservoirs are full and at a lower rate. The diversion would require 1.5 miles of pipe from the existing NNWW raw water main to Ware Creek reservoir and replacement or parallel installation of a portion of the old Chickahominy main from the Walkers pump station to Little Creek outfall.

- Increase in Chickahominy River pump station capacity to 61 mgd when pumping to Little Creek Reservoir only (EIS Alternative No. 17) - An expansion of NNWW's Walker pump station to 61 mgd was also considered when pumping to Little Creek and/or Ware Creek reservoirs. The flow from Chickahominy River would be pumped to either Little Creek or Ware Creek reservoirs and no flow would be transferred directly to the terminal reservoir when 61 mgd is discharged to Little Creek and/or Ware Creek reservoir.

- Increase in Chickahominy River pump station capacity to 61 mgd and raise Diascund and Little Creek Dams (EIS Alternative No. 18).

The EIS concluded that increasing the withdrawal from the Chickahominy River to 61 mgd or greater was infeasible for the following reasons:

- Increases in the maximum withdrawal from the Chickahominy River would likely trigger more restrictive MIF requirements above the current 10-cfs requirement.

- Reliance on the single river source that is already a major water supply for the Lower Peninsula would not be prudent and would not provide a backup source should water quality excursions or extreme low flows limit the withdrawal.

- Increasing the withdrawal to 61 mgd would raise the maximum withdrawal to 30 percent of average streamflow at the intake.

[4] http://watersgeo.epa.gov/mwm/(Last accessed November 13, 2014)

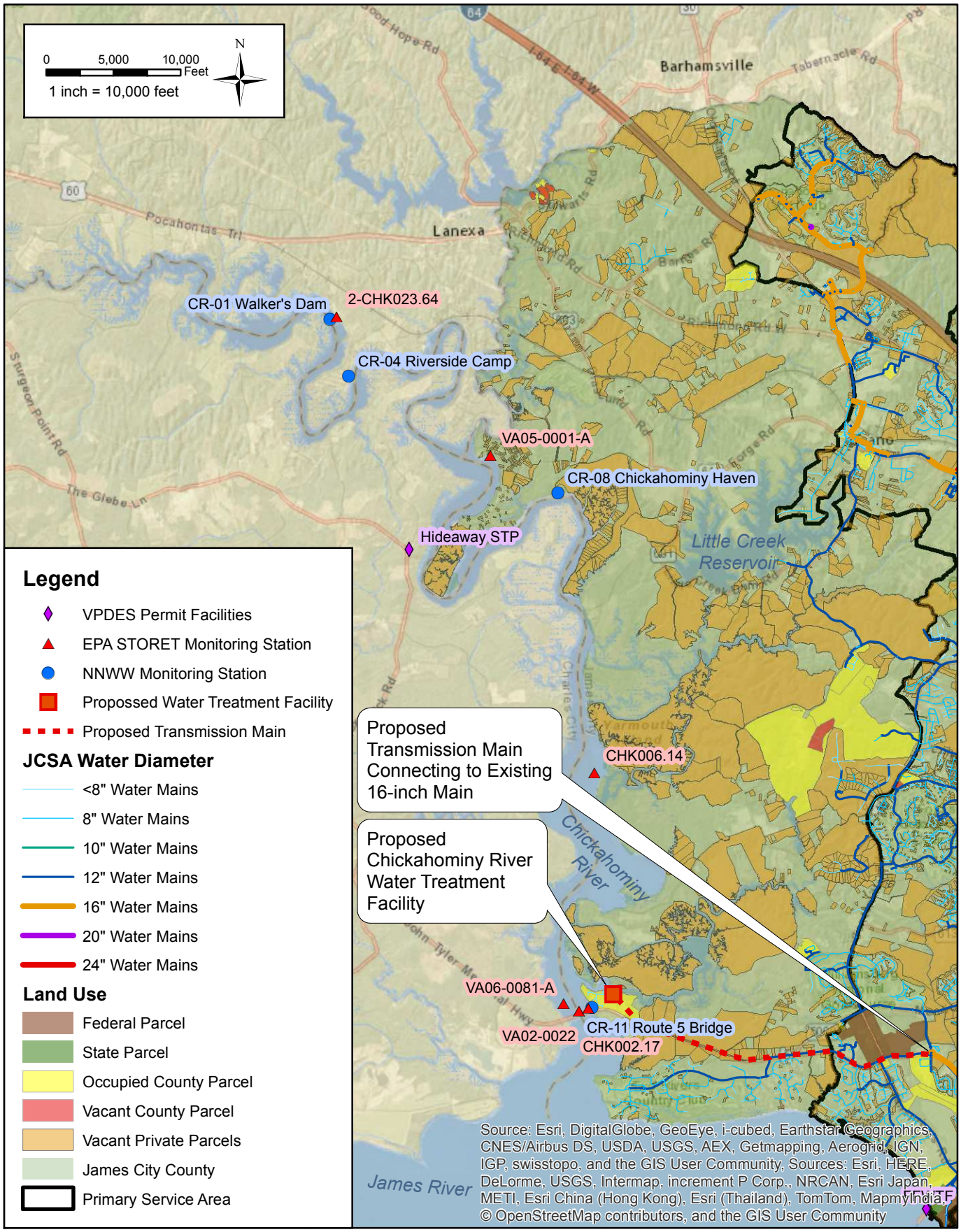

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Figure 9-1
Chickahominy River
Potential Water Supply Source

9.4 Evaluation of Treatment Options

9.4.1 Water Quality Evaluation

The location of a raw water intake in the freshwater section of the Chickahominy River upstream of Walker's Dam would be outside the boundary of James City County. Hence, for the purpose of this study, it is assumed that the raw water intake is located in the brackish section of the Chickahominy River downstream of Walker's Dam. Also, it is assumed that the raw water intake would be located off County-owned property along the Chickahominy River, north of the Route 5 Bridge (i.e. James City County Chickahominy River Front Park). This location is near the Chickahominy River's confluence with the James River.

Water quality data from the following sources were reviewed to determine treatment requirements:

- NNWW historical raw water quality data for the Chickahominy River
- U.S. Environmental Protection Agency. 2014. STORET
- Rice, Karen C., Mark R. Bennett, and Jian Shen. *USGS Open File Report 2011-1191*, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.*

A summary of the available water quality data from the NNWW monitoring stations is presented in Tables 9-1. Water quality data for CR-1 which is located upstream of Walker's Dam is also provided in Appendix B, Table B-1. Data from the DEQ and EPA monitoring stations is provided in Appendix B, Table B-2. The location of the monitoring stations is shown on Figure 9-1.

Table 9-1 Chloride and Conductivity for NNWW Chickahominy River Monitoring Stations (1997-2014)

Monitoring Station	Chloride (mg/L)			Conductivity (x1000, uS/cm)		
	Minimum	Maximum	Average	Minimum	Maximum	Average
CR-1	4	1600	53	0.05	7.02	0.25
CR-4	4	2200	88	0.05	7.70	0.36
CR-8	8	3620	493	0.06	10.96	1.73
CR-11	10	4600	824	0.05	13.85	2.82

NNWW monitoring station CR-11 is located at the proposed raw water intake location. Hence, the chloride and conductivity values were assumed to establish the Chickahominy River treatment requirements.

CDM Smith conducted pilot testing for the Haverstraw RO treatment facility which draws water from the Hudson River. The pilot test results indicated that a chloride concentration of 4,600 mg/L (the maximum value observed at NNWW monitoring station CR-11 as listed in Table 9-1) corresponds with a total dissolved solids (TDS) concentration of 8,800 mg/L. The average chloride concentration of 824 mg/L corresponds with a TDS concentration of 1,650 mg/L. In developing the design concept for the RO facility for this site, the following design criteria were employed:

- Maximum TDS of 8,800 mg/L and average TDS of 1,700 mg/L
- Temperature range of 2 to 28 degrees Celsius (36 to 82 degrees Fahrenheit)

- Total suspended solids (TSS) concentrations similar to the York River and James River sites

It is interesting to note that the average feed TDS concentration of 1,700 mg/L is only about 20 percent of the maximum feed TDS of 8,800 mg/L for the Chickahominy River in contrast to the James and York River sites where the ratios of average to maximum feed TDS values are 45 percent and 60 percent, respectively. It was anticipated that the data base on chloride concentrations collected by NNWW that includes over 450 data points covering a 17-year period would give a fairly accurate average chloride concentration value; however, in reviewing the data again, there does appear to be a disproportionately higher number of readings in 2003 and 2004 which have low chloride values that may be skewing the average; the reason for the higher number of readings is unknown. The concern is that if there is a very large difference between the average feed TDS and the maximum TDS, as in this case where the average TDS is five times lower than the maximum, it may be harder to develop a design that gives relatively good efficiency at both the average and maximum feed conditions.

9.4.2 Recommended Treatment

Based on the water quality evaluation results, RO treatment is recommended for the Chickahominy River. The proposed treatment schematic is shown on Figures 9-2 and 9-3. The capacity and treatment process requirements for the Chickahominy River are similar to the capacity and treatment process discussed in Section 8.4.2 for the James River. The footprint of an 8-mgd treatment facility is estimated to require approximately 7 acres.

Although the treatment processes for the James and Chickahominy rivers are similar, the Chickahominy River has a lower feed TDS which reduces the feed pressure requirements. A membrane feed pressure of 440 psi is proposed for the Chickahominy River with a maximum feed TDS of 8,800 mg/L in comparison to a membrane feed pressure of 639 psi for the James River with a maximum feed TDS of 12,500 mg/L.

The RO system design concept for the Chickahominy River is based on a typical brackish surface water flux rate of 12 gfd with 40 vessels in the first stage and 20 vessels in the second stage, similar to the James River concept. With the maximum feed TDS in the range of 8,800 mg/L, a high rejection CPA5-LD brackish RO membrane can be used in the first stage with ultra-low pressure SWC6 SWRO membranes used in the second stage. This membrane configuration was selected to achieve JCSA's finished water TDS goal of <350 mg/l.[5] The use of brackish water membrane elements in the first stage tends to reduce the operating pressure compared to the use of all SWRO membrane elements for the James River concept. The lower operating pressure indicates that the Chickahominy power consumption and operating cost should be lower than the James River case.

An interstage turbocharger energy recovery system is included in this design concept similar to the York and James River concepts. An RO system recovery of 75 percent was used for this site, although if more information on the scaling potential at this site was available, it might be possible to increase the system recovery to 80 percent.

[5] Movahed, Ben, "Five Forks RO plant in Virginia after 1 year of successful operation" American Membrane Technology Association. 2006. New Facilities Solutions. Table 1. Page 5. (http://www.amtaorg.com/wp-content/uploads/AMTA_Summer06.pdf (Last accessed February 12, 2015)

9.5 Physical Infrastructure Impacts

Based on the location of the Chickahominy River RO treatment facility on the James City County River Front Park property, approximately 26,000 feet of 36-inch diameter main will be required from an 8-or 12-mgd water treatment facility to the existing 16-inch diameter main on John Tyler Highway (Route 5). Additional infrastructure improvements may also be required within the existing system to transmit the flow to the demand centroid. It is recommended that JCSA conduct simulations on their hydraulic water model to define the infrastructure needs for the Chickahominy River RO plant to be hydraulically effective for their system.

9.6 Financial Impacts

Planning-level cost estimates for the Chickahominy River water treatment facility are presented in Table 9-3. The planning-level cost estimates assume that the water treatment facility will be located on the James City County Chickahominy River Front Park property and do not include infrastructure improvements necessary to distribute the flow in the system.

Planning-level O&M costs are presented in Table 9-4. The O&M costs were developed in a similar manner as the O&M costs for the York River as discussed in Section 7.6.

9.7 Potential Environmental Concerns

Implementation of the Chickahominy River water supply option may cause the following potential environmental concerns:

- Impact to the following ecological communities as identified in the Virginia Department of Conservation and Recreation, Natural Heritage Inventory and defined as "habitat of rare, threatened, or endangered plant and animal species, rate or state significant natural communities or geologic sites, and similar features of scientific interest"[6]:
  - Fluvial Terrace Woodlands
  - Coastal Plain/Piedmont Swamp Forests
  - Tidal Bald Cypress Forests and Woodlands
  - Tidal Freshwater and Oligohaline Aquatic Beds
- Impact to the 30-mile segment from Providence Forge to the James River classified in the National Park Service, National Rivers Inventory as having Outstanding Remarkable Value designations of Botanic ("An extensive, well developed cypress-gum swamp forest and bottomland hardwood forest which includes three rare, endemic and possibly endangered species of plants." and Geologic ("Extreme topographic diversity including cliffs up to 100 feet high at Fish Hole Landing.").[7]
- Impact to Riverine wetland areas[8]

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[6] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 3-13.

[7] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Table 3-9.

[8] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Table 3-12.

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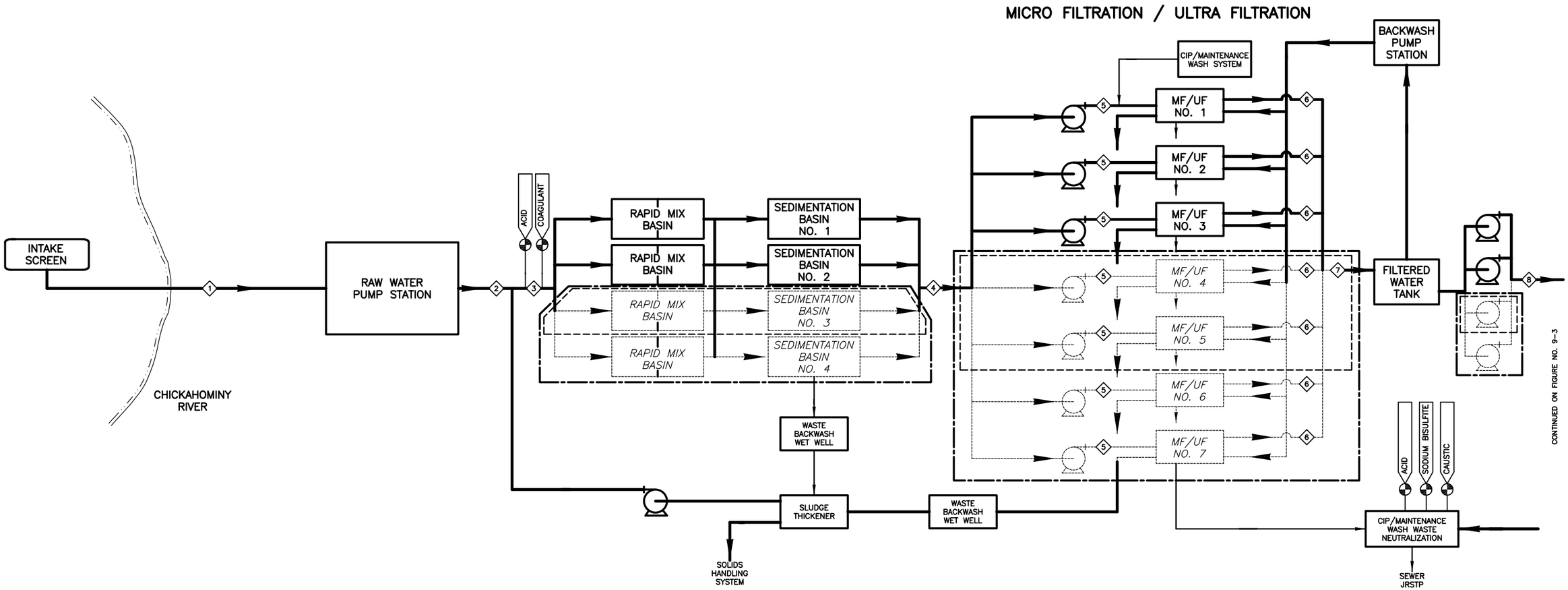


PROCESS DATA

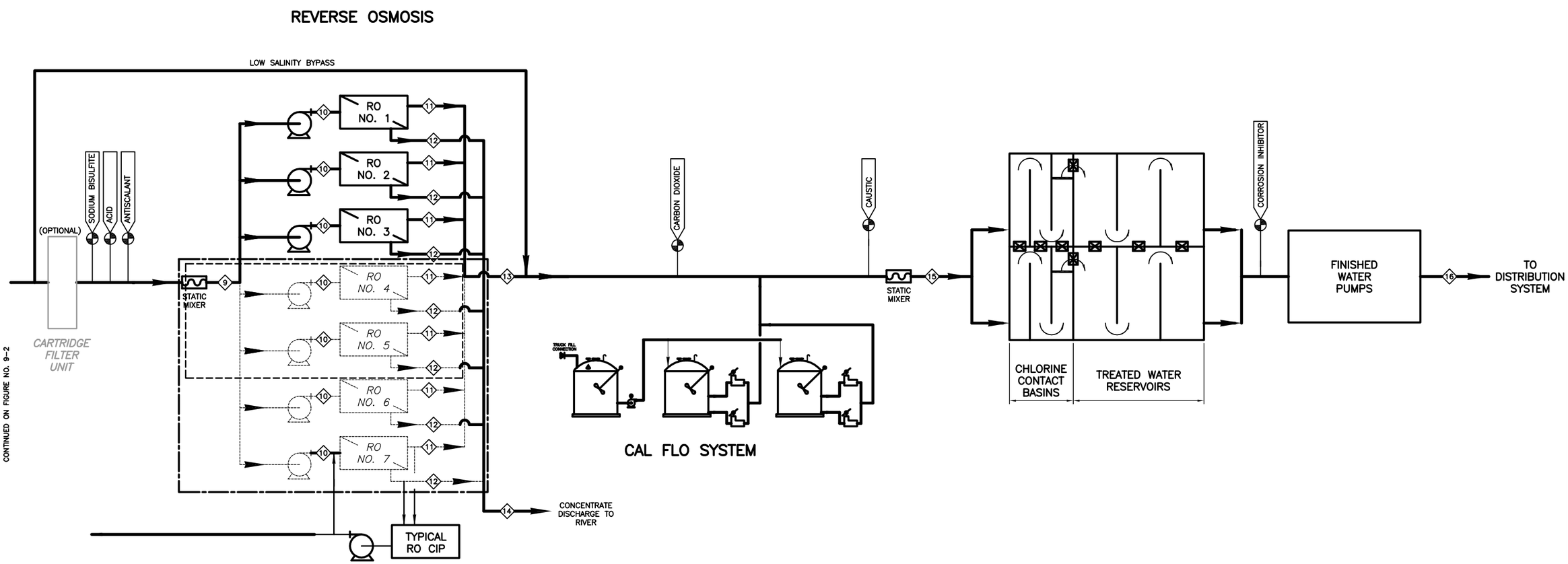
	1	2	3	4	5	6	7	8
FLOWS:								
Phase 1 MGD	5.72	5.72	5.72	5.61	2.81	2.67	5.33	5.33
Build-out MGD	17.17	17.17	17.17	16.84	2.81	2.67	16.0	16.0
CONSTITUENTS:								
TDS, Avg. mg/L	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
TDS, Max. mg/L	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
TSS, Avg. mg/L	58	58	58	12	12	0.5	0.5	0.5
TSS, Max. mg/L								
PRESSURES:								
Avg. psi	atm	45	atm	atm	15	4	4	45
Max. psi	atm	45	atm	atm	35	4	4	45

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis
12 - STREAM NUMBER

LEGEND:
---- 8 MGD
—·— 12 MGD

CDM Smith

Figure No. 9-2
James City Service Authority
Chickahominy River Process Flow Diagram I - Clarification and MF/UF



PROCESS DATA

	9	10	11	12	13	14	15	16
FLOWS:								
Phase 1 MGD	5.34	2.67	2.0	0.67	4.0	1.34	4.0	4.0
Build-out MGD	16	2.67	2.0	0.67	12.0	4.0	12.0	12.0
CONSTITUENTS:								
TDS, Avg. mg/L	1,700	1,700	20	6,740	100	6,740	<100	<100
TDS, Max. mg/L	8,800	8,800	228	34,930	228	34,930	<300	<300
TSS, Avg. mg/L								
TSS, Max. mg/L	0.5	0.5	-	3	-	3	-	-
PRESSURES:								
Avg. psi	30	197	10	249	15	10	8	50
Max. psi	30	440	10	653	15	10	8	50

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis
1 AT MAX TDS MIN TEMP
2 AT MAX TDS MAX TEMP
12 - STREAM NUMBER

LEGEND:
8 MGD
12 MGD

CDM Smith

Figure No. 9-3
James City Service Authority
Chickahominy River Process Flow Diagram II - Desal & Post-Treatment

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Table 9-2 Planning-Level Cost Estimate for Chickahominy River WTF (dollars)

Description	4-mgd Capacity		8-mgd Capacity		12-mgd Capacity	
Intake Facilities						
Intake	13,450,000		13,450,000		13,450,000	
Intake Pump Station	2,000,000		3,000,000		3,900,000	
Raw Water Pipeline	2,440,000		2,440,000		2,440,000	
Instrumentation – Intake Pump Station	570,000		860,000		1,100,000	
Electrical – Intake Pump Station	400,000		610,000		780,000	
Subtotal for Prime Contractor		18,860,000		20,360,000		21,670,000
Construction Contingency		4,720,000		5,090,000		5,420,000
Intake Facilities		23,580,000		25,450,000		27,090,000
Water Treatment Plant						
Yard Piping	1,850,000		2,070,000		2,300,000	
Site	4,460,000		5,310,000		6,160,000	
Pretreatment Basins	2,380,000		3,570,000		4,760,000	
Chemical Systems	3,480,000		4,050,000		4,620,000	
Administration Building	3,060,000		3,060,000		3,060,000	
Process Building	14,880,000		23,510,000		32,140,000	
CCT/Finished Water Storage	1,270,000		1,270,000		1,270,000	
Finished Water Pump Station	2,230,000		3,310,000		4,010,000	
Sludge Processing	950,000		1,420,000		1,890,000	
Instrumentation – WTP	1,280,000		1,420,000		1,570,000	
Electrical – WTP	4,300,000		4,830,000		5,370,000	
Concentrate Discharge Main	1,000,000		1,000,000		1,000,000	
Subtotal for Prime Contractor		41,140,000		54,820,000		68,150,000
Construction Contingency		10,290,000		13,710,000		17,040,000
Water Treatment Plant		51,430,000		68,530,000		85,190,000
Transmission Main						
Approximately 26,000 feet of 36-inch diameter main	13,000,000		13,000,000		13,000,000	
Subtotal for Prime Contractor		13,000,000		13,000,000		13,000,000
Construction Contingency		3,250,000		3,250,000		3,250,000
Transmission Main		16,250,000		16,250,000		16,250,000
Total Construction Cost in 2015 dollars	**91,260,000**		**110,230,000**		**128,530,000**	
Engineering, Legal, and Financial Fees	13,690,000		16,530,000		19,280,000	
Pilot Testing	500,000		500,000		500,000	
Permitting	500,000		500,000		500,000	
Total Project Costs in 2015 dollars	**$105,950,000**		**$127,760,000**		**$148,810,000**	
Total Project Costs in 2015 dollars per million gallons treated	**$26,487,500**		**$15,970,000**		**$12,400,800**	

Notes:

1. All costs expressed in 2015 dollars.
2. Existing distribution system should be evaluated to determine if the flow will require additional infrastructure improvements.

Table 9-3 Planning-Level O&M Cost Estimate for 8-mgd Chickahominy River WTF

Description	Annual O&M Cost $
Chemical Usage	1,250,000
Energy Consumption	1,270,000
Sludge Disposal	210,000
Labor	640,000
Equipment Maintenance/Repairs, annualized	1,290,000
Subtotal	4,660,000
Contingency	470,000
Total O&M Cost	5,130,000
	$ 1.76/1000 gal

Note: All costs expressed in 2015 dollars.

The potential impact of the following environmental factors may also be of concern to the public:

- Potential presence of kepone, a pesticide that was discharged upstream in the 1970s and trapped in the bottom sediments of the James River, that may be at the confluence of the Chickahominy River due to tidal influence
- Potential spill upstream in the vicinity from an automotive bridge crossing and Colonial Petroleum pipeline crossing
- Boat traffic

These potential environmental concerns may impact the ability to obtain permits and approval requirements that are identified in Section 11.

Section 10

Groundwater Sources

10.1 Aquifer Description

James City County is underlain by a seaward-thickening wedge of unconsolidated to partially consolidated layers of sediment deposits with bedrock lying more than 1,200 feet below sea level. As described in Section 3, JCSA currently withdraws water from the aquifers identified as the Lower Potomac, Middle Potomac, Upper Potomac, and Chickahominy Piney Point. Recent interpretations suggest that the Upper, Middle, and Lower Potomac may function as a single aquifer within portions of the EVGMA; however, JCSA has not seen written confirmation that the single aquifer interpretation applies to their location.

The Chesapeake Bay impact crater is located east of James City County. Figure 10-1 presents a generalized hydrogeologic section through the Virginia Coastal Plain. Chloride and total dissolved solids concentrations generally increase with increasing depth and from west to east.

The aquifers underlying James City County are not uniform but consist of alternating layers of sand, silt, clayey sand, and clay. Wells constructed in these aquifers are generally screened in the sand layers to take advantage of the higher productivity. Depending on the specific aquifer and location, these sand units are not laterally continuous or of uniform thickness. This may result in changes in aquifer productivity and water quality over short distances.

10.2 Available Groundwater Supply Resources

As is the experience in existing JCSA wells, individual wells screened in the Potomac and Piney Point aquifers can be quite productive and represent a viable water supply source. Water quality considerations require membrane treatment and or blending of waters to provide an acceptable water supply. However, published data and studies indicate that current and planned future groundwater withdrawal rates may be exceeding the rates of freshwater recharge in the regional aquifer system and raising concerns with declining water levels, increasing chloride concentrations, and land subsidence. Specifically of concern is that the regionally declining water levels will cause the violation of the 80- percent drawdown criteria.

As discussed in Section 2, DEQ and other agencies are developing and implementing strategies to better manage the groundwater resource. As presented in a recent article in the Hampton Roads Planning District Commission Water Resources News (October 21, 2014), DEQ has proposed decreasing permitted groundwater withdrawal rates for 14 of the largest permitted groundwater users in the EVGMA. Four users, including JCSA, have the proposed target less than their current use. Hence, based on DEQ's withdrawal reduction strategy, the expansion of JCSA groundwater withdrawals is not a viable option at this time.

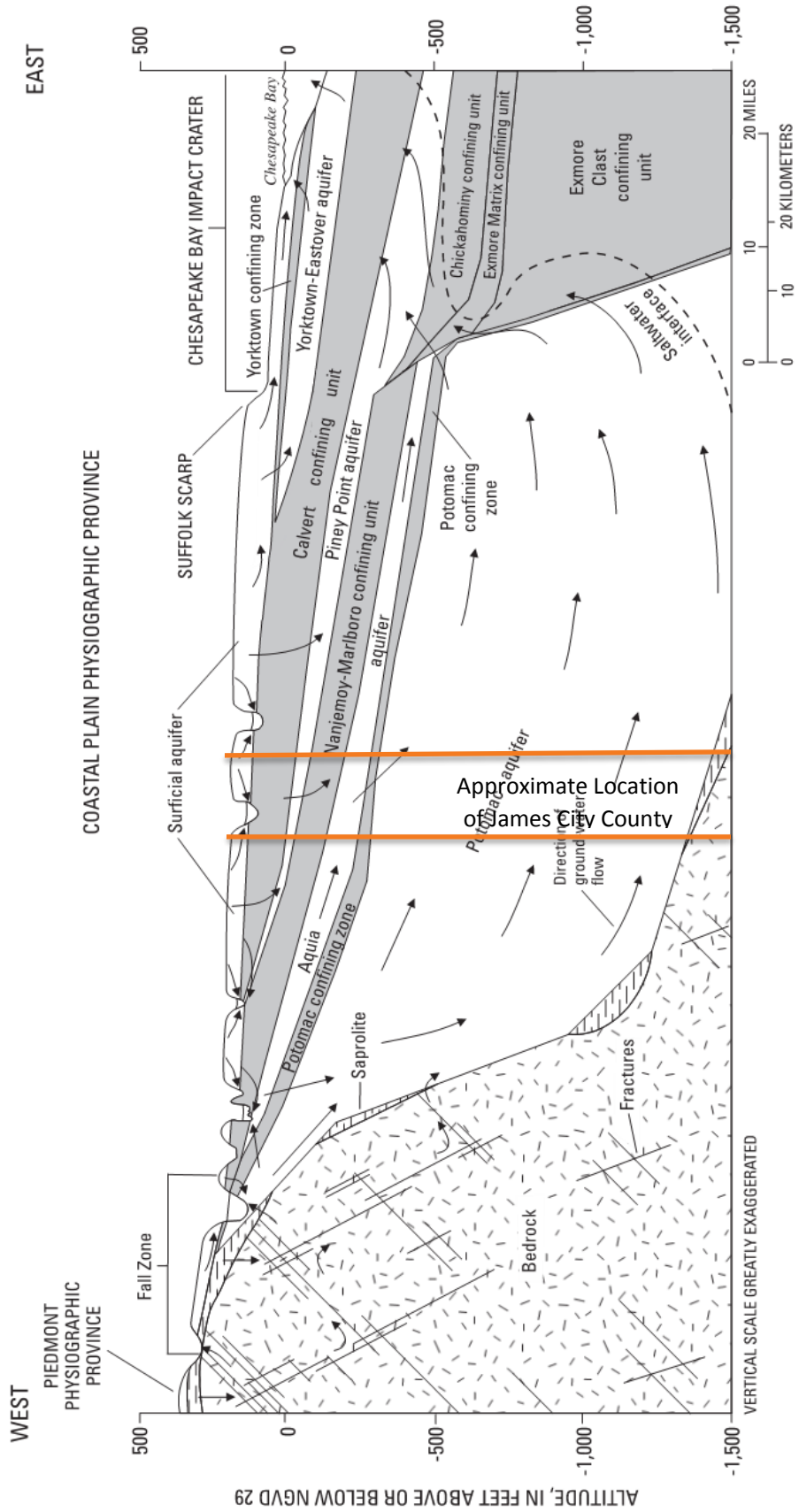

Figure 10-1
Generalized Hydrogeologic Section in the Virginia Coastal Plain (McFarland and Bruce, 2006)

10.3 Riverbank Filtration

Riverbank filtration is a method of withdrawing water from a surface water source by first passing the water through the natural river sediments. This is typically accomplished by constructing shallow wells near the river. Where conditions are appropriate, this sometimes consists of a larger diameter vertical well or shaft with horizontal wells extending radially outward to collect the water. Historically, riverbank filtration systems have been constructed in unconsolidated sand and gravel alluvial deposits near the river bank. Pumping water from the wells produces a gradient that causes river water to move through the sediment towards the well. The filtration of the water through the sediment deposits effectively removes pathogens, reduces organic matter (as measured by soluble organic carbon (SOC)), and removes suspended solids thereby reducing the need and cost of treatment. This also produces a more constant water quality that would improve the treatment process and provide a consistent high quality treated water supply. A further benefit is that it eliminates a direct withdrawal from the river that would have other concerns such as impacting small fish and other aquatic organisms in the water. A direct withdrawal would have to have fine screens and sufficient surface area to reduce the impact on aquatic organisms.

James and York rivers in the areas of interest are brackish with total dissolved solids concentrations varying seasonally. Water withdrawn through the use of riverbank filtration would still require treatment through membranes or other technology to reduce sodium, chloride, and other dissolved solids concentrations to acceptable levels. Riverbank filtration would eliminate the need for sedimentation to address suspended solids and reduce concentrations of bacteria and other organisms that affect the treatment process. Fine screens and filters would be required to prevent membrane clogging by fine particulates in the water withdrawn from the wells. Riverbank filtration would dampen the fluctuations in suspended solids and dissolved solids water quality associated with a direct river withdrawal.

The James River, York River, and downstream tidal portions of the Chickahominy River in the areas of interest near James City County are flooded river valleys. Ancient rivers cut through the deposits when ocean water levels were lower than today and are now tidal estuaries. As such, the riverbanks consist of the unconsolidated and semi-consolidated sediments that comprise the surficial aquifer system. This typically consists of nearly horizontal layers of sand, silty sand, and clay. The layers typically are not horizontally continuous. The local soils are therefore not typical for locations where riverbank filtration is used and extensive testing and piloting would be required to determine if this option is feasible and to provide data that will determine the number of wells required and the optimum well field configuration.

Conceptually, a riverbank withdrawal system for the Chickahominy, York or James River would include multiple shallow wells near the riverbank. The wells could be drilled at an angle to follow the riverbank slope and maintain a constant distance between the well and the river. Depending on the strata found, the wells would be screened to take advantage of the more permeable layers. Exploratory wells would be needed to determine the strata at the specific site of interest. Chesapeake Bay Preservation Area requirements would likely require that the wells be constructed at least 100 feet from the shore. To ensure that much of the water is obtained through induced flow from the river source, the wells should be as close to the river as feasible. A conceptual plan and profile for riverbank filtration along the James, Chickahominy, or York River is shown on Figure 10-2.

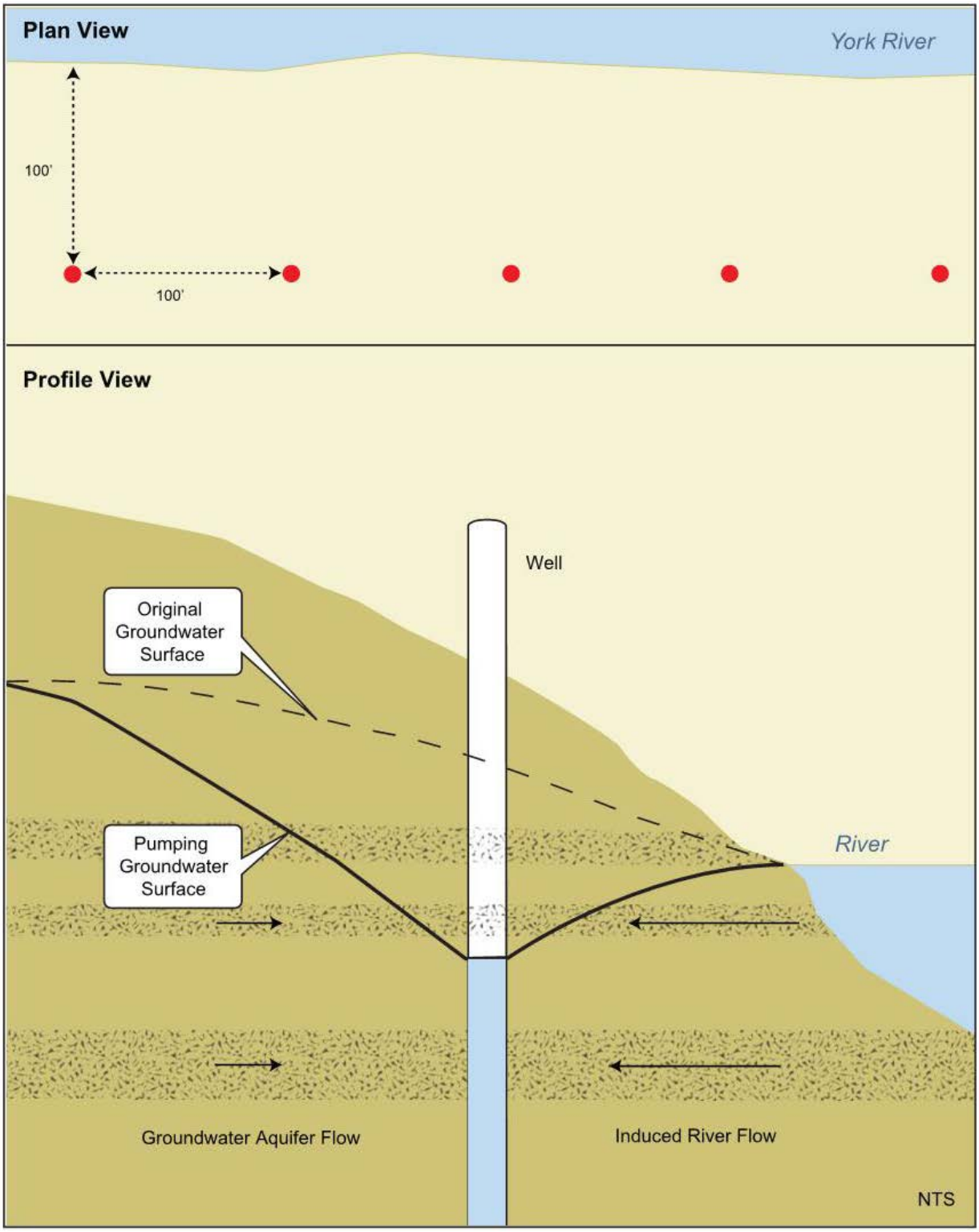

Figure 10-2
Chickahominy, James, and York River
Riverbank Filtration Conceptual Plan and Profile

As an initial conceptual requirement it is assumed that each shallow well could reliably produce 0.12 mgd. A 1-mgd water supply, including 80 percent reject from the RO membranes, would require approximately 10 wells. To avoid inter-well interference, a well-to-well spacing of 100 feet is assumed. This would require a linear well field about 1,000 feet long. Other well field configurations could be considered.

The regulatory requirements of riverbank filtration withdrawal are uncertain. The riverbank withdrawal wells would be constructed in the same stratum that comprises the surficial water system and would likely be regulated by DEQ under the EVGMA. The water withdrawn from the wells would include both river water induced to flow to the well and groundwater. The amount of groundwater withdrawn and impact on the aquifer depends on the local stratigraphy and natural groundwater flow gradients. The naturally occurring groundwater flow direction would be towards the river with the groundwater levels being higher than the river levels. If there were a nearby significant existing groundwater withdrawal, the natural gradient could be away from the river into the aquifer. It would likely not be possible to design and construct a riverbank withdrawal that would not affect the localized groundwater aquifer. DEQ may also raise concerns regarding the riverbank filtration system inducing saltwater intrusion into the local aquifer system.

VDH indicated that the Virginia Water Authority operates a membrane filtration plant with a riverbank filtration source.[1] The infiltration gallery is along the New River in Grayson County which is a freshwater flowing river outside the EVGMA in contrast to the James River which is a brackish tidal river. The New River riverbank infiltration gallery has a design capacity of 1.0 mgd.[2]

10.4 Expansion of the FFWTF from 5 to 6 mgd

For this study, a 20-percent expansion of the FFWTF from 5.0 to 6.0 mgd was considered using riverbank filtration for the James River. It is assumed that the wells would be constructed on the County-owned parcel along the James River, west of the FFWTF concentrate discharge main. As discussed above, it is assumed that a 1-mgd supply, including 80 percent reject from the RO membranes, would require approximately 10 wells, spaced at least 100 feet apart. It is assumed that additional skids and other modifications may be necessary to expand this facility and can be located within the existing structures.

10.5 Physical Infrastructure Impacts

Additional infrastructure improvements may be required within the existing water system to transmit additional flow from the FFWTF to the demand centroid. It is recommended that JCSA conduct simulations on their hydraulic water model to define the infrastructure needs for the FFWTF expansion.

10.6 Financial Impacts

Planning-level cost estimates for the FFWTF 1-mgd expansion are presented in Table 10-1. The planning-level cost estimates do not include costs for infrastructure improvements that may be necessary to distribute the flow in the system.

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[1] Ray Whitner, VDH Office of Drinking Water-Abingdon Field Office (personal communication, November 24, 2014).

[2] VDH Engineering Description Sheet, Virginia Water Authority, Permit No. 1077825, Effective July 1, 2013.

Table 10-1 FFWTF 1-mgd Expansion Planning-Level Cost Estimates

Description		Planning-Level Cost Estimate ($)
Riverbank filtration wells	1,300,000	
1-mgd plant expansion	10,000,000	
Subtotal for Prime Contractor		11,300,000
Construction Contingency		2,830,000
Total Construction Cost		14,130,000
Engineering, Legal, and Financial Contingencies		3,530,000
Total Project Costs in 2015 Dollars		**17,660,000**

Note: Assumes 10 wells installed on County-owned property adjacent to concentrate discharge and that capacity of existing concentrate discharge main is adequate.

Annual O&M costs were also developed for the plant expansion. The O&M cost is presented in Table 10-2 and includes costs associated with chemical usage, energy consumption, and labor costs. The O&M costs were based on unit costs provided by JCSA for chemical purchase, power, and staffing. Under JCSA's budgeting program, membrane replacement and equipment maintenance/repairs for the FFWTF are funded separately from the annual O&M cost and are therefore not included in Table 10-2. The estimated O&M cost for the 5-mgd FFWTF is $0.62/1,000 gallons. The O&M cost is estimated to increase to $0.72/1,000 gallons with the 1-mgd plant expansion; the cost increase includes additional staffing requirements to man the facility 24 hours per day as required for the plant capacity.

Table 10-2 Planning-Level Cost Estimate for FFWTF 1-mgd Expansion

Description	Annual O&M Cost $
Chemical Usage	170,000
Energy Consumption	640,000
Labor	610,000
HRSD Fee	5,000
Landscaping and Mowing	5,000
Subtotal	1,430,000
Contingency	140,000
Total O&M Cost	1,570,000
	$0.72/1,000 Gal

*All Costs expressed in 2015 dollars.

10.7 Potential Environmental Concern

The impact of the riverbank filtration wells on the aquifer is a potential environmental concern to DEQ. Although the primary water source is surface water from the James River, it is uncertain how DEQ will relate the riverbank filtration to the groundwater withdrawal permit. As previously discussed, the water withdrawn from the wells would include both river water induced to flow to the well and groundwater, with the amount of groundwater withdrawn and impact on the aquifer dependent on the local stratigraphy and natural groundwater flow gradients.

The impact of the potential presence of kepone that was discharged upstream into the James River in the 1970s and trapped in the bottom sediments of the river is of potential environmental concern for riverbank filtration on the James River as well as its confluence with the Chickahominy River. It is uncertain if the riverbank filtration withdrawal will disturb the sediments. Further investigation with water sampling from test wells is necessary to determine the potential impact. Prior to sampling, a Health and Safety Plan would need to be developed. EPA Method 8270 will allow for analysis of this compound. The quantity of water that would need to be pumped for the riverbank filtration testing program will have to be established. Disposal methods for the pump test water would have to be identified as part of the riverbank filtration testing program in case kepone is detected in the water sample. The water will have to be containerized pending analytical results.

Section 11

Permit and Approval Requirements

The implementation of a new and/or expanded water supply and treatment facility will require permits and approval from various regulatory agencies. A discussion of the permit and approval requirements for the surface water and groundwater supply and treatment alternatives follows.

11.1 Surface Water Supply

To implement a new surface water supply and treatment facility, permits and review approvals will be needed from the following regulatory agencies:

- Federal
  - United States Army Corps of Engineers
  - United States Environmental Protection Agency
  - National Park Service
- State
  - Virginia Department of Environmental Quality
  - Virginia Department of Conservation and Recreation
  - Virginia Department of Game and Inland Fisheries
  - Virginia Marine Resources Commission
  - Virginia Department of Health
  - Virginia Department of Transportation
- Local
  - James City County Planning Division
  - James City County Division of Engineering and Resource
  - James City County Building Safety and Permits Division

A discussion of each regulatory agency's involvement in the permit and review approval process follows.

11.1.1 Federal

11.1.1.1 U.S. Army Corps of Engineers (USACE)

The USACE is responsible for administrating the requirements of Section 10 of the Rivers and Harbors Act (Section 10) and Section 404 of the Clean Water Act (Section 404). Section 10 of the Rivers and Harbors Act regulates activity within navigable waters of the United States. Activities regulated by Section 10 include any action that would affect the course, location, condition, or capacity of navigable waters including construction, excavation, and deposition of materials. Section 404 governs the discharge of dredged or fill material into waters of the United States. USACE jointly administers

Section 404 authority with EPA. Construction of the intake and disposal of the concentrate in the York, James, or Chickahominy rivers, as well as any construction impact to wetlands, will require a USACE permit. For the Chickahominy River, potential impact to Riverine wetlands will be of concern.

11.1.1.2 U.S. Environmental Protection Agency (EPA)

While the permit decisions and jurisdictional determinations for Section 404 are made by USACE, EPA is responsible for the overall implementation of the Clean Water Act. EPA involvement is limited mostly to providing review and comment; however, EPA has the authority to prohibit or restrict the use of any defined area as a disposal site or reject USACE permit decisions. In Virginia, the National Pollutant Discharge Elimination System (NPDES) permit program authorized by the Clean Water Act is regulated by DEQ under the VPDES program. EPA also has oversight responsibilities over state and local permitting authorities, such as DEQ, in the issuance of operating permits for air pollution sources under Title V of the Clean Air Act.

11.1.1.3 National Park Service

The National Park Service maintains the Nationwide River Inventory which is a "register of river segments that potentially qualify as national wild, scenic or recreational river areas".[1] To be registered, the river must be free-flowing and have an Outstanding Remarkable Value (ORV) designation. The National Park Service will be concerned about the potential impact of the water supply alternatives to the following National River Inventory segments:

- Chickahominy River - 30-mile segment from Providence Forge to the James River classified as having botanic and geologic significance
- James River - 62-mile stretch from Hopewell to Mogarts Beach designated as having a historic significance. Four National Historic Register Sites and one National Historic Park are also located adjacent to the corridor.[2]
- York River – 12-mile section from Almondsville to Plum Point designated as having hydrologic significance

11.1.2 State

11.1.2.1 Virginia Department of Environmental Quality (DEQ)

Protection and improvement of the environment in Virginia is DEQ's primary mission. To achieve this mission, DEQ implements laws and regulations governing air quality, water quality, water supply, and waste management. As a result of their broad mission, DEQ administers numerous permitting programs.

Surface water withdrawal projects are regulated by the Virginia Water Protection (VWP) Permit Program which is administered by the DEQ Office of Wetlands and Stream Protection and the DEQ Office of Water Supply.[3] The VWP Permit is issued through the Joint Permit Application (JPA) process, which allows for concurrent review by the USACE, the Virginia Marine Resources Commission, DEQ, and local wetlands boards. The JPA may also be sent to other agencies for comment.

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[1] Hampton Roads Planning District Commission. 2011. Hampton Roads Regional Water Supply Plan. Page 3-17.

[2] Hampton Roads Planning District Commission. 2011. Hampton Roads Regional Water Supply Plan. Table 3-9.

[3] http://www.deq.virginia.gov/Programs/Water/WetlandsStreams/SurfaceWaterWithdrawalsImpoundments.aspx (Last accessed November 6, 2014)

In accordance with 9VAC25-210-75, JCSA can request DEQ to form a preapplication review panel to assist in the early identification of issues related to the protection of beneficial instream and offstream uses of the river. DEQ would notify the Virginia Marine Resources Commission, the Virginia Institute of Marine Science, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Conservation and Recreation, the Virginia Department of Health, USACE, the U.S. Fish and Wildlife Service, EPA, and any other appropriate local, state, and federal agencies of the preapplication review panel request. The agencies would provide information and guidance on the potential natural resource impacts and regulatory implications of the project and provide comments within 60 days of the initial meeting of the preapplication panel.

The concentrate discharge from the RO treatment facility will require a VPDES permit which is issued by DEQ. Potential impacts to the receiving stream will need to be addressed to obtain a VPDES permit.

11.1.2.2 Virginia Department of Conservation and Recreation (DCR)

DCR protects Virginia's natural and cultural treasures through the management of erosion, sediment runoff, and stormwater resulting from land disturbing activities, which is documented in the Virginia Stormwater Management Program. DCR maintains a natural heritage inventory which documents the location and ecological status of habitat of rare, threatened, or endangered plant and animal species, significant natural communities or geologic sites and administers the Virginia Scenic Rivers program. Potential DCR concerns for the surface water supply alternatives are summarized in Table 11-1.

Table 11-1 Potential DCR Concerns on JCSA Surface Water Supply Alternatives

Surface Water Supply	Potential DCR Concern
Chickahominy River	Impact to following ecological communities identified in Natural Heritage Inventory • Fluvial Terrace Woodlands • Coastal Plain/Piedmont Swamp Forests • Tidal Bald Cypress Forests and Woodlands • Tidal Freshwater and Oligohaline Aquatic Beds
James River	Impact to tidal bald cypress forests and woodlands along the James River near Swanns Point, Surry County, as identified in the DCR Natural Heritage Inventory
	Impact to the 25-mile segment of James River from 1.2 miles east of Trees Point to Lawnes Creek designated as a Scenic River by DCR

11.1.2.3 Virginia Department of Game and Inland Fisheries (VDGIF)

VDGIF is tasked with protecting threatened and endangered wildlife. If threatened or endangered species are encountered during the construction of the water intake and/or treatment facility, a permit to collect and relocate the species may be required.

11.1.2.4 Virginia Marine Resources Commission (VMRC)

VMRC permits most activities over, under, or on state-owned submerged lands. The Habitat Management Division Permit will be required for the intake.

VMRC will be concerned about the potential impact of the York River surface water supply alternative to the York River shellfish management area defined by VMRC between Gloucester Point and Clay Bank Wharf.

11.1.2.5 Virginia Department of Health (VDH)

VDH Office of Drinking Water advocates for safe drinking water on behalf of the public through water quality monitoring, use of engineering judgment, technical assistance, and regulatory enforcement. The intake and treatment facility design must be submitted to VDH for approval. VDH is responsible for issuing JCSA's Waterworks Operation Permit which indicates the approved capacity of the system. JCSA would need to apply for an amendment to the Waterworks Operation Permit to include the new water supply and treatment facility.

In 1997, VDH had strong opposition to the use of the James River below Hopewell as a public water supply source. The presence of kepone trapped in the bottom sediment of the James River was identified as a potential concern. It is uncertain if VDH will continue to have the same opposition today for the development of the James River as a water supply source. The impact of VPDES permitted discharges in the vicinity of a proposed James River intake, boat traffic, and potential spills upstream from major highway/railway crossings may also be of concern to VDH.

Similarly, the impact of potential spills from an automotive bridge crossing and Colonial Petroleum pipe line crossing on the Chickahominy River intake may be of concern to VDH for the development of the Chickahominy River as a water supply source. It is uncertain if the presence of kepone will also be of concern in the tidal section of the Chickahominy River.

11.1.2.6 Virginia Department of Transportation (VDOT)

All activities that affect state highways or rights-of-way must be reviewed by VDOT and receive a Land Use Permit. Activities for this project that will need review include the construction and permanent access roads and utility crossings.

11.1.3 Local

11.1.3.1 James City County Planning Division

The site plan for the water treatment facility must be submitted to the James City County Planning Division for review and approval. The site plan is reviewed by the Development Review Committee. A building permit will not be issued until the site plan has been approved.

The construction and operation of the water treatment facility will require a Special Use Permit which is processed and reviewed by the Planning Division. The Special Use Permit authorizes a use in a specific zoning district that will comply with all the conditions and standards for the location or operation of the use as specified in the zoning ordinance and authorized by the Board of Supervisors. The impact of the use on neighboring property and surrounding areas as well as compatibility with the James City County Comprehensive Plan is taken into consideration.

A Special Use Permit will be more difficult to obtain for the James River surface water treatment facility than the Chickahominy and York River water treatment facilities since most areas in the vicinity of the James River are already developed and/or protected from development.

11.1.3.2 James City County Division of Engineering and Resource Protection

The James City County Division of Engineering and Resource Protection is responsible for reviewing stormwater management plans to ensure compliance with the Virginia Stormwater Management Program (VSMP). The County reviews and approves Stormwater Pollution Prevention Plans, which include sedimentation and erosion control plans and stormwater management plans. The County is responsible for issuing a consolidated erosion and sediment control (land disturbing) and stormwater

management (stormwater construction) permit and obtaining evidence of VPDES/VSMP permit coverage prior to approval to begin land disturbance activities.[4]

11.1.3.3 James City County Building Safety and Permits Division

The James City County Building Safety and Permits Division is responsible for ensuring that public/private structures and facilities constructed in the County do not harm the public's safety and welfare as well as enforcing zoning ordinances. To achieve this goal, the Safety and Permits Division reviews design and construction plans, oversees construction permitting, and issues final approval for occupancy of the project. The water supply and treatment facility will require building, mechanical, plumbing, electrical, and occupancy permits.

11.2 Groundwater

An expansion of the FFWTF will require permit and review approvals from similar agencies as the surface water supply option. A discussion of the involvement of each agency follows.

11.2.1 Federal

USACE and EPA involvement focuses on permits required if the construction of the pipeline from riverbank filtration wells to the FFWTF impacts any wetland area.

11.2.2 State

DEQ is responsible for reviewing modifications to the Groundwater Withdrawal Permit, VPDES permit for the brine concentrate discharge, and air quality, water quality, and waste management permits. Since the riverbank filtration wells would be constructed in the same stratum that comprises the surficial aquifer, it will likely be regulated by DEQ under the EVGMA; it is uncertain how DEQ will relate the riverbank filtration wells to the groundwater withdrawal permit. For an expansion of the FFWTF, a modification to the VPDES permit for the concentrate discharge is required.

VDH is responsible for approving the design for the plant expansion and providing a permit to construct the facility. JSCA will also need to request an amendment to the Waterworks Operation Permit for the expanded facility and new RO facility.

11.2.3 Local

Local permit requirements are similar to those discussed in Section 11.1.3 for new construction.

11.3 Summary

A summary of the permit and approval requirements for the surface water and groundwater supply and treatment alternatives is presented in Table 11-2. The summary includes a rating for the degree of difficulty in obtaining the permits and approvals with "1" as the easiest and "5" as most difficult. Of the surface water supply options, permit and approval of the James River as a water supply source presents the most challenges due to potential environmental impacts and impacts of existing conditions and permitted discharges on raw water quality. The permitting and approval of the 1-mgd expansion of the FFWTF is highly dependent on how DEQ will relate the riverbank filtration wells to the Groundwater Withdrawal Permit; the alternative will not be viable if DEQ determines that the riverbank filtration flow impacts JCSA's permitted groundwater withdrawal.

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[4] http://www.jamescitycountyva.gov/pdf/resourceprotection/Forms-all/VSMPgeneral.pdf (Last accessed February 10, 2015)

Table 11-2 Permit and Approval Summary

Permit	Responsible Agency	Description	Applicability: New Surface Water Source	Applicability: FFWTF Expansion	Difficulty in Obtaining Permit (1 = Easy, 5 = Difficult): York River WTF	James River WTF	Chickahominy River WTF	FFWTF Expansion with Riverbank Filtration of James River
Dept. of the Army Permit (Section 404/Section 10 of Clean Water Act)	USACE	Required for construction in navigable waters or discharge of dredged or fill material into waters of the U.S., including wetlands	✓		4	5	5	
Virginia Water Protection Permit (VWP)	DEQ	Required for impacts to wetlands and/or waterways, water intakes, outfalls	✓		4	5	5	
Virginia Groundwater Withdrawal Permit	DEQ	Required for groundwater withdrawal >300,000 gpd		✓				5
VPDES Permit	DEQ	Required for brine concentrate discharge and if JCSA desires to have flexibility of disposal of process wastewater such as during start-up	✓	✓	3	3	3	3
VPDES/VSMP Permit for Construction	JCC DERP	Obtain evidence of general permit coverage	✓	✓	2	2	2	2
Stormwater Pollution Prevention Plan	JCC DERP	Required for discharge of stormwater from construction activities	✓	✓	2	2	2	2
Virginia Pollution Abatement Permit	DEQ	Required if JCSA land applies wastes						
VDOT Land Use Permit	VDOT	Required for facility entrance (temporary and permanent driveway) and construction of water mains in VDOT right-of-way	✓		2	2	2	
Site Plan Approval	JCC PD	Required prior to building permit approval	✓	✓	3	3	3	2
Special Use Permit	JCC PD	Required for construction and operation of water treatment facility	✓	✓	2	4	2	4
VDH Permit to Construct	VDH	Required before Notice to Proceed	✓	✓	3	3	3	3
Building, Mechanical, Plumbing, Electrical Permits	JCC BSPD	Required for construction approval	✓	✓	2	2	2	2
Waterworks Operation Permit	VDH	Required before plant goes on line	✓	✓	3	3	3	3
Emergency Generator General Permit	DEQ	Required for emissions from onsite generator	✓	✓	2	2	2	2
Fuel Tank Registration	DEQ	Required for fuel tanks	✓	✓	2	2	2	2
Spill Prevention Control and Countermeasure Plans (SPCC)	DEQ/EPA	Required for onsite chemicals and fuel storage	✓	✓	2	2	2	2
Electric – Request for Commercial Hookup	Electric Utility	Discuss during start of design	✓	✓	2	2	2	2
Occupancy Permit	JCC BSPD	Required for building occupancy	✓	✓	2	2	2	2

✓ = Required

Abbreviations:

USACE = U.S. Army Corps of Engineers
DEQ = Virginia Department of Environmental Quality
EPA = U.S. Environmental Protection Agency
JCC BSPD = James City County Building Safety and Permits Division
JCC DERP = James City County Division of Engineering & Resource Protection
JCC PD = James City County Planning Division
VDH = Virginia Department of Health
VDOT = Virginia Department of Transportation

Section 12

Evaluation Results of Potential Alternatives

A summary of the evaluation results of the following water supply alternatives is presented in Table 12-1:

- Newport News Waterworks
- York River
- James River
- Chickahominy River
- Expansion of existing FFTWF from 5 to 6 mgd with riverbank filtration of the James River

The general location of each alternative is shown on Figure 12-1. A discussion of the evaluation results follows.

12.1 Newport News Waterworks

With the existing DEQ Groundwater Withdrawal Permit and reliance solely on their groundwater supply, JCSA is projected to have a deficit of 0.3 mgd by 2030, increasing to 3.4 mgd by 2050 based on the projected maximum day demands. If DEQ reduces the permitted average annual withdrawal to 7.84 mgd, the projected deficit is 1.2 mgd by 2030, increasing to 4.3 mgd by 2050. If DEQ reduces the permitted annual average withdrawal to their proposed limit of 4.0 mgd, JCSA will have an immediate deficit of 2.0 mgd, increasing to 8.2 mgd by 2050.

JCSA entered into a PDA with Newport News in 2008 to purchase supplemental water through two payment installments. JCSA's first payment of 25 million dollars gives the Authority the right to purchase an average safe yield of 4 mgd during drought conditions; the actual cost of the payment was $51.5 million including debt service. If the second payment of 25 million dollars (in 2008 dollars subject to inflation i.e. approximately 34 million dollars in 2019 dollars) is not paid by June 30, 2019, JCSA's safe yield share will be limited to 2 mgd on an annual average; the second payment is estimated to cost JCSA $60 million to finance. With the existing DEQ Groundwater Withdrawal Permit and a supplemental annual average purchase of 2 mgd from Newport News, a deficit of 0.5 mgd is projected by 2050; a second payment to Newport News would delay the deficit beyond 2050. With a revised permitted average annual withdrawal of 7.84 mgd, the projected deficit is 1.5 mgd by 2050; a second payment to Newport News would delay the deficit beyond 2050.

In addition to the payment installments to Newport News, JCSA will need to implement infrastructure improvements, including disinfection compatibility improvements, in order for the Newport News water to be effective in meeting their water supply needs. The location of the two potential interconnections to the Newport News water system is shown on Figure 12-1.

If DEQ reduces the permitted annual average withdrawal to their proposed 4.0 mgd limit and JCSA purchases 2 mgd from Newport News, the projected deficit is 0.7 mgd by 2020, increasing to 5.3 mgd by 2050; if JCSA pays the second installment, the projected deficit is 0.9 mgd by 2040, increasing to 2.5 mgd by 2050. Hence, with a reduction in the DEQ permitted withdrawal to 4 mgd, the need to secure an additional water supply source is imminent for JCSA even with the Newport News water purchase.

JCSA will not be able to have a second water supply source online prior to the June 30, 2019 deadline for the second payment to Newport News due to the time required for permit approval, design, and construction of a new facility. With the existing permitted groundwater withdrawal, the cost to develop a long-term surface water supply source for JCSA should be compared to the cost of the second payment to Newport News to determine if the Newport News second payment is the most feasible option.

12.2 Surface Water Supply Sources

The York, James, and Chickahominy rivers are viable surface water supplies for JCSA. The York, James, and Chickahominy rivers all have brackish water with tidal influence and require RO treatment. Of the three surface water supplies, the Chickahominy River has the lowest estimated salinity and the York River, the highest.

The Chickahominy River and James River have more potential environmental concerns than the York River due to the presence of significant ecological communities, such as tidal bald cypress forests and woodlands. Potential impact to tidal fluvial terrace woodlands, coastal plain/piedmont swamp forests, and tidal freshwater and oligohaline aquatic beds, and riverine wetlands will also be of concern for the Chickahominy River. The James River segment considered for the raw water intake is designated as a Scenic River by DCR and as having historic significance by the National Rivers Inventory. The proposed Chickahominy River intake is located in a segment classified as having botanic and geologic outstanding remarkable values in the National Rivers Inventory.

The James River has more potential water quality impacts that may be of concern to the public than the York or Chickahominy River. There are six dischargers with VPDES permits in close proximity to the proposed raw water intake location. The potential presence of kepone trapped in the sediments that may be disturbed during construction is of concern; it is uncertain if kepone could be present in the tidal section of the Chickahominy River. With the York River alternative, discharges that are located approximately 10 miles upstream in West Point may be of concern. Potential spills from transportation vehicles on major highway crossings across the James River, a bridge crossing and petroleum pipe line crossing across the Chickahominy River, and boat traffic on both rivers are also of concern.

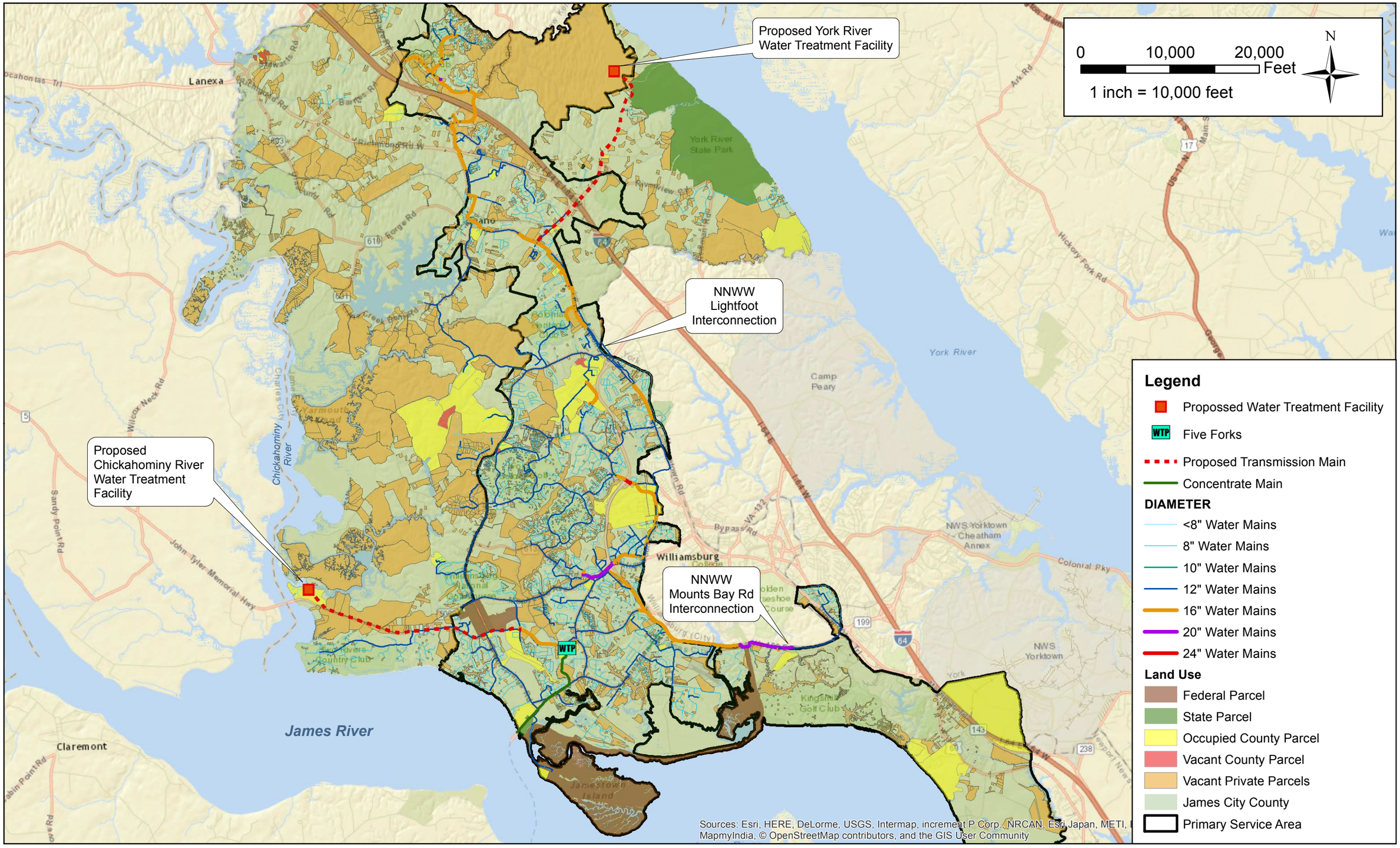
The James River and the York River have more flow than the Chickahominy River. The available flow in the Chickahominy River may also be limited during drought conditions based on the limits stipulated in the NNWW surface water supply agreement which restricts their flow during drought conditions; however, this limitation is on the fresh water side of the Chickahominy River and may not be applicable to the tidal section of the proposed intake.

Table 12- 1 Evaluation Results of Potential Water Supply Alternatives

	Newport News Water Works Purchase Agreement	York River	James River	Chickahominy River	Expansion of FFWTF
Description	Increase in purchase agreement from 2 mgd to 4 mgd	RO facility with intake close to Croaker Road	Intake located upstream of FFWTF concentrate discharge; site to be determined	RO facility located on County-owned Chickahominy River Front Park	Expansion of FFWTF from 5 to 6 mgd with 1 mgd obtained from riverbank filtration of James River
Planning-Level Capital Cost Estimate	MB = Mounts Bay Road Interconnection LT = Lightfoot Connection Scenario A: MB=2 mgd Infrastructure = $6M Scenario B: MB = 2mgd, LT = 2 mgd 2nd Payment w/debt service $60M Infrastructure Improvements 15M Disinfection Improvements 2M Total $77M Scenario C: LT = 4 mgd 2nd Payment w/debt service $60M Infrastructure Improvements 17M Disinfection Improvements 2M Total $79M	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake $ 20M / $ 22M / $ 23M WTF 45M / 60M / 76M Transmission 12M / 12M / 12M Contingencies 19M / 24M / 28M Engineering, Testing, Permitting, Land Acquisition 17M / 20M / 23M Total Project Cost $113M / $138M / $162M	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake[1] 19M / 20M / 22M WTF[2] 43M / 57M / 71M Transmission 5M / 5M / 5M Contingencies 17M / 21M / 24M Engineering, Testing, Permitting, Land Acquisition 16M / 19M / 22M Total Project Cost 99M / 122M / 144M Note: Refine cost for raw water transmission, concentrate discharge main, and finished water main after site is identified	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake $ 19M / $ 20M / $ 22M WTF 41M / 55M / 68M Transmission 13M / 13M / 13M Contingencies 18M / 22M / 26M Engineering, Testing, Permitting 15M / 18M / 20M Total Project Cost $106M / $128M / $149M	Riverbank Filtration Wells $ 1M 1-mgd plant expansion 10M Contingencies 3M Engineering, Testing, Permitting 4M Total Project Cost $18M
O&M Cost Estimate	Per NNWW PDA $1.22/1000 Gallons in 2014	$2.00/1,000 Gallons	$1.88/1,000 Gallons	$1.76/1,000 Gallons	$0.72/1,000 Gallons
Land availability	---	Vacant property available	Limited availability	County-owned property available	Area available on existing FFWTF site
Capacity Limitations in meeting supply needs	Capacity limited to 4 mgd annual average	None	None	None	Limited to 1 mgd
Existing Public Water Supply Withdrawals	Newport News		• Henrico County • Hopewell • Lynchburg • Richmond	Newport News	
Existing Commercial/Industrial Withdrawals		Yorktown Fossil Power Plant	• James River Correctional Center, Goochland County • Honeywell International, Inc., Hopewell • Dupont E. E. DeNemours & Co., Chesterfield County • Dominion Generation Surry Nuclear Plant • Dominion Generation Chesterfield Power Station • Dominion Generation Bremo Bluff Power Plant, Fluvanna County		
Downstream users that may be impacted		Yorktown Fossil Power Plant	Dominion Generation Surry Nuclear Plant		
Existing VPDES discharges		• Rocktenn CP LLC - West Point • HRSD West Point Sewage Treatment Plant	• BASF Corporation – Williamsburg • Colonial Pipeline Company – Yorktown • Colonial Pipeline Surry • Dominion Yorktown • Grays Creek Marina and Restaurant, Surry • HRSD - Williamsburg Sewage Treatment Plant • JCSA – FFWTF Concentrate Discharge	Hideaway Sewage Treatment Plant – Mount Airy	

Table 12- 1 Evaluation Results of Potential Water Supply Alternatives (continuation)

	Newport News Water Works Purchase Agreement	York River	James River	Chickahominy River	Expansion of FFWTF
Potential Environmental Concerns		• 12-mile section of York River from Almondsville to Plum Point designated as having hydrologic significance in National Park Service, National Rivers Inventory • York River shellfish management area from Clay Bank Wharf to Gloucester Point • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal.	• 25-mile segment of James River from 1.2 miles east of Trees Point to Lawnes Creek designated as Scenic River by Virginia DCR • Presence of tidal bald cypress forests and woodlands along James River near Swanns Point, Surry County, listed in DCR Natural Heritage Inventory • Presence of tidal bald cypress forests and woodlands along James River near Swanns Point, Surry County, listed in DCR Natural Heritage Inventory • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal.	• 30-mile segment from Providence Forge to James River classified as having botanic and geologic significance in National Park Service, National Rivers Inventory • Presence of fluvial terrace woodlands, Coastal Plain/Piedmont swamp forests, tidal bald cypress forests and woodlands, and tidal freshwater and Oligohaline aquatic beds as identified in DCR Natural Heritage Inventory • Presence of Riverine wetland areas • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal.	Impact on declining aquifer levels - riverbank withdrawal wells would be constructed in the same stratum that comprises the surficial water system and would likely be regulated by DEQ under the EVGMA. Water withdrawn from wells would include both river water induced to flow to the well and groundwater. Amount of groundwater withdrawn and impact on aquifer depends on local stratigraphy and natural groundwater flow gradients. Naturally occurring groundwater flow direction would be towards the river with groundwater levels being higher than river levels. If there were a nearby significant existing groundwater withdrawal, natural gradient could be away from the river into the aquifer. It would likely not be possible to design and construct a riverbank withdrawal that would not affect the localized groundwater aquifer. DEQ may also raise concerns regarding the riverbank filtration system inducing saltwater intrusion into the local aquifer system.
Potential Water Quality Concerns		Impact of upstream VPDES discharges	• Presence of kepone (pesticide discharged upstream in 1970s), trapped in bottom sediments of the river. • Impact of VPDES discharges • Potential spill upstream from major highway crossings	• Potential presence of kepone at confluence due to James River tidal influence • Impact of upstream VPDES discharge • Potential spill from automotive bridge crossing and Colonial Petroleum pipeline crossing	• Salt water intrusion • Potential presence of kepone
Permitting/Approval Concerns			• JPA Permit Application approval anticipated to be difficult due to environmental impacts • VDH approval as water supply source may be difficult based on historical opposition due to potential raw water quality impact concerns from existing environmental conditions	Approval of JPA Permit Application may be difficult due to environmental impact concerns	May not be approved if DEQ determines riverbank filtration affects Groundwater Withdrawal Permit



CDM Smith

Figure 12-1
Potential Water Supply Alternatives

For the Chickahominy River alternative, the County has property for the treatment facility. With the James River and York River alternatives, the County will have to purchase property for the treatment facility. Undeveloped property is available adjacent to the York River. Available property close to the James River is highly limited; most of the land in close proximity to the river is developed or protected from development, e.g. historic or park preservation.

From a water distribution standpoint, the York River is located in a more strategic area than the James and Chickahominy River options. The York River supply is located in the northern area of James City County where growth is anticipated.

A summary of the planning-level cost estimates for the proposed surface water supply sources and the O&M cost for an 8-mgd facility is presented in Table 12-2. The James River option appears to be the lowest cost of the surface water supply alternatives, pending the additional costs of the raw water and concentrate discharge mains after a site has been identified.

12.3 Expansion of FFWTF from 5 mgd to 6 mgd

As a short-term alternative, the expansion of the FFWTF from 5 mgd to 6 mgd through riverbank filtration of the James River was considered. Although the primary water source is surface water, there is a degree of uncertainty on how DEQ will relate the riverbank filtration to the groundwater withdrawal permit. This alternative would only be viable as a near-term supply if the permit approval is not delayed and if the riverbank filtration does not affect the permitted groundwater withdrawal. It should be noted that the local soils are not typical for locations where riverbank filtration is used and extensive testing and piloting would be required to determine if this option is feasible and to provide data that will determine the number of wells required and the optimum well field configuration.

12.4 Summary

A summary of the advantages and disadvantages of the water supply alternatives is presented in Table 12-2. Based on the obstacles that have been identified and prior history in its consideration as a water supply source, it is anticipated that permit approval of the James River alternative will be difficult to obtain. It is recommended that JCSA further investigate the Chickahominy River and the York River as a water supply source. Although the costs to develop either of these alternatives are high, they appear to be more promising from a permitting standpoint and will be strategically located where growth is anticipated.

Table 12-2 Planning-Level Cost Estimate Summary for Surface Water Supply Alternatives (Dollars)

Surface Water	4-mgd Capacity	8 mgd Capacity	12 mgd Capacity
		Intake	
Chickahominy River	18,860,000	20,360,000	21,670,000
James River[2]	18,920,000	20,420,000	21,730,000
York River	20,180,000	21,780,000	23,180,000
		Treatment Facility	
Chickahominy River	41,140,000	54,820,000	68,150,000
James River[2]	42,640,000	57,120,000	71,250,000
York River	45,070,000	60,490,000	75,730,000
		Transmission[4]	
Chickahominy River	13,000,000	13,000,000	13,000,000
James River[2]	5,000,000	5,000,000	5,000,000
York River	12,000,000	12,000,000	12,000,000
		Contingencies	
Chickahominy River	18,260,000	22,050,000	25,710,000
James River	16,640,000	20,640,000	24,490,000
York River	19,320,000	23,570,000	27,730,000
		Engineering, Testing, Permitting	
Chickahominy River	14,690,000	17,530,000	20,280,000
James River[3]	15,760,000	18,760,000	21,650,000
York River[3]	16,720,000	19,910,000	23,030,000
		Total Project Cost	
Chickahominy River	105,950,000	127,760,000	148,810,000
James River	98,960,000	121,940,000	144,120,000
York River	113,290,000	137,750,000	161,670,000
		O&M Cost Estimate per 1000 Gallons	
Chickahominy River		$1.76	
James River		$1.88	
York River		$2.00	

Notes:

1. All costs expressed in 2015 Dollars
2. Refine cost for raw water transmission main; concentrate discharge, and finished water transmission main after site has been identified.
3. Includes land acquisition cost.
4. Existing distribution system should be evaluated to determine if the flow will require additional infrastructure improvements.

Table 12-3 Advantages and Disadvantages of Potential Water Supply Alternatives

Water Supply	Advantages	Disadvantages
NNWW	Agreement in place	• Capacity limitations – inadequate to meet future water demands if DEQ permitted groundwater withdrawal is reduced to 4 mgd • Disinfection compatibility concerns • Cost for 4 mgd share = $33.7 million based on 2nd payment of $25 million subject to inflation; actual cost for JCSA to finance estimated to be $60 million
York River	• Strategically located in area of County where growth is anticipated. • Vacant property available adjacent to proposed intake • Fewer environmental concerns than James River and Chickahominy River that could affect permittability	• Fluctuations in brackish water quality • Potential environmental concerns – impact to hydrologic significance and shellfish management area • Highest anticipated cost for new surface water source ($114M for 4 mgd; $138M for 8 mgd; $162M for 12 mgd)
James River	• Available flow • No extensive finished water transmission main likely since WTF would be located within existing system if property is available, but costs may be offset by likely transmission upgrades required to deliver water to the northern growth area	• Limited availability of vacant property in the vicinity of the river • Fluctuations in brackish water quality • Potential environmental concerns, impact to Historic, Scenic River, tidal bald cypress forests and woodlands • Impact of potential presence of kepone in bottom sediments of the river on water quality • Potential negative public perception of VDPES discharges in close proximity to intake • Difficulty in obtaining JPA permit application and VDH approval • High costs ($99M for 4 mgd; $122M for 8 mgd; $144M for 12 mgd)
Chickahominy River	County-owned property available	• Fluctuations in brackish water quality if intake located downstream of Walker's Dam • Potential flow limitations during drought conditions • Potential presence of kepone due to tidal influence of James River • High costs ($106M for 4 mgd; $128M for 8 mgd; $149M for 12 mgd)
Expansion of FFWTF from 5- to 6-mgd with riverbank filtration		• Uncertainty in how riverbank filtration will be addressed by DEQ in the groundwater withdrawal permit resulting in potential difficulty in obtaining DEQ approval • Local soils are not typical for locations where riverbank filtration is used and extensive testing and piloting would be required to determine if this option is feasible • Additional plant staff will be required due to higher capacity • Potential presence of kepone • Short-term solution

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APPENDIX A

Appendix A EPA and VDEQ Water Monitoring Stations on James River - Available Data (2005-2014)

Station ID		21VASWCB-2-JMS042.92[a]				EMAP_CS_WQX-VA05-0047-A[b]				21VASWCB-J-JMS032.59[c]			
Parameter	Units	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	ng/g					0.5	0.5	0.5	1				
2,2',3,3',4,4',5,6-Octachlorobiphenyl	ng/g					0	0	0	1				
2,2',3,3',4,4',5-Heptachlorobiphenyl	ng/g					1.1	1.1	1.1	1				
2,2',3,3',4,4'-Hexachlorobiphenyl	ng/g					0	0	0	1				
2,2',3,4,4',5,5'-Heptachlorobiphenyl	ng/g					2	2	2	1				
2,2',3,4,4',5'-Hexachlorobiphenyl	ng/g					2.3	2.3	2.3	1				
2,2',3,4',5,5',6-Heptachlorobiphenyl	ng/g					1.5	1.5	1.5	1				
2,2',3,5'-Tetrachlorobiphenyl	ng/g					1.3	1.3	1.3	1				
2,2',4,4',5,5'-Hexachlorobiphenyl	ng/g					3.4	3.4	3.4	1				
2,2',4,5,5'-Pentachlorobiphenyl	ng/g					3.8	3.8	3.8	1				
2,2',5,5'-Tetrachlorobiphenyl	ng/g					1.8	1.8	1.8	1				
2,2',5-Trichlorobiphenyl	ng/g					0.76	0.76	0.76	1				
2,3,3',4,4'-Pentachlorobiphenyl	ng/g					0	0	0	1				
2,3',4,4',5-Pentachlorobiphenyl	ng/g					0	0	0	1				
2,3',4,4'-Tetrachlorobiphenyl	ng/g					2.3	2.3	2.3	1				
2,4,4'-Trichlorobiphenyl	ng/g					1.3	1.3	1.3	1				
2,4'-Dichlorobiphenyl	ng/g					0	0	0	1				
3,3',4,4',5-Pentachlorobiphenyl	ng/g					1.3	1.3	1.3	1				
3,3',4,4'-Tetrachlorobiphenyl	ng/g					0.97	0.97	0.97	1				
Aluminum	ug/g					65700	65700	65700	1				
Ammonia	mg/l					0.008	0.033	0.018333	3				
Ammonia as N	mg/l	0.004	0.066	0.032273	11					0.009	0.05	0.025875	8
Antimony	ug/g					1.3	1.3	1.3	1				
Arsenic	ug/g					12.6	12.6	12.6	1				
Cadmium	ug/g					1.7	1.7	1.7	1				
Carbon	mg/l	0.096	15.307	4.085267	15					0.408	3.2	1.2685	8
Chlorophyll a	ug/l					5.77	6.3	6.016667	3				
Chlorophyll a, corrected for pheophytin	ug/l	4.15	4.24	4.195	2					2.53	4.04	3.285	2
Chlorophyll a, uncorrected for pheophytin	ug/l	5.59	6.15	5.87	2					3.26	4.75	4.005	2
Chlorophyll b	ug/l	0.1	0.11	0.105	2					0.1	0.1	0.1	2
Chlorophyll c	ug/l	0.33	0.41	0.37	2					0.12	0.5	0.31	2
Chromium	ug/g					75.5	75.5	75.5	1				
Copper	ug/g					48.7	48.7	48.7	1				
Decachlorobiphenyl	ng/g					2.2	2.2	2.2	1				
Depth, Secchi disk depth	m	0.5	0.7	0.6	3	0.6	0.6	0.6	1	0.5	1.1	0.833333	3
Dieldrin	ng/g					3.4	3.4	3.4	1				
Dissolved oxygen (DO)	mg/l	11.6	11.84	11.69	5	5.54	6.42	5.98	2	10.1	10.64	10.376	5
Enterococcus	cfu/100ml	25	25	25	5					25	25	25	4
Fecal Coliform	cfu/100ml	25	25	25	5					25	25	25	4
Fixed suspended solids	mg/l	3	126	44.63636	11					6	122	32.625	8
Heptachlor epoxide	ng/g					3	3	3	1				
Hexachlorobenzene	ng/g					0	0	0	1				
Inorganic nitrogen (nitrate and nitrite)	mg/l					0.12	0.122	0.121	3				
Inorganic nitrogen (nitrate and nitrite) as N	mg/l	0.004	0.429	0.295909	11					0.198	0.425	0.289625	8
Iron	ug/g					55600	55600	55600	1				
Lead	ug/g					69.9	69.9	69.9	1				
Lindane	ng/g					0	0	0	1				
Manganese	ug/g					1130	1130	1130	1				
Mercury	ug/g					0.26	0.26	0.26	1				
Nickel	ug/g					35.9	35.9	35.9	1				
Nitrate	mg/l					0.074	0.076	0.075	3				
Nitrate as N	mg/l	0.004	0.425	0.292273	11					0.197	0.421	0.285	8
Nitrite	mg/l					0.046	0.046	0.046	2				
Nitrite as N	mg/l	0.002	0.006	0.003909	11					0.002	0.01	0.00475	8
Nitrogen	mg/l					0.541	0.718	0.636	3				
Nitrogen as N	mg/l	0.01	3	0.626	26					0.062	0.613	0.347313	16
o,p'-DDE	ng/g					3	3	3	1				
o,p'-DDT	ng/g					0	0	0	1				
Organic carbon	%					2.139	2.139	2.139	1				
Orthophosphate	mg/l					0.023	0.024	0.0235	2				
p,p'-DDD	ng/g					17	17	17	1				
p,p'-DDE	ng/g					11	11	11	1				
p,p'-DDT	ng/g					0	0	0	1				
PCB-77/110	ng/g					2.6	2.6	2.6	1				
pH	None	7.68	8.63	7.902	25	7.2	7.37	7.285	2	7.7	7.95	7.8172	25
Pheophytin a	ug/l	2.13	2.85	2.49	2					0.91	1.04	0.975	2
Pheophytin ratio	%	1.418	1.462	1.44	2					1.496	1.572	1.534	2
Phosphorus	mg/l					0.0771	0.1382	0.105967	3				
Phosphorus as P	mg/l	0.003	0.4325	0.059596	26					0.005	0.039	0.02175	16
Phosphorus, Particulate Organic as P	mg/l	0.0029	0.1608	0.074455	11					0.014	0.1268	0.05145	8
Salinity	ppth	0.04	5.67	3.8668	25	3.6	3.7	3.65	2	0.48	10.38	7.3892	25
Silica	mg/l	0.1	6.9	4.609091	11					6	6.8	6.425	4
Silver	ug/g					0.7	0.7	0.7	1				
Specific conductance	umho/cm	106	10000	6929.56	25					922	17538	12728.32	25
Substrate - sand, coarse	%					5	5	5	1				
Substrate - silt/clay mix	%					95	95	95	1				
Temperature, water	deg C	8.35	15.51	12.3752	25	29.87	30.39	30.13	2	8.49	15.76	12.4872	25
Tin	ug/g					7.1	7.1	7.1	1				
Total suspended solids	mg/l	3	144	51.72727	11	32	118	63	3	8	142	38.875	8
Total volatile solids	mg/l	3	18	7.454545	11					2	20	6.25	8
Turbidity	NTU	0.95	80.2	37.91364	11					6.63	88.6	25.845	8
Zinc	ug/g					317	317	317	1				

source: http://watersgeo.epa.gov/mwm/

APPENDIX B

Table B-1 Water Quality Data for NNWW Chickahominy River Monitoring Station CR-1 (May 1, 1991 – October 13, 2014)

Parameter	Unit	Minimum	Maximum	Average
Blue-Green Algae-Hydrolab	ug/L	0.00	7.30	0.08
Chlorophyll A	mg/M3	0.35	25.60	7.52
Chlorophyll a –Hydrolab	ug/L	0.20	111.40	14.87
Color	Std Units	2.00	140.00	55.32
Specific Conductance	uS/CM as 25C	0.00	2.76	0.14
Copper, Dissolved	ug/L Cu	9.60	9.60	9.60
Oxygen, Dissolved	mg/L DO	0.00	13.65	8.02
DOC	mg/L as C	7.70	12.07	9.41
Absorbance 254 (Filtered)	CM -1	0.16	0.46	0.32
Absorbance 280 (Filtered)	CM -1	0.11	0.34	0.24
Hydrophilic Acid	mg/L as C	1.50	5.10	2.62
Hydrophilic Bases	mg/L as C	0.10	1.00	0.49
Hydrophobic Acid	mg/L as C	1.70	5.80	3.53
Hydrophobic Bases	mg/L as C	0.00	0.80	0.37
Neutrals	mg/L as C	0.00	1.50	0.73
pH, WH, Field	Std Units	1.46	10.73	7.13
Visibility	ft	1.60	7.00	3.89
Alkalinity, Total	mg/L as CaCO3	2.00	32.00	15.12
Ammonia, Total	mg/L as N	0.00	4.71	0.04
Bromide, Total	mg/L as Br	0.02	0.20	0.07
Calcium, Total	mg/L as Ca	2.56	30.80	7.54
Chloride, Total	mg/L as Cl	1.00	24.00	13.41
Copper, Total	ug/L Cu	1.00	146.00	23.30
HAAFP, Total	ug/L HAA	234.00	1511.00	693.36
Hardness, Total	mg/L as CaCO3	5.00	78.00	35.50
Iron, Total	ug/L as Fe	0.78	3906.00	1001.95
Magnesium, Total	mg/L as Mg	0.87	43.00	2.41
Manganese, Total	ug/L as Mn	18.00	1432.55	113.48
Nitrate, Total	mg/L as N	0.00	2.20	0.05
Nitrite, Total	mg/L as N	0.00	0.02	0.00
Orthophosphate, Total	mg/L as P	0.00	0.13	0.02
Phosphorus, Total	mg/L as P	0.01	0.56	0.06
Potassium, Total	mg/L as K	0.04	20.70	2.30
Silica, Total	mg/L SiO2	1.55	8.43	5.12
Sodium, Total	mg/L as Na	2.30	389.20	14.71
Sulfate, Total	mg/L as SO4	0.00	15.30	5.11
THMFP, Total	ug/L THM	6.00	2754.00	550.47
TKN, Total	mg/L as N	0.04	2.45	0.58
TOC, Total	mg/L	3.51	17.96	8.74
TOC < 10K Daltons	mg/L as C	4.60	8.36	6.05
TOC < 1K Daltons	mg/L as C	1.40	5.16	2.97
TOC < 3K Daltons	mg/L as C	2.50	6.05	4.39
TOXFP	ug/L TOX	1126.00	3334.00	1939.29
Absorbance 254 (Unfiltered)	CM -1	0.11	4.52	0.78
Absorbance 280 (Unfiltered)	CM -1	0.17	0.32	0.24
Water Temperature	Degrees Celsius	1.10	32.70	17.02

Note: Values provided by NNWW

Table B-2 EPA and DEQ Water Monitoring Stations on Chickahominy River

Station ID		2-CHK023.64				VA05-0001-A				2-CHK006.14			
Parameter	Units	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples
2,2',3,4,4',5,5'-Heptachlorobiphenyl	ng/g					0.38	0.38	0.38	1				
2,2',3,4,4',5'-Hexachlorobiphenyl	ng/g					0.8	0.8	0.8	1				
2,2',3,4',5,5',6-Heptachlorobiphenyl	ng/g					0	0	0	1				
2,2',3,5'-Tetrachlorobiphenyl	ng/g					0.52	0.52	0.52	1				
2,2',4,4',5,5'-Hexachlorobiphenyl	ng/g					0.78	0.78	0.78	1				
2,2',4,5,5'-Pentachlorobiphenyl	ng/g					3.9	3.9	3.9	1				
2,2',5,5'-Tetrachlorobiphenyl	ng/g					0	0	0	1				
2,2',5-Trichlorobiphenyl	ng/g					0.55	0.55	0.55	1				
Aluminum	ug/g					28000	28000	28000	1				
Ammonia	mg/l					0.015	0.015	0.015	1				
Ammonia as N	mg/l									0.008	0.056	0.026375	8
Ammonium as NH4	mg/l												
Anthracene	ng/g												
Antimony	ug/g					0.4	0.4	0.4	1				
Arsenic	ug/g					6.7	6.7	6.7	1				
Benz[a]anthracene	ng/g					11	11	11	1				
Benzo(b)fluoranthene	ng/g					13	13	13	1				
Benzo[a]pyrene	ng/g												
Benzo[ghi]perylene	ng/g												
Benzo[k]fluoranthene	ng/g												
Biphenyl	ng/g												
Cadmium	ug/g					0.55	0.55	0.55	1				
Carbon	mg/l									0.5	3.63	1.7576	10
Chlorophyll a	ug/l					6.942	6.942	6.942	1				
Chlorophyll a, corrected for pheophytin	ug/l									11.6	12.9	12.25	2
Chlorophyll b	ug/l									0.1	0.1	0.1	2
Chlorophyll c	ug/l									1.48	1.99	1.735	2
Chromium	ug/g					35.1	35.1	35.1	1				
Chrysene	ng/g					12	12	12	1				
Copper	ug/g					30	30	30	1				
Depth, Secchi disk depth	m					0.3	0.3	0.3	1	0.3	0.8	0.5	3
Dibenz[a,h]anthracene	ng/g												
Dibenzothiophene	ng/g												
Dieldrin	ng/g												
Dissolved oxygen (DO)	mg/l	8.56	9.54	9.05	2	9.34	9.34	9.34	1	9.38	11.67	10.50917	12
Endosulfan	ng/g												
Enterococcus	cfu/100ml									25	25	25	2
Escherichia coli	cfu/100ml	25	25	25	1					25	25	25	2
Fecal Coliform	cfu/100ml	25	25	25	1					25	50	31.25	4
Fixed suspended solids	mg/l									3	72	21.6	10
Fluoranthene	ng/g					18	18	18	1				
Fluorene	ng/g												
Hardness, Ca, Mg	mg/l	31.1	31.1	31.1	1					33.9	52	42.95	2
Indeno[1,2,3-cd]pyrene	ng/g												
Inorganic nitrogen (nitrate and nitrite)	mg/l					0.003	0.003	0.003	1				
Inorganic nitrogen (nitrate and nitrite) as N	mg/l									0.06	0.299	0.169375	8
Iron	ug/g					27000	27000	27000	1				
Kjeldahl nitrogen as N	mg/l	0.5	0.5	0.5	1								
Lead	ug/g					18.8	18.8	18.8	1				
Lindane	ng/g					0	0	0	1				
Manganese	ug/g					439	439	439	1				
Mercury	ug/g					0.054	0.054	0.054	1				
Naphthalene	ng/g												
Nickel	ug/g					15.4	15.4	15.4	1				
Nitrate	mg/l												
Nitrate as N	mg/l									0.058	0.295	0.167	8
Nitrite	mg/l												
Nitrite as N	mg/l									0.002	0.004	0.0025	8
Nitrogen	mg/l					4.6179	4.6179	4.6179	1				
Nitrogen as N	mg/l	0.5	0.6	0.55	2					0.185	0.49	0.337667	18
Organic carbon	%					6.763	6.763	6.763	1				
Orthophosphate	mg/l					0.016	0.016	0.016	1				
Orthophosphate as PO4	mg/l												
p,p'-DDD	ng/g												
p,p'-DDE	ng/g												
p,p'-DDT	ng/g												
PCB-77/110	ng/g					0.97	0.97	0.97	1				
pH	None	6.36	7.36	6.86	2	8.8	8.8	8.8	1	7.53	8.01	7.673333	12
Phenanthrene	ng/g												
Pheophytin a	ug/l									7.31	8.56	7.935	2
Pheophytin ratio	%									1.421	1.429	1.425	2
Phosphorus	mg/l					0.1081	0.1081	0.1081	1				
Phosphorus as P	mg/l	0.06	0.06	0.06	2					0.005	0.019	0.009688	16
Phosphorus, Particulate Organic as P	mg/l									0.0162	0.0715	0.04575	10
Pyrene	ng/g					26	26	26	1				
Salinity	ppth	0	0	0	1	0.34	0.34	0.34	1	0	2.2	1.45	12
Selenium	ug/g												
Silica	mg/l									4.2	6	5.075	4
Silver	ug/g					0.1	0.1	0.1	1				
Specific conductance	umho/cm	109	118	113.5	2					136	4041	2356.857	14
Substrate - sand, coarse	%					46	46	46	1				
Substrate - silt/clay mix	%					54	54	54	1				
Temperature, water	deg C	7.2	17.5	12.35	2	28.8	28.8	28.8	1	7.6	15.66	12.48083	12
Tin	ug/g					3.7	3.7	3.7	1				
Total fixed solids	mg/l									83	103	93	2
Total solids	mg/l	89	95	92	2					103	122	112.5	2
Total suspended solids	mg/l	5	5	5	2	43.8	43.8	43.8	1	3	86	26.6	10
Total volatile solids	mg/l									3	20	7.833333	12
Toxicity sediment survival	%												
Trimethylnaphthalene	ng/g												
Turbidity	NTU	3.9	5.07	4.485	2					0.12	54.4	18.136	10
Zinc	ug/g					78.8	78.8	78.8	1				

Source: Environmental Protection Agency. 2014. STORET (http://watersgeo.epa.gov/mwm/)

Table B-2 EPA and DEQ Water Monitoring Stations on Chickahominy River (continuation)

Station ID		VA06-0081-A				VA02-0022				2-CHK002.17			
Parameter	Units	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples
2,2',3,4,4',5,5'-Heptachlorobiphenyl	ng/g					0.29	0.29	0.29	1				
2,2',3,4,4',5'-Hexachlorobiphenyl	ng/g					0.26	0.26	0.26	1				
2,2',3,4',5,5',6-Heptachlorobiphenyl	ng/g					0.15	0.15	0.15	1				
2,2',3,5'-Tetrachlorobiphenyl	ng/g					0	0	0	1				
2,2',4,4',5,5'-Hexachlorobiphenyl	ng/g					0.52	0.52	0.52	1				
2,2',4,5,5'-Pentachlorobiphenyl	ng/g					0.32	0.32	0.32	1				
2,2',5,5'-Tetrachlorobiphenyl	ng/g												
2,2',5-Trichlorobiphenyl	ng/g												
Aluminum	ug/g	50500	50500	50500	1	22300	22300	22300	1				
Ammonia	mg/l	0	0.007	0.004333	3								
Ammonia as N	mg/l												
Ammonium as NH4	mg/l					0	0.004	0.002667	3				
Anthracene	ng/g	10.9	10.9	10.9	1								
Antimony	ug/g	0.981	0.981	0.981	1	0.59	0.59	0.59	1				
Arsenic	ug/g	9	9	9	1	2.9	2.9	2.9	1				
Benz[a]anthracene	ng/g	28.5	28.5	28.5	1								
Benzo(b)fluoranthene	ng/g	31.4	31.4	31.4	1								
Benzo[a]pyrene	ng/g	35.1	35.1	35.1	1								
Benzo[ghi]perylene	ng/g	19.5	19.5	19.5	1								
Benzo[k]fluoranthene	ng/g	36.8	36.8	36.8	1								
Biphenyl	ng/g	4.4	4.4	4.4	1								
Cadmium	ug/g	0.331	0.331	0.331	1	0.73	0.73	0.73	1				
Carbon	mg/l												
Chlorophyll a	ug/l	18.156	25.632	21.538	3	10.25	10.7	10.47333	3				
Chlorophyll a, corrected for pheophytin	ug/l												
Chlorophyll b	ug/l												
Chlorophyll c	ug/l												
Chromium	ug/g	65.6	65.6	65.6	1	20	20	20	1				
Chrysene	ng/g	32.3	32.3	32.3	1	0	0	0	1				
Copper	ug/g	24.4	24.4	24.4	1	9.9	9.9	9.9	1				
Depth, Secchi disk depth	m	0.5	0.5	0.5	1								
Dibenz[a,h]anthracene	ng/g	6.3	6.3	6.3	1								
Dibenzothiophene	ng/g	3.6	3.6	3.6	1								
Dieldrin	ng/g	0	0	0	1								
Dissolved oxygen (DO)	mg/l	7.9	8.4	8.15	2					9.9	12.4	11.15	2
Endosulfan	ng/g												
Enterococcus	cfu/100ml									25	25	25	1
Escherichia coli	cfu/100ml												
Fecal Coliform	cfu/100ml									25	25	25	1
Fixed suspended solids	mg/l												
Fluoranthene	ng/g	61	61	61	1	16	16	16	1				
Fluorene	ng/g	6.7	6.7	6.7	1								
Hardness, Ca, Mg	mg/l									43.8	43.8	43.8	1
Indeno[1,2,3-cd]pyrene	ng/g	24.7	24.7	24.7	1								
Inorganic nitrogen (nitrate and nitrite)	mg/l	0	0.007	0.004333	3								
Inorganic nitrogen (nitrate and nitrite) as N	mg/l												
Iron	ug/g	43000	43000	43000	1	16100	16100	16100	1				
Kjeldahl nitrogen as N	mg/l									0.9	0.9	0.9	1
Lead	ug/g	26.3	26.3	26.3	1	17.9	17.9	17.9	1				
Lindane	ng/g	0	0	0	1	0	0	0	1				
Manganese	ug/g	1350	1350	1350	1	522	522	522	1				
Mercury	ug/g	0.1	0.1	0.1	1	0.041	0.041	0.041	1				
Naphthalene	ng/g	5.8	5.8	5.8	1								
Nickel	ug/g	31.2	31.2	31.2	1	8.4	8.4	8.4	1				
Nitrate	mg/l	0.002	0.005	0.003667	3								
Nitrate as N	mg/l												
Nitrite	mg/l	0.002	0.002	0.002	2								
Nitrite as N	mg/l												
Nitrogen	mg/l	2.357	3.383	2.737667	3								
Nitrogen as N	mg/l									0.58	0.72	0.65	2
Organic carbon	%	2.763	2.763	2.763	1	0.81	0.81	0.81	1				
Orthophosphate	mg/l	0.012	0.014	0.013	3								
Orthophosphate as PO4	mg/l					0.017	0.018	0.017667	3				
p,p'-DDD	ng/g	0	0	0	1	0	0	0	1				
p,p'-DDE	ng/g	1.4	1.4	1.4	1	0.48	0.48	0.48	1				
p,p'-DDT	ng/g	10	10	10	1								
PCB-77/110	ng/g												
pH	None	7.8	7.9	7.85	2					7.4	7.9	7.65	2
Phenanthrene	ng/g					10	10	10	1				
Pheophytin a	ug/l												
Pheophytin ratio	%												
Phosphorus	mg/l	0.071	0.097	0.082333	3								
Phosphorus as P	mg/l									0.06	0.09	0.075	2
Phosphorus, Particulate Organic as P	mg/l												
Pyrene	ng/g	48.9	48.9	48.9	1	15	15	15	1				
Salinity	ppth	1.8	1.8	1.8	1					0	1.09	0.545	2
Selenium	ug/g	0.719	0.719	0.719	1	0.65	0.65	0.65	1				
Silica	mg/l												
Silver	ug/g	0.379	0.379	0.379	1	0.12	0.12	0.12	1				
Specific conductance	umho/cm									129	2064	1096.5	2
Substrate - sand, coarse	%	15	15	15	1								
Substrate - silt/clay mix	%	85	85	85	1	27.47	27.47	27.47	1				
Temperature, water	deg C	30.3	30.4	30.35	2					8.08	17	12.54	2
Tin	ug/g	3.19	3.19	3.19	1	4.4	4.4	4.4	1				
Total fixed solids	mg/l												
Total solids	mg/l									113	1230	671.5	2
Total suspended solids	mg/l	29.6	48.1	37.83333	3					20	27	23.5	2
Total volatile solids	mg/l												
Toxicity sediment survival	%					97.8	97.8	97.8	1				
Trimethylnaphthalene	ng/g	4.2	4.2	4.2	1								
Turbidity	NTU												
Zinc	ug/g	124	124	124	1	48.4	48.4	48.4	1				

Source: Environmental Protection Agency. 2014. STORET (http

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ATTACHMENT B

Protected Species and Habitats

Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
FRESHWATER FISHES				
Atlantic sturgeon	*Acipenser oxyrinchus*	FE	SE	II
Blackbanded sunfish	*Enneacanthus chaetodon*		SE	I
Blackside dace	*Chrosomus (=Phoxinus) cumberlandensis*	FT	ST	III
Carolina darter	*Etheostoma collis*		ST	II
Duskytail darter	*Etheostoma percnurum*	FE	SE	I
Emerald shiner	*Notropis atherinoides*		ST	III
Golden darter	*Etheostoma denoncourti*	SOC	ST	
Greenfin darter	*Etheostoma chlorobranchium*		ST	II
Orangefin madtom	*Noturus gilberti*	SOC	ST	II
Paddlefish	*Polyodon spathula*		ST	II
Roanoke logperch	*Percina rex*	FE	SE	I
Sharphead darter	*Etheostoma acuticeps*		SE	I
Shortnose sturgeon	*Acipenser brevirostrum*	FE	SE	I
Sickle darter	*Percina williamsi*		ST	II
Slender chub	*Erimystax cahni*	FT	ST	I
Spotfin chub	*Erimonax monachus*	FT	ST	I
Steelcolor shiner	*Cyprinella whipplei*		ST	III
Tennessee dace	*Chrosomus (=Phoxinus) tennesseensis*		SE	I
Variegate darter	*Etheostoma variatum*		SE	II
Western sand darter	*Ammocrypta clara*		ST	II
Whitemouth shiner	*Notropis alborus*		ST	IV
Yellowfin madtom	*Noturus flavipinnis*	FT	ST	I
AMPHIBIANS				
	Frogs			
Barking treefrog	*Hyla gratiosa*		ST	II
	Salamanders			
Eastern tiger salamander	*Ambystoma tigrinum*		SE	II
Mabee's salamander	*Ambystoma mabeei*		ST	II
Shenandoah salamander	*Plethodon shenandoah*	FE	SE	I
REPTILES				
	Lizards			
Eastern glass lizard	*Ophisaurus ventralis*		ST	II
	Snakes			
Canebrake rattlesnake (Coastal Plain population of timber rattlesnake)	*Crotalus horridus*		SE	II
	Turtles			
Bog (= Muhlenberg) turtle	*Glyptemys (=Clemmys) muhlenbergii*	FT(S/A)	SE	I
Eastern chicken turtle	*Deirochelys reticularia reticularia*		SE	I
Green sea turtle	*Chelonia mydas*	FT	ST	
Hawksbill sea turtle	*Eretmochelys imbricata*	FE	SE	

[1] FE=Federal Endangered; FT=Federal Threatened; S/A=Similarity of Appearance; FC=Federal Candidate; FP=Federal Proposed; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; WAP Tier = Virginia Wildlife Action Plan Tiered Species, from the Species of Greatest Conservation Need list that is defined in the plan: Tiers I-IV (not a legal status, Tier levels defined in the Virginia Wildlife Action Plan).

Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
Kemp's ridley sea turtle	*Lepidochelys kempii*	FE	SE	
Leatherback sea turtle	*Dermochelys coriacea*	FE	SE	
Loggerhead sea turtle	*Caretta caretta*	FT	ST	I
Wood turtle	*Glyptemys insculpta*		ST	I
BIRDS				
Bachman's sparrow	*Aimophila aestivalis*		ST	I
Bachman's warbler (=wood)	*Vermivora bachmanii*	FE	SE	
Bewick's wren	*Thryomanes bewickii*		SE	I
Black rail	*Laterallus jamaicensis*		SE	I
Gull-billed tern	*Sterna nilotica*		ST	I
Henslow's sparrow	*Ammodramus henslowii*		ST	I
Kirtland's warbler (=wood)	*Dendroica kirtlandii*	FE	SE	IV
Loggerhead shrike	*Lanius ludovicianus*		ST	I
Peregrine falcon	*Falco peregrinus*		ST	I
Piping plover	*Charadrius melodus*	FT	ST	I
Red-cockaded woodpecker	*Picoides borealis*	FE	SE	I
Red knot	*Calidris canutus*	FT		IV
Roseate tern	*Sterna dougallii dougallii*	FE	SE	IV
Upland sandpiper	*Bartramia longicauda*		ST	I
Wilson's plover	*Charadrius wilsonia*		SE	I
MAMMALS				
American water shrew	*Sorex palustris*		SE	II
Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	FE	SE	I
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	FE	SE	II
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*		ST	IV
Eastern puma (=cougar)	*Puma (=Felis) concolor cougar*	FE	SE	
Gray bat	*Myotis grisescens*	FE	SE	II
Gray wolf	*Canis lupus*	FE	SE	
Indiana bat	*Myotis sodalis*	FE	SE	I
Northern long-eared bat	*Myotis septentrionalis*	FT		
Rafinesque's eastern big-eared bat	*Corynorhinus rafinesquii macrotis*		SE	I
Rock vole	*Microtus chrotorrhinus*		SE	II
Snowshoe hare	*Lepus americanus*		SE	I
Virginia big-eared bat	*Corynorhinus (=Plecotus) townsendii virginianus*	FE	SE	II
Virginia northern flying squirrel	*Glaucomys sabrinus fuscus*	FE	SE	I
MOLLUSKS				
	Freshwater Mussels			
Appalachian monkeyface (pearlymussel)	*Quadrula sparsa*	FE	SE	I
Atlantic pigtoe	*Fusconaia masoni*	SOC	ST	II
Birdwing pearlymussel	*Lemiox rimosus*	FE	SE	I
Black sandshell	*Ligumia recta*		ST	III
Brook floater	*Alasmidonta varicosa*		SE	II
Cracking pearlymussel	*Hemistena lata*	FE	SE	I
Cumberland bean (pearlymussel)	*Villosa trabalis*	FE	SE	I
Cumberland monkeyface (pearlymussel)	*Quadrula intermedia*	FE	SE	I

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Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
Cumberlandian combshell	*Epioblasma brevidens*	FE	SE	I
Deertoe	*Truncilla truncata*		SE	IV
Dromedary pearlymussel	*Dromus dromas*	FE	SE	I
Dwarf wedgemussel	*Alasmidonta heterodon*	FE	SE	II
Elephantear	*Elliptio crassidens*		SE	IV
Fanshell	*Cyprogenia stegaria*	FE	SE	I
Finerayed pigtoe	*Fusconaia cuneolus*	FE	SE	I
Fluted kidneyshell	*Ptychobranchus subtentum*	FE	SE	II
Fragile papershell	*Leptodea fragilis*		ST	IV
Green blossom (pearlymussel)	*Epioblasma torulosa gubernaculum*	FE	SE	I
Green floater	*Lasmigona subviridis*		ST	II
James spinymussel	*Pleurobema collina*	FE	SE	I
Littlewing pearlymussel	*Pegias fabula*	FE	SE	I
Ohio pigtoe	*Pleurobema cordatum*		SE	III
Oyster mussel	*Epioblasma capsaeformis*	FE	SE	I
Pimpleback	*Quadrula pustulosa pustulosa*		ST	IV
Pink mucket (pearlymussel)	*Lampsilis abrupta*	FE	SE	I
Pistolgrip	*Tritogonia verrucosa*		ST	IV
Purple bean	*Villosa perpurpurea*	FE	SE	I
Purple lilliput	*Toxolasma lividus*	SOC	SE	II
Pyramid pigtoe	*Pleurobema rubrum*	SOC	SE	II
Rayed bean	*Villosa fabalis*	FE	SE	II
Rough pigtoe	*Pleurobema plenum*	FE	SE	I
Rough rabbitsfoot	*Quadrula cylindrica strigillata*	FE	SE	I
Sheepnose	*Plethobasus cyphyus*	FE	SE	II
Shiny pigtoe	*Fusconaia cor*	FE	SE	I
Slabside pearlymussel	*Lexingtonia dolabelloides*	FE	SE	II
Slippershell mussel	*Alasmidonta viridis*		SE	II
Snuffbox	*Epioblasma triquetra*	FE	SE	II
Spectaclecase	*Cumberlandia monodonta*	FE	SE	II
Tan riffleshell	*Epioblasma florentina walkeri (=E. walkeri)*	FE	SE	I
Tennessee heelsplitter	*Lasmigona holstonia*		SE	II
	Freshwater & Land Snails			
Appalachian springsnail	*Fontigens bottimeri*	SOC	SE	II
Brown supercoil	*Paravitrea septadens*	SOC	ST	I
Rubble coil	*Helicodiscus lirellus*	SOC	SE	I
Shaggy coil	*Helicodiscus diadema*	SOC	SE	I
Spider elimia	*Elimia arachnoidea*		SE	II
Spiny riversnail	*Io fluvialis*	SOC	ST	III
Spirit supercoil	*Paravitrea hera*	SOC	SE	I
Springsnail (no common name)	*Fontigens morrisoni*	SOC	SE	I
Thankless ghostsnail	*Holsingeria unthanksensis*	SOC	SE	I
Virginia fringed mountain snail	*Polygyriscus virginianus*	FE	SE	I
FRESHWATER CRUSTACEANS				
Big Sandy crayfish	*Cambarus veteranus*	SOC	SE	II
Lee County Cave isopod	*Lirceus usdagalun*	FE	SE	I
Madison Cave amphipod	*Stygobromus stegerorum*	SOC	ST	I
Madison Cave isopod	*Antrolana lira*	FT	ST	II

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Virginia Department of Game and Inland Fisheries

Special Legal Status Faunal Species in Virginia

Common Name	Scientific Name	Federal[1]	State	WAP Tier
MILLIPEDES				
Ellett Valley pseudotremia	*Pseudotremia cavernarum*	SOC	ST	II
Laurel Creek xystodesmid	*Sigmoria whiteheadi*	SOC	ST	I
ARACHNIDS				
Spruce-fir moss spider	*Microhexura montivaga*	FE	SE	
INSECTS[2]				
American burying beetle	*Nicrophorus americanus*	FE		I
Appalachian grizzled skipper	*Pyrgus wyandot (=Pyrgus centaureae wyandot)*	SOC	ST	I
Buffalo Mountain mealybug	*Puto kosztarabi*	SOC	SE	I
Holsinger's cave beetle	*Pseudanophthalmus holsingeri*	SOC	SE	I
Mitchell's satyr butterfly	*Neonympha mitchellii*	FE	SE	I
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	FT	ST	II
Virginia Piedmont water boatman	*Sigara depressa*	SOC	SE	I

[2] all insects listed as federal or state endangered or threatened are protected by regulations that fall under the Virginia Department of Agriculture and Consumer Services' jurisdiction

MARINE MAMMALS			
Blue whale	*Balaenoptera musculus*	FE	SE
Finback whale	*Balaenoptera physalus*	FE	SE
Humpback whale	*Megaptera novaeangliae*	FE	SE
North Atlantic Right whale	*Eubalaena glacialis*	FE	SE
Sei whale	*Balaenoptera borealis*	FE	SE
Sperm whale	*Physeter catodon (= macrocephalus)*	FE	SE
West Indian manatee	*Trichechus manatus*	FE	SE

For further information or details regarding this list or any species listed herein, please contact:

Bureau of Wildlife Resources, Statewide Resources
Virginia Department of Game and Inland Fisheries
Physical Address: 7870 Villa Park Dr, Suite 400
Mailing Address: P. O. Box 90778
Henrico, VA 23228
(804) 367-6913

[1] FE=Federal Endangered; FT=Federal Threatened; S/A=Similarity of Appearance; FC=Federal Candidate; FP=Federal Proposed; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; WAP Tier = Virginia Wildlife Action Plan Tiered Species, from the Species of Greatest Conservation Need list that is defined in the plan: Tiers I-IV (not a legal status, Tier levels defined in the Virginia Wildlife Action Plan).

Link, Matthew (DEQ)

From: Ewing, Amy (DGIF)
Sent: Monday, October 26, 2015 5:21 PM
To: Link, Matthew (DEQ)
Cc: Greenlee, Bob (DGIF); Smith, Scott (DGIF)
Subject: RE: JCSA Pre-Application Meeting Comments (ESSLog# 35985)

Matthew,
You heard from us during the pre-app conference call, but to reiterate our comments and to provide additional information, I offer the below. Please note that these are preliminary only as we are currently unsure of the exact intake locations and are unsure about the route any pipes must take to move water from the intake/treatment plant locations to existing dispersal systems.

Potential Intake on Chickahominy River:
We document bald eagle nests and the James River/Chickahominy River Eagle Concentration Zone from the project area (approximate intake location) . Significant habitat alteration, location of water-dependent facilities within concentration zones, or other recreational and commercial activities may result in adverse impacts upon eagles. Therefore, we recommend that the applicant ensure that this project is consistent with state and federal guidelines for protection of bald eagles; and that he coordinate as indicated with us or with the U.S. Fish and Wildlife Service regarding possible impacts upon bald eagles or the need for a federal bald eagle take permit.

The Chickahominy River and James River at this site have been documented Anadromous Fish Use Areas. To best protect these important fisheries, we recommend that any instream work associated with the project adhere to a time of year restriction from February 15 through June 30 of any year. In addition, federally Endangered Atlantic sturgeon are known from this drainage. They are known to also engage in reproductive behaviors in Fall. Data are still coming in, we are still learning about the behaviors of this species within our waters. We are likely to recommend some restrictions on instream work during Fall and will provide that guidance as we can. We recommend coordination with NOAA Fisheries Service regarding possible impacts upon Atlantic sturgeon.

Potential Intake on York River:
We document bald eagle nests from the project area (approximate intake location). Therefore, we recommend that the applicant ensure that this project is consistent with state and federal guidelines for protection of bald eagles; and that he coordinate as indicated with us or with the U.S. Fish and Wildlife Service regarding possible impacts upon bald eagles or the need for a federal bald eagle take permit.

The York River at this site has been designated an Anadromous Fish Use Area. To best protect this important fishery, we recommend that any instream work associated with the project adhere to a time of year restriction from February 15 through June 15 of any year. In addition, federally Endangered Atlantic sturgeon are known from this drainage. They are known to engage in reproductive behaviors in Fall in addition to those in Spring. Data are still coming in and we are still learning about the behaviors of this species within our waters. We are likely to recommend some restrictions on instream work during Fall and will provide that guidance as it becomes available. We recommend coordination with NOAA Fisheries Service regarding possible impacts upon Atlantic sturgeon.

We document colonial waterbird colonies from the project area. We typically recommend that these colonies be identified and a 500-ft no-disturbance, naturally vegetated buffer be maintained on the colony. We also may recommend adherence to time of year restrictions within some distance of the colony depending on the timing and scope of project work.

Both intake locations:
This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend coordination with VDCR-DNH regarding the protection of these resources.

We recommend coordination with the USFWS regarding potential impacts upon federally Threatened northern long-eared bats associated with tree removal, if such is proposed.

To protect resident aquatic species from impingement and entrainment, we recommend that the intake be fitted with a 1mm mesh screen and that the intake velocity not exceed 0.25 fps. Further, we recommend that the withdrawal volume not exceed 10% of instantaneous flow.

To best inform our assessment of impacts the proposed project may have on instream habitat and resident aquatic species, we recommend that the applicant and/or DEQ provide for our review the results of spatio/temporal modeling of the salinity changes resulting from the proposed intake. We recommend modeling of at least two scenarios (full withdrawal and something less than full withdrawal) be performed to determine if/at what point switching from the surface water intake back to ground water may be necessary to protect water quality/ fish and wildlife habitat.

Thanks, Amy

Amy Ewing
Environmental Services Biologist/FWIS Manager
VA Dept. of Game and Inland Fisheries
7870 Villa Park Dr., Henrico, VA 23228
804-367-2211 DGIF.virginia.gov

From: Link, Matthew (DEQ)
Sent: Wednesday, October 21, 2015 10:03 AM
To: Ewing, Amy (DGIF)
Subject: JCSA Pre-Application Meeting Comments

Amy,

Just a friendly reminder that the comments for the JCSA Pre-Application Review Panel should be submitted to DEQ by next Friday 10/30. Since this project is of critical importance to DEQ programs and initiatives, any additional insight into possible concerns of DGIF would be highly valued and appreciated. Please contact me at any time if you have questions or concerns. Thanks!

Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218
804-698-4078
matthew.link@deq.virginia.gov
www.deq.virginia.gov

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VIRGINIA INSTITUTE OF MARINE SCIENCE

Office of Research and Advisory Services

October 19, 2015

Mr. Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218

Dear Mr. Link:

The Virginia Institute of Marine Science has reviewed the information provided to the pre-application review panel by the James City Service Authority (JCSA) for alternative water withdrawal strategies either from the Chickahominy or York river. If the JCSA has sufficiently justified the need for additional water sources, and if it has been determined by DEQ that additional groundwater withdrawal is not a viable or reasonable alternative, then we offer the following comments for moving forward with a surface water withdrawal strategy.

The VIMS review of the potential environmental impacts resulting from construction and operation of a riverine surface water intake will require information on intake design and flow rate, characterization of the estuarine environment in the vicinity of each proposed intake, and the physical and chemical metrics associated with the effluent. Existing data will be valuable to the applicants for environmental characterization, but may not be sufficient to address the suite of issues associated with water withdrawal. Each targeted area has unique ecological aspects that may be influenced or affected by surface water withdrawal, especially larval fish and shellfish. Intake design, including flow rate, can mitigate many potential adverse impacts to nekton, and we recommend that the JCSA plan to use intake screens with no greater than one millimeter slot size and operate at a maximum flow rate of 0.25 cubic feet per second.

Fouling may be problematic for intakes and outfalls placed in estuarine environments, especially those intakes designed to be protective of aquatic living resources. When the method for managing fouling has been determined, we recommend that the JCSA provide a profile of all chemicals that may be used in the cleaning/defouling process and estimates of treatment schedules and chemical volumes.

Release of brine from the desalination process into the estuary causes concern with respect to how it may permanently alter ambient conditions within the zone of influence of the outfall. Before these potential effects can be analyzed properly it is necessary to have a detailed understanding of the salinity and volume of the effluent, the location of the effluent pipe, and the salinity regime of the receiving waters. Hydrodynamic modeling may be necessary to understand the spatial expanse of the dilution plume unless the effluent is planned for release in waters of like salinity.

PO Box 1346 • 1375 Greate Road • Gloucester Point, Virginia 23062-1346 USA
804.684.7482 • www.vims.edu

As more detailed information becomes available, we will be able to provide advice beyond the general concepts presented above. To facilitate the review and permitting process, we are available to work directly with DEQ staff and the applicant throughout this process. Thank you for the opportunity to comment and please do not hesitate to contact me if you have questions or require additional information.

Sincerely,

Lyle Varnell
Associate Director for Advisory Services

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Joe Elton
Deputy Director of Operations

Rochelle Altholz
Deputy Director of Administration and Finance

David Dowling
Deputy Director of Soil and Water and Dam Safety

October 30, 2015

Matthew Link
DEQ
P.O. Box 1105
Richmond, VA 23218

Re: James City Service Authority Surface Water Supply

Dear Mr. Link:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

York River Site

Biotics documents the presence of natural heritage resources within two miles of the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

James River Site

According to the information currently in our files, the Atlantic sturgeon (*Acipenser oxyrinchus,* G3/S2/LE/LT) has been documented downstream from the project site. Atlantic sturgeon is a large fish that reaches a maximum length of about 4.3 meters and may live for several decades. The adults migrate between fresh water spawning areas and salt water non-spawning areas. They feed primarily on benthic invertebrates and small fishes as available.

Stocks on the Atlantic slope have been severely reduced by overfishing (mainly late 1800s and early 1900s), pollution, sedimentation, and blockage of access to spawning areas by dams (Gilbert 1989, Burkhead and Jenkins 1991, Marine and Coastal Species Information System 1996). In Chesapeake Bay and elsewhere in the range, hypoxic events have increased and may degrade nursery habitat for Atlantic sturgeon (Secor and Gunderson 1997). Habitat loss due to dam construction and water pollution are thought to be major factors impeding full recovery of populations (Smith 1985, cited by Johnson et al. 1997; Gilbert 1989). A late maturation age and use of estuaries, coastal bays, and upstream areas of rivers for spawning and juvenile development make stocks vulnerable to habitat alterations in many areas (NatureServe 2012). Please note that this species is currently classified as endangered by the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Please note this project is within a section of the James River, which has been designated as a scenic river in the state of Virginia. Due to this designation, DCR recommends you contact Lynn Crump of the DCR-Division of Planning and Recreation at 804-786-5054 or Lynn.Crump@dcr.virginia.gov.

Chickahominy River Site

According to the information currently in our files, this site is located within the Gordon Creek Conservation Site and within two miles of the Morris Creek Conservation Site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Gordon Creek Conservation Site has been given a biodiversity significance ranking of B2, which represents a site of very high significance. The natural heritage resource of concern at Gordon Creek Conservation Site is:

Tidal Freshwater Marsh (Arrow-arum – Pickerelweed Type) G3G4/S3S4/NL/NL

This Tidal Freshwater Marsh community, the Arrow-arum - Pickerelweed Type, is codominated by leafy forbs arrow arum and pickerelweed. Associated species can include wild rice, duck potato, sweet leaf, halberdleaf tearthumb, swamp smartweed, arrowleaf tearthumb, and begger ticks spp. Species occurring less frequently can include cattail spp. and jewelweed. (NatureServe, 2011)

Morris Creek Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at Morris Creek Conservation Site is:

Tidal Freshwater Marsh (Common Spatterdock – Arrow-arum Mudflat Type) G3G4/S3S4/NL/NL

At the southern end of the range of Tidal Freshwater Marsh (Arrow-arum – Pickerelweed Type) in Virginia, there is a well-marked variant in which spatterdock is codominant with arrow arum and pickerelweed in variable mixtures. This Spatterdock – Arrow Arum Mud Flat Type community occurs low within freshwater tidal marshes on muck substrates of variable depth. There is a long duration of tidal flooding, and the community is exposed only for a short period of time each day when the tide is out, supporting higher mean species richness and containing a number of taxa absent from the low intertidal portions of mudflats. (NatureServe, 2012)

Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary. They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. (NatureServe, 2011)

To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. Due to the legal status of the Atlantic sturgeon, DCR also recommends coordination with NOAA Fisheries and Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with endangered species legislation. Finally, DCR recommends a hydrologic study be prepared to determine water quality issues due to changes in salinity regimes from water withdrawal, downstream brine discharge and sedimentation increases.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

Should you have any questions or concerns, feel free to contact me at (804) 692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

Cc: Amy Ewing, VDGIF
Christine Vaccaro, NOAA
Lynn Crump, DCR-DPRR

Literature Cited

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Gilbert, C. R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight) Atlantic and shortnose sturgeons. U.S. Fish and Wildlife Service Biological Report. 82(11.22). U.S Army Corps of Engineers TR EL-82-4. 28 pp.

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Secor, D. H., and T. E. Gunderson. 1997. Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon, Acipenser oxyrinchus. Fisheries Bulletin 96:603-613.

Link, Matthew (DEQ)

From: Eversole, Mark (MRC)
Sent: Tuesday, October 27, 2015 3:15 PM
To: Link, Matthew (DEQ)
Cc: Lyle M Varnell; Emily A. Hein; Eversole, Mark (MRC)
Subject: FW: JCSA Pre-Application Meeting Comments
Attachments: Chickahominy River at Barrets Ferry.jpg; York River at Sycamore Landing.jpg

Matthew, in response to your request, VRMC offers the following comments concerning a proposal to install a municipal water intake structure in either the York River near Sycamore Landing, or in the Chickahominy River, immediately upstream of the Route 5 bridge, both in James City County.

Our Fisheries Division reports that there is a healthy commercial harvest in the immediate vicinity of both locations, including blue crab harvest by crab pot; eel harvest; public oyster harvest by tong and dredge (near the York River site); and gillnet harvest of striped bass, spot and croaker. In addition to any impacts associated with the withdrawal of water including effects of the withdrawal at the intake structure, the return of a concentrated saline solution could have an impact to fisheries in the vicinity.

Our Engineering/Surveying Department reports that there are numerous oyster ground leases immediately offshore of the proposed intake location in the York River. The installation of an intake in this location could present issues with impacts to those leases. There are no oyster ground leases in the vicinity of the proposed location in the Chickahominy River. I have attached copies of our oyster lease maps for both locations. Privately leased oyster grounds are shown in yellow and are prevalent in the York River near the proposed intake. Again, the introduction of a concentrated saline solution in this area could impact the oyster industry in this portion of the York.

We look forward to working with the applicant, and we will provide additional comments as they develop more definitive plans.

Mark Eversole
Virginia Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, Virginia 23607
Office: (757)-247-8028
email: mark.eversole@mrc.virginia.gov

Petty, Matthew

From: storage@vhost42.sitevision.com on behalf of nhreview@dcr.virginia.gov
Sent: Thursday, June 16, 2016 3:09 PM
To: Petty, Matthew
Subject: JCSA Chickahominy Riverfront Raw Water Supply Project

Thank you for submitting your request. Upon review of this project, DCR-Natural Heritage will provide comments via email within 30 calendar days. Project reference ID is **16061615090987**.

Application: http://www.dcr.virginia.gov/natural-heritage/nhserviceform/?id=2016-06-16-15-09-09-875595-5pm

Natural Heritage Resources

Your Criteria

Taxonomic Group: Select All

Federal Legal Status: Select All

State Legal Status: Select All

County: James City

Physiographic Province: Select All

Watershed (8 digit HUC): 02080206 - Lower James River

Subwatershed (12 digit HUC): Select All

Search Run: 1/5/2016 15:13:23 PM

Result Summary

Total Species returned: 54

Total Communities returned: 0

Click scientific names below to go to NatureServe report.

Click column headings for an explanation of species and community ranks.

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
James City							
Northern Coastal Plain							
Lower James							
(Lower) Chesapeake Bay (Deep)							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
(Lower) Chesapeake Bay-Back River-Harris River							
FISH							
* Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Chickahominy River-Barrows Creek							
VASCULAR PLANTS							
* Narrow-leaved Spatterdock	Nuphar sagittifolia	G2	S1	SOC	LT	2	Y
Chickahominy River-Big Swamp							
VASCULAR PLANTS							
Narrow-leaved Spatterdock	Nuphar sagittifolia	G2	S1	SOC	LT	2	Y
Chickahominy River-Morris Creek							
VASCULAR PLANTS							
* Small Whorled Pogonia	Isotria medeoloides	G2	S2	LT	LE	49	Y
Chickahominy River-Rumley Marsh							
VASCULAR PLANTS							
Narrow-leaved Spatterdock	Nuphar sagittifolia	G2	S1	SOC	LT	2	Y

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
Chickahominy River-Yarmouth Creek							
VASCULAR PLANTS							
Sensitive Joint-vetch	Aeschynomene virginica	G2	S2	LT	LT	22	Y
Small Whorled Pogonia	Isotria medeoloides	G2	S2	LT	LE	49	Y
Narrow-leaved Spatterdock	Nuphar sagittifolia	G2	S1	SOC	LT	2	Y
College Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Diascund Creek-Mill Creek							
VASCULAR PLANTS							
Narrow-leaved Spatterdock	Nuphar sagittifolia	G2	S1	SOC	LT	2	Y
Grays Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads Channel							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads-Hampton River							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads-Streeter Creek							

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Broad Swamp							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Cooper Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Lower Chippokes Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
VASCULAR PLANTS							
Sensitive Joint-vetch	Aeschynomene virginica	G2	S2	LT	LT	22	Y
New Jersey Rush	Juncus caesariensis	G2G3	S2	SOC	LT	12	Y
Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC	None	33	Y
James River-Morrisons Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Skiffes Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Powhatan Creek							

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
VASCULAR PLANTS							
Small Whorled Pogonia	Isotria medeoloides	G2	S2	LT	LE	49	Y
New Jersey Rush	Juncus caesariensis	G2G3	S2	SOC	LT	12	Y
Virginia Least Trillium	Trillium pusillum var. virginianum	G3T2	S2	SOC	None	33	Y
Willoughby Bay-Masons Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
York River-Carter Creek-King Creek							
AMPHIBIANS							
Mabee's Salamander	Ambystoma mabeei	G4	S1S2	None	LT	17	Y
Outer Coastal Plain							
Lower James							
(Lower) Chesapeake Bay (Deep)							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
(Lower) Chesapeake Bay-Back River-Harris River							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
College Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Grays Creek							

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads Channel							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads-Hampton River							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads-Streeter Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Broad Swamp							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Cooper Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Lower Chippokes Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Morrisons Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Skiffes Creek							

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Willoughby Bay-Masons Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Southern Coastal Plain							
Lower James							
(Lower) Chesapeake Bay (Deep)							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
(Lower) Chesapeake Bay-Back River-Harris River							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
College Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Grays Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads Channel							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Hampton Roads-Hampton River							
FISH							
Atlantic	Acipenser	G3	S2	LE	LE	2	Y

Common Name/Natural Community	Scientific Name	Global Conservation Status Rank	State Conservation Status Rank	Federal Legal Status	State Legal Status	Statewide Occurrences	Virginia Coastal Zone
Sturgeon	oxyrinchus						
Hampton Roads-Streeter Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Broad Swamp							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Cooper Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Lower Chippokes Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Morrisons Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
James River-Skiffes Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y
Willoughby Bay-Masons Creek							
FISH							
Atlantic Sturgeon	Acipenser oxyrinchus	G3	S2	LE	LE	2	Y

Note: On-line queries provide basic information from DCR's databases at the time of the request. They are NOT to be substituted for a project review or for on-site surveys required for environmental assessments of specific project areas.

For Additional Information on locations of Natural Heritage Resources please submit an information request.

To Contribute information on locations of natural heritage resources, please fill out and submit a rare species sighting form.

Memorandum

To: *Michael Vergakis, JCSA*
Karina Hull, CDM Smith

From: *Matt Petty*

Date: *January 28, 2016*

Subject: *Chickahominy Riverfront Raw Water Supply: Threatened and Endangered Species and Wildlife Resources*

Virginia Department of Game and Inland Fisheries (VDGIF) Database Review:

The Virginia Department of Game and Inland Fisheries (VDGIF) and the Virginia Department of Conservation and Recreation (DCR) were contacted to review the proposed project site for the likely presence of federal and state protected fauna, flora, and invertebrates. VDGIF provides a searchable database, the Virginia Fish and Wildlife Information Service (VaFWIS), to conduct a review of potential wildlife and recreational resources within a 2-mile radius of the project area. If the search results do not meet VDGIF coordination guidelines, no further review is necessary.

A search of the VaFWIS database was conducted on January 26, 2016. VaFWIS indicates that there are 32 species of status concern for conservation known or likely to occur within a 2-mile radius of the Chickahominy Riverfront Raw Water Supply project area (Table 1). Status concern for conservation includes listed species and species given state Tier 1- Critical Conservation Need and Tier II – Very High Conservation Need designations as outlined in the Virginia Wildlife Action Plan (WAP). Of the 32 species of status concern for conservation, one is listed as federal endangered (Atlantic sturgeon) and two are listed as federal threatened (red knot and northern long-eared bat). Additionally, three species (Atlantic sturgeon, black rail, and Rafinesque's eastern big-eared bat) are state listed as endangered and six species (peregrine falcon, upland sandpiper, loggerhead Shrike, Mabee's Salamander, barking treefrog, and migrant loggerhead shrike) are state listed as threatened. Two species, the spotted turtle and the northern diamond-backed terrapin, are listed as collection concerns because they are desired for commercial (e.g., pet trade) reasons. The remaining 19 species are federal species of concern or are designated as Tier 1 or Tier 2 species.

Of the 32 species of status concern for conservation, three federal species of concern, bald eagle, alewife, and blueback herring, and one Tier I species, bridle shiner, were confirmed by scientific collections or historical surveys (Species Observation dataset) to exist within a 2-mile radius of

the project area. Additionally, two species of status concern for conservation, the state threatened Mabee's salamander and the Tier II species king rail, were found to be potentially present within a 2-mile radius of the project area.

Table 1. VaFWIS species of status concern or critical conservation need known or likely to occur within a 2 mile radius of the Chickahominy Riverfront Raw Water Supply project area

Common Name	Scientific Name	Conservation Status	VA Wildlife Action Plan Tier*
Atlantic Sturgeon	*Acipenser oxyrinchus*	Federal Endangered; State Endangered	II
Red Knot	*Calidris canutus rufa*	Federal Threatened	IV
Northern Long-eared Bat	*Myotis septentrionalis*	Federal Threatened	None Listed
Bald Eagle	*Haliaeetus leucocephalus*	Federal Species of Concern	II
Blueback Herring	*Alosa aestivalis*	Federal Species of Concern	None Listed
Alewife	*Alosa pseudoharengus*	Federal Species of Concern	IV
Diana Fritillary	*Speyeria diana*	Federal Species of Concern	IV
Rare Skipper	*Problema bulenta*	Federal Species of Concern	II
Black Rail	*Laterallus jamaicensis*	State Endangered	I
Rafinesque's Eastern Big-eared Bat	*Corynorhinus rafinesquii macrotis*	State Endangered	I
Peregrine Falcon	*Falco peregrinus*	State Threatened	I
Upland Sandpiper	*Bartramia longicauda*	State Threatened	I
Loggerhead Shrike	*Lanius ludovicianus*	State Threatened	I
Mabee's Salamander	*Ambystoma mabeei*	State Threatened	II
Barking Treefrog	*Hyla gratiosa*	State Threatened	II
Migrant Loggerhead Shrike	*Lanius ludovicianus migrans*	State Threatened	None Listed
Spotted Turtle	*Clemmys guttata*	Collection Concern	III
Northern Diamond-backed Terrapin	*Malaclemys terrapin terrapin*	Collection Concern	II
Bridle Shiner	*Notropis bifrenatus*	None Listed	I
Yellow-bellied Sapsucker	*Sphyrapicus varius*	None Listed	I
Black-throated Green Warbler	*Setophaga virens*	None Listed	I
American Bittern	*Botaurus lentiginosus*	None Listed	II
American Black Duck	*Anas rubripes*	None Listed	II
Little Blue Heron	*Egretta caerulea caerulea*	None Listed	II
Yellow-crowned Night Heron	*Nyctanassa violacea violacea*	None Listed	II
Northern Saw-whet Owl	*Aegolius acadicus*	None Listed	II
King Rail	*Rallus elegans*	None Listed	II
Least Tern	*Sterna antillarium*	None Listed	II
Royal Tern	*Sterna maxima maximus*	None Listed	II
Cerulean Warbler	*Setophaga cerulea*	None Listed	II
Winter Wren	*Troglodytes troglodytes*	None Listed	II
Oak Toad	*Anaxyrus quercicus*	None Listed	II

*Tier I - Critical Conservation Need; Tier II - Very High Conservation Need;
Tier III - High Conservation Need; Tier IV - Moderate Conservation Need

Blueback herring and alewife were observed at the Route 5 Bridge, adjacent to the project area in 1994, and were observed at the Chickahominy Riverfront Park boat ramp in the project in 2009 and 2010, respectively. Bridle Shiner were observed in 2001 at the mouth of Morris Creek, 1.1 miles northwest of project area. Bald eagle observations will be discussed in detail below.

For the two species determined to be potentially present, predicted habitat exists within 2 miles of the project area. Predicted habitat for the Mabee's salamander consists of the entire east shoreline of the Chickahominy River, including the north and west shorelines of the project area. Predicted habitat for the king rail is located along the entire west shoreline of the Chickahominy River and nearby tributaries. Is not located within 2,300 feet of the project area.

For the federal species of concern and Tier I species confirmed present, no coordination is required because they are not protected by law; however, VDGIF recommends contacting the U.S. Fish and Wildlife Service (USFWS) or VDGIF at the applicant's discretion. The bald eagle is protected under the Bald and Golden Eagle Protection Act and other statutes, and will be discussed separately below. For the two species found to be potentially present, no coordination is required because there are no recent confirmed observations within 2 miles of the project area. The presence of predicted habitat is also not enough to initiate additional consultation.

Despite the potential presence of an additional 26 rare and threatened wildlife resources (Table 1), search results do not meet VDGIF coordination guidelines for these species. Unless surveys of the site encounter these wildlife resources of status concern or critical conservation need, further coordination with VDGIF is not required.

Four records of bald eagle concentration areas or roosts (BECARs) were identified within 2 miles of the project area. BECARs 48 and 49 are summer concentration areas located south of the project area near the confluence of the Chickahominy River and James River. They are characterized as low eagle use and moderate eagle use, respectively. BECARs 50 and 52 are winter concentration areas and extend along both banks of the Chickahominy River into the western portion of the project area. They are characterized as high eagle use and moderate eagle use, respectively.

In addition to the four BECARs, the database search indicated that 21 records of bald eagle nests are located within 2 miles of the project area. Of the 21 nests, 10 are historic, six are recently active and five are of unknown nest status. None of the 21 nest locations are within 660 feet of the project area; 660 feet is the minimum distance required between a nest and construction activities to avoid eagle disturbance, as stated in the VDGIF 2012 Bald Eagle Management Guidelines. The Guidelines also require blasting activities be at least 0.5-miles from a nest location. Of the 21 nests, four are located within 0.5-miles of the project area: JC0303, JC1104, JC1109, and JC9401. JC0303 and JC9401 are historic nests last occupied in 2007 and 2002, respectively. JC1104 and JC1109 are recently active nests located on Gordon Island to the north of the project area and last occupied in 2011. The annual Center for Conservation Biology (CCB) bald eagle nest survey confirmed the presence of nests JC1104 and JC1109, but recorded them as occupied in 2015.

Bald eagles are sensitive to human disturbance and VDGIF has prepared bald eagle management guidelines for Virginia, based off of the USFWS national guidelines that are generally appropriate to avoid take of bald eagles, and thus avoid the need for any state or federal permits or consultation. No eagle nests are documented within 660 feet of the

project area, therefore nest set-back distances and seasonal restrictions for normal construction activities near nests should not be needed. However, two recently active nests are located within 0.5-miles of the project area on Gordon Island. According to the Guidelines, blasting activities should not take place during the breeding season (i.e., December 15-July 15).

The western shoreline of the project area is also mapped as an eagle winter concentration area; therefore, activity restrictions will also be required. No blasting should occur during the winter eagle concentration season (i.e., December 15 – March 15), mature trees should not be removed from the east bank of the Chickahominy River, and potentially disruptive activities (e.g. crane use) should avoid direct flight paths between nests and roost/foraging sites. The potential for bald eagles to concentrate in the area does exist, and construction managers should be aware of seasonal eagle movements. If bald eagles are observed, activities that could potentially disturb or harm eagles should stop immediately and VDGIF/UFSWS should be notified and consulted.

In addition to following the bald eagle management guidelines, the presence of bald eagle nests and concentration areas within the 2 mile search area necessitates coordination with Jeff Cooper (Jeff.Cooper@dgif.virginia.gov) at VDGIF.

For the Virginia breeding bird atlas, the only threatened or endangered species or Tier I/II species documented as breeding in the Brandon and Norge breeding bird atlas quadrangle blocks, which contain the project area, is the bald eagle. No other protected bird species are documented as breeding in or around the project area.

The VaFWIS database search identified five records of anadromous fish use streams within a 2 mile radius of the project area:

- Gordon Creek: Yellow perch (*Perca flavescens*)
- Morris Creek: Yellow perch; Striped bass (*Morone saxatillis*)
- Nettles Creek: Yellow perch
- Chickahominy River 1 – Walkers Dam to James River: Yellow perch, Striped bass, Alewife (*Alosa pseudoharengus*), Blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), and Hickory shad (*Alosa mediocris*)
- James River 1 – Upstream to Manchester Dam: Yellow perch, Striped bass, Alewife, Blueback herring, American shad, and Hickory shad

Of the five anadromous fish use streams, the project area borders Gordon Creek (located to the north) and Chickahominy River 1 (located to the west). Any potential impacts to anadromous fish use streams requires consultation with Alan Weaver (Alan.Weaver@dgif.virginia.gov) at VDGIF.

No known bat colonies or hibernacula, impediments to fish passage, colonial water bird colonies, state threatened or endangered waters, or managed trout streams are present within a 2 mile radius of the project area.

The VDGIF Chickahominy Wildlife Management Area is located within a 2-mile radius to the northwest of the project area. **Since VDGIF lands are located adjacent to the project area, James Adams (James.Adams@dgif.virginia.gov), VDGIF Facilities Manager, should be contacted.**

Summary:
In summary, further coordination with VDGIF and/or USFWS is only required for the bald eagle, anadromous fish use streams, and nearby VDGIF lands. The confirmed recent presence of bald eagle nests and concentration areas and anadromous fish use within the 2 mile search radius indicates that the proposed action could affect these wildlife resources. However, due to the distance between the recently active eagle nests and the project area, implementation of protection measures (i.e. activity/distance restrictions) and the nature of the proposed action, adverse impacts to the bald eagle are not expected. Likewise, protection measures (e.g. screening) for anadromous fish will be put in place to ensure that construction and operation of the intake will not adversely affect target species.

Update – VDGIF Coordination: CDM Smith recently coordinated with VDGIF regarding nearby projects. Due to staffing limitations, VDGIF indicated that they were unable to review submitted pre-applications or scoping documents. The lack of response from VDGIF does not constitute a "no comment" response, nor does it imply support of the project or associated activities. VDGIF has indicated that when the Joint Permit Application for wetland impacts is submitted along with the project plans, VDGIF Environmental Services staff will review and provide official comments and recommendations to VDEQ and VMRC at that time.

VaFWIS - Department of Game and Inland Fisheries

37,16,01.0 -76,52,17.9
is the Search Point

Submit Cancel

Search Point

- **Change** to "clicked" map point
- **Fixed** at 37,16,01.0 -76,52,17.9

Show Position Rings

Yes No

1/2 mile and 1/8 mile at the **Search Point**

Show Search Area

Yes No

2 Search distance miles radius

Search Point is at map center

Base Map Choices

Color Aerial Photography

Map Overlay Choices

Current List: Position

Map Overlay Legend

Position Rings 1/2 mile and 1/8 mile at the Search Point

back

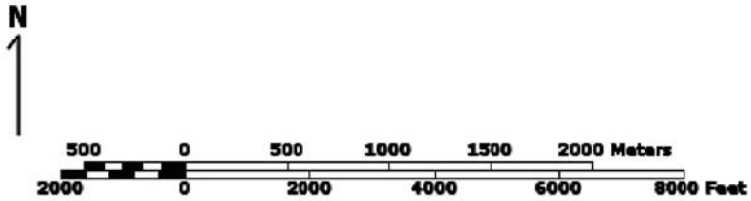
Refresh Browser Page

Map Click Pan Id M

Map Scale In Zoom Out

Screen Size Small Size Big

Help



Point of Search 37,16,01.0 -76,52,17.9

Map Location 37,16,01.0 -76,52,17.9

Select **Coordinate System:**

- Degrees,Minutes,Seconds Latitude - Longitude
- Decimal Degrees Latitude - Longitude
- Meters UTM NAD83 East North Zone
- Meters UTM NAD27 East North Zone

Base Map source: Color Aerial Photography 2002 - Virginia Base Mapping Program, Virginia Geographic Information Network

Map projection is UTM Zone 18 NAD 1983 with left 331647 and top 4128530. Pixel size is 8 meters . Coordinates displayed are Degrees, Minutes, Seconds North and West. Map is currently displayed as 600 columns by 600 rows for a total of 360000 pixles. The map display represents

4800 meters east to west by 4800 meters north to south for a total of 23.0 square kilometers. The map display represents 15750 feet east to west by 15750 feet north to south for a total of 8.9 square miles.

Topographic maps and Black and white aerial photography for year 1990+-
are from the United States Department of the Interior, United States Geological Survey.
Color aerial photography aquired 2002 is from Virginia Base Mapping Program, Virginia Geographic Information Network.
Shaded topographic maps are from TOPO! ©2006 National Geographic
http://www.national.geographic.com/topo
All other map products are from the Commonwealth of Virginia Department of Game and Inland Fisheries.

map assembled 2016-01-26 14:47:27 (qa/qc December 5, 2012 8:04 - tn=703587
dist=3218.688 I)
$poi=37.3388889 -80.3388889

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VaFWIS Search Report Compiled on 1/26/2016, 2:56:46 PM

Help

Known or likely to occur within a **2 mile radius around point 37,16,01.0 -76,52,17.9** in **036 Charles City County, 095 James City County, VA**

View Map of Site Location

515 Known or Likely Species ordered by Status Concern for Conservation (displaying first 32) (32 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
010032	FESE	II	Sturgeon, Atlantic	Acipenser oxyrinchus		BOVA,HU6
040144	FT	IV	Knot, red	Calidris canutus rufa		HU6
050022	FT		Bat, northern long-eared	Myotis septentrionalis		BOVA
040110	SE	I	Rail, black	Laterallus jamaicensis		BOVA
050034	SE	I	Bat, Rafinesque's eastern big-eared	Corynorhinus rafinesquii macrotis		BOVA,HU6
040096	ST	I	Falcon, peregrine	Falco peregrinus		BOVA
040129	ST	I	Sandpiper, upland	Bartramia longicauda		BOVA
040293	ST	I	Shrike, loggerhead	Lanius ludovicianus		BOVA
020044	ST	II	Salamander, Mabee's	Ambystoma mabeei	Potential	BOVA,Habitat,HU6
020002	ST	II	Treefrog, barking	Hyla gratiosa		HU6
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
040093	FS	II	Eagle, bald	Haliaeetus leucocephalus	Yes	BOVA,BECAR,BBA,BAEANests,HU6
100003	FS	II	Skipper, rare	Problema bulenta		HU6
010038	FS	IV	Alewife	Alosa pseudoharengus	Yes	BOVA,SppObs,HU6
100001	FS	IV	fritillary,	Speyeria diana		BOVA

			Diana			
010045	FS		Herring, blueback	Alosa aestivalis	Yes	BOVA,SppObs,HU6
030067	CC	II	Terrapin, northern diamond-backed	Malaclemys terrapin terrapin		BOVA
030063	CC	III	Turtle, spotted	Clemmys guttata		BOVA,HU6
010077		I	Shiner, bridle	Notropis bifrenatus	Yes	BOVA,SppObs,HU6
040225		I	Sapsucker, yellow-bellied	Sphyrapicus varius		BOVA
040319		I	Warbler, black-throated green	Setophaga virens		BOVA
020063		II	Toad, oak	Anaxyrus quercicus		HU6
040038		II	Bittern, American	Botaurus lentiginosus		BOVA
040052		II	Duck, American black	Anas rubripes		BOVA,HU6
040029		II	Heron, little blue	Egretta caerulea caerulea		BOVA
040036		II	Night-heron, yellow-crowned	Nyctanassa violacea violacea		BOVA
040213		II	Owl, northern saw-whet	Aegolius acadicus		BOVA
040105		II	Rail, king	Rallus elegans	Potential	BOVA,Habitat,HU6
040186		II	Tern, least	Sterna antillarum		BOVA
040187		II	Tern, royal	Sterna maxima maximus		BOVA
040320		II	Warbler, cerulean	Setophaga cerulea		BOVA,HU6
040266		II	Wren, winter	Troglodytes troglodytes		BOVA

To view **All 515 species** View 515

* FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC=Federal Candidate; FS=Federal Species of Concern; CC=Collection Concern

** I=VA Wildlife Action Plan - Tier I - Critical Conservation Need;
II=VA Wildlife Action Plan - Tier II - Very High Conservation Need;
III=VA Wildlife Action Plan - Tier III - High Conservation Need;
IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need

View Map of All Query Results from All Observation Tables

Bat Colonies or Hibernacula: **Not Known**

Anadromous Fish Use Streams (5 records)

View Map of All Anadromous Fish Use Streams

Stream ID	Stream Name	Reach Status	Anadromous Fish Species			View Map
			Different Species	Highest TE*	Highest Tier**	
C28	Gordon Creek	Confirmed	1			Yes
C51	Morris Creek	Confirmed	2			Yes
C53	Nettles Creek	Confirmed	1			Yes
C90	Chickahominy River 1	Confirmed	6	FC	IV	Yes
C92	James River 1	Confirmed	6	FC	IV	Yes

Impediments to Fish Passage

N/A

Colonial Water Bird Survey

N/A

Threatened and Endangered Waters

N/A

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

are present. **View Map of Bald Eagle Concentration Areas and Roosts**

(4 records)

BECAR ID	Observation Year	Authority	Type	Comments	View Map
48	2006 - 2007	Center for Conservation Biology at the College of William and Mary/Virginia Commonwealth University	Summer Concentration Area	Eagle_use Low	Yes
49	2006 - 2007	Center for Conservation Biology at the College of William and Mary/Virginia Commonwealth University	Summer Concentration Area	Eagle_use Moderate	Yes
50	2006 - 2007	Center for Conservation Biology at the College of William and Mary/Virginia Commonwealth University	Winter Concentration Area	Eagle_use High	Yes
52	2006 - 2007	Center for Conservation Biology at the College of William and Mary/Virginia Commonwealth University	Winter Concentration Area	Eagle_use Moderate	Yes

Bald Eagle Nests (21 records)

View Map of All Query Results
Bald Eagle Nests

Nest	N Obs	Latest Date	DGIF Nest Status	View Map
CC0406	14	Apr 18 2011	HISTORIC	Yes
CC0606	13	Apr 18 2011	UNKNOWN	Yes
CC1105	2	Apr 18 2011	RECENTLY ACTIVE	Yes
CC8801	1	Jan 1 1988	HISTORIC	Yes
CC9806	4	May 10 1999	HISTORIC	Yes
CC9905	9	Jan 1 2003	HISTORIC	Yes
JC0303	8	Apr 26 2007	HISTORIC	Yes
JC0307	9	Apr 23 2008	UNKNOWN	Yes
JC0405	14	Apr 18 2011	UNKNOWN	Yes
JC0406	7	Apr 26 2007	HISTORIC	Yes
JC0407	15	Apr 18 2011	UNKNOWN	Yes
JC0602	13	Apr 18 2011	UNKNOWN	Yes
JC0603	5	Apr 26 2007	HISTORIC	Yes
JC0702	10	Apr 18 2011	RECENTLY ACTIVE	Yes
JC0902	6	Apr 18 2011	RECENTLY ACTIVE	Yes
JC1103	2	Apr 18 2011	RECENTLY ACTIVE	Yes
JC1104	2	Apr 18 2011	RECENTLY ACTIVE	Yes
JC1109	1	Apr 18 2011	RECENTLY ACTIVE	Yes
JC9401	17	Jan 1 2002	HISTORIC	Yes
JC9801	5	May 10 1999	HISTORIC	Yes
JC9902	4	May 10 1999	HISTORIC	Yes

Displayed 21 Bald Eagle Nests

Species Observations (97 records - displaying first 20 , 9 Observations with Threatened or Endangered species)

View Map of All Query Results
Species Observations

obsID	class	Date Observed	Observer	N Species			View Map
				Different Species	Highest TE*	Highest Tier**	
609062	SppObs	Sep 22 2010	Rob; Dorbad| Brooke; Newton	4	FS	IV	Yes
339445	SppObs	Apr 26 2001	Greenlee, Blommel, DMC	18	FS	IV	Yes
339371	SppObs	Apr 14 1994	DOWLING, HENNAMAN	14	FS	IV	Yes
15668	SppObs	Sep 21 1978	VIMS	7	FS	IV	Yes
15669	SppObs	Sep 21 1978	VIMS	7	FS	IV	Yes
336614	SppObs	Jan 1 1978	VIMS-B-VA. INST. MARINE SCI.	7	FS	IV	Yes
603380	SppObs	Oct 27 2009	Robert; Dorbad| Brooke; Newton	4	FS		Yes
339439	SppObs	May 11 1994	HENNAMAN, DOWLING	9	FS		Yes
339437	SppObs	Apr 14 1994	HENNAMAN, DOWLING	14	FS		Yes
339461	SppObs	Apr 26 2001	Greenlee, Blommel, DMC	18		I	Yes
60567	SppObs	May 3 1987	LORENZ, J	1		III	Yes
601417	SppObs	Nov 2 2009	Robert; Dorbad| Brooke; Newton	4		IV	Yes
339444	SppObs	Sep 20 2000	D. FOWLER, B. MEHL	22		IV	Yes
55051	SppObs	Mar 1 1997	DANIEL S. DROMBOWSKI, VIRGINIA COMMONWEALTH UNIVERSITY	5		IV	Yes
339460	SppObs	Dec 2 1994	FOWLER, K. WHITE	17		IV	Yes
339443	SppObs	Nov 2 1994	FOWLER, MEARS	17		IV	Yes
339355	SppObs	Oct 28 1994	FOWLER, DOWLING	20		IV	Yes
339459	SppObs	Aug 30 1994	FOWLER, STEPHENS	17		IV	Yes
339442	SppObs	Aug 29 1994	FOWLER, STEPHENS	18		IV	Yes

339406	SppObs	Aug 23 1994	STEPHENS, FOWLER	19		IV	Yes

Displayed 20 Species Observations

Selected 97 Observations View all 97 Species Observations

Habitat Predicted for Aquatic WAP Tier I & II Species

N/A

Habitat Predicted for Terrestrial WAP Tier I & II Species (2 Species)

View Map of Combined Terrestrial Habitat Predicted for 2 WAP Tier I & II Species Listed Below

ordered by Status Concern for Conservation

BOVA Code	Status*	Tier**	Common Name	Scientific Name	View Map
020044	ST	II	Salamander, Mabee's	Ambystoma mabeei	Yes
040105		II	Rail, king	Rallus elegans	Yes

Virginia Breeding Bird Atlas Blocks (4 records)

View Map of All Query Results
Virginia Breeding Bird Atlas Blocks

BBA ID	Atlas Quadrangle Block Name	Breeding Bird Atlas Species			View Map
		Different Species	Highest TE*	Highest Tier**	
55074	Brandon, CE	5			Yes
55076	Brandon, SE	80	FS	II	Yes
56073	Norge, CW	4	FS	II	Yes
56075	Norge, SW	1			Yes

Public Holdings: (1 names)

Name	Agency	Level
Chickahominy Wildlife Management Area	Va DGIF	

Summary of BOVA Species Associated with Cities and Counties of the Commonwealth of Virginia:

FIPS Code	City and County Name	Different Species	Highest TE	Highest Tier
036	Charles City	394	FTSE	I
095	James City	420	FESE	I

USGS 7.5' Quadrangles:
Claremont
Brandon

Surry
Norge

USGS NRCS Watersheds in Virginia:

N/A

USGS National 6th Order Watersheds Summary of Wildlife Action Plan Tier I, II, III, and IV Species:

HU6 Code	USGS 6th Order Hydrologic Unit	Different Species	Highest TE	Highest Tier
JL29	Chickahominy River-Morris Creek	66	FSSE	I
JL30	James River-Broad Swamp	77	FESE	I

Compiled on 1/26/2016, 2:57:04 PM I703587.0 report=all searchType= R dist= 3218.688 poi= 37,16,01.0 -76,52,17.9

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Virginia Ecological Services Field Office
6669 SHORT LANE
GLOUCESTER, VA 23061
PHONE: (804)693-6694 FAX: (804)693-9032
URL: www.fws.gov/northeast/virginiafield/

Consultation Code: 05E2VA00-2016-SLI-1024 January 05, 2016
Event Code: 05E2VA00-2016-E-01244
Project Name: JCSA Chickahominy Intake and WTP

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: JCSA Chickahominy Intake and WTP

Official Species List

Provided by:

Virginia Ecological Services Field Office
6669 SHORT LANE
GLOUCESTER, VA 23061
(804) 693-6694
http://www.fws.gov/northeast/virginiafield/

Consultation Code: 05E2VA00-2016-SLI-1024
Event Code: 05E2VA00-2016-E-01244

Project Type: WATER SUPPLY / DELIVERY

Project Name: JCSA Chickahominy Intake and WTP
Project Description: The James City Sewer Authority (JCSA) is proposing a new raw water intake on the Chickahominy River and associated raw water piping, pump station and water treatment plant located north of Route 5 in the County-owned Chickahominy Riverfront Park. The project is currently in the conceptual design stage, and the exact location of project elements has not been determined. This T&E species list is being requested to support the preparation of a Section 404 Joint Permit Application to USACE.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:
Not Available
Project Coordinates: MULTIPOLYGON (((-76.87837600708008 37.270501147832505, -76.87545776367186 37.27009132988016, -76.8716812133789 37.2688618626393, -76.86464309692383 37.26817881660863, -76.86120986938477 37.267495764381856, -76.86035156249999 37.26530995561875, -76.86138153076172 37.26107477059168, -76.86927795410156 37.26462687736873, -76.87356948852539 37.264080410307685, -76.87837600708008 37.270501147832505)))

Project Counties: James City, VA

Endangered Species Act Species List

There are a total of 2 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Flowering Plants	**Status**	**Has Critical Habitat**	**Condition(s)**
sensitive joint-vetch *(Aeschynomene virginica)*	Threatened		
Mammals			
Northern long-eared Bat *(Myotis septentrionalis)*	Threatened		

Critical habitats that lie within your project area

There are no critical habitats within your project area.

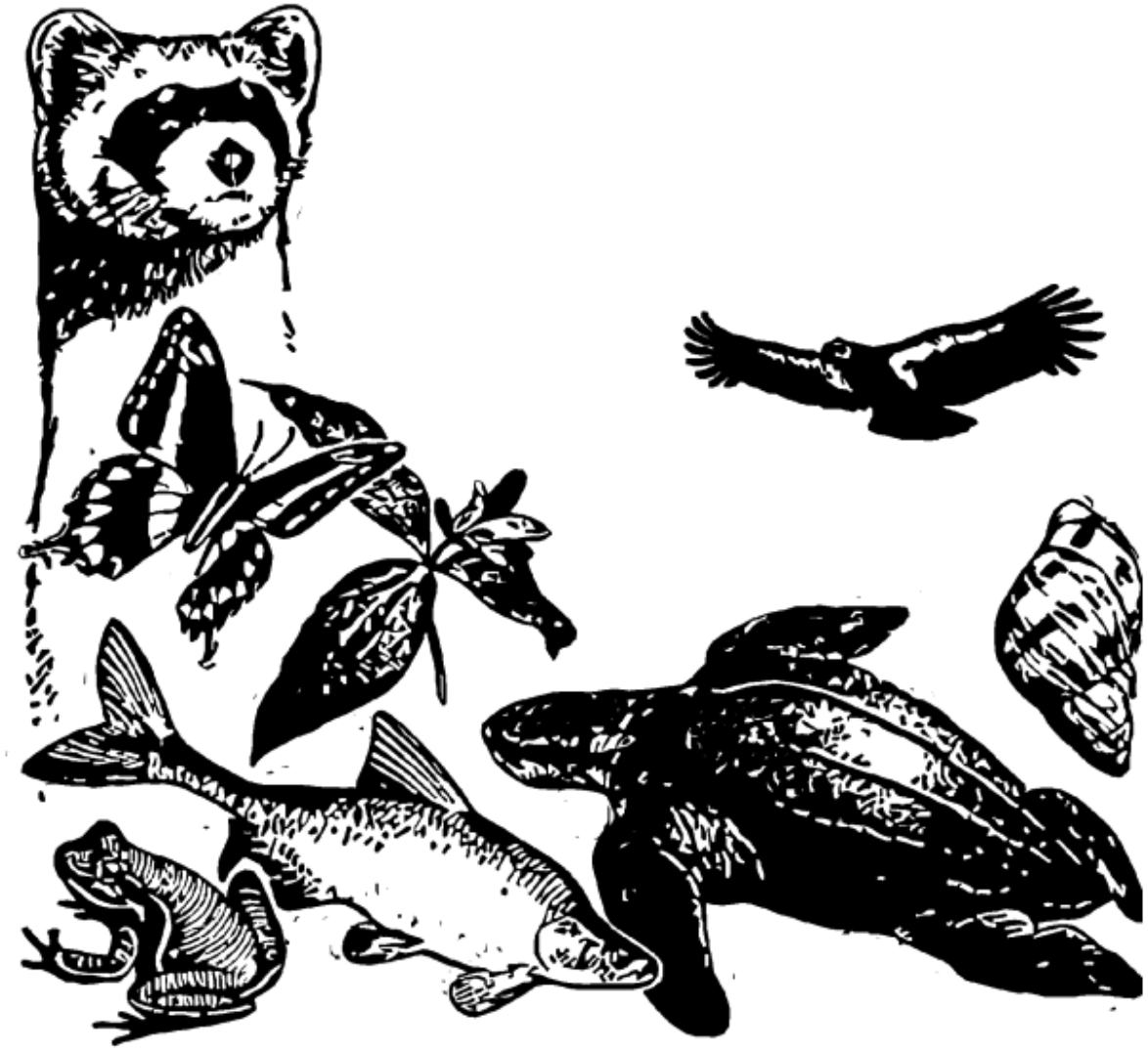
U.S. Fish & Wildlife Service

JCSA Chickahominy Intake and WTP

IPaC Trust Resource Report

Generated January 05, 2016 12:45 PM MST, IPaC v2.3.2

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (http://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

US Fish & Wildlife Service

IPaC Trust Resource Report

NAME

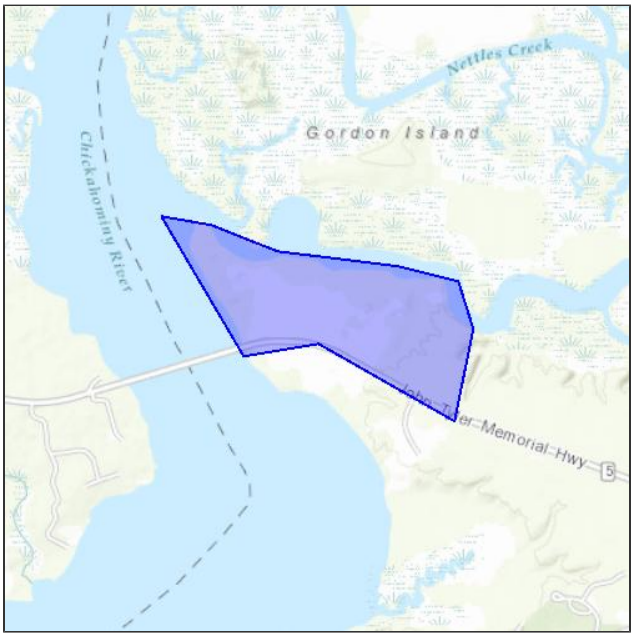
JCSA Chickahominy Intake and WTP

LOCATION

James City County, Virginia

IPAC LINK

http://ecos.fws.gov/ipac/project/ZG6O5-35DEJ-D7HO2-7AJIR-DSLRHM



U.S. Fish & Wildlife Contact Information

Trust resources in this location are managed by:

Virginia Ecological Services Field Office
6669 Short Lane
Gloucester, VA 23061-4410
(804) 693-6694

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require FWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list from the Regulatory Documents section in IPaC.

The list of species below are those that may occur or could potentially be affected by activities in this location:

Flowering Plants

Sensitive Joint-vetch Aeschynomene virginica — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=Q24J

Mammals

Northern Long-eared Bat Myotis septentrionalis — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0JE

Critical Habitats

There are no critical habitats in this location

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity which results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service (1). There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/akn-histogram-tools.php

The following species of migratory birds could potentially be affected by activities in this location:

American Kestrel Falco sparverius paulus — Bird of conservation concern
Year-round

American Oystercatcher Haematopus palliatus — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0G8

American Bittern Botaurus lentiginosus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F3

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Year-round
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Black Rail Laterallus jamaicensis — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B09A

Black Skimmer Rynchops niger — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0EO

Black-billed Cuckoo Coccyzus erythropthalmus — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HI

Black-throated Green Warbler Dendroica virens — Bird of conservation concern
Season: Breeding

Fox Sparrow Passerella iliaca — Bird of conservation concern
Season: Wintering

Gull-billed Tern Gelochelidon nilotica — Bird of conservation concern
Season: Breeding
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JV

Kentucky Warbler Oporornis formosus — Bird of conservation concern
Season: Breeding

Least Bittern Ixobrychus exilis — Bird of conservation concern
Season: Breeding

Lesser Yellowlegs Tringa flavipes — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0MD

Peregrine Falcon Falco peregrinus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FU

Pied-billed Grebe Podilymbus podiceps — Bird of conservation concern
Year-round

Prairie Warbler Dendroica discolor — Bird of conservation concern
Season: Breeding

Prothonotary Warbler Protonotaria citrea — Bird of conservation concern
Season: Breeding

Purple Sandpiper Calidris maritima — Bird of conservation concern
Season: Wintering

Red Knot Calidris canutus rufa — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DM

Red-headed Woodpecker Melanerpes erythrocephalus — Bird of conservation concern
Year-round

Rusty Blackbird Euphagus carolinus — Bird of conservation concern
Season: Wintering

Saltmarsh Sparrow Ammodramus caudacutus — Bird of conservation concern
Year-round

Seaside Sparrow Ammodramus maritimus — Bird of conservation concern
Year-round

Sedge Wren Cistothorus platensis — Bird of conservation concern
Season: Migrating

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Wintering
https://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Snowy Egret Egretta thula — Bird of conservation concern
Season: Breeding

Wood Thrush Hylocichla mustelina — Bird of conservation concern

Season: Breeding

Worm Eating Warbler Helmitheros vermivorum — Bird of conservation concern

Season: Breeding

Refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

Refuge data is unavailable at this time.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

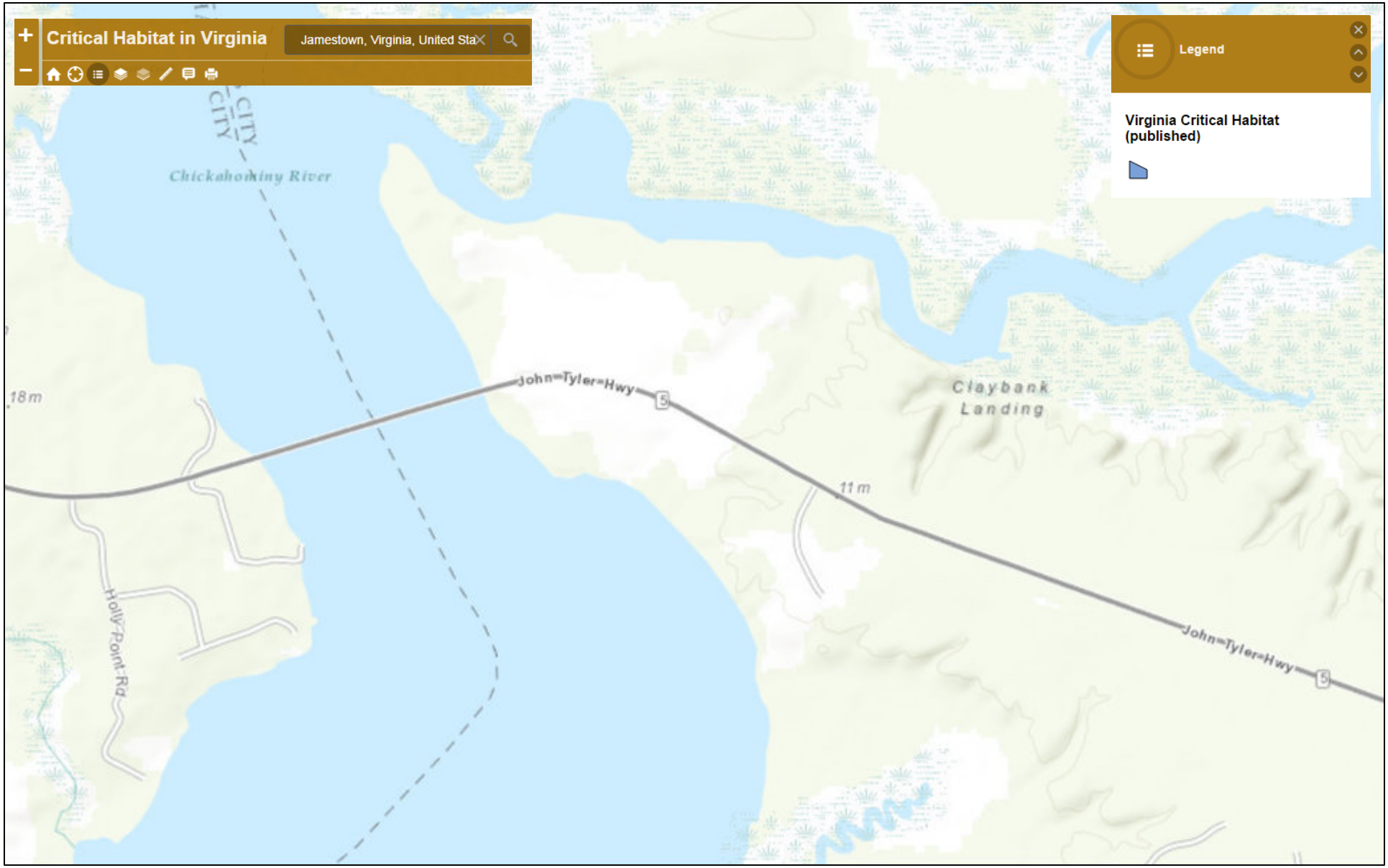
Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Wetland data is unavailable at this time.

JCSA Chickahominy Riverfront Raw Water Supply



January 26, 2016

1:18,056

0 0.15 0.3 0.6 mi

0 0.25 0.5 1 km

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey,

ATTACHMENT C

Historic Resources

Doug Powell

From: LaBudde, Gregory (DHR)
Sent: Friday, September 25, 2015 4:31 PM
To: Link, Matthew (DEQ)
Subject: RE: JCSA Pre Application Review Panel (DHR File No. 2015-0968)

Dear Mr. Link,

Thank you for inviting the Department of Historic Resources (DHR) to attend the JCSA Pre Application Review Panel. It is our understanding that the setting and scope of the project have not been determined. As such, DHR is unable to provide meaningful comments or recommendations at this time. Please continue to consult with us when plans for the project are developed.

On September 19, 2015, we received notification that notes and additional materials from the James City Service Authority Pre-Application Review Panel Meeting were uploaded to VITASHARE. According to the notification, the file package would be available for 14 days. However, the download link provided in the notification is no longer accessible. So that we may have a copy of the notes and materials for our files, please provide this information at your nearest convenience.

We look forward to working with the DEQ on this project as it develops.

Sincerely,

Greg LaBudde, Archaeologist
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6103
fax: 804-367-2391
gregory.labudde@dhr.virginia.gov

From: Link, Matthew (DEQ)
Sent: Friday, August 28, 2015 10:46 AM
To: Watkinson, Tony (MRC); Lyle M Varnell; Smith, Scott (DGIF); Ewing, Amy (DGIF); Baird, Alice (DCR); Eversole, Mark (MRC); Bunch, Aaron (DGIF); Caruthers, Michelle (VDH); lynette.r.rhodes@usace.army.mil; Horne, Daniel (VDH); Soto, Roy (VDH); Michael Vergakis; Powell, Doug; bryan.hill@jamescitycountyva.gov;

LaBudde, Gregory (DHR); matt.m.wicks@usace.army.mil; Kimberly_Smith@fws.gov; wkatchmark@hrpdcva.gov; Rhur, Robbie (DCR); Lapp.Jeffrey@epamail.epa.gov; Douglas, Susan (VDH); Aulbach, John (VDH)
Cc: Nicol, Craig (DEQ); Kudlas, Scott (DEQ); Stephenson, Tammy (DEQ); Mackey, Heather (DEQ); McGurk, Brian (DEQ)
Subject: JCSA Pre Application Review Panel Documents

To: Pre-Application Review Panel Invitees

RE: Pre-Application Review Panel Meeting Documents
James City Service Authority

Attached are the available documents for your review prior to the meeting on Monday. Meeting notes and any additional materials will be distributed following the meeting. Please contact me at any time with any questions, comments, or concerns. Thank you.

Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218
804-698-4078
matthew.link@deq.virginia.gov
www.deq.virginia.gov

CDM Smith
3201 Jermantown Road, Suite 400
Fairfax, VA 22030
tel: 703 691-6467
fax: 703 267-6083

January 20, 2016

Archives Search Service
c/o Quatro Hubbard
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221-2470

Subject: Request for Archives Search

Dear Mr. Hubbard:

The James City Service Authority (JCSA) is investigating the areas within the Chickahominy Riverfront Park, located north of Route 5 on the east bank of the Chickahominy River, for a new raw water intake and associated raw water piping, pump station, and water treatment plant on the County-owned property. The area of investigation consists largely of maintained turf fields and parklands, open forested campground, undeveloped upland forest, forested wetland, and marsh. The majority of the raw water supply infrastructure would not be located in wetland or floodplain areas, except for the intake structure itself and some of the associated piping.

The project area will consist of a portion of the Chickahominy Riverfront Park parcel of approximately 140 acres, located in the Virginia Inner Coastal Plain. This region is typically a flat to hilly area dissected by numerous streams and major rivers. The site is at the confluence of Gordon Creek and the Chickahominy River, which flows into the James River. Land use in surrounding areas generally consists of undeveloped forests and marshes, parklands, and single-family residential neighborhoods.

Project area – center location: 37° 15' 59.17"N 76° 52' 13.11"W

The specific project is undergoing conceptual design at this time. Any future project could potentially include low-rise structural elements, earth moving and/or clearing of vegetation.

Included with this letter is a completed DHR Archives Search request form, a shapefile delineating the Area of Potential Effects (APE), a USGS quadrangle map, and a signed Conditions for Use agreement. I appreciate your input on this matter, and if any further information is needed, please contact me at (703) 691-6467.

Very truly yours,

Matthew E. Petty
Environmental Scientist
CDM Smith Inc.

cc: Karina Hull (CDM Smith)
Gary St. John (CDM Smith)
File

COMMONWEALTH of VIRGINIA

Department of Historic Resources

Molly Joseph Ward
Secretary of Natural Resources

2801 Kensington Avenue, Richmond, Virginia 23221

Julie V. Langan
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
www.dhr.virginia.gov

February 1, 2016

CDM Smith, Inc.
Matthew E. Petty
3201 Jermantown Rd, Suite 400
Fairfax, VA 22030

RE: **General Planning/Research Archives Search**
James City Service Authority Chickahominy Riverfront Raw Water Supply

Dear Matthew E. Petty:

Thank you for your recent request for information from our archives on previously recorded archaeological and architectural resources within the area of potential effect, as delineated on your map, for the above-referenced project. Please note that your request for information from the Department of Historic Resources (DHR) Archives concerning the location of historic resources does not relieve you or your client from possible obligations under state or federal historic preservation regulations. I strongly recommend that you contact **Roger Kirchen**, DHR's Resource Services and Review Division at (804) 482-6091, if you have any questions concerning state and federal regulatory requirements.

Enclosed are the maps showing the location of any archaeological or architectural resources in or near the project area. If after examining the maps, you determine that you will require copies of files, those can be provided to you at the standard five dollar per file charge. An invoice is enclosed for the charges incurred through your use of our archives search service.

DHR serves as the official state repository on historic resources. This information has been compiled primarily by independent cultural resource consultants. DHR makes no warranty as to the fitness of the data for any purpose. The absence of historic resources in DHR records does not necessarily mean that no historic properties are present. It is advisable to check with local government planning offices for information on any properties that may meet the age and significance tests of the National Register criteria and have not yet been recorded in the DHR archives. Also, the area in question may not have been systematically surveyed for resources, possibly necessitating a survey and submittal of that data with your Project Review application.

Sincerely,

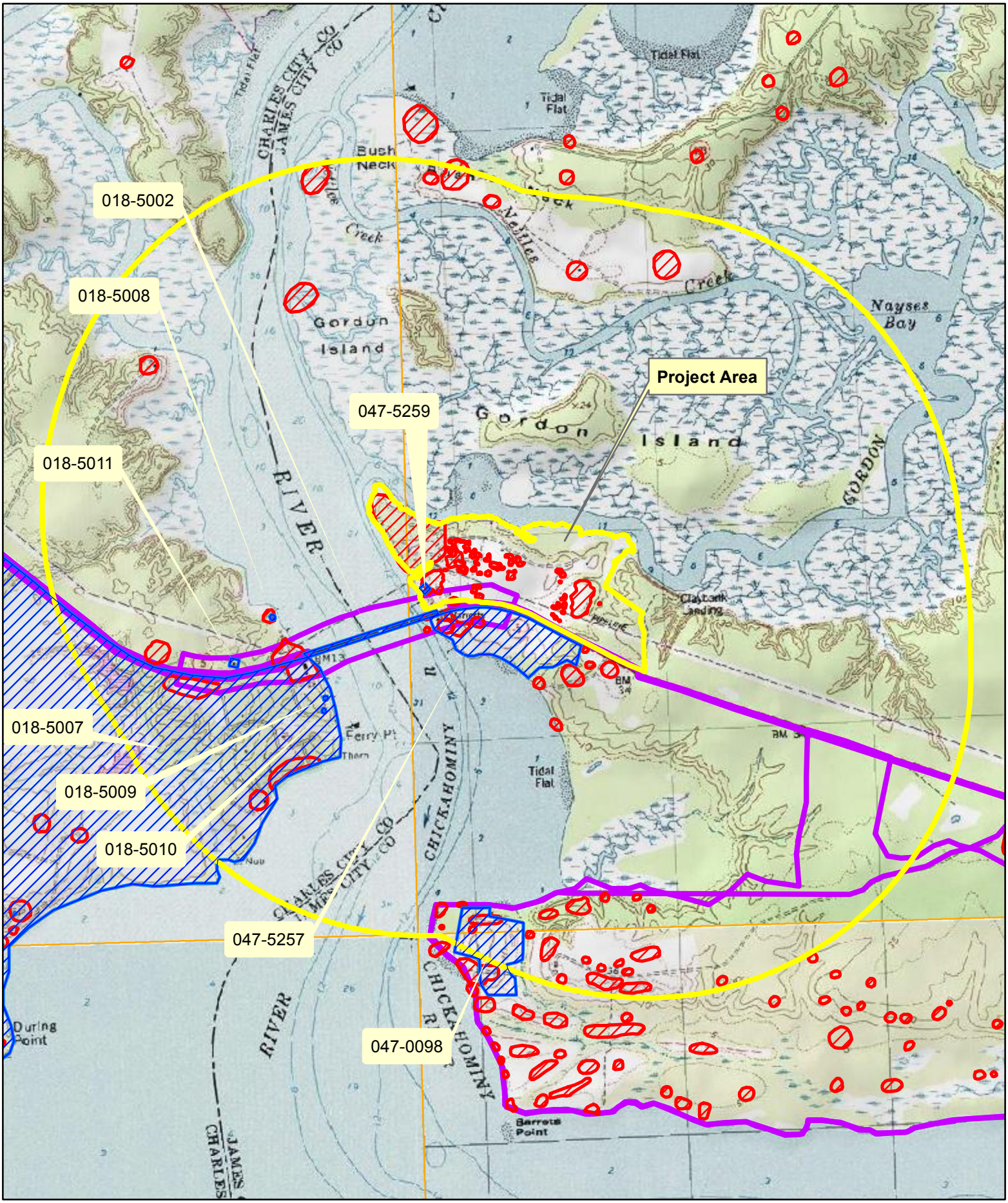
Lauren Leake
Archives - DHR

Administrative Services
10 Courthouse Ave.
Petersburg, VA 23803
Tel: (804) 862-6408
Fax: (804) 862-6196

Eastern Region Office
2801 Kensington Avenue
Richmond, VA 23221
Tel: (804) 367-2323
Fax: (804) 367-2391

Western Region Office
962 Kime Lane
Salem, VA 24153
Tel: (540) 387-5443
Fax: (540) 387-5446

Northern Region Office
5357 Main Street
PO Box 519
Stephens City, VA 22655
Tel: (540) 868-7029
Fax: (540) 868-7033



James City Service Authority
Chickahominy Riverfront Raw Water Supply
1350 John Tyler Memorial Hwy
WIlliamsburg, VA 23185
February 03, 2016
L. Leake

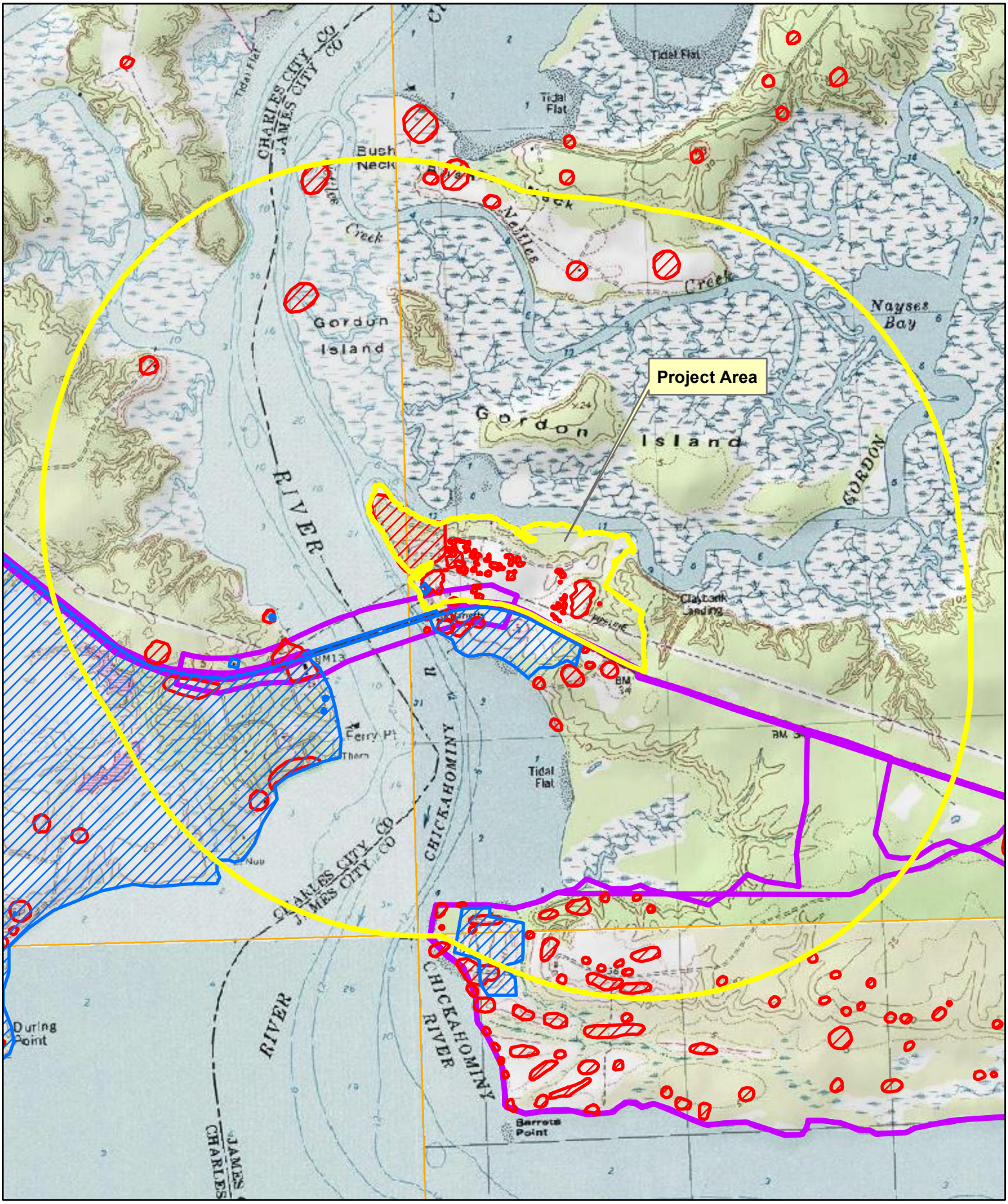
Legend

- Selected AH Resources
- 1 Mile Search Radius
- Area_of_Potential_Effects_20160120
- Architecture Resources
- Archaeological Resources
- **Phase I CRM Survey Areas**

Sources: VDHR 2015, USGS 2002
Records of the Virginia Department of Historic Resources (DHR) have been gathered over many years and the representation depicted is based on the field observation date and may not reflect current ground conditions. The map is for general illustration purposes and is not intended for engineering, legal or other site-specific uses.
The map may contain errors and is provided "as-is". Contact DHR for the most recent information as data is updated continually.

1 inch = 2,000 feet

DHR Department of Historic Resources



James City Service Authority
Chickahominy Riverfront Raw Water Supply
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Legend

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1 inch = 2,000 feet

DHR Department of Historic Resources

DHR_ID	Restrict_	SiteName	SiteCatego	SiteTypes	TimePeriod	NREligibil	County	Resource_N	Theme	Historic_E	Temporal_D	Quad	Other_DHR_	Eligible
44JC0328	Restricted: No release						James City	null	Indeterminate	null	null	NORGE		
44JC0013	Restricted: No release		DSS Legacy	Village/Town	Woodland (1200 B.C. - 1606 A.D.)		James City	null	Domestic	Village	Woodland	NORGE		
44JC1225	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy	Trash scatter	Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1226	Restricted: No release		Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City					NORGE		
44JC1231	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 2nd half (1750 - 1799), 19th Century: 2nd quarter (1825 - 1849), 19th Century: 2nd half (1850 - 1899), 20th Century: 1st quarter (1900 - 1924)		James City	Chickahominy Riverfront Park				NORGE		
44CC0128	Restricted: No release						Charles City	null	Indeterminate	null	null	BRANDON		
44JC0529	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.)	DHR Staff: Eligible	James City	null	Indeterminate	null	Prehistoric/Unknown	NORGE		Y
44JC0629	Restricted: No release				Paleo-Indian (15000 - 8501 B.C.)		James City	null	Indeterminate	null	Paleo-Indian	NORGE		
44JC0142	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	null	Indeterminate	null	Prehistoric/Unknown	BRANDON		
44CC0188	Restricted: No release				19th Century (1800 - 1899)		Charles City	null	Indeterminate	null	19th Century	BRANDON		
44JC0021	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	null	Indeterminate	null	Prehistoric/Unknown	NORGE		
44JC1236	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 2nd half (1750 - 1799), 19th Century: 1st quarter (1800 - 1825)		James City	Chickahominy Riverfront Park				NORGE		
44JC1235	Restricted: No release		Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44CC0190	Restricted: No release	Holly Point Road Farmstead	Domestic	Farmstead	18th Century: 4th quarter (1775 - 1799), 19th Century (1800 - 1899), 19th Century: 1st quarter (1800 - 1825)	DHR Staff: Potentially Eligible	Charles City	Holly Point Road Farmstead	Subsistence/Agriculture	Farmstead	18th Century: 3rd quarter, 18th Century: 4th quarter, 19th Century	BRANDON		P
44JC0354	Restricted: No release				19th Century (1800 - 1899)		James City	null	Domestic	null	19th Century	SURRY		
44JC0530	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.)	DHR Staff: Eligible	James City	null	Indeterminate	null	Prehistoric/Unknown	NORGE		Y
44JC0298	Restricted: No release		DSS Legacy	Other, Trash scatter	17th Century (1600 - 1699), 18th Century (1700 - 1799), 20th Century (1900 - 1999)		James City	null	Domestic	Other, Trash scatter	17th Century, 18th Century, 20th Century	SURRY		
44JC0161	Restricted: No release		Industry/Processing/Extraction	Lithic workshop	Late Archaic (3000 - 1201 B.C.)		James City	null	Industry/Processing/Extraction	Lithic workshop	Late Archaic	NORGE		
44JC1123	Restricted: No release	Barrett's Ferry Site	Domestic	Dwelling, single, Farmstead	Protohistoric, Late Archaic (3000 - 1201 B.C.), 17th Century: 2nd half (1650 - 1699), 18th Century: 2nd/3rd quarter (1725 - 1774)	DHR Staff: Eligible	James City	Barrett's Ferry Site	Domestic	Dwelling, single	18th Century, 19th Century, 19th Century: 1st quarter	NORGE		Y
44JC0636	Restricted: No release				Historic/Unknown	DHR Staff: Not Eligible	James City	null	Indeterminate	null	Historic/Unknown	SURRY		N
44JC0331	Restricted: No release				19th Century (1800 - 1899)		James City	null	Indeterminate	null	19th Century	NORGE		
44CC0192	Restricted: No release						Charles City	null	Indeterminate	null	null	BRANDON		
44JC1220	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1222	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy	Trash scatter	18th Century (1700 - 1799), 19th Century (1800 - 1899), 20th Century (1900 - 1999)		James City	Chickahominy Riverfront Park				NORGE		
44CC0189	Restricted: No release				19th Century (1800 - 1899)		Charles City	null	Indeterminate	null	19th Century	BRANDON		
44CC0389	Restricted: No release				18th Century (1700 - 1799), 19th Century (1800 - 1899), 20th Century: 1st half (1900 - 1949)	DHR Staff: Not Eligible	Charles City	null	Commerce/Trade, Domestic	null	18th Century, 19th Century: 2nd half, 20th Century: 1st half	BRANDON		N
44JC0356	Restricted: No release		Domestic, DSS Legacy	Camp, Dwelling, single	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 19th Century (1800 - 1899)	DHR Staff: Eligible	James City	null	Domestic	Camp, Dwelling, single	19th Century, Prehistoric/Unknown	SURRY		Y
44JC1221	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 2nd half (1750 - 1799), 19th Century: 1st quarter (1800 - 1825)		James City	Chickahominy Riverfront Park				NORGE		
44JC1217	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1218	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 19th Century (1800 - 1899)		James City	Chickahominy Riverfront Park				NORGE		
44JC1219	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy	Other	Historic/Unknown		James City	Chickahominy Riverfront Park				NORGE		
44JC0531	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.)	DHR Staff: Eligible	James City	null	Indeterminate	null	Prehistoric/Unknown	NORGE		Y
44JC1123	Restricted: No release	Barrett's Ferry Site	Domestic	Dwelling, single, Farmstead	Protohistoric, Late Archaic (3000 - 1201 B.C.), 17th Century: 2nd half (1650 - 1699), 18th Century: 2nd/3rd quarter (1725 - 1774)	DHR Staff: Eligible	James City	Barrett's Ferry Site	Domestic	Dwelling, single	18th Century, 19th Century, 19th Century: 1st quarter	NORGE		Y
44JC0526	Restricted: No release				Archaic (8500 - 1201 B.C.), 20th Century (1900 - 1999)		James City	null	Indeterminate	null	20th Century, Archaic	NORGE		
44JC0735	Restricted: No release		Domestic, Industry/Processing/Extraction	Camp, base, Kiln, brick	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 17th Century (1600 - 1699), 18th Century (1700 - 1799), 20th Century (1900 - 1999)		James City	null	Domestic, Industry/Processing/Extraction	Camp, base, Kiln, brick	17th Century, 18th Century, 20th Century, Prehistoric/Unknown	SURRY		
44JC0022	Restricted: No release				Indeterminate		James City	null	Indeterminate	null	Indeterminate	NORGE		
44JC0012	Restricted: No release				Indeterminate		James City	null	Indeterminate	null	Indeterminate	NORGE		
44JC1136	Restricted: No release	Target A	Commerce/Trade	Wharf	18th Century (1700 - 1799), 19th Century (1800 - 1899)	DHR Staff: Potentially Eligible	James City	Target A	Commerce/Trade, Transportation/Communication	Wharf	18th Century, 19th Century	NORGE		P
44JC0136	Restricted: No release		DSS Legacy	Other	18th Century (1700 - 1799), 19th Century (1800 - 1899)	DHR Staff: Potentially Eligible	James City	null	Domestic, Military/Defense	Other	18th Century, 19th Century	NORGE		
44JC0129	Restricted: No release		Domestic	Dwelling, multiple	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 19th Century (1800 - 1899), 20th Century (1900 - 1999)	DHR Staff: Not Eligible	James City	null	Domestic	Dwelling, multiple	19th Century, 20th Century, Prehistoric/Unknown	SURRY		N
44JC1237	Restricted: No release		Domestic	Camp, temporary	Woodland (1200 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1238	Restricted: No release		DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 4th quarter (1775 - 1799), 19th Century: 1st half (1800 - 1849)		James City	Chickahominy Riverfront Park				NORGE		
44CC0308	Restricted: No release		DSS Legacy	Camp	Middle Archaic (6500 - 3001 B.C.)		Charles City	null	Domestic	Camp	Middle Archaic	BRANDON		
44JC0536	Restricted: No release				19th Century (1800 - 1899), 20th Century (1900 - 1999)		James City	null	Indeterminate	null	19th Century, 20th Century	SURRY		
44JC1203	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC0357	Restricted: No release		DSS Legacy	Camp	Middle Archaic (6500 - 3001 B.C.), Late Archaic (3000 - 1201 B.C.), 18th Century (1700 - 1799)		James City	null	Domestic	Camp	18th Century, Late Archaic, Middle Archaic	SURRY		
44JC1223	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Other	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 4th quarter (1775 - 1799)		James City	Chickahominy Riverfront Park				NORGE		
44JC0031	Restricted: No release				Woodland (1200 B.C. - 1606 A.D.)		James City	null	Indeterminate	null	Woodland	NORGE		
44JC0355	Restricted: No release		Domestic, DSS Legacy	Camp, Dwelling, single	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	null	Domestic	Camp, Dwelling, single	Prehistoric/Unknown	SURRY		
44JC0327	Restricted: No release				19th Century (1800 - 1899)		James City	null	Indeterminate	null	19th Century	NORGE		
44JC1215	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1224	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC0136	Restricted: No release		DSS Legacy	Other	18th Century (1700 - 1799), 19th Century (1800 - 1899)	DHR Staff: Potentially Eligible	James City	null	Domestic, Military/Defense	Other	18th Century, 19th Century	NORGE		
44JC1203	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1204	Restricted: No release		DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 2nd half (1750 - 1799), 18th Century: 4th quarter (1775 - 1799), 19th Century: 1st half (1800 - 1849), 19th Century: 1st quarter (1800 - 1825)		James City					NORGE		
44JC1241	Restricted: No release		Domestic, Industry/Processing/Extraction	Camp, temporary, Dwelling, single, Lithic workshop	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), Archaic (8500 - 1201 B.C.), Early/Middle Woodland (1200 B.C. - 999 A.D.), Late Woodland (1000 - 1606), 17th Century (1600 - 1699), 18th Century (1700 - 1799), 19th Century (1800 - 1899)		James City	Chickahominy Riverfront Park				NORGE		
44JC0332	Restricted: No release				19th Century (1800 - 1899)		James City	null	Indeterminate	null	19th Century	NORGE		
44JC1204	Restricted: No release		DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 2nd half (1750 - 1799), 18th Century: 4th quarter (1775 - 1799), 19th Century: 1st half (1800 - 1849), 19th Century: 1st quarter (1800 - 1825)		James City					NORGE		
44JC0143	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	null	Indeterminate	null	Prehistoric/Unknown	BRANDON		
44JC1230	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 19th Century (1800 - 1899)		James City	Chickahominy Riverfront Park				NORGE		
44JC1229	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century (1700 - 1799)		James City	Chickahominy Riverfront Park				NORGE		
44JC1228	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy	Other	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1227	Restricted: No release		Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City					NORGE		
44JC1239	Restricted: No release		Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1240	Restricted: No release		Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1128	Restricted: No release				18th Century (1700 - 1799), 19th Century (1800 - 1899), 20th Century: 1st half (1900 - 1949), 20th Century: 4th quarter (1975 - 1999)	DHR Staff: Not Eligible	James City	null	Commerce/Trade, Domestic	null	18th Century, 19th Century, 20th Century: 1st half, 20th Century: 4th quarter	NORGE		P
44JC1216	Restricted: No release	Chickahominy Riverfront Park	Industry/Processing/Extraction	Lithic scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1234	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	Chickahominy Riverfront Park				NORGE		
44JC1233	Restricted: No release	Chickahominy Riverfront Park	DSS Legacy, Industry/Processing/Extraction	Lithic scatter, Trash scatter	Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century: 4th quarter (1775 - 1799), 19th Century: 1st quarter (1800 - 1825)		James City	Chickahominy Riverfront Park				NORGE		
44JC0319	Restricted: No release		Domestic	Camp, temporary, Trash pit	Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	null	Domestic	Camp, temporary, Trash pit	Historic/Unknown, Prehistoric/Unknown	SURRY		
44JC0315	Restricted: No release		DSS Legacy	Camp	18th Century: 2nd half (1750 - 1799)	DHR Staff: Not Eligible	James City	null	Domestic, Indeterminate	Camp	18th Century: 2nd half	SURRY		N
44JC1135	Restricted: No release	Pier Site	Commerce/Trade, DSS Legacy	Other, Wharf	18th Century (1700 - 1799), 19th Century (1800 - 1899)	DHR Staff: Potentially Eligible	James City	Pier Site	Commerce/Trade, Transportation/Communication	Other, Wharf	18th Century, 19th Century	NORGE		P
44JC0135	Restricted: No release		Domestic	Camp, temporary	Archaic (8500 - 1201 B.C.), Woodland (1200 B.C. - 1606 A.D.), 19th Century: 2nd/3rd quarter (1825 - 1874)		James City	null	Domestic, Military/Defense	Camp, temporary	19th Century: 2nd/3rd quarter, Archaic, Woodland	NORGE		
44JC0310	Restricted: No release		DSS Legacy	Village/Town	Middle Woodland (300 - 999 A.D.)		James City	null	Domestic	Village	Middle Woodland	NORGE		
44JC0309	Restricted: No release				Historic/Unknown, Prehistoric/Unknown (15000 B.C. - 1606 A.D.)	DHR Staff: Eligible	James City	null	Indeterminate	null	Historic/Unknown, Prehistoric/Unknown	NORGE		Y
44JC0320	Restricted: No release		Domestic	Camp, temporary	Prehistoric/Unknown (15000 B.C. - 1606 A.D.)		James City	null	Domestic	Camp, temporary	Prehistoric/Unknown	SURRY		
44JC0023	Restricted: No release				Prehistoric/Unknown (15000 B.C. - 1606 A.D.), 18th Century (1700 - 1799)	DHR Staff: Eligible	James City	null	Indeterminate	null	18th Century, Prehistoric/Unknown	NORGE		Y
44JC1126	Restricted: No release		Domestic	Dwelling, single	19th Century: 4th quarter (1875 - 1899), 20th Century: 1st half (1900 - 1949)	DHR Staff: Not Eligible	James City	null	Domestic	Dwelling, single	19th Century: 4th quarter, 20th Century: 1st half	NORGE		N

Petty, Matthew

From: ePIX Portal <ePIX@dhr.virginia.gov>
Sent: Thursday, June 16, 2016 11:20 AM
To: Petty, Matthew
Subject: James City Service Authority (JCSA) Chickahominy Riverfront Raw Water Supply Project (2016-3588) | e-Mail #01229

Dear Mr. Matt Petty:

Thank you for submitting your application through the ePIX system and requesting the comments of the Department of Historic Resources on the referenced project. Your application is being processed and our 30-day review period will start on the next business day after submission. You will be notified if your application is insufficient or if additional materials are required for our review.

You may view the submitted application and track our review of this project through your ePIX account under "My Projects" (http://solutions.virginia.gov/epix/secure/dashboard.aspx). When our review is complete, comments will be emailed to you and attached to the application in your ePIX account. No project activities that have the potential to impact historic properties should take place until the lead agency has provided a notice to proceed.

If you wish or are asked to submit additional materials in support of your application, documents must be submitted electronically to the appropriate reviewer. Submissions with a total size of less than 10mb may be submitted via email. Submissions larger than 10mb must be made through VITAShare (https://vitashare.vita.virginia.gov).

Please reference the assigned DHR File Number on all future correspondence.

If you have any questions concerning the review process or if we may provide any further assistance, please do not hesitate to contact me. We look forward to working with you on this project.

Sincerely,

Gregory LaBudde
Office of Review and Compliance
Division of Resource Services and Review

VIRGINIA DEPARTMENT OF HISTORIC RESOURCES (DHR) PROJECT REVIEW COMMENTS

PENDING

WILL BE INCLUDED IN THE JOINT PERMIT APPLICATION WHEN RECEIVED

ATTACHMENT D

Wetland Impacts and Wetland Delineation

9. WETLANDS, WATERS, AND DUNES/BEACHES IMPACT INFORMATION			
Report each impact site in a separate column. If needed, attach additional sheets using a similar table format. Please ensure that the associated project drawings clearly depict the location and footprint of each numbered impact site. For dredging, mining, and excavating projects, use Section 18.			
	Chickahominy River Raw Water Intake	Southern PEM/PSS Wetland & Int. Channel Water Treatment Facility	Catch & Release Pond Water Treatment Facility
Impact description (use all that apply): F=fill EX=excavation S=Structure T=tidal NT=non-tidal TE=temporary PE=permanent PR=perennial IN=intermittent SB=subaqueous bottom DB=dune/beach IS=hydrologically isolated V=vegetated NV=non-vegetated MC=Mechanized Clearing of PFO	F, EX, S, T, TE, PE, PR, SB, NV	NT, TE, IN, V, MC	F, EX, S, TE, PE, IS, NV
Wetland/waters impact area (square feet)	**42,780 (0.98 ac)**	**29,247.6 (0.67 ac)**	**13,462.6 (0.31 ac)**
Dune/beach impact area (square feet)	N/A	N/A	N/A
Stream dimensions at impact site (length and average width in linear feet, and area in sq. ft.)	Length: 125 lf Width = ~ 5,000 lf	Length = 640 lf Width = 5 lf	N/A
Volume of fill below Mean High Water or Ordinary High Water (cubic yards)	92,260 cy (329.5' long x 20' wide x 14' deep [avg])	N/A	N/A
Cowardin classification of impacted wetland/water or geomorphological classification of stream (Ex: PFO wetland; 'C' Channel Stream)	R1UBV; 'C5 channel (tidal large river)	PEM1/PSS1C wetland; G6 intermittent channel	PUBHx
Average stream flow at site (flow rate under normal rainfall conditions) (cubic feet per second)	480 cfs; Tidal Influx = 35,301 cfs	Intermittent; < 10 cfs	N/A
Contributing drainage area (acres or square miles)	454 mi^2	15 acres	8 acres
DEQ classification of impacted resource(s): Estuarine Class II Non-tidal waters Class III Mountainous zone waters Class IV Stockable trout waters Class V Natural trout waters Class VI Wetlands Class VII	Estuarine Class II	Non-Tidal Waters Class III; Wetlands Class VII	Non-Tidal Waters Class III

9. WETLANDS, WATERS, AND DUNES/BEACHES IMPACT INFORMATION (continued)			
Report each impact site in a separate column. If needed, attach additional sheets using a similar table format. Please ensure that the associated project drawings clearly depict the location and footprint of each numbered impact site. For dredging, mining, and excavating projects, use Section 18.			
	Isolated Forested Wetland Water Treatment Facility		
Impact description (use all that apply): F=fill EX=excavation S=Structure T=tidal NT=non-tidal TE=temporary PE=permanent PR=perennial IN=intermittent SB=subaqueous bottom DB=dune/beach IS=hydrologically isolated V=vegetated NV=non-vegetated MC=Mechanized Clearing of PFO	F, EX, S, TE, PE, IS, V, MC		
Wetland/waters impact area (square feet)	**10,225.5 (0.23 ac)**		
Dune/beach impact area (square feet)	N/A		
Stream dimensions at impact site (length and average width in linear feet, and area in sq. ft.)	N/A		
Volume of fill below Mean High Water or Ordinary High Water (cubic yards)	N/A		
Cowardin classification of impacted wetland/water or geomorphological classification of stream (Ex: PFO wetland; 'C' Channel Stream)	PFO1A		
Average stream flow at site (flow rate under normal rainfall conditions) (cubic feet per second)	N/A		
Contributing drainage area (acres or square miles)	1.75 acres		
DEQ classification of impacted resource(s): Estuarine Class II Non-tidal waters Class III Mountainous zone waters Class IV Stockable trout waters Class V Natural trout waters Class VI Wetlands Class VII	Wetlands Class VII		

Memorandum

To: *Michael Vergakis, P.E.*
James City Service Authority (JCSA)

From: *Matt Petty, P.W.S.*
Laura Burbage, P.W.D.

Date: *February 22, 2016*

Subject: *Field Completion Memorandum for Wetlands Delineation, Chickahominy Riverfront Raw Water Supply, James City County, Virginia*

1.0 Introduction

CDM Smith Professional Wetland Scientist (PWS), Matt Petty, and Virginia Professional Wetland Delineator (PWD), Laura Burbage, delineated wetlands in James City County, Virginia, on February 1-5 and 12, 2016, for the purpose of the planning, design, and construction of a raw water intake, water treatment facility, and associated infrastructure in Chickahominy Riverfront Park. Wetlands were delineated in conformance with the *2010 Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Atlantic and Gulf Coastal Plain Region* (Version 2.0). The general location of the limits of investigation are shown in Figure 1. Wetland exhibits showing the locations of wetland boundaries and United States Army Corps of Engineers (USACE) wetland determination plots are provided in Appendices A and C, respectively; the wetland line was surveyed using a handheld global positioning system (GPS) unit with sub-meter accuracy. Site photographs are provided in Appendix B.

2.0 Site Conditions

2.1 General Site Description

The area of investigation is located in the southwestern corner of James City County, Virginia, to the west of the City of Williamsburg. Within the overall landscape, the area of investigation is situated in the Inner Coastal Plain, which is separated from the Piedmont by the Fall Line – a distinct topographic break. The Inner Coastal Plain is differentiated from surrounding regions by the combination of flat to slightly hilly topography, a relatively warm and humid climate with abundant rainfall, mixed pine and hardwood natural vegetation, and current land cover dominated by forests or by a mosaic of forest, agriculture and urban land uses (USACE 2010). The area is heavily dissected by streams, and hydrologic modifications (e.g., levees, ditches, subsurface drains) are common in agricultural areas. The soils largely derive from material eroded from the ancestral Appalachian Mountains and deposited in the ocean. Wind-blown loess covers the older marine sediments. The predominant forest vegetation of this area is classified as oak-hickory-pine forest

(USACE 2010). Today, pines tend to predominate in large areas that once were farmed or cleared but later abandoned or allowed to regenerate. Typical pine species include shortleaf (*Pinus echinata*) and loblolly (*Pinus taeda*) pines. Sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*) and southern red oak (*Quercus falcata*) are also common canopy species. Dogwoods (*Cornus* spp.) and American holly (*Ilex opaca*) are common understory species (USACE 2010).

The area of investigation itself is located on approximately 98 acres in the 140-acre Chickahominy Riverfront Park, located on John Tyler Highway (Route 5) (Figure 1). It is bounded on the north by Gordon Creek, the east by low-density residential and forested lands, the south by the Colonial Pipeline (which largely runs east-west through the southern portion of the park), and the west by the Chickahominy River. The site is approximately 1.0 mile upstream of the confluence of the Chickahominy River and James River. The Chickahominy River and Gordon Creek are tidal freshwater systems, with water levels fluctuating significantly depending on the tide. Much of the undeveloped land within the area of investigation consists of mixed oak-pine forest with wetlands and intermittent stream channels associated with Chickahominy River and Gordon Creek inlets and shorelines. Developed lands are historical croplands that were turned into maintained parklands managed for recreation with the establishment of the park. The central, interior portion of the area of investigation is a slightly elevated event field consisting of maintained turf grasses. A 1.6-acre, man-made catch-and-release fishing pond sits in the southeast corner of the area of investigation.

Topographic contours are shown on Figure 2 and National Wetlands Inventory (NWI) Mapping is shown on Figure 3. The topographic contours give a rough approximation as to where elevated mounds and low-lying shoreline areas are located within the area of investigation. NWI mapping identifies likely wetland areas, and will be discussed further in Section 2.4.

2.2 Site Hydrology

Hydrologic conditions found during the site visits were used to delineate wetland areas (along with vegetation and soil characteristics). On the final two days of the delineation, significant rain events inundated wetland and upland areas alike, increasing the difficulty of determining the wetland boundary due to saturated soils and localized ponding. On these days, hydric soils and hydrophytic vegetation were determining factors. Floodplain mapping is shown on Figure 4. The 100-year floodplain includes areas along the Chickahominy River and Gordon Creek shorelines, including several inlets that reach far into the area of investigation's interior from the north and west. Those investigated areas above the 100-year floodplain are located within the 500-year floodplain.

The Chickahominy River is tidal up to Walkers Dam, roughly 20 river miles upstream of the area of investigation. Therefore, hydrology in shoreline wetlands and inlets is heavily dependent on periodic inundation and exposure provided by the tides. It also is influenced by wave action, with Federal Emergency Management Agency (FEMA) maps indicating moderate wave action (i.e. up to

3 feet) for the Chickahominy River and Gordon Creek shorelines. In non-tidal wetland areas, hydrology is largely a product of a high water table.

The eastern portion of the area of investigation consists of several intermittent and ephemeral stream channels that flow downslope to the large eastern inlet of Gordon Creek. These channels were largely narrow and undefined, but contained flow due to recent snowmelt and rainfall. South of the catch-and-release pond, an excavated ditch flows west-to-east from near the swimming pool at the park entrance to the large eastern inlet. Only the portion of this ditch to the south and east of the pond is within the area of investigation. Downstream of the culverted, dirt road crossing, the ditch takes on natural stream characteristics (e.g. sinuosity) and is referred to as intermittent stream 1.

In many wetland areas, standing water was present, or recently receded due to the tides. In areas without standing water, soils were often saturated to the surface, a likely result of recent precipitation. Additional primary indicators of hydrology found in wetland portions of the area of investigation include high water table, water marks, drift deposits, inundation visible on aerial imagery, water-stained leaves, aquatic fauna, oxidized rhizospheres on living roots, and the presence of a hydrogen sulfide odor. Observed secondary indicators of hydrology included drainage patterns, moss trim lines, saturation visible on aerial imagery, crayfish burrows, geomorphic position, and the passing of the facultative (FAC)-neutral test.

2.3 Site Soils

Natural Resource Conservation Service (NRCS) soil mapping (Figure 5) indicates that a wide variety of soils are present in the area investigated. The western portion of the site along the Chickahominy River consists largely of the Emporia complex (15 to 25 percent slopes) soils along the shoreline, and Pamunkey soils (2 to 6 percent slopes) in adjacent uplands. The northern portion of the site along Gordon Creek consists largely of Emporia complex (15 to 25 percent slopes) and Altavista fine sandy loam (0 to 3 percent slopes) along the shoreline, and Pamunkey soils (2 to 6 percent slopes) and urban land in adjacent uplands. The eastern portion of the site consists largely of Emporia complex (10 to 25 percent slopes), Craven-Uchee complex (6 to10 percent slopes), Chickahominy silt loam (02 percent slopes), and Johnston Complex (0 to 2 percent slopes) in wetland areas. Soils in the eastern uplands and in the central portion of the site consist primarily of Pamunkey soils (2 to 6 percent slopes), Tetotum silt loam (0 to 2 percent slopes), Udorthents-loamy (0 to 70 percent slopes), and urban land. Soil characteristics for the area of investigation are summarized in Table 1.

Soils were examined at numerous locations during the site visit in order to perform the wetland delineation. Soil characteristics were documented at twelve wetland determination plot locations; the detailed soil profiles are provided on the determination plot data forms located in Appendix C. Hydric soil indicators that were routinely encountered in wetland areas included histosol (A1), depleted matrix (F3), and 5 cm mucky mineral (A7). Depleted matrix was the indicator encountered

the most frequently, with histosol and 5 cm mucky mineral present in the tidally-inundated portions of inlets and in bottomland bald cypress (*Taxodium distichum*)/tupelo (*Nyssa* spp.) forests. Loamy mucky mineral was also observed in some inlets; however, this hydric soil indicator is limited by USACE guidance to the Mississippi Alluvial Valley (LRR O) and not the Inner Coastal Plain (LRR P). Therefore, while it was noted, it was not used as a primary indicator of wetland soils during the wetland delineation.

Table 1: NRCS Soil Survey Mapping Units and Component Soil Characteristics

Map Unit	Component and Percent	Drainage	Depth to Water Table (inches)	Flooding/ Ponding	Hydrologic Soil Group	Hydric
Altavista fine sandy loam, 0 to 3 percent slopes	Altavista and similar soils 85%	Moderately Well Drained	18-30	None	C	No
Chickahominy silt loam, 0 to 2 percent slopes	Chickahominy and similar soils 80%	Poorly Drained	0-6	None	C/D	Yes
Craven-Uchee complex, 6 to 10 percent slopes	Uchee and similar soils 35%	Well Drained	42-60	None	B	No
	Craven and similar soils 35%	Moderately Well Drained	24-36	None	D	No
Dogue loam, 0 to 3 percent slopes	Dogue and similar soils 85%	Moderately Well Drained	18-36	None	C	No
	Chickahominy silt loam 3%	Poorly Drained	0-6	None	C/D	Yes
Emporia Complex, 10 to 50 percent slopes	Emporia and similar soils 75%	Well Drained	36-54	None	B	No
	Johnston 5%	Very Poorly Drained	0	Frequent	A/D	Yes
Johnston Complex, 0 to 2 percent slopes	Johnston and similar soils 75%	Very Poorly Drained	0	Frequent	A/D	Yes
	Bohicket 5%	Very Poorly Drained	0	Frequent	D	Yes
	Axis 5%	Very Poorly Drained	0	Frequent	C/D	Yes
	Levy 5%	Very Poorly Drained	0	Frequent	D	Yes
	Nimmo 5%	Poorly Drained	0-12	None	B/D	Yes
	Tomotley 5%	Poorly Drained	0-12	Rare/None	B/D	Yes
Newflat silt loam, 0 to 2 percent slopes	Newflat and similar soils 80%	Somewhat Poorly Drained	6-18	None	D	No
	Chickahominy silt loam 7%	Poorly Drained	0-6	None	C/D	Yes

Table 1: NRCS Soil Survey Mapping Units and Component Soil Characteristics (Continued)

Map Unit	Map Unit	Map Unit	Map Unit	Map Unit	Map Unit	Map Unit
Pamunkey soils, 2 to 6 percent slopes	Pamunkey and similar soils 85%	Well Drained	48-72	None	B	No
Peawick silt loam, 0 to 3 percent slopes	Peawick and similar soils 80%	Moderately Well Drained	18-36	None	D	No
	Chickahominy silt loam 5%	Poorly Drained	0-6	None	C/D	Yes
Tetotum silt loam, 0 to 2 percent slopes	Tetotum and similar soils 85%	Moderately Well Drained	18-30	None	C	No
	Chickahominy silt loam 3%	Poorly Drained	0-6	None	C/D	Yes
Udorthents-loamy, 0 to 70 percent slopes	Udorthents and similar soils 75%		>80	None		No
Urban land, 0 to 15 percent slopes	Urban land 85%		24-79			
Water			>80	None		

Source: Natural Resources Conservation Service, United States Department of Agriculture, Custom Soil Resource Report for James City and York Counties and the City of Williamsburg, Virginia; January 5, 2016.

2.4 Wetland Delineation and Habitat Types

An initial desktop delineation was conducted to identify likely stream and wetland locations within the environmental boundary. Topographic contours (Figure 2), NWI mapping (Figure 3), and NRCS soils mapping (Figure 5) were evaluated. Within the area of investigation, NWI mapping identified a total of 12 wetland types as being present, as described in Table 2. Of the 12 wetland types, three are riverine wetlands associated with the Chickahominy River and Gordon Creek channels; two are open water wetlands (i.e. catch-and-release pond); and seven are vegetated wetlands (i.e. forested, scrub-shrub or emergent). NWI mapping indicates that the majority of the vegetated wetlands are located along the north shore of the area of investigation along Gordon Creek's shorelines and inlets. As noted in the wetland type and water regime columns of Table 2, the majority of wetlands in the investigated area are tidally-influenced.

Despite being useful preliminary site evaluation tools, desktop delineations often significantly underestimate the total number of streams and wetlands actually present. Therefore, wetlands and stream systems within the project area were delineated in the field.

Table 2: NWI Mapping – Wetland Types and Locations for the Chickahominy Riverfront Raw Water Supply Area of Investigation

NWI Code	Wetland Type	Subclass	Water Regime	Special Modifier	General Location
R1UBV	Riverine Tidal	Unconsolidated Bottom	Permanent-Tidal	None	Chickahominy River; Gordon Creek-Main Channel
R1EM2N	Riverine Tidal-Emergent	Non-persistent	Regularly Flooded	None	Shallow, Vegetated Portions of Gordon Creek
R1USN	Riverine Tidal	Unconsolidated Shore	Regularly Flooded	None	Shallow, Un-vegetated Portions of Gordon Creek
PUBHx	Palustrine Unconsolidated Bottom	None	Permanently Flooded	Excavated	Catch-and-Release Pond
PUBV	Palustrine Unconsolidated Bottom	None	Permanent-Tidal	None	North of Gordon Island
PEM1R	Palustrine Emergent	Persistent	Seasonal-Tidal	None	Northwest Point; Gordon Creek Inlets
PEM1/FO4C	Palustrine Emergent/Palustrine Forested	Persistent/Needle-Leaved Evergreen	Seasonally Flooded	None	Small Wetland South of Area of Investigation and Event Field
PFO1/4R	Palustrine Forested	Broad-Leaved Deciduous/Needle-Leaved Evergreen	Seasonal-Tidal	None	Northwest Point; Gordon Creek Shoreline
PFO1R	Palustrine Forested	Broad-Leaved Deciduous	Seasonal-Tidal	None	Gordon Creek Shoreline
PFO1/SS1R	Palustrine Forested/Palustrine Scrub-Shrub	Broad-Leaved Deciduous	Seasonal-Tidal	None	Large Eastern Inlet – Gordon Creek
PFO4R	Palustrine Forested	Needle-Leaved Evergreen	Seasonal-Tidal	None	Gordon Creek Shoreline
PFO4/1R	Palustrine Forested	Needle-Leaved Evergreen/Broad-Leaved Deciduous	Seasonal-Tidal	None	Gordon Creek Shoreline

Weather conditions for the field delineation were as follows:

February 1: 51°F/72°F; Clear to Partly Cloudy, Rain (0.05”; after 6:00 pm)
February 2: 45°F/55°F; Mostly Cloudy
February 3: 53°F/74°F; Mostly Cloudy, Rain (0.88”; after 2:00 pm)
February 4: 41°F/63°F; Rain (0.46”; all day)
February 5: 31°F/45°F; Wintry Mix (0.50”; until 11:00 am), Partly Cloudy
February 12: 18°F/32°F; Mostly Cloudy

The field delineation determined that a narrow band of vegetated wetlands are located along the entirety of Chickahominy River and Gordon Creek shorelines. Additionally, the field delineation identified that the wetlands associated with the large Gordon Creek inlet at the eastern site boundary extend far to the south, and include one ephemeral and three intermittent stream channels. Finally, the field delineation discovered wetlands not mapped by NWI. They include an emergent/scrub-shrub wetland to the south and east of the catch-and-release pond that eventually drains to the large eastern inlet, and an isolated forested wetland east of and adjacent to the north basin of the catch-and-release pond. The locations of delineated wetlands are provided in Appendix A; representative photographs of each stream and wetland type are provided in Appendix B; and USACE wetland determination data forms are provided in Appendix C. Table 3 provides a list of the wetland field flag identification numbers and the associated sampling points referenced in the wetland determination data forms. A discussion of each wetland delineation and habitat type follows.

Table 3: Wetland Delineation and Habitat Identification

Wetland/Habitat Area	Field Designation Number	Wetland Determination Data Form Sampling Point (Appendix C)
Chickahominy River Shoreline Wetlands – Western Extent of the Area of Investigation	Flags 1-1 to 1-90	Wetland Plot 6 (WET-6) Upland Plot 6 (UP-6)
Cypress Forested Wetlands – Northwest Point	Flags 1-91 to 1-97	
Gordon Creek Shoreline Wetlands – Northern Extent of the Area of Investigation	Flags 1-98 to 1-286	Wetland Plot 5 (WET-5) Upland Plot 5 (UP-5)
Gordon Creek – Large Eastern Inlet Wetlands – Eastern Extent of the Area of Investigation	Flags 1-287 to 1-455 Intermittent Stream 1 (Flags 1-320 to 1-349); Intermittent stream 2 (Flags 1-387 to 1-424); Intermittent stream 3 (Flags 1-435 to 1-446); Ephemeral stream (Flags ES 1-1 to ES 1-6)	Wetland Plot 3 (WET-3) Upland Plot 3 (UP-3); Wetland Plot 4 (WET-4) Upland Plot 4 (UP-4)
Southern Emergent/Scrub-shrub Wetland and Drainage Ditch	Excavated drainage ditch (Flags 2-1 to 2-20); Emergent and scrub-shrub wetland (Flags 5-1 to 5-15)	Wetland Plot 2 (WET-2) Upland Plot 2 (UP-2)
Catch-and-Release Pond	Flags 3-1 to 3-46	
Isolated Forested Wetland East of the Catch-and-Release Pond	Flags 4-1 to 4-15	Wetland Plot 1 (WET-1) Upland Plot 1 (UP-1)

<u>Chickahominy River Shoreline Wetlands – Western Extent of the Area of Investigation</u>

The eastern Chickahominy River shoreline makes up the western extent of the area of investigation. The wetlands along the Chickahominy River shoreline (Flags 1-1 to 1-90) are tidal riverine and freshwater forested wetlands. In general, wetland areas extend from the water's edge

approximately 5 to 25 feet inland. The inland limit of wetland areas is often at the toe of slope or slightly higher up the 15- to 20-foot river bank. At low tide, an additional 10 to 20 feet of sand/gravel beach is exposed; however, no submerged aquatic vegetation (SAV) or emergent vegetation was observed. It should be noted, however, that SAV may be present during the growing season.

Wetland areas consist largely of bald cypress red maple (*Acer rubrum*), and loblolly pine in the canopy, with sweetbay magnolia (*Magnolia virginiana*), winterberry (*Ilex verticillata*), wax myrtle (*Morella cerifera*), American holly, and black gum (*Nyssa sylvatica*) also common in the understory. In some depressions, soft rush (*Juncus effusus*) and river cane (*Arundinaria gigantea*) were observed; otherwise, the herbaceous layer was very sparse or absent.

The inlet located approximately 425 feet north of the park fishing pier that stretches eastward from the shoreline harbors additional wetland species sheltered from wave action and established along the inlet's gentler slopes. The canopy consists largely of bald cypress, sweetbay magnolia and green ash, with silky dogwood (*Cornus amomum*), privet (*Ligustrum sinense*), American holly, and multiflora rose (*Rosa multiflora*) also present in the understory. Herbaceous species include rose-mallow (*Hibiscus moscheutos*) and vines include muscadine (*Vitis rotundifolia*).

The topography along the Chickahominy River shoreline often provides a stark visual demarcation between wetland and upland areas. Upland areas commonly contain black cherry (*Prunus serotina*), loblolly pine, shortleaf pine, white oak, southern red oak, and northern red oak (*Quercus rubra*) in the canopy, with American holly, devil's walkingstick (*Aralia spinosa*), wax myrtle, eastern red cedar (*Juniperus virginiana*), and persimmon (*Diospyros virginiana*) also present in the understory. Blue Ridge blueberry (*Vaccinium pallidum*), broomsedge (*Andropogon virginicus*), and turf grasses are commonly found in the herbaceous stratum. Greenbrier (*Smilax* sp.) and poison ivy (*Toxicodendron radicans*) were often found right along the wetland-upland interface.

USACE wetland determination plot data forms for Wetland Plot 6 and Upland Plot 6, provided in Appendix C, contain additional detailed information on wetlands found along the Chickahominy River shoreline.

<u>Cypress Forested Wetlands – Northwest Point</u>

While the majority of the Chickahominy River and Gordon Creek shorelines possess forested wetlands dominated by bald cypress, the northwest point of the area of investigation is unique in that the canopy is entirely composed of the species, with little to no understory and an herbaceous stratum dominated by sedges (*Carex* sp.) (Flags 1-91 to 1-97). The northwest point has an 80 percent canopy cover closer to the shoreline, and thins out to approximately 50 percent cover moving farther out into the stream channel. These areas with a thinner canopy support increasing numbers of emergent plants, which had died back or did not possess identifiable characteristics

(e.g. flowers) at the time of delineation. These cypress forested wetlands are supported by the unique hydrology; tides completely inundate the point to a depth of 1 to 4 feet (based off of water marks at low tide), which prevents the establishment of less-tolerant trees and shrubs. Photographs 16-18 in Appendix B accurately depict the cypress forested wetlands along the northwest point.

Gordon Creek Shoreline Wetlands – Northern Extent of the Area of Investigation

The wetlands along the Gordon Creek shoreline (Flags 1-98 to 1-286) are extremely similar to those wetlands found along the Chickahominy River shoreline. The Gordon Creek shoreline wetlands are tidal riverine and freshwater forested wetlands, with a few tidal emergent wetland areas at the mouths of the larger inlets. In areas with steep (i.e. 15- to 20-foot) banks, located from the northwest point to approximately 1,000 feet east of the boat ramp, wetland areas extend from the water's edge approximately 5 to15 feet inland. The inland limit of wetland areas is often at the toe of slope or slightly higher up the 15- to 20-foot river bank. At low tide, an additional 10 to 20 feet of sand/gravel beach is exposed. In a few areas, submerged and/or emergent vegetation was made visible or exposed by the retreating tides, and could be more prevalent during the growing season. Wetland areas consist largely of bald cypress, green ash, and loblolly pine in the canopy, with red maple, American elm (*Ulmus americana*), privet, winterberry, wax myrtle, American holly, and black gum also common in the understory. In some depressions, soft rush and sedges (*Carex* spp.) were observed; otherwise, the herbaceous layer was very sparse or absent.

In addition to the narrow band of forested wetlands along the Gordon Creek shoreline, the northern extent of the area of investigation includes two large inlets that extend southward from Gordon Creek on either side of a raised berm and mound. Much like the inlet along the Chickahominy River shoreline, these Gordon Creek inlets harbor additional wetland species sheltered from wave action and established along the inlet's gentler slopes. The canopy consists largely of bald cypress, red maple, swamp/water tupelo (*Nyssa biflora* and/or *aquatica*), sweetgum, and overcup oak (*Quercus lyrata*), with dogwoods, privet, American holly, and red mulberry (*Morus rubra*) also present in the understory. Herbaceous species include various sedges (*Carex* sp.), sensitive fern (*Onoclea sensibillis*), pennywort (*Hydrocotyle* spp.), river-bank wild rye (*Elymus riparius*), and panicgrasses (*Panicum* spp.).

The topography along the Gordon Creek shoreline and between inlets and adjacent campground areas often provides a stark visual demarcation between wetland and upland areas. Upland areas commonly contain loblolly pine, shortleaf pine, American holly, white oak, southern red oak, and northern red oak in the canopy, with highbush blueberry (*Vaccinium corymbosum*) and wax myrtle also present in the understory. Tree seedlings, Blue Ridge blueberry, broomsedge, and turf grasses are commonly found in a very sparse herbaceous stratum. Greenbrier and poison ivy were often found right along the wetland-upland interface.

On either side of the two inlets along the Gordon Creek shoreline is an elevated mound connected

to campground features to the south by a narrow, constructed berm or access road. This elevated mound is only slightly higher than the forested wetlands surrounding it; however, it lacked hydrology and hydric soils, and there was a noticeable change in the plant community. The plant community on the mound was dominated by FAC species such as loblolly pine and American holly, whereas, the surrounding wetland had obligate and FAC-Wetland species such as bald cypress, tupelo, sensitive fern, and pennywort. A 2008 wetland delineation suggests there is also a small upland island to the west of the elevated mound, but deep water made it unsafe to access this area.

USACE wetland determination plot data forms for Wetland Plot 5 and Upland Plot 5, provided in Appendix C, contain additional detailed information on wetlands found along the Gordon Creek shoreline.

Gordon Creek – Large Eastern Inlet Wetlands – Eastern Extent of the Area of Investigation

In the northeast corner of the area of investigation is a very large inlet that extends south from Gordon Creek to the Colonial Pipeline easement. The wetlands along this large eastern inlet (Flags 1-287 to 1-455) are extremely similar to those wetlands found along the Chickahominy River and smaller Gordon Creek inlets. Near its mouth, the large eastern inlet wetlands are tidal riverine and freshwater forested wetlands, with a few tidal emergent wetland areas near the center of the inlet channel. Banks along the inlet can be steep (i.e. up to 20 feet), but in general are much shorter and more gently-sloped than the banks along the main channels of the Chickahominy River and Gordon Creek.

In wetland areas of the main inlet, the canopy consists largely of bald cypress, red maple, swamp/water tupelo, American elm, black gum, and sweetgum, with dogwoods, privet, winterberry, wax myrtle, American holly, highbush blueberry, and red mulberry also present in the understory. Herbaceous species include various sedges (*Carex* sp.), sensitive fern, royal fern (*Osmunda regalis*), lizard's tail (*Saururus cernuus*), iris (*Iris* sp.), Jesuit's bark (*Iva fruitescens*), and panicgrasses.

The topography along the inlet and adjacent upland park areas often provides a stark visual demarcation between wetland and upland areas. Upland areas commonly contain loblolly pine, shortleaf pine, sweetgum, American holly, white oak, southern red oak, post oak (*Quercus stellata*) and northern red oak in the canopy, with American beech (*Fagus grandifolia*), winged elm (*Ulmus alata*), eastern red cedar, devil's walkingstick, highbush blueberry (*Vaccinium corymbosum*) and wax myrtle also present in the understory. Pine and holly seedlings, Blue Ridge blueberry, Japanese honeysuckle (*Lonicera japonica*), broomsedge, cranefly orchid (*Tipularia discolor*), and turf grasses are commonly found in a very sparse herbaceous stratum. Greenbrier and poison ivy were often found right along the wetland-upland interface.

Intermittent and Ephemeral Stream Channels

The large eastern inlet is fed by one ephemeral and three intermittent stream channels. Stream classification was determined visually using the North Carolina Division of Water Quality *Identification Methods for Origin of Intermittent and Perennial Streams, Version 4.11*. All four stream channels lack a defined channel, bed/bank, or floodplain, except for in extreme lower reaches of the intermittent channels and at their confluences with the large eastern inlet.

Intermittent stream 1 (Flags 1-320 to 1-349) begins as an excavated ditch near the Chickahominy Riverfront Park swimming pool and flows largely west-to-east, past the south bank of the catch-and-release pond, before entering the large eastern inlet from the west. It is only after intermittent stream 1 crosses a dirt road east of the catch-and-release pond, does it begin to take on natural stream characteristics (e.g. sinuosity). Intermittent stream 1 goes underground approximately 50 feet (Flags 1-321 to 1-327; 1-344 to 1-348), only to resurface immediately upstream of its confluence with the large eastern inlet. Along its length, the stream itself is the central component of a narrow band of forested wetland. The stream channel, while not well defined, is 12 to 24 inches wide and is covered in leaf litter, suggesting low-volume flows. Intermittent stream 1 can be seen in photographs 51 to 53 in Appendix B.

Intermittent stream 2 (Flags 1-387 to 1-424) flows largely southeast-to-northwest before entering the large eastern inlet from the southeast. The headwaters of intermittent stream 2 are a wide forested wetland that appears to be a concave depression in the landscape. Water slowly flows overland before accumulating in the undefined 12- to 18-inch wide channel of intermittent stream 2. While intermittent stream 1 is low-gradient, intermittent stream 2 is more of a higher-gradient stream as it drops in elevation to the eastern inlet below. Along its length, the stream itself is the central component of a narrow band of forested wetland. This wetland and the adjacent upland are documented in detail by the determination plots, Wetland 4 and Upland 4 (Appendix C). The stream channel, while not well defined, is covered in leaf litter, suggesting low-volume flows. Intermittent stream 2 can be seen in photographs 58-62 in Appendix B.

Intermittent stream 3 (Flags 1-435 to 1-446) flows largely east-to-west before entering the large eastern inlet from the east. Intermittent stream 3 is very similar to intermittent stream 2 in channel width, flow, and gradient. However, intermittent stream 3, roughly 150 feet in length, is only half as long as intermittent stream 2, and possesses a shallower channel (i.e. conveys less volume). Intermittent stream 3 can be seen in photographs 63 to 65 in Appendix B.

The ephemeral stream (Flags ES 1-1 to ES 1-6) flows largely south-to-north from its origins at the Colonial Pipeline easement until its confluence with the southern extent of the large eastern inlet (e.g. Flags 1-368 to Flags 1-371). Due to extremely heavy rain at the time of the delineation, portions of the ephemeral channel were flowing with water. However, the ephemeral stream lacked any semblance of a defined channel, and is better described as concentrated overland flow. Water

would flow down-gradient, but would pond and spread out in some areas and disappear underground in others. When water did go underground, it actively flowed downstream approximately 8 inches below the surface. In contrast to the intermittent channels, the soils in the ephemeral channel were not hydric, and wetlands were not found in its vicinity. The ephemeral stream channel can be seen in photographs 55 to 57 in Appendix B.

Southern Emergent/Scrub-shrub Wetland and Drainage Ditch

Beginning near the Chickahominy Riverfront Park swimming pool and flowing largely west-to-east, the excavated drainage ditch (Flags 2-1 to 2-20) continues past the south bank of the catch-and-release pond before taking on natural stream characteristics and becoming intermittent stream 1. The drainage ditch has a well-defined channel, bed and banks, but is largely disconnected from its floodplain on the north side by an elevated berm. Channel depths range from 0.5 to 3.0 feet and channel widths average 3.0 to 5.0 feet. At the time of delineation, the drainage ditch had overtopped its south bank. Even during the observed flood event, flow was largely stagnant, and water moved very slowly downstream.

The drainage ditch forms the northern boundary of an emergent and scrub-shrub wetland (Flags 5-1 to 5-15). This wetland is also bounded to the south by the Colonial Pipeline easement – the southern limit of the area of investigation. The emergent wetland is largely restricted to those areas directly alongside the drainage ditch. This narrow band of vegetation consists largely of cattail, soft rush, woolgrass (*Scirpus cyperinus*), and other herbaceous wetland plants. That vast majority of this wetland area is classified as a scrub-shrub wetland consisting largely of sweetgum and red maple saplings, with loblolly pine and American holly seedlings also present. Herbaceous species include soft rush, wild garlic (*Allium vineale*), blackberry, hairy buttercup (*Ranunculus sardous*), Japanese honeysuckle, royal fern, and an unknown grass. Greenbrier was often found along the wetland-upland interface.

There is no identifiable topographic break between these wetland and upland areas; therefore, the three wetland indicators, and particularly hydric soils, were deterministic factors. Upland areas commonly contain eastern red cedar and loblolly pine in the canopy, with winged elm, sweetgum and American plum (*Prunus americana*) also present in the understory. Timothy (*Phleum pratense*), dog fennel (*Eupatorium capillifolium*), Japanese honeysuckle, broomsedge, and blackberry are commonly found in a dense herbaceous stratum.

Catch-and-Release Pond

The catch-and-release pond (Flags 3-1 to 3-46) is a man-made pond constructed and maintained for recreational fishing. The majority of the 1.6-acre pond is an open water system with an unconsolidated bottom. Surrounding the pond on all sides are elevated berms with dirt roads/trails for easy site access. Between the water's edge and the elevated berms is a narrow (i.e. 5 to 20 feet)

vegetated wetland fringe. For the most part, this wetland fringe is a mixed forested wetland dominated by red maples, willows, loblolly pines, and dogwoods. The trees along the north and west banks are generally smaller than those along the south and east banks. The pond also contains two upland peninsulas; one extends into the center of the pond from the west bank and the other from the east bank. These upland peninsulas are largely un-vegetated (except for the wetland fringe) and provide access paths for anglers.

While uncommon, portions of the pond shoreline possess partially-submerged emergent vegetation. In the northwest corner of the pond, the wetland fringe contains clumps of soft rush, and in the northeast corner, the wetland fringe contains cattails (*Typha* sp.). Since the wetland delineation was conducted in the winter, it is possible the wetland fringe around the pond contains more emergent and/or submerged vegetation during the growing season.

Isolated Forested Wetland East of the Catch-and-Release Pond

The isolated forested wetland east of the north basin of the catch-and-release pond was flagged as Wetland Line 4 (Flags 4-1 to 4-15). It is a small, depression within the landscape. The majority of the wetland is perched on clay, but the soils on the west-northwest side bordering the wetland are sandy, and it appears to slowly drain in that direction into a transmissive lower layer. Dominant canopy tree species include sweetgum and black willow (*Salix nigra*). Sweetgum is also dominant in the sapling/shrub stratum. Dominant herbaceous species are blackberry (*Rubus* spp.), greenbrier (*Smilax* spp.), and unknown grasses. The wetland is likely partly shaded during the growing season. It is bordered by loblolly pine and eastern red cedar on most sides, except the west-northwest side, where it is bordered by an access road and oldfield species (e.g., grasses, blackberry, and dog fennel).

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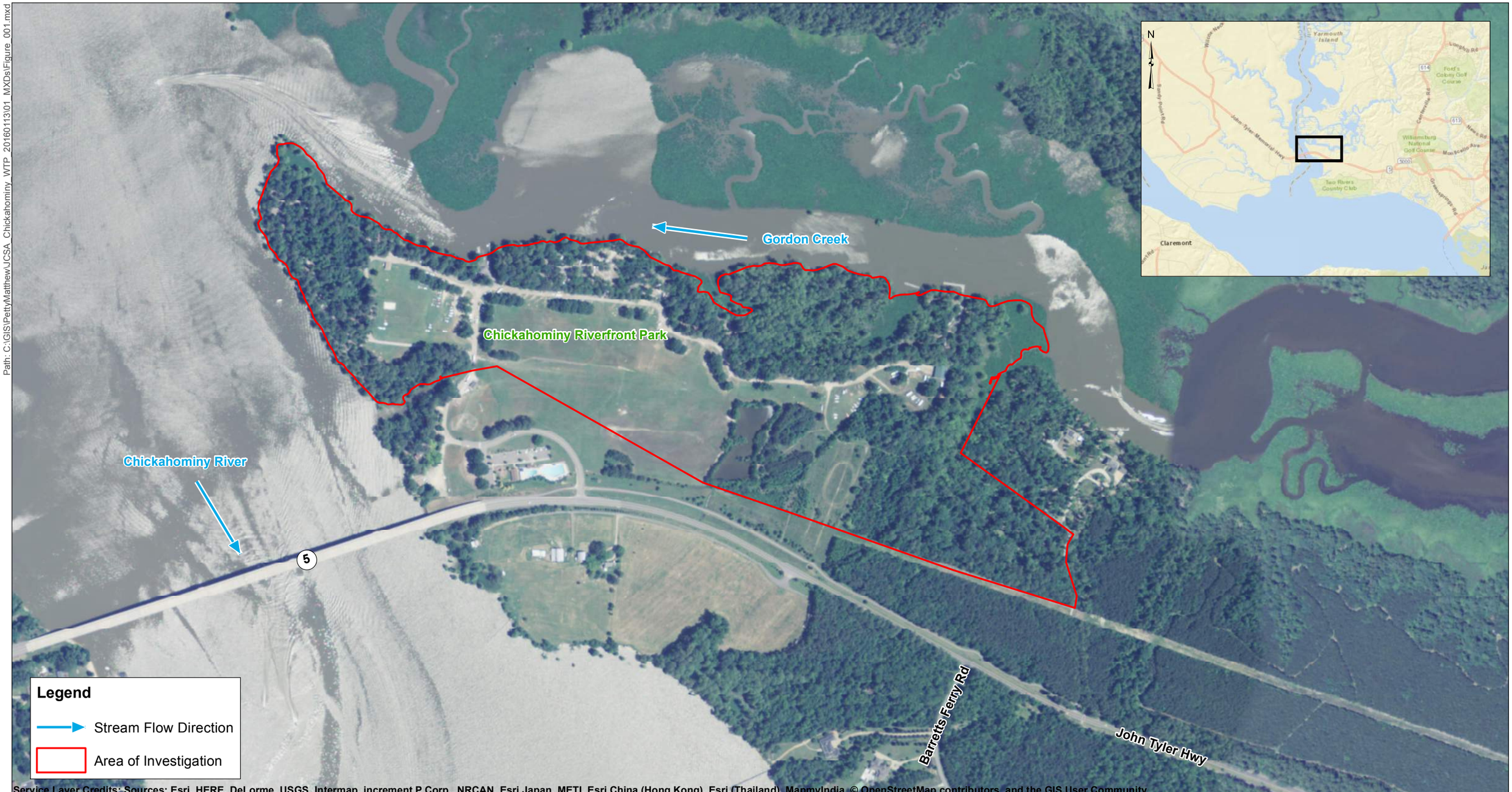

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1 inch = 500 feet

Submitted on: 2/19/2016

CDM Smith

N

0 500 1,000 2,000 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 1
Area of Investigation
James City County, VA

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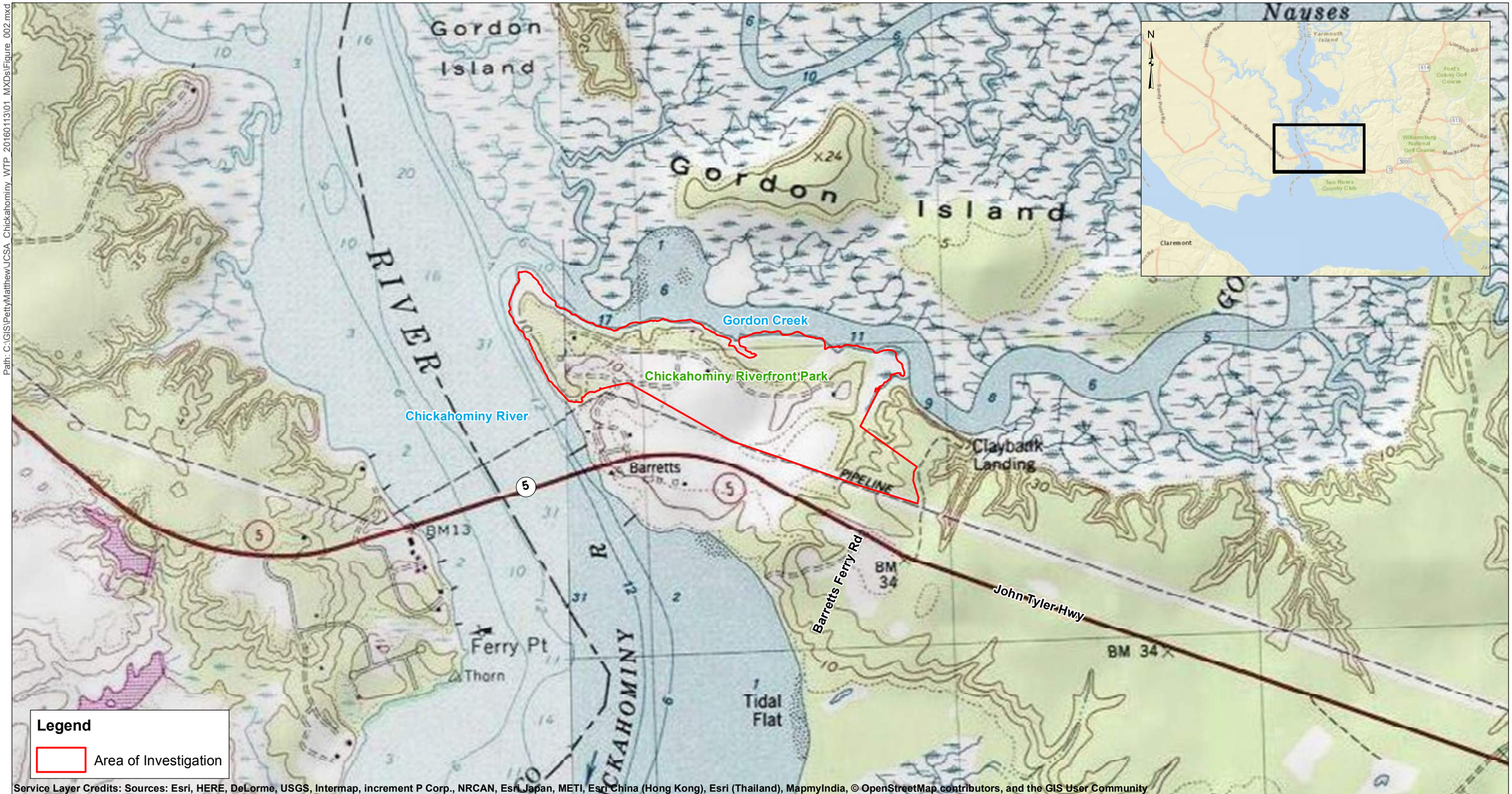

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1 inch = 1,000 feet

Submitted on: 2/19/2016

0 1,000 2,000 4,000 Feet

CDM Smith

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James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 2
USGS Topographic Map
James City County, VA

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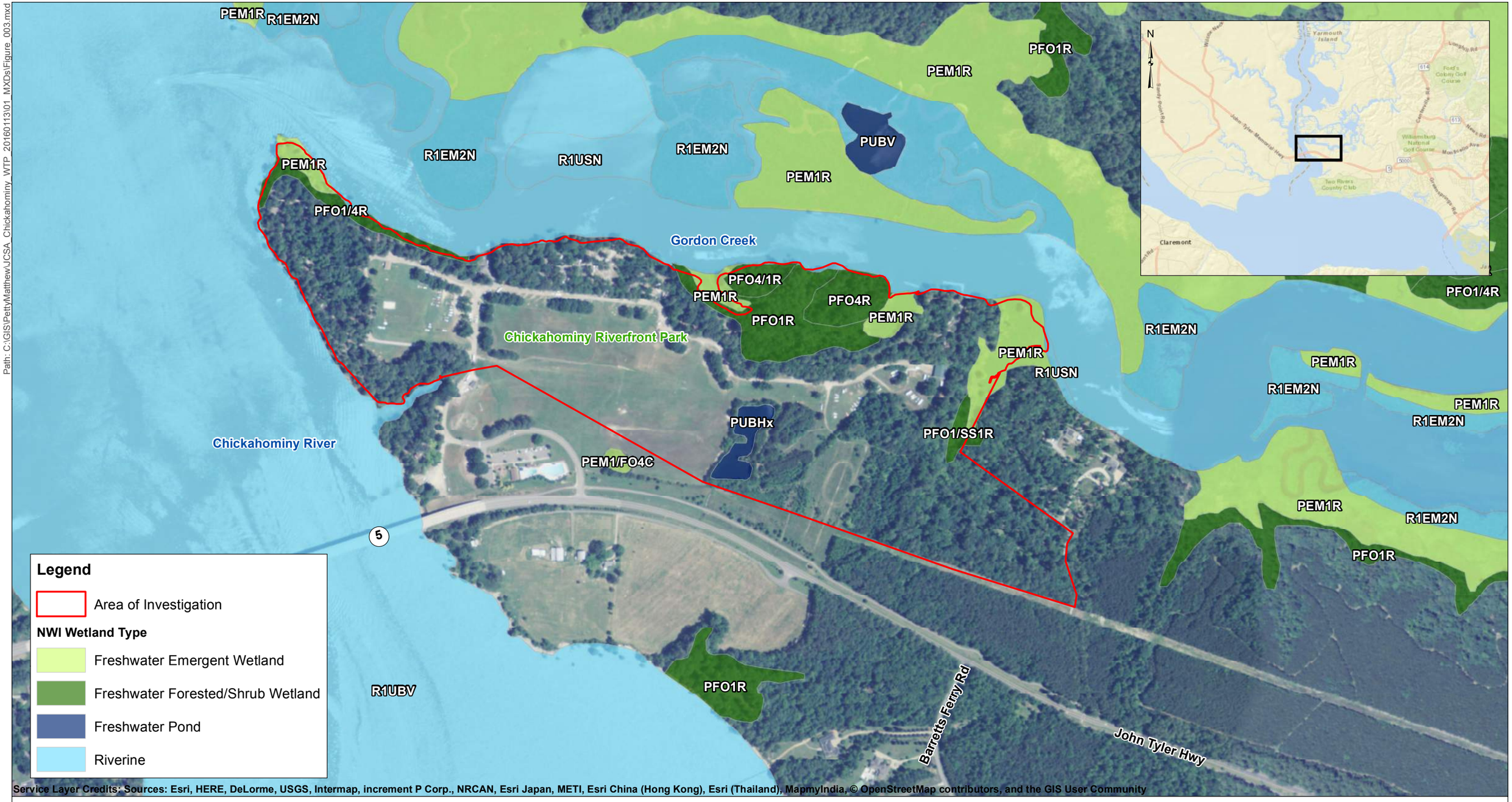

1 inch = 500 feet

Submitted on: 2/19/2016

CDM Smith

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James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 3
USFWS National Wetlands Inventory
James City County, VA

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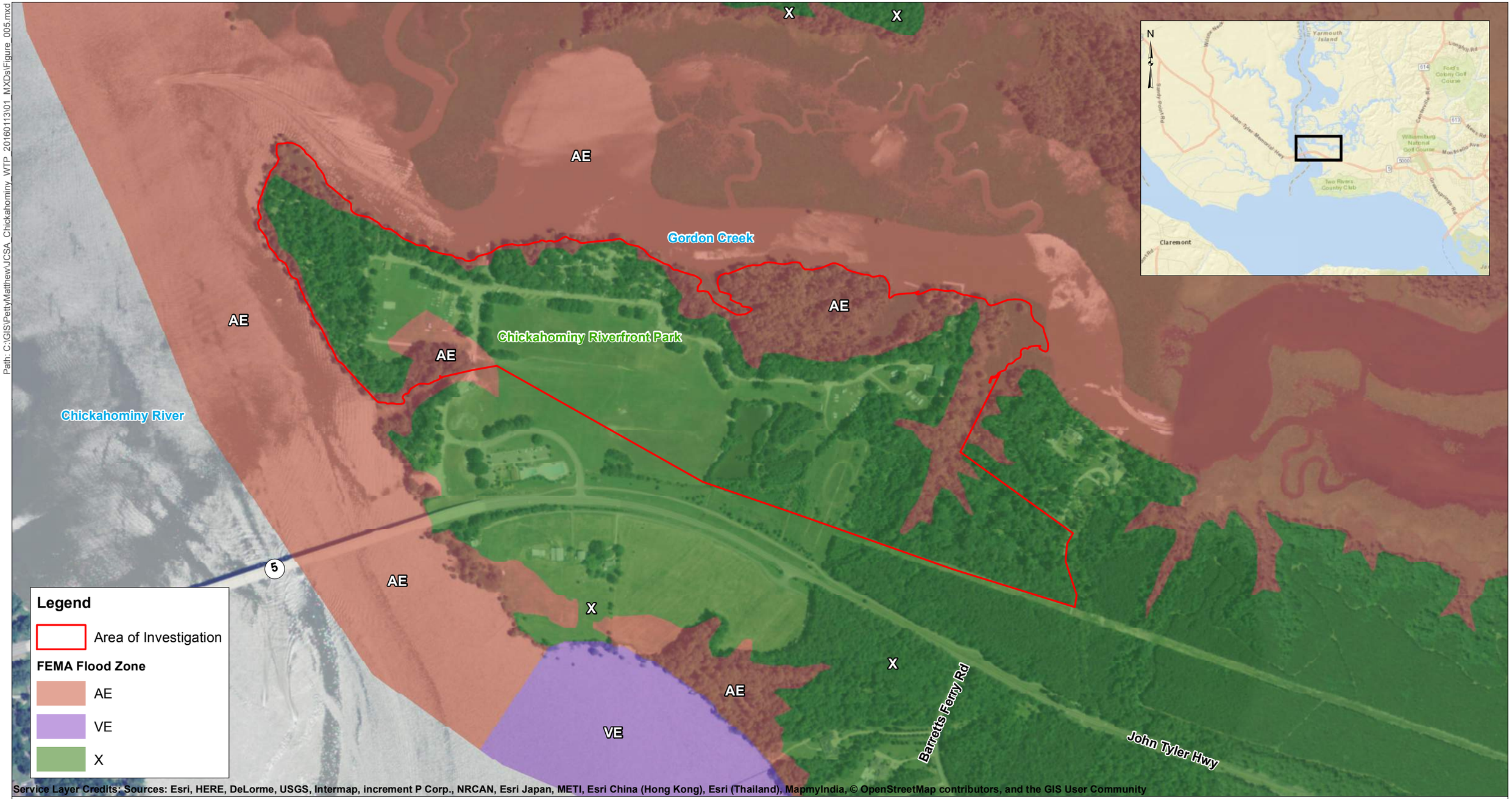

1 inch = 500 feet

Submitted on: 2/19/2016

CDM Smith

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James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 4
FEMA Flood Zones
James City County, VA

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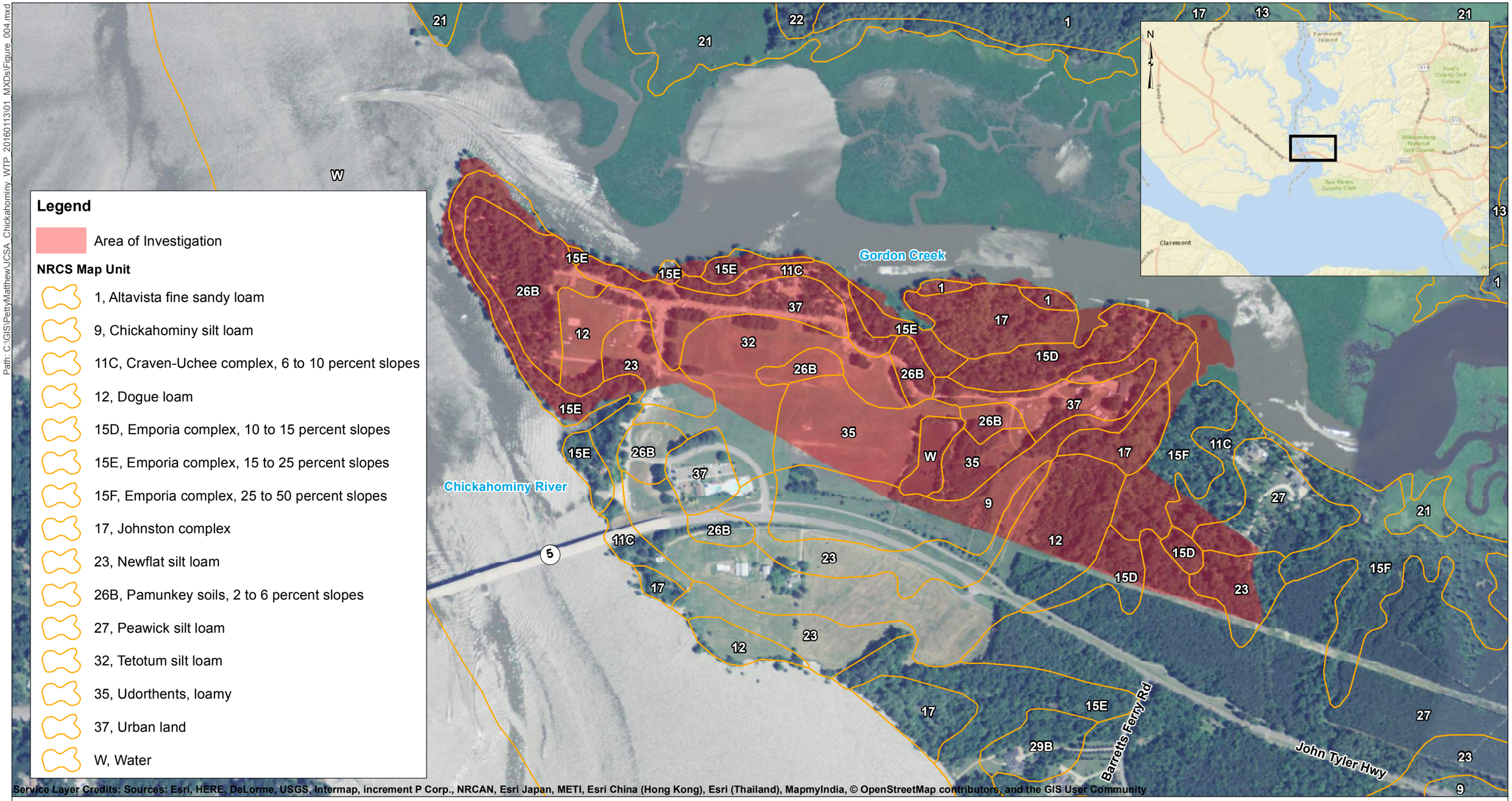

1 inch = 500 feet

Submitted on: 2/19/2016

CDM Smith

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James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 5
NRCS Soil Survey
James City County, VA

Appendix A
Wetland Exhibits

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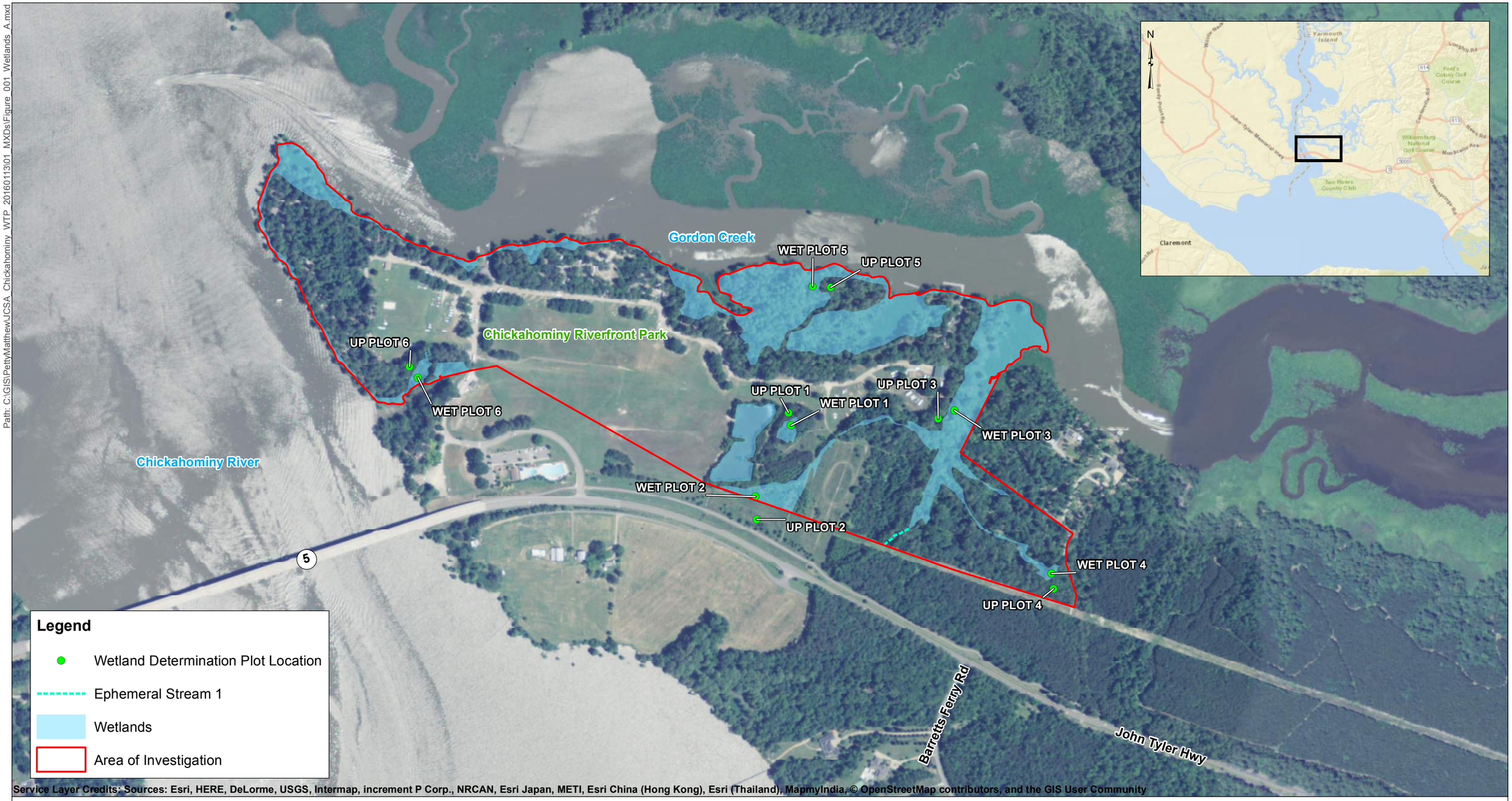

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1 inch = 500 feet

Submitted on: 2/19/2016

CDM Smith

N

0 500 1,000 2,000 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 1
Wetland Locations Overview
James City County, VA

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1 inch = 150 feet

Submitted on: 2/19/2016

CDM Smith

N

0 150 300 600 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 2
Wetland Locations - Northwest
James City County, VA

Path: C:\GIS\PettyMatthew\JCSA_Chickahominy_WTP_20160113\01_MXDs\Figure_003_Wetlands_C.mxd

1 inch = 150 feet

Submitted on: 2/19/2016

CDM Smith

N

0 150 300 600 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 3
Wetland Locations - Southwest
James City County, VA

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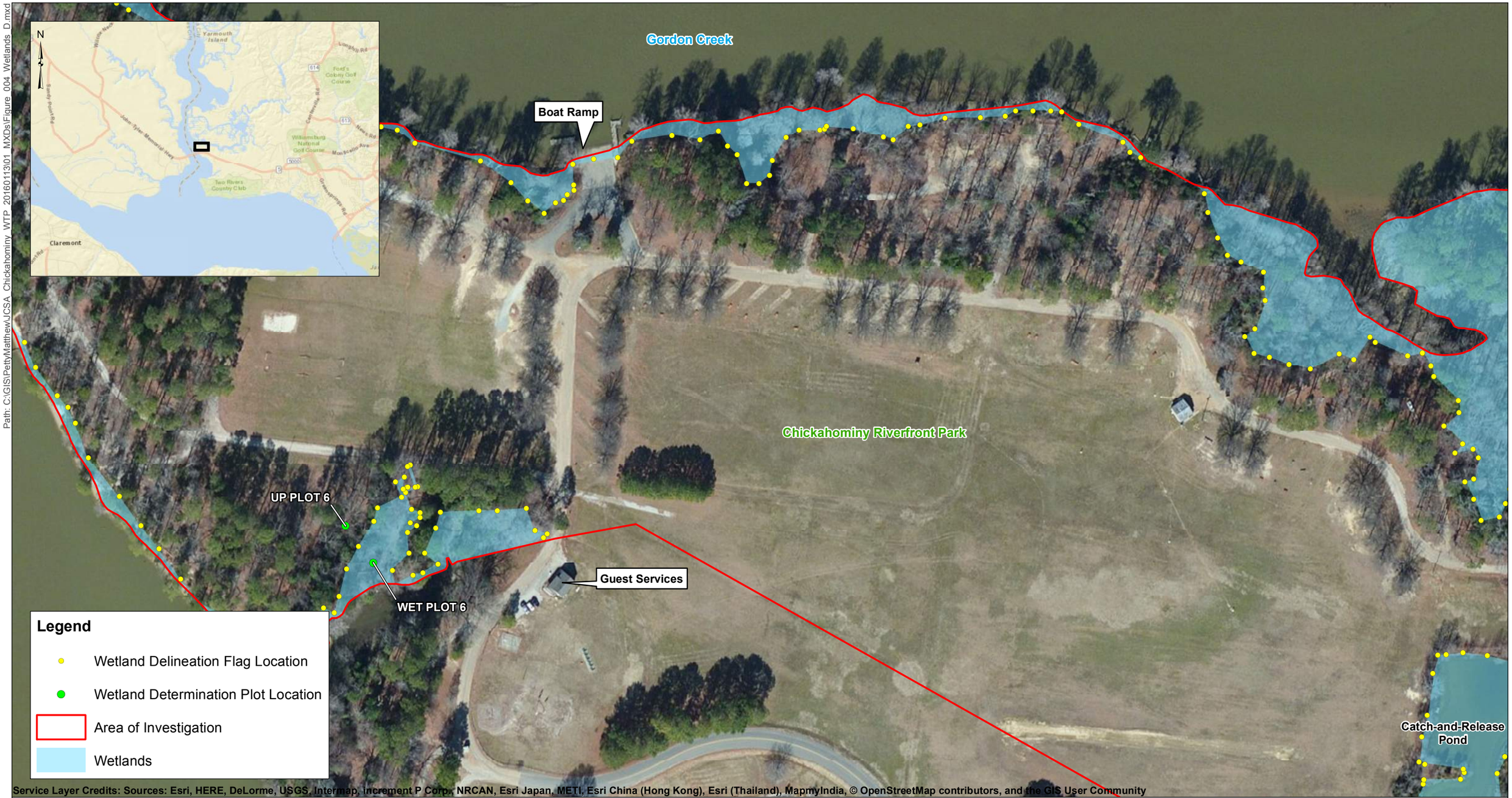

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1 inch = 150 feet

Submitted on: 2/19/2016

CDM Smith

N

0 150 300 600 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 4
Wetland Locations - Central
James City County, VA

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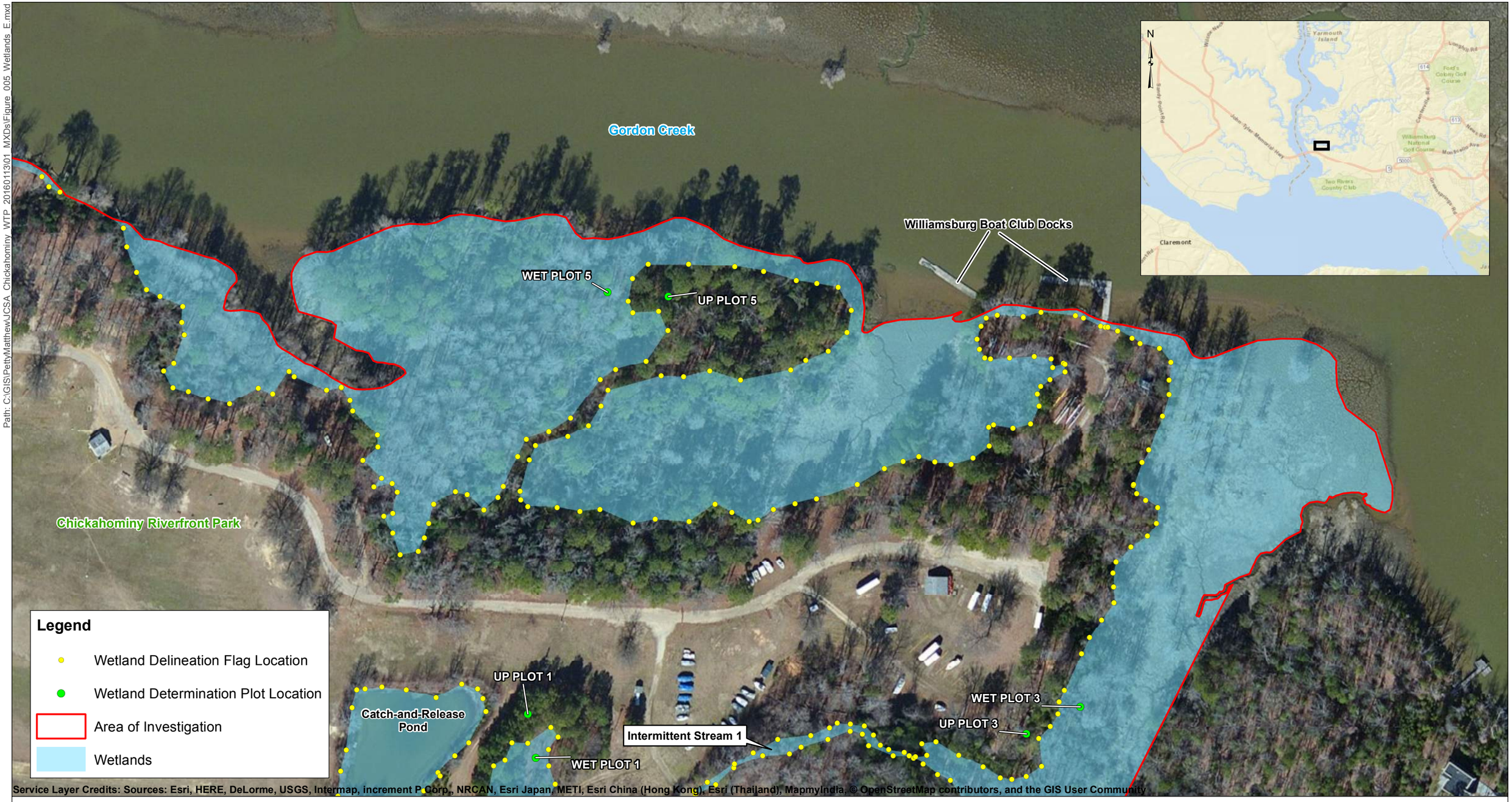


1 inch = 150 feet

Submitted on: 2/19/2016

CDM Smith

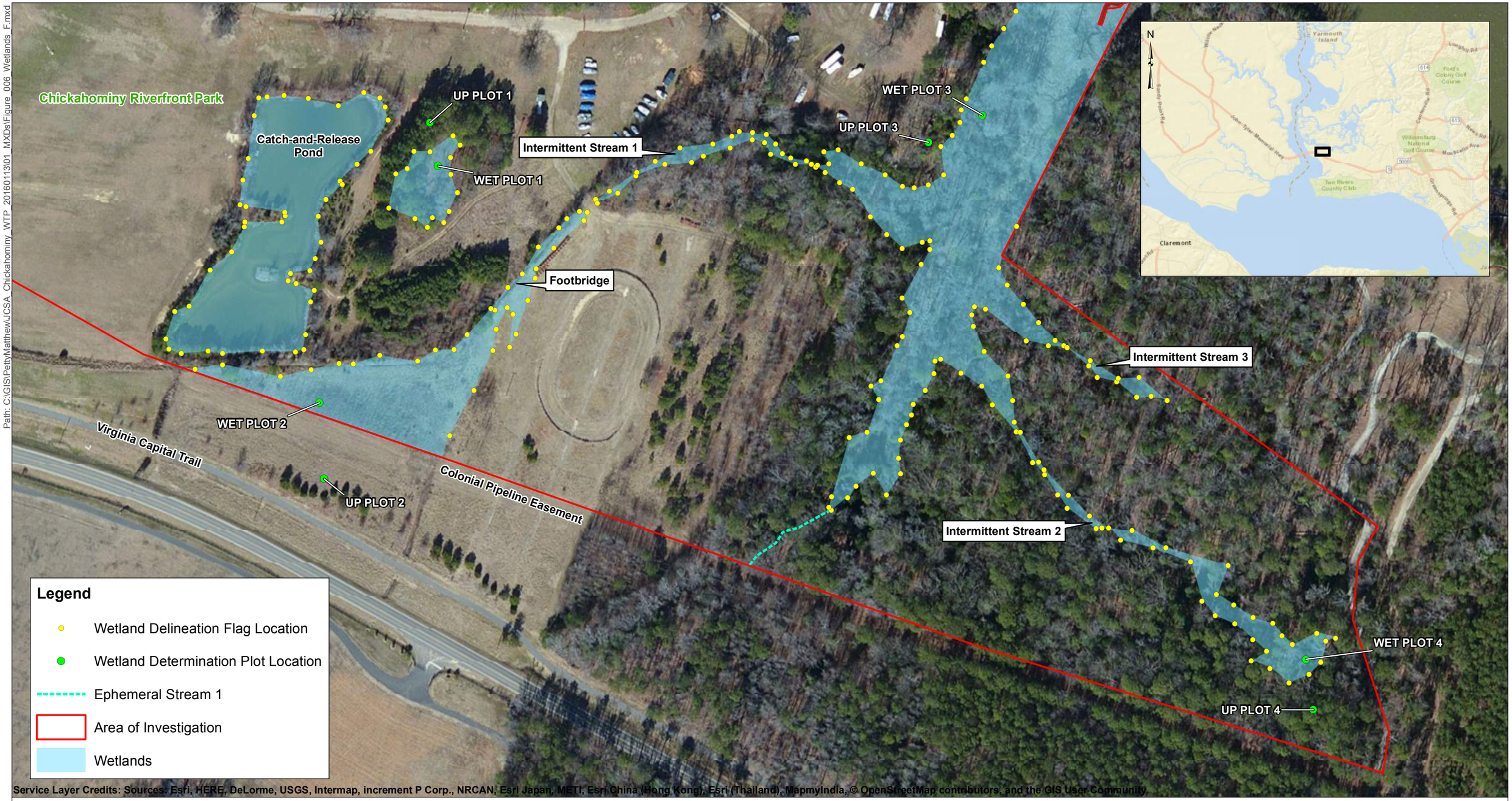
N

0 150 300 600 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 5
Wetland Locations - Northeast
James City County, VA

Path: C:\GIS\PettyMatthew\JCSA_Chickahominy_WTP_20160113\01_MXDs\Figure_006_Wetlands_F.mxd



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1 inch = 150 feet

Submitted on: 2/19/2016

CDM Smith

N

0 150 300 600 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Figure 6
Wetland Locations - Southeast
James City County, VA

Appendix B
Site Photographs

Appendix B

Chickahominy Riverfront Raw Water Supply Wetland Delineation Site Photographs

Chickahominy River Shoreline Wetlands – Western Extent of the Project Area

Photo 1: East bank of the Chickahominy River – View looking north from the park fishing pier

Photo 2: East bank of the Chickahominy River – View looking south from the park fishing pier

Photo 3: Forested east bank of the Chickahominy River north of the park fishing pier

Photo 4: Tidal inlet in the southeast corner of the project area near Guest Services – View from the mouth of the inlet looking east

Photo 5: View from the south bank of the southeastern tidal inlet looking north

Photo 6: Forested wetland at the upstream extent of the southeastern tidal inlet

Photo 7: View of the southeastern tidal inlet at low tide from the north bank looking east

Photo 8: The mouth of the southeastern tidal inlet – View from the north bank looking west

Photo 9: Typical Chickahominy River eastern shoreline with 15-foot tall banks and 10-foot wide sand/gravel beach – View from the water's edge looking east

Photo 10: Chickahominy River east shoreline to the north of the southeastern tidal inlet – View is looking to the south at the inlet

Photo 11: Chickahominy River east shoreline looking north

Photo 12: View of severe erosion (i.e. bank failure) along the Chickahominy River east bank

Photo 13: View of the Chickahominy River east bank at the northwest point – View is to the north looking at the confluence with Gordon Creek

Photo 14: View of the Chickahominy River east bank at the northwest point – View is to the west and shows bank heights of up to 20 feet

Photo 15: An example of severe erosion along the east bank of the Chickahominy River at the northwest point

Gordon Creek Shoreline Wetlands – Northern Extent of the Project Area

Photo 16: Cypress forested wetland at confluence of Gordon Creek and the Chickahominy River

Photo 17: View from the cypress wetland at the northwest point down the south bank of Gordon Creek

Photo 18: View from the top of bank north across Gordon Creek

Photo 19: Steep banks roughly 500 feet west of the boat ramp – View looking to the east

Photo 20: View from the boat ramp north towards Gordon Island

Photo 21: View from the boat ramp west towards the confluence of Gordon Creek and the Chickahominy River

Photo 22: View from the east side of the boat ramp towards the west (south bank of Gordon Creek)

Photo 23: View looking west from the top of the steep south bank of Gordon Creek to the east of the boat ramp

Photo 24: View looking north at emergent vegetation in the Gordon Creek channel

Photo 25: View looking east at a small cypress grove located approximately 400 feet east of the boat ramp

Photo 26: View looking west from a small cypress grove located approximately 400 feet east of the boat ramp

Photo 27: View of submerged vegetation in the tidal shallows approximately 500 feet east of the boat ramp

Photo 28: Typical Gordon Creek south shoreline to the west of the north Chickahominy Riverfront Park fishing pier

Photo 29: Typical Gordon Creek south bank along the Chickahominy Riverfront Park north shoreline

Photo 30: View looking west at a typical Gordon Creek south bank at low tide along the Chickahominy Riverfront Park north shoreline

Photo 31: Example of submerged aquatic vegetation that is exposed at low tide – Chickahominy Riverfront Park north shoreline

Photo 32: View looking north at the forested wetland to the west of the upland mound – Gordon Creek visible in the background

Photo 33: View looking southwest at the forested wetland to the west of the upland mound along the north shore of Chickahominy Riverfront Park

Photo 34: View from the wetland line looking east at the upland mound along the north shore of Chickahominy Riverfront Park

Photo 35: View from the wetland line at the upland mound looking north at Gordon Creek

Photo 36: View from the wetland line at the upland mound looking south

Photo 37: View from the upland mound looking east back towards the elevated berm

Photo 38: View from the northern terminus of the elevated berm looking west at forested wetlands along the Gordon Creek south shore

Photo 39: View from the wetland line along the elevated berm looking at forested wetlands to the east

Photo 40: View from the wetland line along the elevated berm looking at forested wetlands to the northeast

Photo 41: View from the elevated upland berm looking north towards Gordon Creek

Photo 42: View looking north at forested wetlands in the small inlet to the southwest of the Williamsburg Boat Club docks

Photo 43: View from the Williamsburg Boat Club docks looking south at the tidal emergent and palustrine forested wetlands in the nearby inlet

Photo 44: View from the Williamsburg Boat Club docks looking west at the mouth of the inlet and Gordon Creek

Photo 45: View from the Williamsburg Boat Club docks looking southeast at the elevated boat storage area and shoreline wetlands

Photo 46: View from the Williamsburg Boat Club docks looking east at the Gordon Creek south shoreline along Chickahominy Riverfront Park north bank

Eastern Boundary of Chickahominy Riverfront Park (Large Inlet – South Bank of Gordon Creek)

Photo 47: View looking north of the forested wetland at the mouth/west bank of the large eastern inlet

Photo 48: View looking east at the large eastern inlet – from the wetland line east of the large William and Mary Rowing Club shed

Photo 49: View looking east at the forested wetland along the west shore of the large eastern inlet

Photo 50: Typical downstream west bank of the large eastern inlet

Photo 51: View looking to the east of the large eastern inlet near the mouth of intermittent stream 1 (during a day-long, heavy downpour)

Photo 52: The point at which intermittent stream 1 goes underground for approximately 50 feet before draining into the large eastern inlet

Photo 53: Intermittent stream 1 – downstream of the dirt road crossing and culvert

Photo 54: View looking north at the upstream extent of the large eastern inlet defined channel

Photo 55: Headwaters of ephemeral stream 1 at the Colonial Pipeline easement

Photo 56: Ephemeral, overland flow associated with ephemeral stream 1 – View looking downstream from Flag ES-3

Photo 57: Downstream extent of ephemeral stream 1 before any semblance of a defined channel fades away and water flows over land into wetlands associated with the large eastern inlet

Photo 58: Eastern inlet downstream of where intermittent stream 2 enters – View looking downstream to the northwest

Photo 59: Mouth of intermittent stream 2 at the confluence with the large eastern inlet – View is looking downstream to the northwest

Photo 60: Intermittent stream 2, approximately 100 feet upstream of its confluence with the large eastern inlet

Photo 61: Intermittent stream 2, approximately 250 feet upstream of its confluence with the large eastern inlet

Photo 62: Forested wetland headwaters of intermittent stream 2

Photo 63: View approximately 50 feet upstream of the confluence of intermittent stream 3 with the large eastern inlet

Photo 64: Intermittent stream 3 approximately 100 feet upstream of its confluence with the large eastern inlet

Photo 65: The upstream extent of intermittent stream 3, looking downstream to the west

Photo 66: View from the east bank of the large eastern inlet downstream of intermittent stream 3, looking west.

Photo 67: View looking northeast at the end of wetland flag line 1 along the east bank of the large eastern inlet at the Chickahominy Riverfront Park property boundary

Isolated Forested Wetland Located East of the Catch-and-Release Pond

Photo 68: View from the center of the isolated forested wetland looking south

Photo 69: View from the western edge of the isolated forested wetland looking east

Catch-and-Release Pond

Photo 70: View looking west at the narrow forested buffer along the north bank of the pond

Photo 71: View looking south from the north bank of the pond

Photo 72: View looking north from the west bank at the northwest corner of the pond

Photo 73: View looking south from the west bank of the pond

Photo 74: View looking east from the western peninsula of the pond

Photo 75: View of the south bank of the pond from the west bank

Photo 76: View looking north from the southwest corner of the pond

Southern Emergent/Scrub-shrub Wetland

Photo 77: View looking south at the Virginia Capital Trail (upland) – Represents the abnormally high water levels during the delineation

Photo 78: Western extent of the emergent wetland and forested ditch within the project area (i.e. north of the Colonial Pipeline easement) – View looking southeast

Photo 79: Western extent of the emergent wetland and forested ditch within the project area (i.e. north of the Colonial Pipeline easement) – View looking northwest

Photo 80: View looking south from the scrub-shrub wetland southeast of the catch-and-release pond

Photo 81: The ditch approximately 150 feet east of the catch-and-release pond – View looking downstream and to the east

Photo 82: Scrub-shrub wetland located north of the Colonial Pipeline easement at the eastern extent of the wetland

Photo 83: View of the ditch downstream of the footbridge crossing

Photo 84: View of the ditch upstream of the footbridge crossing

Photo 87: View of the ditch from the dirt road crossing and culvert – downstream extent of the ditch (takes on natural stream characteristics downstream as intermittent stream 1)

Appendix C
USACE Wetland Determination Field Data Forms

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: WET-1

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P Lat: 37°15'56.92"N Long: 76°52'0.80"W Datum: WGS

Soil Map Unit Name: Udorthents, loamy NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? **Yes** X **No** _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [x] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): puddles
Water Table Present?	Yes X	No _____	Depth (inches): 4
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

There appears to be a transmissive layer under the clay at this wetland, as two existing holes (approx 16" diameter) on the WNW side appear to drain during heavy rain and do not fill up. This wetland appears to be perched on clay.

VEGETATION - use scientific names of plants. Sampling Point: WET-1

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix nigra (black willow)*	60	X	OBL
2. *Liquidambar styraciflua* (sweetgum)	10		FAC
3.			
4.			
5.			
6.			
7.			
8.			
	70	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Liquidambar styraciflua* (sweetgum)	10	X	FAC
2. *Salix nigra (black willow)*	10	X	OBL
3.			
4.			
5.			
6.			
7.			
8.			
	20	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Stellaria media* (common chickweed)	15	X	FACU
2. *Rubus* (likely *pensilvanicus*)	10	X	FAC
3. Unknown sedge	5	X	
4. *Rubus* (likely *pensilvanicus*)	10		FAC
5. *Rumex crispus* (curly dock)	5		FAC
6. *Lonicera japonica* (Japanese honeysuckle)	5		FACU
7. *Potentilla indica* (Indian strawberry)	2		FACU
9. *Juniiperus virginiana* (red cedar)	1		FACU
10. *Ilex opac* a (American holly)	1		FAC
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	54	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *Lonicera japonica* (Japanese honeysuckle)	5	X	FACU
2. *Toxicodendron radicans (poison ivy)*	5	X	FAC
3.			
4.			
5.			
6.			
	10	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **63%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	0	x 2 =	0
FAC species	51	x 3 =	153
FACU species	28	x 4 =	112
UPL species	0	x 5 =	0
Column Totals	149 (A)		335 (B)

Prevalence Index = B/A = **2.25**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: WET-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/2	100					org. loam	
1-8	10YR 4/2	85	10YR 4/6	10	C	M	clay loam	contains pebbles
			10YR 3/6	5	C	M		
8-15	10YR 4/2	40	10YR 5/1	30		M	clay	
			10YR 4/6	20	C	M		
			10YR 3/6	10	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: clay

Depth (inches): 8

Hydric Soil Present? Yes X No ____

Remarks: Soil profile continued:

15-18" 10YR 4/2 40% 10YR 5/1 30% clay loam
10YR 4/6 20%
10YR 3/6

18-24" 10YR 5/8 90% 10YR 5/2 10% clay

Wetland Plot 1 (WET-1)

Photo 1: View from the center of wetland plot 1 to the north

Photo 2: View from the center of wetland plot 1 to the east

Photo 3: View from the center of wetland plot 1 to the south

Photo 4: View from the center of wetland plot 1 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: UP-1

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): none Slope (%): 2

Subregion (LRR or MLRA): LRR P Lat: 37°15'57.62"N Long: 76°52'0.94"W Datum: WGS

Soil Map Unit Name: Pamunkey soils, 2 to 6 percent slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology

VEGETATION - use scientific names of plants. Sampling Point: UP-1

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus taeda (loblolly pine)*	90	X	FAC
2. *Liquidambar styraciflua* (sweetgum)	8		FAC
3.			
4.			
5.			
6.			
7.			
8.			
	98	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Liquidambar styraciflua* (sweetgum)	30	X	FAC
2. *Pinus taeda (loblolly pine)*	20	X	FAC
3. *Morella cerifera* (southern bayberry)	15		FAC
4. *Juniperus virginiana* (red cedar)	15		FACU
5. *Ilex opaca* (American holly)	8		FAC
6.			
7.			
8.			
	88	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Ilex opac* a (American holly)	15	X	FAC
2. *Juniperus virginiana* (red cedar)	8	X	FACU
3.			
4.			
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	23	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *None*			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **80%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	186	x 3 =	558
FACU species	23	x 4 =	92
UPL species	0	x 5 =	0
Column Totals	209 (A)		650 (B)

Prevalence Index = B/A = **3.11**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

__ Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-0.5	10YR 3/2						humus	
.5-6	10YR 5/6	100					clay	
6-18	10YR 5/6	80	10YR 5/3	20			clay	very tightly packed

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Upland Plot 1 (UP-1)

Photo 5: View from the center of upland plot 1 to the north

Photo 6: View from the center of upland plot 1 to the east

Photo 7: View from the center of upland plot 1 to the south

Photo 8: View from the center of upland plot 1 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: WET-2

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR or MLRA): LRR P Lat: 37°15'53.15"N Long: 76°52'3.26"W Datum: WGS

Soil Map Unit Name: Chickahominy silt loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? **Yes** X **No** _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☑ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 10

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION - use scientific names of plants. Sampling Point: WET-2

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua *(sweetgum)*	50	X	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	50	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. Liquidambar styraciflua *(sweetgum)*	50	X	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	50	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Allium vineale* (wild garlic)	40	X	FACU
2. *Rubus* (likely *pensilvanicus*)	5		FAC
3. *Ilex opaca* (Amerian holly)	5		FAC
4. *Ranunculus sardous* (hairy buttercup)	5		FAC
5. *Pinus taeda* (loblolly pine)	5		FAC
6. Unknown graminoid	5		
7. *Lonicera japonica* (Japanese honeysuckle)	5		FACU
9. *Juncus effusus*	2		OBL
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	72	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *Smilax spp.*	2	X	FAC
2. *Lonicera japonica* (Japanese honeysuckle)	1	X	FACU
3. *Lonicera japonica* (Japanese honeysuckle)			
4.			
5.			
6.			
	3	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **60%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	0	x 2 =	0
FAC species	122	x 3 =	366
FACU species	46	x 4 =	184
UPL species	0	x 5 =	0
Column Totals	170 (A)		552 (B)

Prevalence Index = B/A = **3.25**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

__ Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: WET-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/2	100					silty loam	
1-7	10YR 5/1	93	10YR 5/6	7	C	M	silty clay	
7-18	10YR 6/1	92	10YR 5/6	8	C	M	silty clay	contains oxidized rhisospheres
18-24	10YR 7/1	90	10YR 5/6	10	C	M	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: clay

Depth (inches): 18

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Wetland Plot 2 (WET-2)

Photo 9: View from the center of wetland plot 2 to the north

Photo 10: View from the center of wetland plot 2 to the east

Photo 11: View from the center of wetland plot 2 to the south

Photo 12: View from the center of wetland plot 2 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: UP-2

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): 1

Subregion (LRR or MLRA): LRR P Lat: 37°15'51.93"N Long: 76°52'3.19"W Datum: WGS

Soil Map Unit Name: Chickahominy silt loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology.

VEGETATION - use scientific names of plants. Sampling Point: UP-2

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Juniperus virginiana (red cedar)*	10	X	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	10	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Pinus taeda* (loblolly pine)	10	X	FAC
2. Liquidambar styraciflua *(sweetgum)*	5	X	FAC
3. *Prunus americana* (American plum)	5	X	UPL
4.			
5.			
6.			
7.			
8.			
	20	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Phleum pratense* (timothy)	50	X	FACU
2. *Eupatorium capillifolium* (dog fennel)	20	X	FACU
3. *Andropogon virginicus* (broomsedge)	20		FAC
4. *Rubus* (likely *pensilvanicus*)	10		FAC
5. *Lonicera japonica* (Japanese honeysuckle)	5		FACU
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	105	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *Lonicera japonica* (Japanese honeysuckle)	2	X	FACU
2.			
3.			
4.			
5.			
6.			
	2	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **29%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	87	x 4 =	348
UPL species	5	x 5 =	25
Column Totals	137 (A)		508 (B)

Prevalence Index = B/A = **3.71**

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index ≤3.0 [1]
- ___ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes ___ No **X**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/2	100					silty loam	
3-11	10YR 5/3	100					silty loam	
11-18	10YR 5/2	90	10YR 5/6	10	C	M	clay	
18-24	10YR 5/6	80	10YR 4/6	12	C	M	clay	
			10YR 5/2	8	D	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Upland Plot 2 (UP-2)

Photo 13: View from the center of upland plot 2 to the north

Photo 14: View from the center of upland plot 2 to the east

Photo 15: View from the center of upland plot 2 to the south

Photo 16: View from the center of upland plot 2 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: WET-3

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): lowland swamp Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR or MLRA): LRR P Lat: 37°15'57.58"N Long: 76°51'49.84"W Datum: WGS

Soil Map Unit Name: Johnston complex NWI classification: adj. to PFO1/SS1R

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? **Yes** X **No** _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): puddles
Water Table Present?	Yes X	No _____	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION - use scientific names of plants. Sampling Point: WET-3

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Nyssa* (likely *biflora* or *aquatica*) (tupelo)	70	X	OBL
2. *Taxodium distichum* (bald cypress)	15		OBL
3. *Pinus taeda* (loblolly pine)	5		FAC
4.			
5.			
6.			
7.			
8.			
	90	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Morella cerifera* (southern bayberry)	15	X	FAC
2. *Ilex verticillata* (common winterberry)	10	X	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	25	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Carex* spp.	50	X	
2. *Panicum* (possibly *dichotomiflorum*)	10		FACW
3. *Iva fruitescens* (Jesuit's bark)	2		FACW
4.			
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	62	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *Smilax laurifolia* (laurel-leaved greenbrier)	1	X	FACW
2.			
3.			
4.			
5.			
6.			
	1	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **80%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	85	x 1 =	85
FACW species	23	x 2 =	46
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals	128 (A)		191 (B)

Prevalence Index = B/A = **1.49**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index ≤3.0 [1]

___ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No ___

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: WET-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 2/2	100					muck	
18-24	**10YR 3/2**	100					silty muck	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☑ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Wetland Plot 3 (WET-3)

Photo 17: View from the center of wetland plot 3 to the north

Photo 18: View from the center of wetland plot 3 to the east

Photo 19: View from the center of wetland plot 3 to the south

Photo 20: View from the center of wetland plot 3 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: UP-3

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): slope Local relief (concave, convex, none): none Slope (%): est. 30

Subregion (LRR or MLRA): LRR P Lat: 37°15'57.16"N Long: 76°51'50.93"W Datum: WGS

Soil Map Unit Name: Johnston complex NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No signs of wetland hydrology

VEGETATION - use scientific names of plants. Sampling Point: UP-3

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus rubra* (red oak)	25	X	FAC
2. *Liquidambar styraciflua* (sweetgum)	20	X	FAC
3. *Ilex opaca* (American holly)	10		FAC
4. *Quercus alba* (white oak)	10		FACU
5.			
6.			
7.			
8.			
	65	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Pinus taeda* (loblolly pine)	30	X	FAC
2. *Ilex opaca* (American holly)	10		FAC
3. *Fagus grandifolia* (American beech)	5		FACU
4. *Vaccinium corymbosum* (highbush blueberry)	5		FACW
5. *Aralia spinosa* (devil's walking stick)	2		FAC
6. *Liquidambar styraciflua* (sweetgum)	2		FAC
7.			
8.			
	54	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Vaccinium pallidum* (lowbush blueberry)	60	X	UPL
2. *Ilex opaca* (American holly)	2		FAC
3. *Pinus taeda* (loblolly pine)	2		FAC
4. *Lonicera japonica* (Japanese honeysuckle)	2		FACU
5. *Persea borbonia* (Red Bay)	1		FACW
6. *Tipularia discolor* (crippled cranefly orchid)	2		FACU
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	69	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *None*			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **75%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	6	x 2 =	12
FAC species	103	x 3 =	309
FACU species	19	x 4 =	76
UPL species	60	x 5 =	300
Column Totals	188 (A)		697 (B)

Prevalence Index = B/A = **3.71**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

__ Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 2/2	100					sl. sdy humus	
2-3	10YR 3/2	100					loam	
3-7	10YR 4/3	100					loam	
7-10	10YR 6/4	95	10YR 4/6	5			clay	
10-13	10YR 6/4	50	10YR 4/6	50			clay	
13-15	10YR 4/6	70	10YR 6/4	30			clay	
15-18	10YR 5/6	70	10YR 6/4	30			clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: clay

Depth (inches): 7

Hydric Soil Present? **Yes** _____ **No** X

Remarks: Soil profile continued

18-24" 10YR 5/6 100% clay

Upland Plot 3 (UP-3)

Photo 21: View from the center of upland plot 3 to the north

Photo 22: View from the center of upland plot 3 to the east

Photo 23: View from the center of upland plot 3 to the south

Photo 24: View from the center of upland plot 3 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: WET-4

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): very slight slope Local relief (concave, convex, none): v. slightly concave Slope (%): <1

Subregion (LRR or MLRA): LRR P Lat: 37°15'48.76"N Long: 76°51'43.53"W Datum: WGS

Soil Map Unit Name: Newflat silt loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

Wetland is at the headwaters of a small tributary

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Soil is saturated to the surface; auger hole filled with water.

VEGETATION - use scientific names of plants. Sampling Point: WET-4

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ilex opaca* (American holly)	40	X	FAC
2. *Liquidambar styraciflua* (sweetgum)	25	X	FAC
3. *Pinus taeda* (loblolly pine)	15		FAC
4. *Nyssa sylvatica* (most likely sp) (black gum)	15		FAC
5.			
6.			
7.			
8.			
	95	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Ilex opaca* (American holly)	25	X	FAC
2. *Pinus taeda* (loblolly pine)	10	X	FAC
3. *Liquidambar styraciflua* (sweetgum)	5		FAC
4.			
5.			
6.			
7.			
8.			
	40	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Pinus taeda* (loblolly pine)	10	X	FAC
2. *Ilex opaca* (American holly)	5	X	FAC
3. Unknown grass	5	X	
4. *Mitchella repens* (partridge berry)	3		FAC
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	23	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *None*			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **86%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	153	x 3 =	459
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals	153 (A)		459 (B)

Prevalence Index = B/A = **3.00**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: WET-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2							humus	saturated to surface
2-5	10YR 4/2	100					silty loam	
5-10	10YR 5/1	80	10YR 5/8	20	C	M	loamy clay	
10-16	10YR 6/2	60	10YR 5/1	20	D	M	clay	
			10YR 5/8	20	C	M		
16-20	10YR 6/1	70	10YR 6/8	30	C	M	clay	
20-24	10YR 6/1	70	7.5YR 5/6	30	C	M	clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Wetland Plot 4 (WET-4)

Photo 25: View from the center of wetland plot 4 to the north

Photo 26: View from the center of wetland plot 4 to the east

Photo 27: View from the center of wetland plot 4 to the south

Photo 28: View from the center of wetland plot 4 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: UP-4

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): very slight slope Local relief (concave, convex, none): none Slope (%): 1

Subregion (LRR or MLRA): LRR P Lat: 37°15'47.95"N Long: 76°51'43.40"W Datum: WGS

Soil Map Unit Name: Newflat silt loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland hydrology not present.

VEGETATION - use scientific names of plants. Sampling Point: UP-4

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ilex opaca* (American holly)	50	X	FAC
2. *Quercus rubra* (northern red oak)	20	X	FACU
3. *Quercus falcata* (southern red oak)	10		FACU
4. *Pinus taeda* (loblolly pine)	10		FAC
5. *Liquidambar styraciflua* (sweetgum)	5		FAC
6.			
7.			
8.			
	95	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Ilex opaca* (American holly)	15	X	FAC
2. Fagus grandifolia (American beech)	10	X	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	25	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Ilex opaca* (American holly)	5	X	FAC
2. *Mitchella repens* (partridge berry)	1		FAC
3.			
4.			
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	6	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *None*			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **60%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	86	x 3 =	258
FACU species	40	x 4 =	160
UPL species	0	x 5 =	0
Column Totals	126 (A)		418 (B)

Prevalence Index = B/A = **3.32**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

__ Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/3	60	10YR 6/3	40			silt loam	
2-10	**10YR 6/3**	80	10YR 5/2	20	D	M	loamy clay	
10-14	10YR 6/3	80	10YR 5/2	20	D	M	clay	
14-18	10YR 6/3	70	10YR 6/6	30	C	M	clay	
18-24	10YR 6/3	50	10YR 6/6	50			clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: clay

Depth (inches): 10

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Upland Plot 4 (UP-4)

Photo 29: View from the center of upland plot 4 to the north

Photo 30: View from the center of upland plot 4 to the east

Photo 31: View from the center of upland plot 4 to the south

Photo 32: View from the center of upland plot 4 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: WET-5

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): non-tidal edge of tidal shore Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR or MLRA): LRR P Lat: 37°16'4.37"N Long: 76°51'59.20"W Datum: WGS

Soil Map Unit Name: Johnston complex NWI classification: PFO1R

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** X **No** _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☑ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☑ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): 0-2
Water Table Present?	Yes X	No _____	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? **Yes** _____ **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION - use scientific names of plants. Sampling Point: WET-5

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. Taxodium distichum (bald cypress)	30	X	OBL
2. *Pinus taeda* (loblolly pine)	10	X	FAC
3. *Nyssa* (likely *biflora* or *aquatica*) (tupelo)	10	X	OBL
4. *Quercus lyrata* (overcup oak)	10	X	OBL
5. *Juniperus virginiana* (red cedar)	5		FACU
6. *Ilex opaca* (American holly)	5		FAC
7. *Acer rubrum* (red maple)	5		FAC
8.			
	75	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Morella cerifera* (southern bayberry)	20	X	FAC
2. Morus rubra (red mulberry)	5		FACU
3. Unknown sapling #2	2		
4.			
5.			
6.			
7.			
8.			
	27	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Carex* spp.	45	X	
2. *Onoclea sensibilis* (sensitive fern)	45	X	FACW
3. Hydrocotyle *spp.*	10		OBL
4. *Elymus riparius* (river-bank wild rye)	1		FACW
5. *Panicum* spp.	1		
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	102	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *None*			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **86%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	46	x 2 =	92
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals	156 (A)		312 (B)

Prevalence Index = B/A = **2.00**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

Cypress knees present in abundance

SOIL

Sampling Point: WET-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	100					muck	
6-13	10YR 2/2	100					mucky silt loam	
13-24	10YR 4/2	95	10YR 4/6	5	C	M	fine sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☑ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Wetland Plot 5 (WET-5)

Photo 33: View from the center of wetland plot 5 to the north

Photo 34: View from the center of wetland plot 5 to the east

Photo 35: View from the center of wetland plot 5 to the south

Photo 36: View from the center of wetland plot 5 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: UP-5

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): gentle mound Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR P Lat: 37°16'4.29"N Long: 76°51'57.97"W Datum: WGS

Soil Map Unit Name: Johnston complex NWI classification: PFO4R

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

This area is mapped by NWI as forested wetland, but neither wetland hydrology nor hydric soils are present.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 15

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION - use scientific names of plants. Sampling Point: UP-5

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Pinus taeda* (loblolly pine)	50	X	FAC
2. *Ilex opaca* (American holly)	30	X	FAC
3. *Unknown #3*	10		
4. *Quercus michaeuxii* (swamp chestnut oak)	5		FACW
5.			
6.			
7.			
8.			
	95	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Ilex opaca* (American holly)	5	X	FAC
2. Vaccinium corymbosum (highbush blueberry)	5	X	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	10	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Ilex opaca* (American holly)	5	X	FAC
2. *Pinus taeda* (loblolly pine)	1		FAC
3.			
4.			
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	6	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *None*			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **100%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	91	x 3 =	273
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals	101	(A)	293 (B)

Prevalence Index = B/A = **2.90**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

Cypress knees present in abundance

SOIL

Sampling Point: UP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5YR 3/3	100					humus	
2-6	7.5YR 3/1	100					sandy loam	
6-13	10YR 5/6	50	10YR 5/4	50			sandy loam	
13-16	10YR 5/4	80	10YR 5/6	20			sandy loam	
16-22	10YR 5/4	100					sandy loam	
22-26	10YR 5/4	90	10YR 5/8	10			sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Upland Plot 5 (UP-5)

Photo 37: View from the center of upland plot 5 to the north

Photo 38: View from the center of upland plot 5 to the east

Photo 39: View from the center of upland plot 5 to the south

Photo 40: View from the center of upland plot 5 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: WET-6

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): bottomland swamp Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): LRR P Lat: 37°15'59.84"N Long: 76°52'25.73"W Datum: WGS

Soil Map Unit Name: Emporia complex, 15 to 25 percent slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____
Hydric Soil Present?	Yes X	No _____
Wetland Hydrology Present?	Yes X	No _____

Is the Sampled Area within a Wetland? **Yes** X **No** _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes X	No _____	Depth (inches): puddles
Water Table Present?	Yes X	No _____	Depth (inches): 2
Saturation Present? (includes capillary fringe)	Yes X	No _____	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION - use scientific names of plants. Sampling Point: WET-6

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Magnolia virginian* a (sweet bay magnolia)	10	X	FACW
2. *Taxodium distichum* (bald cypress)	10	X	OBL
3. *Fraxinus pennsylvanica* (green ash)	10	X	FACW
4.			
5.			
6.			
7.			
8.			
	30	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Magnolia virginian* a (sweet bay magnolia)	20	X	FACW
2. *Cornus amomum (silky dogwood)*	20	X	FACW
3. *Taxodium distichum* (bald cypress)	20	X	OBL
4. *Ligustrum sinense (privet)*	10		FAC
5. *Ilex opaca* (American holly)	10		FAC
6. *Rosa multiflora* (multiflora rose)	5		FACU
7.			
8.			
	85	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Hibiscus moscheutos* (rose-mallow)	15	X	OBL
2.			
3.			
4.			
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	15	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1. *Vitis rotundifolia* (muscadine)	5	X	FAC
2.			
3.			
4.			
5.			
6.			
	5	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 8 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **100%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	60	x 2 =	120
FAC species	25	x 3 =	75
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals	135 (A)		260 (B)

Prevalence Index = B/A = **1.93**

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index ≤3.0 [1]

__ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes **X** No __

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: WET-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 2/1	100					mucky loam	
18-24	10YR 2/1	50	10YR 3/2	50			mucky loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☑ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

Wetland Plot 6 (WET-6)

Photo 41: View from the center of wetland plot 6 to the north

Photo 42: View from the center of wetland plot 6 to the east

Photo 43: View from the center of wetland plot 6 to the south

Photo 44: View from the center of wetland plot 6 to the west

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Chickahominy Riverfront Park Water Intake City/County: James City County Sampling Date: 2/12/2016

Applicant/Owner: James City Service Authority State: VA Sampling Point: UP-6

Investigator(s): Laura Burbage Section, Township, Range: _____

Landform (hillslope, terrace, etc.): slight hillslope Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR or MLRA): LRR P Lat: 37°16'0.44"N Long: 76°52'26.27"W Datum: WGS

Soil Map Unit Name: Dogue loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** **Yes** _____ **No** X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes _____	No _____	Depth (inches): _____
Water Table Present?	Yes _____	No _____	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No _____	Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No evidence of wetland hydrology

VEGETATION - use scientific names of plants. Sampling Point: UP-6

Tree Stratum (Plot size: 30' radius)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Quercus rubra* (red oak)	40	X	FACU
2. *Quercus alba* (white oak)	20	X	FACU
3. *Quercus falcata* (southern red oak)	20	X	FACU
4. *Ilex opaca* (American holly)	10		FAC
5.			
6.			
7.			
8.			
	90	=Total Cover	

Sapling/Shrub Stratum (Plot size: 30' radius)			
1. *Aralia spinosa* (devil's walking stick)	15	X	FAC
2. *Unknown spp #4*	15	X	
3. *Unknown spp. #5*	5		
4. *Pinus taeda* (loblolly pine)	5		FAC
5.			
6.			
7.			
8.			
	40	=Total Cover	

Herb Stratum (Plot size: 30' radius)			
1. *Vaccinium pallidum* (lowbush blueberry)	5	X	UPL
2. *Aralia spinosa* (devil's walking stick)	5	X	FAC
3. *Ilex opaca* (American holly)	5	X	FAC
4. *Pinus taeda* (loblolly pine)	5	X	FAC
5.			
6.			
7.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
	20	=Total Cover	

Woody Vine Stratum (Plot size: 30' radius)			
1.			
2.			
3.			
4.			
5.			
6.			
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 9 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: **44%** (A/B)

Prevalence Index Worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	45	x 3 =	135
FACU species	80	x 4 =	320
UPL species	5	x 5 =	25
Column Totals	130 (A)		480 (B)

Prevalence Index = B/A = **3.69**

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index ≤3.0 [1]
- ___ Problematic Hydrophytic Vegetation [1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling - Woody plants, excluding woody vines, approximately 20 ft (6m) or more in height and less than 3 in. (7.6 cm) (DBH).

Shrub - Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Woody Vine - All woody vines, regardless of height

Hydrophytic Vegetation Present? Yes ___ No **X**

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: UP-6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/3	100					loam	
2-4	10YR 5/3	100					loam	
4-12	10YR 6/3	100					loam	
12-20	10YR 6/3	80	10YR 5/2	20	D	M	loamy clay	tightly packed

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

Upland Plot 6 (UP-6)

Photo 45: View from the center of upland plot 6 to the north

Photo 46: View from the center of upland plot 6 to the east

Photo 47: View from the center of upland plot 6 to the south

Photo 48: View from the center of upland plot 6 to the west

CDM Smith
3201 Jermantown Rd, Suite 400
Fairfax, Virginia 22030
tel: 703 691-6467
fax: 703 267-6083

March 7, 2016

U.S. Army Corps of Engineers
Norfolk District Office
803 Front Street
Norfolk, VA 23510

Subject: Chickahominy Riverfront Raw Water Supply Project
Request for Approved Jurisdictional Determination

Dear USACE Engineer:

This letter is to request a review of the wetland delineation within the proposed Chickahominy Riverfront Raw Water Supply project area of investigation. The James City Service Authority (JCSA) is investigating the areas within the Chickahominy Riverfront Park, located north of Route 5 on the east bank of the Chickahominy River (Latitude 37° 15' 59.17"N, Longitude 76° 52' 13.11"W), for a new raw water intake and associated raw water piping, pump station, and water treatment plant on the County-owned property. The area of investigation consists largely of maintained turf fields and parklands, open forested campground, undeveloped upland forest, forested wetland, and marsh. The majority of the raw water supply infrastructure would not be located in wetland or floodplain areas, except for the intake structure itself and some of the associated piping.

The project area will consist of a portion of the Chickahominy Riverfront Park parcel of approximately 140 acres, located in the Virginia Inner Coastal Plain. This region is typically a flat to hilly area dissected by numerous streams and major rivers. The site is at the confluence of Gordon Creek and the Chickahominy River, which flows into the James River. Land use in surrounding areas generally consists of undeveloped forests and marshes, parklands, and single-family residential neighborhoods.

The specific project is undergoing conceptual design at this time. Any future project could potentially include low-rise structural elements, earth moving and/or clearing of vegetation.

Following a preliminary desktop delineation, wetlands were field delineated by CDM Smith Professional Wetland Scientist (PWS), Matt Petty, and Virginia Professional Wetland Delineator (PWD), Laura Burbage, on February 1-5 and 12, 2016. Wetlands were delineated in conformance with the *2010 Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Atlantic and Gulf Coastal Plain Region* (Version 2.0). The findings of the wetland delineation, including site maps, wetland locations, site photographs, and USACE wetland determination field data forms, can

be found in the field completion memorandum appended to the Approved JD Form. Within the project area of investigation, wetlands largely consist of forested wetlands along the shorelines and inlets of the Chickahominy River and Gordon Creek (19.34 acres). This includes several small ephemeral and intermittent tributaries that enter a large inlet to Gordon Creek on the eastern edge of the area of investigation. Wetlands within the area of investigation also include an isolated forested wetland (0.23 acres), a man-made catch-and-release pond (1.64 acres), and an emergent/scrub-shrub wetland south of the catch-and-release pond (1.10 acres).

Included with this request are the following documents:

- Norfolk District Regulatory Office Pre-Application and/or Jurisdictional Waters Determination Request Form with project location map, plat, and deed
- Completed Approved JD Form
- Chickahominy Riverfront Park Raw Water Supply Wetlands Delineation Field Completion Final Memorandum dated March 2016 with accompanying figures detailing soil types, floodplains, and National Wetlands Inventory (NWI) wetland locations within and adjacent to the project area
- CD containing a digital copy of all Jurisdictional Determination application material

Please contact me at (703) 691-6467 if you need any additional information and to schedule a site visit.

Very truly yours,

Matthew E. Petty

Matthew E. Petty
Environmental Scientist
CDM Smith, Inc.

cc: Karina Hull (CDM Smith)
Laura Burbage (CDM Smith)
Doug Powell (JCSA)
Michael Vergakis (JCSA)
File

NORFOLK DISTRICT REGULATORY OFFICE PRE-APPLICATION AND/OR JURISDICTIONAL WATERS DETERMINATION REQUEST FORM

This form is used when you want to determine if areas on your property fall under regulatory requirements of the U.S. Army Corps of Engineers (USACE). Please supply the following information and supporting documents described below. This form can be filled out online and/or printed and then mailed, faxed, or e-mailed to the Norfolk District. Submitting this request authorizes the US Army Corps of Engineers to field inspect the property site, if necessary, to help in the determination process. **THIS FORM MUST BE SIGNED BY THE PROPERTY OWNER TO BE CONSIDERED A FORMAL REQUEST.**

The printed form and supporting documents should be mailed to:

U.S. Army Corps of Engineers, Norfolk District
Regulatory Office
803 Front Street
Norfolk, Virginia 23510-1096

Or faxed to (757) 201-7678

Or sent via e-mail to: CENAO.REG_ROD@usace.army.mil

Additional information on the Regulatory Program is available on our website at:
http://www.nao.usace.army.mil/technical%20services/Regulatory%20branch/homepage.asp

Please contact us at 757-201-7652 if you need any assistance with filling out this form.

Location and Information about Property to be subject to a Jurisdictional Determination:

1. Date of Request: March 3, 2016

2. City or County where property located: James City County, Virginia

3. Address of property and directions (attach a map of the property location and a copy of the property plat): Chickahominy Riverfront Park
   1350 John Tyler Memorial Highway
   Williamsburg, Virginia 23185

4. Size of property in acres: 140 (site is 98 acres)

5. Tax Parcel Number / GPIN (if available): 3430100002

6. Name of Nearest Waterway: Chickahominy River

7. Brief Description of Proposed Activity, Reason for Preapplication Request, and/or Reason for Jurisdictional Waters Determination Request:
   Construction of a new raw water supply intake, pump station, water main, and water treatment facility

8. Has a wetland delineation/determination been completed by a consultant or the Corps on the property previously? ☒ YES ☐ NO ☐ UNKNOWN

   If yes, please provide the name of the consultant and/or Corps staff and Corps permit number, if available: A wetland delineation was performed by Vanasse Hangen Brustlin, Inc in 2008. A verification of the wetland delineation (File # NAO-2008-01032) was provided by USACE on 10/2/2008.

Property Owner Contact Information:

Property Owner Name: James City County
Mailing Address: 101-D Mounts Bay Road
City: State: Zip: Williamsburg, VA 23185
Daytime Telephone: 757-253-6603 (Bryan J. Hill, County Administrator)
E-mail Address: Bryan.Hill@jamescitycountyva.gov

If the person requesting the Jurisdictional Determination is **NOT** the Property Owner, please also supply the Requestor's contact information here:

		Represented by:
Requestor Name:	Doug Powell, General Manager	Matt Petty, PWS
Mailing Address:	James City Service Authority	CDM Smith
City: State: Zip:	119 Tewning Road	3201 Jermantown Road, Suite 400
Daytime Telephone:	Williamsburg, VA 23188	Fairfax, VA 22030
E-mail Address:	757-259-5453	703-691-6467
	doug.powell@jamescitycountyva.gov	pettyme@cdmsmith.com

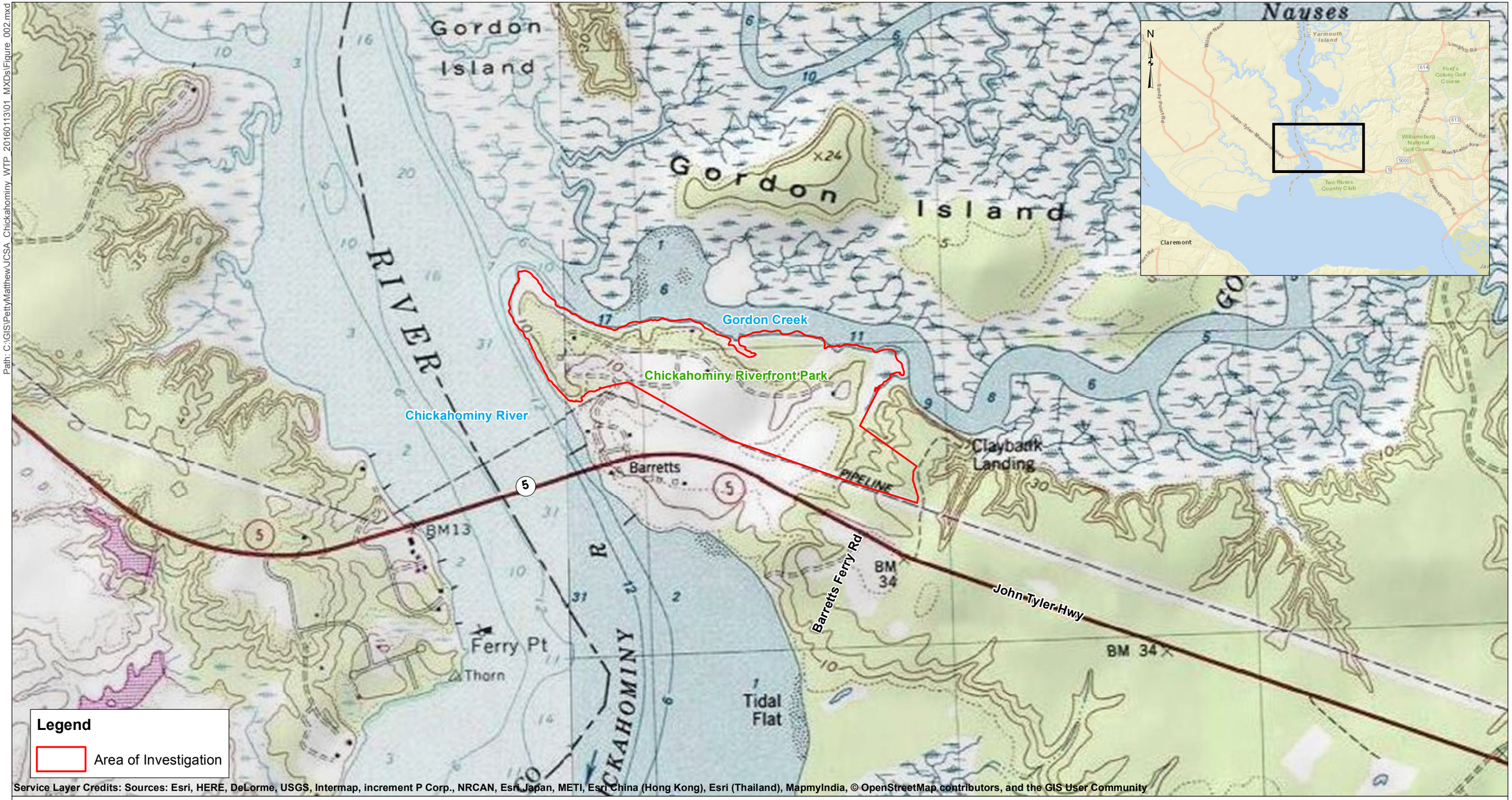
Additionally, if you have any of the following information, please include it with your request: wetland delineation map, other relevant maps, drain tile survey, topographic survey, and/or site photographs.

CERTIFICATION: I am hereby requesting a preapplication consultation or jurisdictional waters and/or wetlands determination from the U.S. Army Corps of Engineers, for the property(ies) I have described herein. I agree to allow the duly authorized representatives of the Norfolk District Corps of Engineers and other regulatory or advisory agencies to enter upon the premises of the project site at reasonable times to evaluate inspect and photograph site conditions. This consent to enter the property is superior to, takes precedence over, and waives any communication to the contrary. For example, if the property is posted as "no trespassing" this consent specifically supercedes and waives that prohibition and grants permission to enter the property despite such posting. I hereby certify that the information contained in the Request for a Jurisdictional Determination is accurate and complete:

J Hill — 3/3/2016

Property Owner's Signature — Date

Path: C:\GIS\PettyMatthew\JCSA_Chickahominy_WTP_20160113\01_MXDs\Figure_002.mxd



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

1 inch = 1,000 feet

Submitted on: 2/19/2016

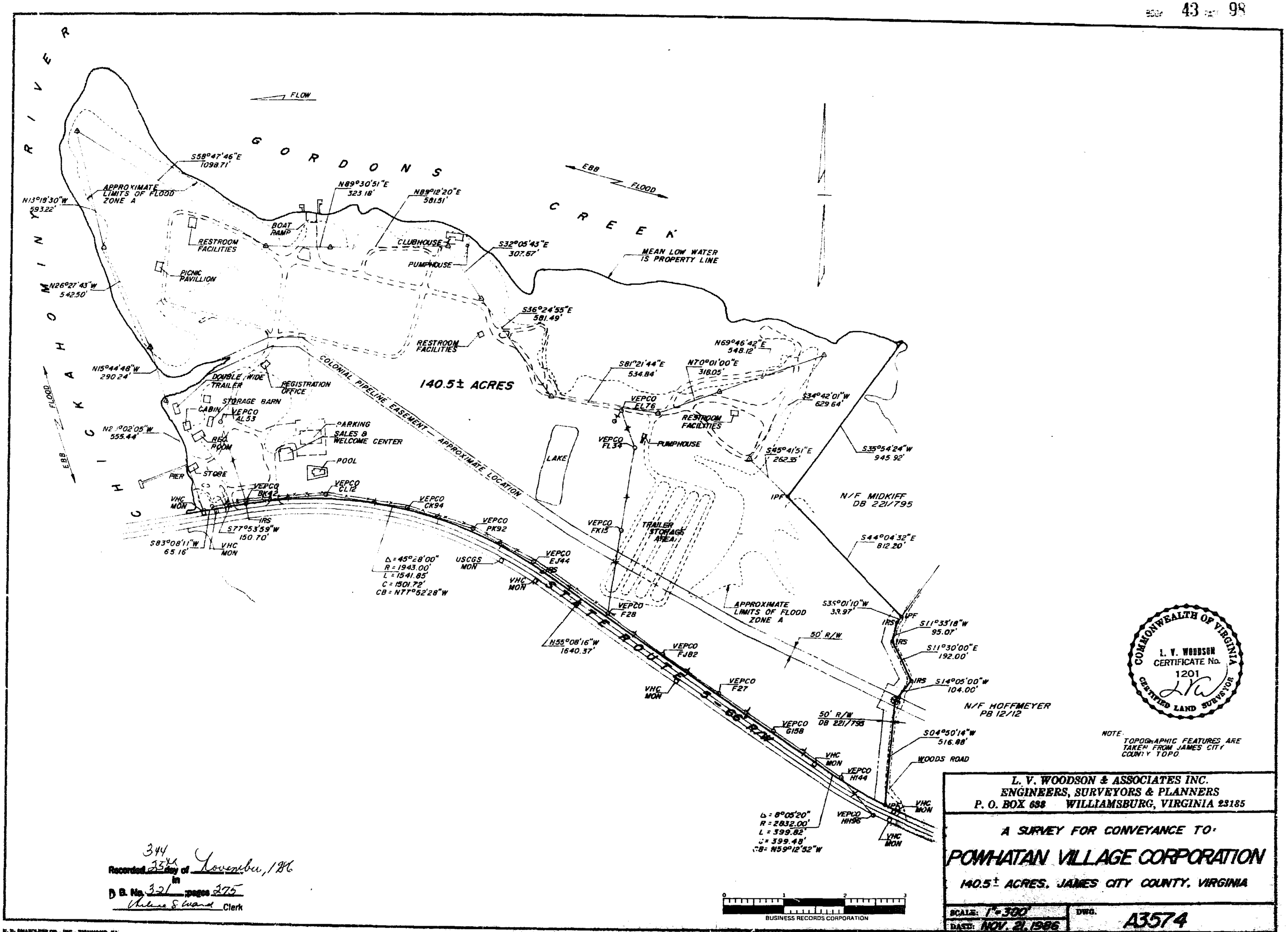
CDM Smith

N

0 1,000 2,000 4,000 Feet

James City Service Authority (JCSA)
Chickahominy Riverfront Raw Water Supply Project

Project Location Map
James City County, VA



Recorded 344 this 25th day of November, 198[illegible]
in D.B. No. 321 pages 275
Arlene S. Guard Clerk

010023938

Effective 12/19/01 at 1:30 p.m.
GPIN No. 34-3-01-0-0002

THIS QUITCLAIM DEED, made this 19th day of December, 2001, by and between **SVLH, INC.**, a Virginia corporation, Grantor, and **COUNTY OF JAMES CITY**, a political subdivision of the Commonwealth of Virginia, Grantee.

WITNESSETH:

THAT FOR AND IN CONSIDERATION of the sum of TEN DOLLARS ($10.00) cash in hand paid by the Grantee to the Grantor and other good and valuable consideration, the receipt whereof is hereby acknowledged, the Grantor does hereby bargain, sell, grant and convey, with covenants of Quitclaim of title only, unto the **COUNTY OF JAMES CITY**, all of that certain lot or parcel of land described as follows:

> **ALL THAT** certain tract, piece or parcel of land situate, lying and being in Powhatan District, James City County, Virginia, as shown on that certain plat, entitled "A SURVEY FOR CONVEYANCE TO POWHATAN VILLAGE CORPORATION, 140.5± ACRES, JAMES CITY COUNTY, VIRGINIA", dated November 21, 1986, made by L.V. Woodson and Associates, Inc., Engineers and Surveyors, Williamsburg, Virginia, recorded in the Clerk's Office of the Circuit Court for James City County and the City of Williamsburg, Virginia (the "Clerk's Office") in Plat Book 43, page 98, to which reference is hereby made.
>
> **SUBJECT** to the restrictions, covenants, conditions and easements of record in the Clerk's Office, and specifically subject to a fifty foot (50') non-exclusive perpetual easement for purposes of ingress and egress along the eastern line of the parcel reserved in a deed recorded in Deed Book 221, page 795.

DEC 20 5 04 11

This instrument prepared by:
Francis T. Eck, Esquire
16 South Second Street
Richmond, Virginia 23219
(804) 788-4457

Exempt from taxes
imposed by § 58.1-801
Pursuant to § 58.1-811(3)

TOGETHER with the Undivided Interests of all Owners reconveyed by deeds recorded in the Clerk's Office.

LESS AND EXCEPT the Undivided Interests of 134 Owners conveyed by deeds recorded in the Clerk's Office as of May 15, 1987.

Grantor does hereby also convey and assign to Grantee all right, title and interest of and as the Developer as set forth in the following declaration:

Declaration of Joint Use and Reservation System dated November 25, 1986, recorded in the Clerk's Office in Deed Book 321, at page 321; as amended by the Amended and Restated Declaration of Joint Use and Reservation System, dated December 31, 1986 and recorded February 2, 1987 in the Clerk's Office in Deed Book 329, at page 339; as amended by the First Amendment to Amended and Restated Declaration of Joint Use and Reservation System, dated July 27, 1987 and recorded July 27, 1987 in Deed Book 355, at page 586; and as supplemented by Supplemental Declaration dated August 23, 1991, recorded August 29, 1991, in the Clerk's Office in Deed Book 528, page 385; the above being collectively referred to herein as the "Declaration".

It being the same property conveyed to SVLH, INC., a Virginia corporation by Deed from Powhatan Village Corporation, a Virginia corporation, dated May 15, 1997 and recorded May 19, 1997 as Document Number 970008029.

Capitalized or block terms used herein shall have those meanings ascribed to them in the Declaration.

IN WITNESS WHEREOF, Seller has executed this Quitclaim Deed on the day and year first above written.

SVLH, INC.,
a Virginia corporation

By: _____
Gregory F. Rayburn, President

DEC 20 2001 04 12

SEEN AND AGREED to by the only stockholder of SVLH, INC.

SUNTERRA CORPORATION

By: _____
Gregory F. Rayburn, Senior Vice President

STATE OF FLORIDA
COUNTY OF ORANGE, to-wit:

I, the undersigned, a Notary Public in and for the jurisdiction aforesaid, do hereby certify that Gregory F. Rayburn, President of SVLH, INC., a Virginia corporation, and Senior Vice President of Sunterra Corp, a Maryland corporation, whose name is signed as such to the foregoing Deed bearing date of the 19th day of December, 2001 has this day acknowledged the same before me in my jurisdiction aforesaid.

Given under my hand this the 19th day of December, 2001.

My Commission expires: 9-13-04

_____
NOTARY PUBLIC

Notarial Seal

B J Franklin
My Commission CC967709
Expires September 13, 2004

Grantee's Address:
P.O. Box 8784
Williamsburg, Virginia 23187

DEC 20 2 04 13

VIRGINIA: City of Williamsburg and County of James City, to-wit:
This DEED was presented with the certificate annexed and admitted to record on 20 Dec, 20 01 at 3:06 AM/PM in the Clerk's Office of the Circuit Court for the City of Williamsburg and County of James City. The taxes imposed by VA Code Section 58.1-801 802 & 814 have been paid.

STATE TAX	LOCAL TAX	ADDITIONAL TAX
$ —	$ —	$ 2075.00

TESTE: BETSY B. WOODRIDGE, CLERK
_____, Deputy Clerk

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD):

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State:Virginia County/parish/borough: James City City: Williamsburg
Center coordinates of site (lat/long in degree decimal format): Lat. 37.266436° **N**, Long. 76.870308° **W**.
Universal Transverse Mercator:
Name of nearest waterbody: Chickahominy River; Gordon Creek
Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: Chickahominy River; Gordon Creek
Name of watershed or Hydrologic Unit Code (HUC): 0208020606 (Lower Chickahominy River)

- ☒ Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.
- ☐ Check if other sites (e.g., offsite mitigation sites, disposal sites, etc…) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

- ☒ Office (Desk) Determination. Date: January/February 2016
- ☒ Field Determination. Date(s): February 1-5/12, 2016

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **are and are not** "*navigable waters of the U.S.*" within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [*Required*]

- ☒ Waters subject to the ebb and flow of the tide.
- ☒ Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Explain: The Chickahominy River and Gordon Creek are subject to the ebb and flow of the tide. The Chickahominy River is used/was historically used, and is susceptible for use, to transport interstate or foreign commerce.

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **are and are not** "*waters of the U.S.*" within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [*Required*]

1. **Waters of the U.S.**
   a. **Indicate presence of waters of U.S. in review area (check all that apply):** [1]
   - ☒ TNWs, including territorial seas
   - ☒ Wetlands adjacent to TNWs
   - ☒ Relatively permanent waters[2] (RPWs) that flow directly or indirectly into TNWs
   - ☒ Non-RPWs that flow directly or indirectly into TNWs
   - ☒ Wetlands directly abutting RPWs that flow directly or indirectly into TNWs
   - ☐ Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs
   - ☒ Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs
   - ☐ Impoundments of jurisdictional waters
   - ☒ Isolated (interstate or intrastate) waters, including isolated wetlands

   b. **Identify (estimate) size of waters of the U.S. in the review area:**
   Non-wetland waters: 1725' (Chickahominy River), 5006' (Gordon Creek), aprox 1,000' (unnamed tributary to Gordon Creek) and 1,218' (intermittent streams) linear feet: 2,100' (Chickahominy River), aprox. 350' (Gordon Creek), aprox. 2-8 ' (unnamed tributary to Gordon Creek), 2-4' (intermittent streams), width (ft) and/or acres.
   Wetlands: 20.67 acres.

   c. **Limits (boundaries) of jurisdiction** based on: **1987 Delineation Manual**
   Elevation of established OHWM (if known): .

2. **Non-regulated waters/wetlands (check if applicable):**[3]

---

[1] Boxes checked below shall be supported by completing the appropriate sections in Section III below.
[2] For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).
[3] Supporting documentation is presented in Section III.F.

☒ Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional. Explain: **The catch-and-release pond is man-made, excavated and isolated (1.64 acres). A forested wetland to the east of the pond is isolated (0.23 acres)**.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW

Identify TNW: **Chickahominy River and Gordon Creek**.

Summarize rationale supporting determination: These water bodies are used for recreational boating.

2. Wetland adjacent to TNW

Summarize rationale supporting conclusion that wetland is "adjacent": Some of the wetlands on the site directly abut these waterways.

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody[4] is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:

Watershed size: **Pick List**
Drainage area: 40 acres total for all three intermittent streams **acres**
Average annual rainfall: 51.03 inches
Average annual snowfall: 5.3 inches

(ii) Physical Characteristics:

(a) Relationship with TNW:

☒ Tributary flows directly into TNW.
☒ Tributary flows through **2** tributaries before entering TNW.

Project waters are **1 (or less)** river miles from TNW.
Project waters are **1 (or less)** river miles from RPW.
Project waters are **1 (or less)** aerial (straight) miles from TNW.
Project waters are **1 (or less)** aerial (straight) miles from RPW.
Project waters cross or serve as state boundaries. Explain: .

Identify flow route to TNW[5]: Three intermittent tributaries flow into an unnamed tributary to Gordon Creek.

---

[4] Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

[5] Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

Tributary stream order, if known: First order.

(b) General Tributary Characteristics (check all that apply):

Tributary is: ☒ Natural
☐ Artificial (man-made). Explain: .
☐ Manipulated (man-altered). Explain: .

Tributary properties with respect to top of bank (estimate):
Average width: 2-8 feet
Average depth: est. 0.5-2 feet
Average side slopes: **3:1 .**

Primary tributary substrate composition (check all that apply):

☒ Silts	☒ Sands	☐ Concrete
☐ Cobbles	☐ Gravel	☒ Muck
☐ Bedrock	☒ Vegetation. Type/% cover: Herbaceous emergent wetland vegetation (20-40% cover)	
☐ Other. Explain: .		

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: Stable.
Presence of run/riffle/pool complexes. Explain: non-tidal tributaries are very small and lack these features.
Tributary geometry: **Meandering**
Tributary gradient (approximate average slope): <1 to 10, varying by location %

(c) Flow:
Tributary provides for: **Seasonal flow**
Estimate average number of flow events in review area/year: **20 (or greater)**
Describe flow regime: The intermittent streams likely dry out in the summer.
Other information on duration and volume: .

Surface flow is: **Discrete and confined.** Characteristics: .

Subsurface flow: **Yes**. Explain findings: Intermittent Stream 1 has an approximately 50 foot section that is underground.
☐ Dye (or other) test performed: .

Tributary has (check all that apply):
☒ Bed and banks
☒ OHWM[6] (check all indicators that apply):

☐ clear, natural line impressed on the bank	☒ the presence of litter and debris
☒ changes in the character of soil	☐ destruction of terrestrial vegetation
☐ shelving	☐ the presence of wrack line
☐ vegetation matted down, bent, or absent	☐ sediment sorting
☐ leaf litter disturbed or washed away	☐ scour
☒ sediment deposition	☐ multiple observed or predicted flow events
☒ water staining	☐ abrupt change in plant community
☐ other (list):	

☒ Discontinuous OHWM.[7] Explain: Intermittent Stream 1 has an approximately 50 foot section that is underground.

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

☐ High Tide Line indicated by:	☐ Mean High Water Mark indicated by:
☐ oil or scum line along shore objects	☐ survey to available datum;
☐ fine shell or debris deposits (foreshore)	☐ physical markings;
☐ physical markings/characteristics	☐ vegetation lines/changes in vegetation types.
☐ tidal gauges	
☐ other (list):	

(iii) Chemical Characteristics:
Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).
Explain: Water is clear in non-tidal reaches. Tidal portion of the the tributary to Gordon Creek was not observed due to inaccessibilty (unstable wetland sediments).
Identify specific pollutants, if known: .

---

[6]A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.
[7]Ibid.

(iv) Biological Characteristics. Channel supports (check all that apply):

☒ Riparian corridor. Characteristics (type, average width): Forested drainage area on the eastern portion of the drainage area. The western portion of the drainage area (surrounding the ditch) is a mix of oldfield and turf.

☒ Wetland fringe. Characteristics: Forested wetlands on eastern portion of site, oldfield and early successional wetlands on the western portion of the drainage area.

☐ Habitat for:

☐ Federally Listed species. Explain findings: .

☐ Fish/spawn areas. Explain findings: .

☐ Other environmentally-sensitive species. Explain findings: .

☐ Aquatic/wildlife diversity. Explain findings: .

2. Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW

(i) Physical Characteristics:

(a) General Wetland Characteristics:

Properties:

Wetland size:7.5 acres

Wetland type. Explain: Mature forest, oldfield, early successional woodland.

Wetland quality. Explain: Forested wetland is undisturbed. Oldfield wetland appears to be occasionally cleared; a portion of it is within an easement for Colonial pipeline and is regularly cleared.

Project wetlands cross or serve as state boundaries. Explain: .

(b) General Flow Relationship with Non-TNW:

Flow is: **No Flow** . Explain: There is no flow in the wetlands outside the tributary channels except during flood events.

Surface flow is**: Not present**

Characteristics: .

Subsurface flow: **Pick List**. Explain findings: .

☐ Dye (or other) test performed: .

(c) Wetland Adjacency Determination with Non-TNW:

☒ Directly abutting

☒ Not directly abutting

☐ Discrete wetland hydrologic connection. Explain: .

☐ Ecological connection. Explain: .

☒ Separated by berm/barrier. Explain: The catch and release pond is separated from the ditch draining to Intermittent Stream 1 by a berm. .

(d) Proximity (Relationship) to TNW

Project wetlands are **1 (or less)** river miles from TNW.

Project waters are **1 (or less)** aerial (straight) miles from TNW.

Flow is from: **Wetland to navigable waters.**

Estimate approximate location of wetland as within the **5 - 10-year** floodplain.

(ii) Chemical Characteristics:

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain: Wetlands in forested and oldfield areas are expected to support good water quality.

Identify specific pollutants, if known: .

(iii) Biological Characteristics. Wetland supports (check all that apply):

☒ Riparian buffer. Characteristics (type, average width):Where forested, 5-100 feet.

☒ Vegetation type/percent cover. Explain: Forested wetlands have approximately 75% cover.

☐ Habitat for:

☐ Federally Listed species. Explain findings: .

☐ Fish/spawn areas. Explain findings: .

☐ Other environmentally-sensitive species. Explain findings: .

☒ Aquatic/wildlife diversity. Explain findings: This wetland supports wildlife habitats.

3. Characteristics of all wetlands adjacent to the tributary (if any)

All wetland(s) being considered in the cumulative analysis: **1**

Approximately (7.5) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)	Size (in acres)	Directly abuts? (Y/N)	Size (in acres)
Y	7.5		

Summarize overall biological, chemical and physical functions being performed: Wetlands provide aquifer discharge/recharge, water quality benefits. Forested wetlands provide wildlife habitat. Some wildlife habitat provided in oldfield wetlands.

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D: The ephemeral channel that drains to the unnamed tributary to the Gordon Creek Inlet .

2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: The three intermittent streams and their abutting wetlands have a significant nexus to the TNW.

3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D: The 1.64 acre catch and release pond is separated by a berm from wetlands and a ditch that drain into Intermittent Stream 1. This pond does not serve as a stormwater basin and appears to have been originally excavated as a farm pond. Its contributions to water quality and quantity are minimal.

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
   ☒ TNWs: aprox. 6731 linear feet variable width (ft), Or, acres.
   ☒ Wetlands adjacent to TNWs: 20.283 acres.

2. **RPWs that flow directly or indirectly into TNWs.**

☒ Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial: An unnamed tributary that flows to the Gordon Creek inlet appears to be of a size that is likely perennial.

☒ Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: The intermittent streams were flowing during the week of February 1 through 5. These streams have defined bed and bank characteristics as well as water staining, leaf litter that has been washed away, and changes in the character of the soil .

Provide estimates for jurisdictional waters in the review area (check all that apply):

☒ Tributary waters: **2,218** linear feet **2 - 8** width (ft).

☐ Other non-wetland waters: acres.

Identify type(s) of waters: .

3. Non-RPWs[8] that flow directly or indirectly into TNWs.

☒ Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):

☒ Tributary waters: **166** linear feet **0.5-1.5** width (ft).

☐ Other non-wetland waters: acres.

Identify type(s) of waters: **.**

4. Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.

☒ Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.

☒ Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: **wetlands are contiguous with the perennial and intermittent stream channels that flow to Gordon Creek.**

☒ Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: Wetlands are contiguous with the intermittent stream channels.

Provide acreage estimates for jurisdictional wetlands in the review area: **0.157 (these wetlands are only those at the headwaters of the seasonal RPWs (tributaries 2 and 3), as those abutting the perennial RPW are also abutting Gordon Creek (a TNW) and are included in the acreage for wetlands adjacent to TNWs)** acres.

5. Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.

☐ Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisidictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.

☐ Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. Impoundments of jurisdictional waters.[9]

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.

☐ Demonstrate that impoundment was created from "waters of the U.S.," or

☐ Demonstrate that water meets the criteria for one of the categories presented above (1-6), or

☐ Demonstrate that water is isolated with a nexus to commerce (see E below).

---

[8] See Footnote # 3.

[9] To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):[10]

☐ which are or could be used by interstate or foreign travelers for recreational or other purposes.
☐ from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
☐ which are or could be used for industrial purposes by industries in interstate commerce.
☐ Interstate isolated waters. Explain: .
☐ Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

Provide estimates for jurisdictional waters in the review area (check all that apply):
☐ Tributary waters: linear feet width (ft).
☐ Other non-wetland waters: acres.
Identify type(s) of waters: **.**
☐ Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

☐ If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
☐ Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
☐ Prior to the Jan 2001 Supreme Court decision in "*SWANCC*," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
☒ Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: **The catch-and-release pond and the isolated forested wetland east of the pond do not have a hydrologic connection to jurisdictional waters. The pond is a man-made, excavated feature that appears to have been originally excavated as a farm pond. The isolated wetland is a depression within the landscape that drains to an area where infiltration occurs and water filters underground.**
☐ Other: (explain, if not covered above): **.**

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
☒ Lakes/ponds: 1.64 acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☐ Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):
☐ Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
☒ Lakes/ponds: 1.64 acres.
☐ Other non-wetland waters: acres. List type of aquatic resource: .
☒ Wetlands: 0.23 acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
☐ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
☐ USGS NHD data.
☐ USGS 8 and 12 digit HUC maps.

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[10] Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA *Memorandum Regarding CWA Act Jurisdiction Following Rapanos.*

- ☒ U.S. Geological Survey map(s). Cite scale & quad name: Norge, VA quadrangle 1:24,000 (printed at 1' = 1,000').
- ☒ USDA Natural Resources Conservation Service Soil Survey. Citation:Web Soil Survey Custom Soil Report (January 2016).
- ☒ National wetlands inventory map(s). Cite name:NWI Online Wetlands Mapper (January 2016).
- ☐ State/Local wetland inventory map(s): .
- ☒ FEMA/FIRM maps: 51095C0094D; 51095C0113D.
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☒ Photographs: ☒ Aerial (Name & Date): USDA FSA (May/June 2014) - In attached memo.
  or ☒ Other (Name & Date): Site Photographs (February 2016) - In attached memo.
- ☒ Previous determination(s). File no. and date of response letter: NAO-2008-01032 10/2/2008.
- ☐ Applicable/supporting case law: .
- ☐ Applicable/supporting scientific literature: .
- ☐ Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD: .

ATTACHMENT E

Chickahominy River Flow Determination

Memorandum

To: *Michael Vergakis, P.E.*

From: *Frances Bui, P.E.*
Mitchell Heineman, P.E.
Karina Hull, P.E.

Date: *May 2, 2016*

Subject: *Chickahominy River Flow Determination*

Objective

This memorandum documents the approach to provide an estimate of the available flow in the Chickahominy River at Brickyard Landing and Chickahominy Riverfront Park to determine the feasibility of constructing a 12 million gallon per day (mgd) reverse osmosis water treatment facility with a raw water withdrawal of 18 mgd (27.9 cubic feet per second (cfs)). The estimated flows in this memorandum are also necessary for the Joint Permit Application (JPA) of the Chickahominy Riverfront Park raw water intake, pump station, and treatment facility.

Background

On March 11, 2016, the following organizations met at the James City Service Authority (JCSA) to outline the flow determination approach:

- JCSA
- Virginia Department of Environmental Quality (DEQ)
- Virginia Marine Resources Commission (VMRC)
- Virginia Institute of Marine Science (VIMS)
- CDM Smith

A meeting summary was distributed to the attendees on March 15, 2016.

Based on this discussion, it was determined that the traditional method of estimating flow based on drainage area is not applicable to the Chickahominy River due to the tidal influence. VIMS recommended that flow be estimated by adding the tidal prism to the nearest United States Geological Survey (USGS) gage with historical data. This memorandum provides a description of the existing data that was reviewed, including monitoring gages, existing withdrawals, and drainage

area estimates. A discussion of how the data was applied to develop the flow estimates by the tidal prism method and by linear scaling of the stream gages follows.

Existing Data

USGS Gage on Chickahominy River

The nearest USGS gage on the Chickahominy River to the proposed sites is located at Providence Forge (USGS site 02042500), 11 miles northwest of Brickyard Landing. The period of record at this gage is January 1942 to present.

Tidal Gage

The nearest long-term tide gage monitored by the National Oceanic and Atmospheric Administration (NOAA) is located at Sewell's Point (Station ID 8638610). The station has been in service since 1927.

Since August 2015, USGS has maintained a tide gage on the James River at the Jamestown Ferry Pier (USGS site 02042770).

Walker's Dam and Newport News Waterworks Withdrawal

Walker's Dam is a low-head impoundment of Chickahominy River located 11 river miles downstream of the Providence Forge gage and 22 river miles upstream of the confluence of the Chickahominy and James rivers. Walker's Dam was built in 1942. Because of its age, the dam does not have a fixed maximum withdrawal stipulated on its permit. Flow is uncontrolled during normal operation. NNWW opens the fish ladder gates to maintain the 10-cfs minimum-instream-flow (MIF) requirement when the water level is below 3 feet. In the 1970s, it was stipulated that NNWW could not pump to Little Creek Reservoir when the water level is below 3 feet. Above 3 feet, NNWW can pump up to 40 mgd to Little Creek Reservoir. There is no limit to the quantity they can pump to the terminal reservoirs located 30 miles away; the limit is based on the hydraulic capacity of the physical structure.

CDM Smith contacted DEQ and questioned what flow should be assumed for the NNWW withdrawal. DEQ indicated that the NNWW permitted withdrawal limit is being evaluated. Historical data of NNWW's maximum day withdrawal provided by DEQ is included in the Appendix. For the purposes of this analysis, the NNWW maximum withdrawal is assumed to be 42.2 mgd based on the data from 1997 to 2015; the maximum withdrawal should be refined once DEQ has established the limit.

Drainage Area Estimates

Drainage area estimates for the USGS gage and proposed sites are summarized in **Table 1**.

Table 1 Chickahominy River Drainage Area Estimates

Location	Drainage Area (square miles (mi^2))	Reference
Providence Forge	251	USGS 02042500 Chickahominy River near Providence Forge, VA waterdata.usgs.gov/nwis/inventory/?site_no=02042500
Brickyard Landing	385	USGS StreamStats (NAD 1983 Latitude 37.3693, NAD 1983 Longitude -76.8799
Chickahominy Riverfront Park	454	USGS StreamStats (NAD 1983 Latitude 37.2669, NAD 1983 Longitude -76.8792

Flow Estimation by Tidal Prism Method

The tidal prism is the volume of water that flows in and out of a bay with the tide, excluding freshwater flow. Tidal flux can be determined from the tidal prism volume based on the half-period of the principal lunar semi-diurnal (M_2) tide. The period of the M_2 (e.g., from high tide to high tide) is 12.42 hours; the duration from low tide to high tide is half that duration, or 6.21 hours. The mean tidal range at Sewell's Point is 2.43 feet.

The surface area of the Chickahominy River above the proposed sites is shown in **Figure 1**. The tidal prism volume is the tidal range multiplied by the surface area of water that passes by during a tide cycle. For example, the tidal area that influences the proposed site at Brickyard Landing is the area from the landing to Walker's Dam. At Chickahominy Riverfront Park, the tidal area is the area from the park to Walker's Dam. Surface area of tidal water upstream of the proposed locations is summarized in **Table 2**.

Table 2 Chickahominy River Tidal Surface Area

Location	Surface Area of Tidal Water Upstream of Location (mi^2)
Brickyard Landing	4.39
Chickahominy Riverfront Park	11.65

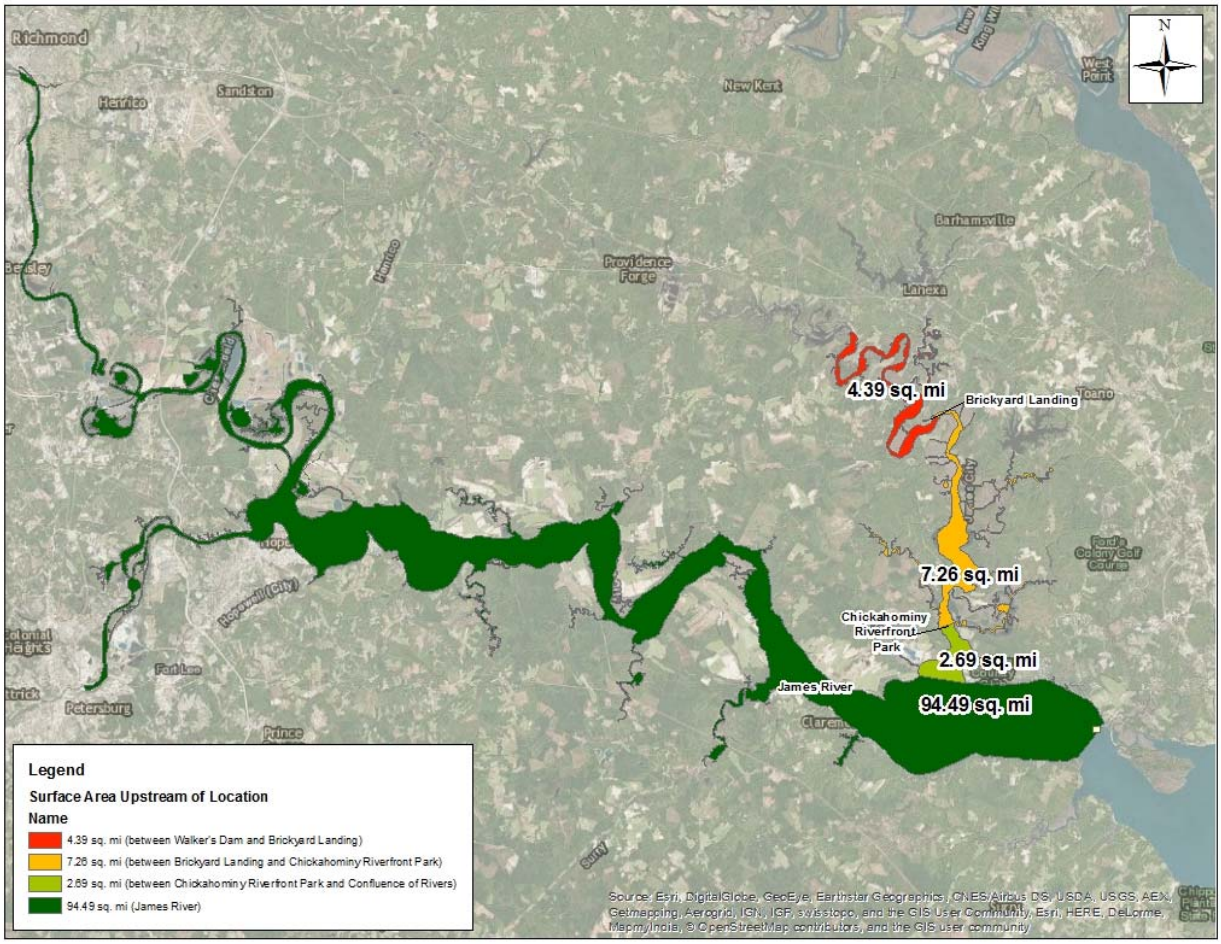

Figure 1. Surface Area Calculation

Tidal flux is summarized in **Table 3** based on the mean tidal range at Sewell's Point, surface areas at each location, and the half-M_2 period (6.21 hours).

Table 3 Tidal Prism Summary

Parameter	Brickyard Landing	Chickahominy Riverfront Park
Upstream tidal surface area (mi^2)	4.39	11.65
Upstream tidal surface area (ft^2)	1.22E+08	3.25E+08
Tidal range (ft)	2.43	2.43
Tidal prism (ft^3)	2.97E+08	7.89E+08
Tidal flux (ft^3/hr)	4.79E+07	1.27E+08
Tidal flux (cfs)	13,302	35,301
Tidal flux (mgd)	8,599	22,819

Flow Estimates by Linear Scaling of Stream Gages

Using the information provided in Table 1 and USGS data for Chickahominy River near Providence Forge, average stream flows at the proposed locations were estimated using linear scaling, as presented in **Table 4**.

Table 4 Chickahominy River Streamflow Estimates

Description	Providence Forge	Brickyard Landing	Chickahominy Riverfront Park
Drainage area (mi^2):	251	385	454
Average streamflow (cfs):	265	407	480
Median monthly flow (cfs):			
January	294	451	532
February	341	523	617
March	359	551	649
April	275	422	497
May	168	257	303
June	87	133	157
July	61	94	110
August	62	95	112
September	44	68	80
October	62	95	112
November	131	201	237
December	225	345	407

The flow estimates in Table 4 do not account for NNWW's withdrawal from the Chickahominy River at Walker's Dam. NNWW's raw water withdrawal is assumed to be 42.2 mgd (65.4 cfs), based on the 1997 to 2015 historical data. Estimated streamflow with the reduction due to NNWW's withdrawal is summarized in **Table 5**. Table 4 indicates that the lowest median monthly flows occur in September; NNWW's withdrawal is approximately 96 percent of the Brickyard Landing median monthly flow for September and 82 percent of the Chickahominy Riverfront Park median monthly flow for September.

Table 5 Chickahominy River Streamflow Estimates with 42.2 mgd NNWW Withdrawal

Description	Brickyard Landing	Chickahominy Riverfront Park
Average streamflow (cfs):	342	415

Summary

Table 6 compares tidal flux and average streamflow. Tidal flux is much greater than freshwater streamflow. At Brickyard Landing, tidal flux averages 13,302 cfs, while average freshwater flow is

407 cfs without the NNWW withdrawal, or 342 cfs with the NNWW withdrawal. At Chickahominy Riverfront Park, tidal flux averages 35,301 cfs, while average streamflow is 480 cfs without the NNWW withdrawal and 415 cfs with the NNWW withdrawal. Since tide ebbs and floods every 12.4 hours, net tidal flux is zero and does not affect the total monthly streamflow. The proposed raw water withdrawal of 27.9 cfs (18 mgd) constitutes 7 and 6 percent of estimated average streamflow at Brickyard Landing and Chickahominy Riverfront Park, respectively, without the NNWW withdrawal, or 8 and 7 percent, respectively, with the NNWW withdrawal.

Table 4 indicates that the lowest flows occur in September. NNWW's withdrawal constitutes approximately 96 percent of the Brickyard Landing median flow for September and 82 percent of the Chickahominy Riverfront Park median flow for September; there would be minimal freshwater flow in the river during a typical September. Streamflow at Brickyard Landing and Chickahominy Riverfront Park would be primarily tidal flow in September if NNWW withdraws at 42.2 mgd.

Table 6 Flow Estimates with NNWW Withdrawal

Description	Brickyard Landing	Chickahominy Riverfront Park
Average streamflow without NNWW withdrawal (cfs):	407	480
Average streamflow with NNWW withdrawal (cfs):*	342	415
September median flow without NNWW withdrawal (cfs)	68	80
Tidal flux (cfs)	13,302	35,301

*Assumes NNWW's withdrawal is 42.2 mgd based on maximum day withdrawal from 1997 to 2015 provided by DEQ.

Appendix A

NNWW Historical Data Provided by DEQ

Source	Year	Maximum Day Withdrawal (mgd)
CHICKAHOMINY RIVER	2015	19.6
CHICKAHOMINY RIVER	2014	20
CHICKAHOMINY RIVER	2013	21
CHICKAHOMINY RIVER	2012	29
CHICKAHOMINY RIVER	2011	37
CHICKAHOMINY RIVER	2010	39.1
CHICKAHOMINY RIVER	2009	38
CHICKAHOMINY RIVER	2008	N/A
CHICKAHOMINY RIVER	2007	38
CHICKAHOMINY RIVER	2006	37.2
CHICKAHOMINY RIVER	2005	37.1
CHICKAHOMINY RIVER	2004	37.3
CHICKAHOMINY RIVER	2003	40.5
CHICKAHOMINY RIVER	2002	N/A
CHICKAHOMINY RIVER	2001	37.2
CHICKAHOMINY RIVER	2000	37.3
CHICKAHOMINY RIVER	1999	38.7
CHICKAHOMINY RIVER	1998	40.66
CHICKAHOMINY RIVER	1997	42.17
CHICKAHOMINY RIVER	1996	N/A
CHICKAHOMINY RIVER	1995	N/A
CHICKAHOMINY RIVER	1994	N/A
CHICKAHOMINY RIVER	1993	40
CHICKAHOMINY RIVER	1992	N/A
CHICKAHOMINY RIVER	1991	N/A
CHICKAHOMINY RIVER	1990	N/A
CHICKAHOMINY RIVER	1989	61

*Assumes NNWW's withdrawal is 42.2 mgd based on maximum day withdrawal from 1997 to 2015 provided by DEQ.

N/A = Not Available

ATTACHMENT F

JCSA Water Demand Variation

Water Demand Variation

Seasonal Demand Variation

The water withdrawal is anticipated to vary with the seasonal demands of the year. Figures F-1 through F-6 provide examples of the variation in daily demands since 2010. As shown on these graphs, the demands typically increase during the warmer weather months from May through September. The projected maximum day demand is estimated to be 1.5 times the average day demand.

Daily Demand Variation

Water withdrawal is also anticipated to vary with the hourly demands during the day. Figures F-7 through F-10 provide SCADA hourly demand data for representative days. As shown on these figures higher demands generally occur in the early morning hours around 6 a.m. and during the evening hours around 7 p.m. When the demand curve is higher than the supply provided by the wells and the Five Forks Water Treatment Facility, the demand greater than the supply is met by flow from the storage facilities. When the demand curve is lower than the supply, the supply is being used to fill the storage facilities.

It should be noted that the demand curve for Monday, June 20, 2016 has a lower peak demand than the demand curve for Tuesday, June 21, 2016. The lower peak demand is reflective of JCSA's conservation plan which designates each Monday as a non-irrigation day.

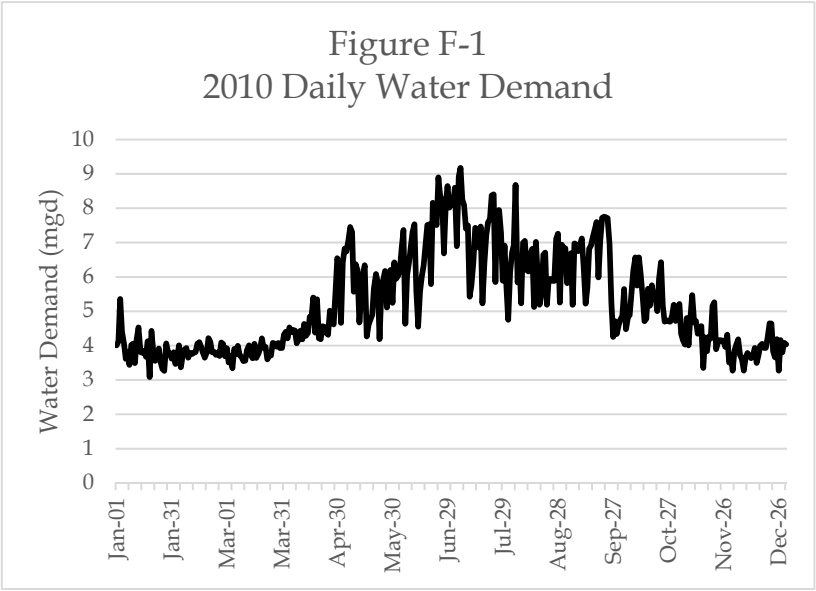
Figure F-1
2010 Daily Water Demand
Water Demand (mgd)
0
1
2
3
4
5
6
7
8
9
10
Jan-01
Jan-31
Mar-01
Mar-31
Apr-30
May-30
Jun-29
Jul-29
Aug-28
Sep-27
Oct-27
Nov-26
Dec-26

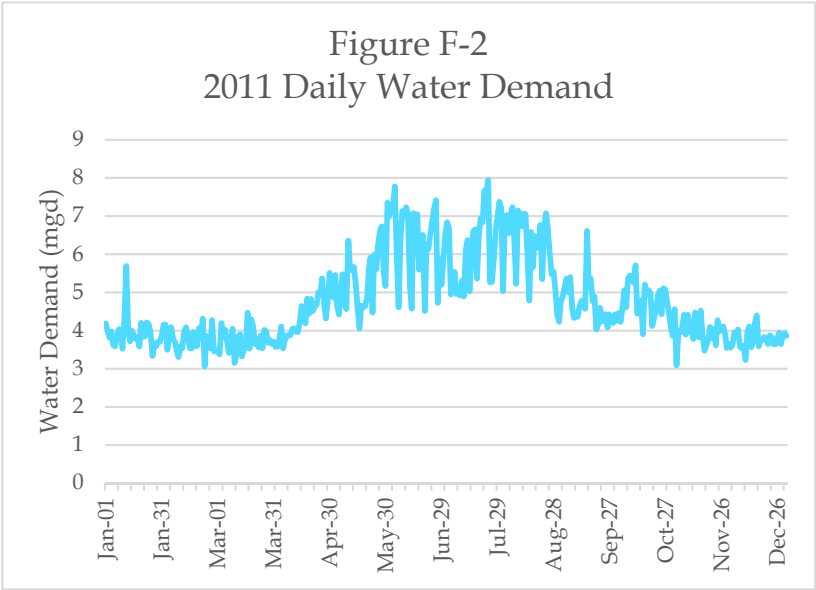
Figure F-2
2011 Daily Water Demand
Water Demand (mgd)
0
1
2
3
4
5
6
7
8
9
Jan-01
Jan-31
Mar-01
Mar-31
Apr-30
May-30
Jun-29
Jul-29
Aug-28
Sep-27
Oct-27
Nov-26
Dec-26

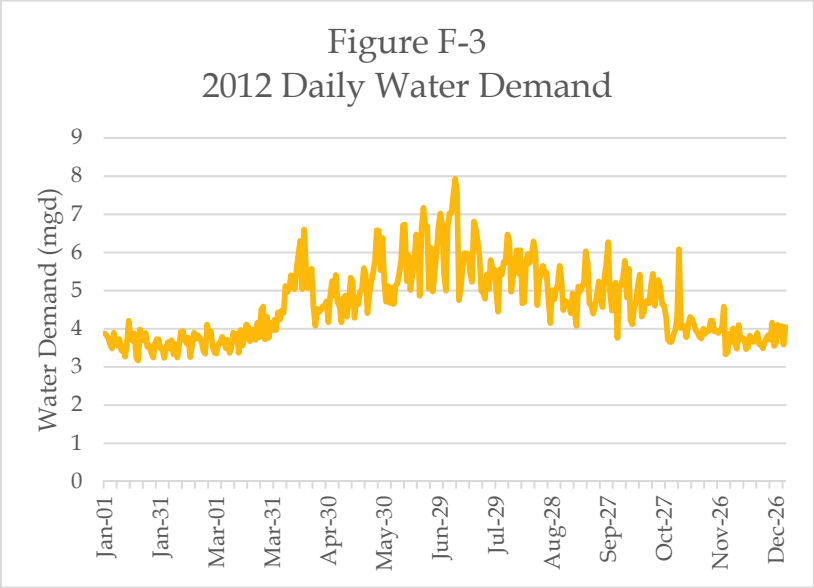
Figure F-3
2012 Daily Water Demand
Water Demand (mgd)
0
1
2
3
4
5
6
7
8
9
Jan-01
Jan-31
Mar-01
Mar-31
Apr-30
May-30
Jun-29
Jul-29
Aug-28
Sep-27
Oct-27
Nov-26
Dec-26

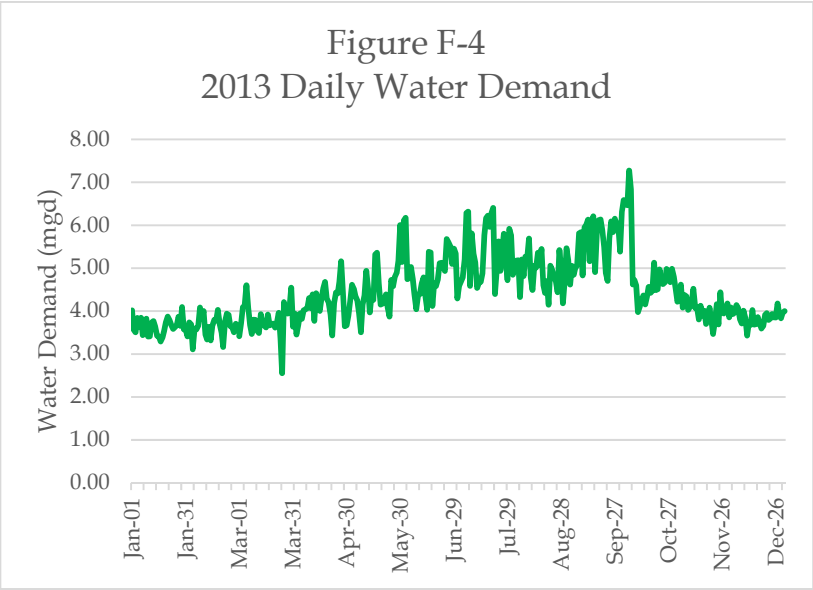
Figure F-4
2013 Daily Water Demand
Water Demand (mgd)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan-01
Jan-31
Mar-01
Mar-31
Apr-30
May-30
Jun-29
Jul-29
Aug-28
Sep-27
Oct-27
Nov-26
Dec-26

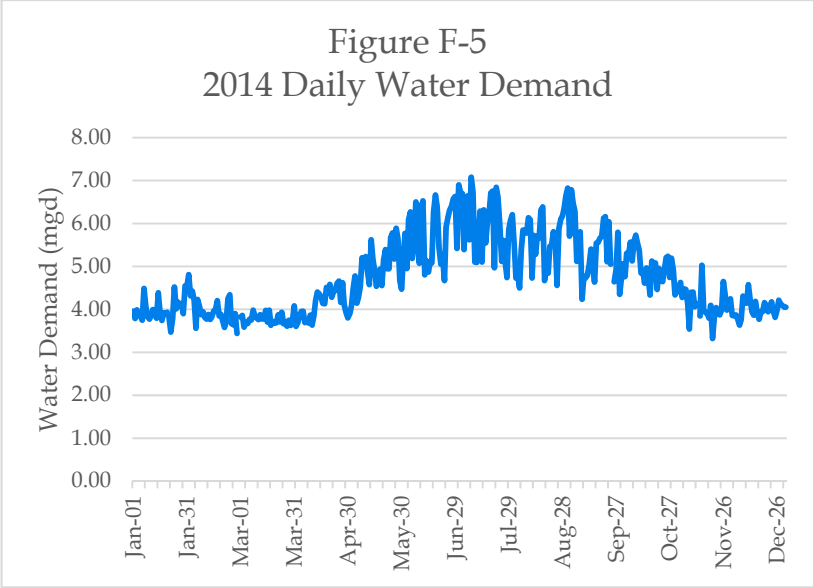
Figure F-5
2014 Daily Water Demand
Water Demand (mgd)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan-01
Jan-31
Mar-01
Mar-31
Apr-30
May-30
Jun-29
Jul-29
Aug-28
Sep-27
Oct-27
Nov-26
Dec-26

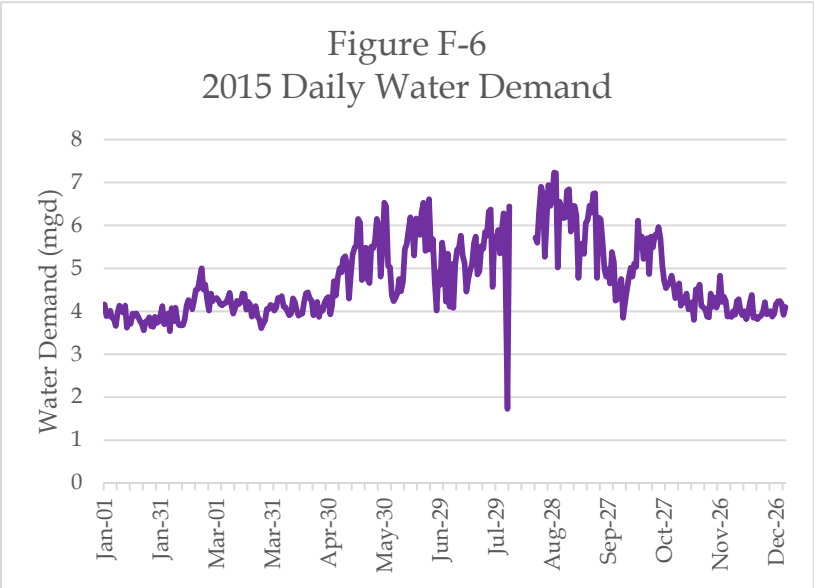
Figure F-6
2015 Daily Water Demand
Water Demand (mgd)
8
7
6
5
4
3
2
1
0
Jan-01
Jan-31
Mar-01
Mar-31
Apr-30
May-30
Jun-29
Jul-29
Aug-28
Sep-27
Oct-27
Nov-26
Dec-26

Figure F-7
August 29, 2015 – SCADA Hourly Demand Graph

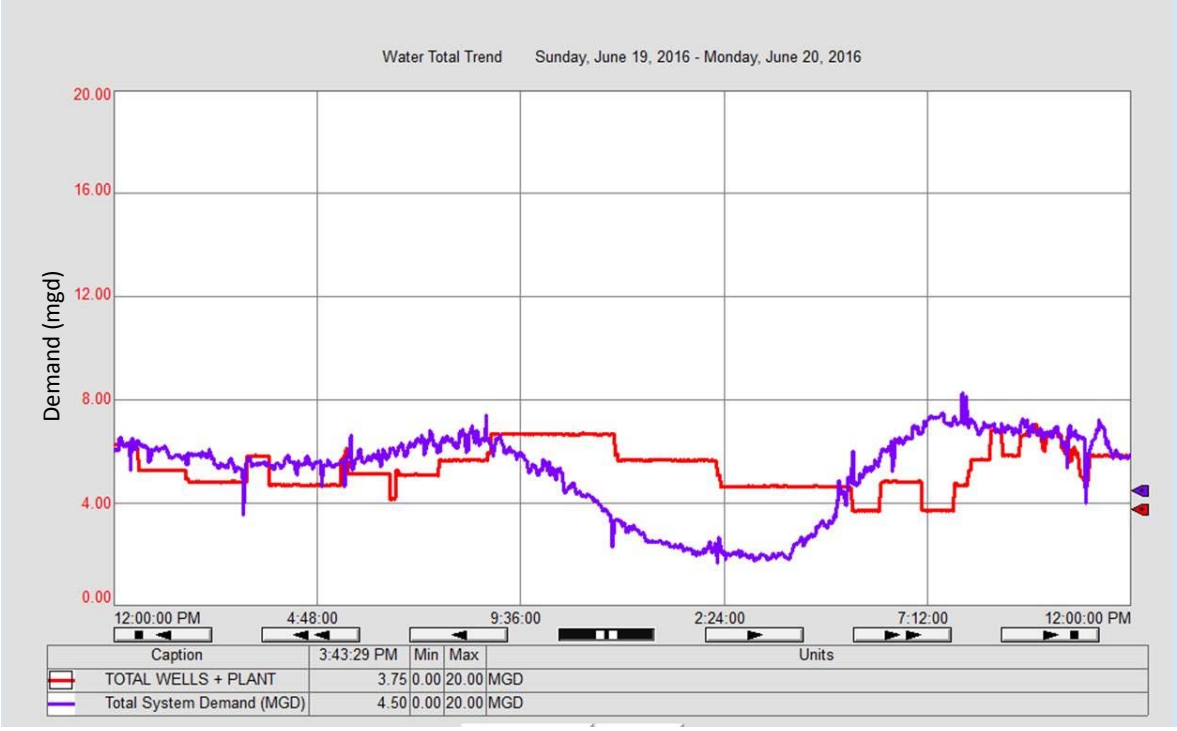

Figure F-8
June 19, 2016 – SCADA Hourly Demand Graph

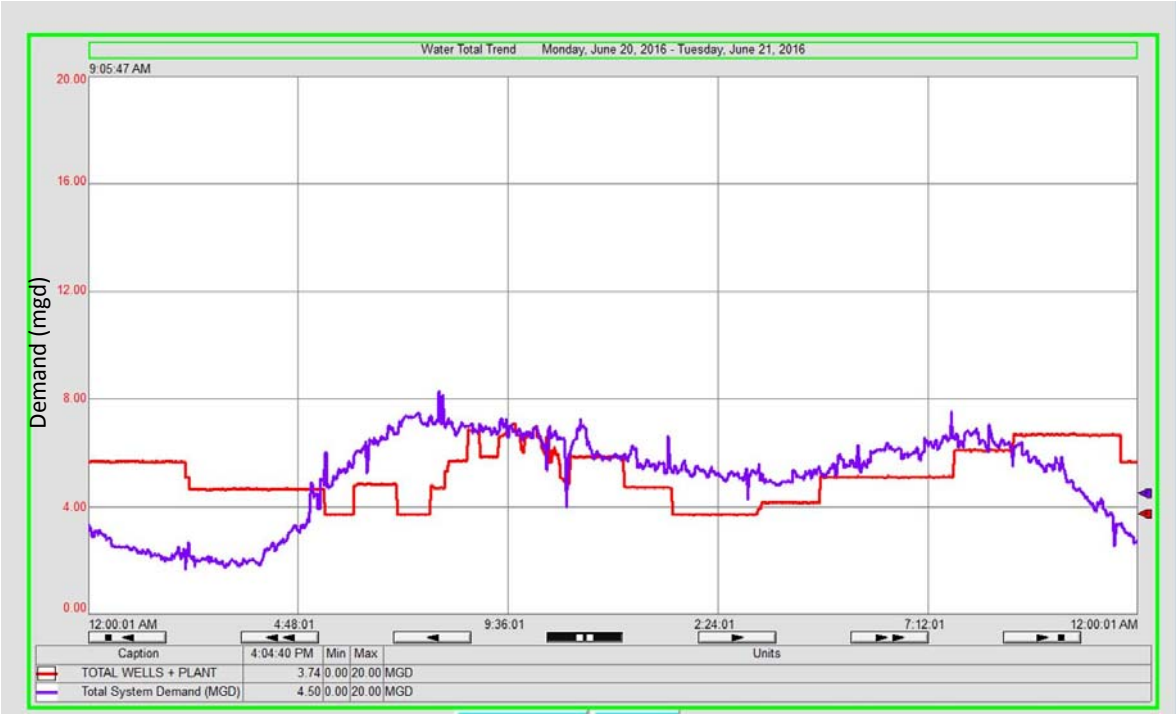

Figure F-9
June 20, 2016 – SCADA Hourly Demand Graph

Figure F-10
June 21, 2016 – SCADA Hourly Demand Graph

ATTACHMENT G

JCSA Water Conservation

And Drought Response Plan

Amended October 22, 2002

SECTION 33. WATER CONSERVATION AND DROUGHT MANAGEMENT PLAN

The purpose of this section is to establish policies that support County Ordinance, Chapter 11, Article VI, Drought Management.

A. Water Conservation Plan

1. Introduction

Population projections and economic growth within James City County have raised public awareness of the inadequacy of public water supplies to satisfy future needs. Of particular concern is the reliability of the quality and quantity of the surface water and groundwater resources in the region. Another concern is the adequacy of surface and groundwater supplies to meet current and projected demands during drought conditions or during a well facility failure. Therefore, conservation of available and proposed water supplies shall be a key element of the James City Service Authority's (JCSA) long-range strategy for public water supply management.

Conservation is not the complete solution. However, conservation can extend a finite water supply, postponing the need for costly repairs and expansion while reducing the impacts of future growth and water supply emergencies.

The goals of this water conservation program are:

- Reduce future demands on limited water supplies.
- Reduce the magnitude of seasonal peak water demands.
- Fully integrate water conservation into long-range water supply planning and management.
- Fully integrate water conservation into land use planning and development.

Water conservation means measures intended to improve the efficiency of water use and reduce waste. The intent of this definition is to focus on technical methods of reducing water demands through efficiency. This definition is not to be equated with a similar level of sacrifice by end users to comply with temporary emergency measures that are implemented during drought conditions or a water supply emergency.

2. Conservation Measures

(a) Water Conservation Staff

In 2000, JCSA upgraded the part-time Water Conservation Coordinator to a full-time staff position. The Water Conservation Coordinator is responsible for implementing and managing all conservation related activities, with an emphasis on public information and education.

(b) Public Information and Education

Public acceptance of this conservation plan requires information and education. The primary goals of the education program are as follows:

(1) Educate citizens of local public water supply issues and problems.

(2) Inform citizens of the benefits of water conservation that include:

- Optimized use and efficiency of public water supplies
- Cost savings by reducing, delaying, or eliminating utility system expansions
- Reduced risk of public water supply shortages
- Protection of economic viability of the area

(3) Educate citizens on water-conserving measures such as water efficient landscaping and low flow fixtures.

Local target groups for water conservation education include:

- Government boards and commissions
- News Media
- Homeowners associations
- Industrial and commercial establishments
- Students and teachers
- Community leaders and influential citizens
- Professionals and tradesmen, landscape contractors, irrigation contractors, nursery owners, builders and developers)
- High water-use industries and businesses (golf courses, laundries, motels, hotels, car washes, and restaurants)

In April 2001, the JCSA launched "Let's be Water Smart," a public/private water management initiative. The goal of Let's be Water Smart is to promote responsible water usage in James City County.

Let's be Water Smart is a public education program and a partnership between JCSA and local stakeholder businesses, including landscape contractors, irrigation contractors, nurseries, builders and developers. The program offers partnership opportunities to these businesses, in exchange for promoting "Water Smart" practices to their customers. Most, if not all, of JCSA's water conservation efforts are promoted as Let's be Water Smart programs. The program includes educational advertising, brochures, product giveaways, contests, workshops, demonstration landscapes, public presentations, environmental events participation, Water Smart communities, and policy development.

The JCSA also participates in the Hampton Roads Water Efficiency Team (HRWET) a regional organization representing all water purveyors in the Hampton Roads area. The mission of HRWET is to educate the public and promote water conservation. The group distributes educational material at public events and to groups across the region. The following is a list of potential public education "forums": The Water Conservation Coordinator represents JCSA at HRWET meetings and events.

(c) Water Conservation Committee

In January 2000, the JCSA Board of Directors adopted a resolution establishing a citizen-based Water Conservation Committee. The Committee's purpose is to "raise public awareness of water conservation issues and recommend water conservation initiatives." The Committee works with staff to achieve the following goals:

- Provide a community perspective on water conservation issues;
- Assist and advise the JCSA and Water Conservation Coordinator in the development of water conservation programs;
- Assist in the promotion of water conservation goals throughout the County;
- Provide citizen input on the implementation of JCSA/JCC water conservation programs; and
- Raise public awareness of the County's water supply and the need to use water efficiently with the objective of changing water use habits.

(d) Water Conserving Plumbing Code

Interior water-use in both residential and commercial settings is largely "technology based," that is, the water use rate of fixtures and appliances determines the amount of water required to accomplish a function. Improvement of end use efficiency by reducing water use rates is a major means of conserving public water supplies.

The various methods of increasing interior water-use efficiency can be classified in two basic categories: (1) code standards for new construction and (2) retrofitting of

existing structures. Although the potential water savings for each category are similar, they differ in the institutional and regulatory issues and the water savings they realize.

Section 15 of these Regulations were last revised in July 1995. The Regulations allow the termination of utility service when "service to a customer is of such magnitude or such character that utility service to other customers is affected" or for "negligent and wasteful use of water during periods when restrictions on consumption are imposed to conserve water."

James City County adopted the Uniform Statewide Building Code (USBC) as the County building code in 1974. The 1984 revision of this code required the installation of low flow (3 gallons per minute) shower heads, low volume (3.5 gallons per flush) toilets, water saving washing and dishwashing machines, and flow controlled or aerated faucets in new construction and renovation of existing structures. The 1996 Edition of this code with 2000 Amendments further increased conservation methods by requiring the installation of low flow shower heads (2.5 gallons per minute), low volume toilets (1.6 gallons per flush), and water conserving sink faucets (2.2 gallons per minute).

The General Assembly passed legislation in 1993 allowing localities to adopt standards for plumbing fixtures more stringent than those of the 1990 Building Officials and Code Administration (BOCA) Plumbing Code. The 1993 revision of the BOCA Plumbing Code further decreased the flow rate, or consumption of water per use, for plumbing fixtures. The Virginia Department of Housing and Community Development incorporated the 1993 BOCA Plumbing Code Plumbing Code into the USBC in April 1994. The JCSA incorporated those rates in the latest revision of the Regulations. The 1995 BOCA Plumbing Code further decreased flow rates to the same rates as the 1996 USBC Edition.

All plumbing work in James City County must conform to the latest requirements for water conserving fixtures.- High water use plumbing fixtures remain on the market, and home or business owners may replace water-saving fixtures with higher usage fixtures if the replacement is not part of a renovation project.

(e) Water Conservation Retrofit Program

The water demand projections prepared by County staff 1986, considered that residential demand should reduce from 81 gallons per capita day (gpcd) to 69 gpcd through an active water conservation program, new construction utilizing water-conserving fixtures required by the plumbing code, and the replacement of existing fixtures with water-conserving fixtures. Replacement of existing fixtures was projected to occur at a rate of 1 percent per year.

In March 2000, the JCSA participated in an EPA Environmental Justice Grant, administered by the Hampton Roads Planning District Commission, HRWET's umbrella organization. With EPA grant monies, JCSA, HRWET, and local volunteers retrofitted ninety lower-income homes with 1.6 gpf low flow toilets.

(f) Water Conservation-Oriented Rate Structure

(1) The key issues that must be addressed to achieve demand reductions through the rate structure are conservation pricing and marginal cost pricing.

Conservation Pricing

Water is relatively inexpensive in comparison to other household purchases so reduction in use is limited even when price increases. Most studies have found consumption somewhat responsive to price changes, but the change in consumption is usually proportionally less than the associated price change and often is only temporary. Essential water uses are generally less responsive to price changes than nonessential uses. Water use within the home, for example, is less responsive to price increases than exterior water use.

Estimates of the price elasticity in water demand from other areas vary widely. Studies estimate a 100 percent increase in water rates will decrease total residential water use from 1 to 60 percent and exterior water use from 27 to 70 percent. These studies suggest consumer behavior can be modified with rate increases but permanent behavioral adjustment may take several years to occur.

Marginal Cost Pricing

Utilities have set water rates in the past to reflect the average cost of water. Economists have argued that water rates should reflect the cost of the next unit of water obtained by the utility, or the marginal cost. The charge for water from a new and expensive source should reflect that additional cost even if it is greater than the average cost. Rates based on these marginal costs would reflect the increasing scarcity and cost of new water supplies.

Effective October 1, 2000, a new increasing block rate structure replaced the existing block rate structure for residential customers.

Other rate options that may be set up if needed are: replacing the single block rate that will remain in effect for commercial customers with the increasing block rate; implementing the seasonal surcharge and apply it to residential customers again; eliminating the current practice of allowing sub-meters off private service lines for outdoor uses and require a separate service connection and meter with appropriate fees; and assessing a pumpage fee similar to the

peaking factor charged by electric utilities to encourage individual conservation efforts.

(g) Universal Metering and Meter Repair and Replacement

The JCSA meters all customer accounts. Studies show that metering results in lower water use since customers become "sensitized" to the amount of water used through the effect it has on the water bill. Metering is also an aid to detecting leaks on both sides of the meter.

Maintenance programs for water meters are essential to ensure that an accurate measure of system integrity is obtained. Under-registration by meters may result in a significant percentage of unaccounted for water and loss of revenue.

The JCSA has a meter replacement program that requires the replacement of residential meters every 15 years. Fifteen (15) years is the average service life of residential meters. After all residential meters are within that 15-year service life, a percentage of the total meters in the system will be changed every year to maintain that standard.

The JCSA is also considering a program to evaluate the sizing of meter installations for larger commercial customers. This study will evaluate the development of a routine maintenance and replacement program for these meters. Meanwhile, these meters are calibrated and repaired or replaced upon special request by a customer or based on irregular readings in error by three percent or greater.

The JCSA has an ongoing program for purchasing private water systems in James City County. Many systems the JCSA acquired were not metered or there were no records about the maintenance or age of the customer's meters. The JCSA installed meters in those systems that were not metered and replaced the meters in the systems that had no records of their age.

(h) Water Conserving Landscaping

Landscape irrigation can create seasonal peak water demands. Landscape irrigation use is largely dependent on weather conditions so large variations in peak demand occur between wet, normal, and dry years. Drought conditions typically increase total water use and peak water demands. In 2001, the average peak summer month demands on the JCSA systems were 18% greater than average day demands, and the highest peak demand month was 82% higher than the lowest demand month of 2001. Reducing the magnitude of seasonal peak water demand offers the greatest potential for optimal sizing of water supply, treatment, transmission, and distribution facilities.

One method of reducing the seasonal peak demand for landscape irrigation is to promote and encourage water efficient landscape practices for this region, such as:

- Planning and design to maximize water efficiency.
- Implementing an annual maintenance plan for the specific needs of the landscape.
- Replacing turf with landscaped beds, mulched areas, ground covers, or hard structures.
- Improving soil to ensure water holding capacity, absorption properties, and nutrients for plant growth.
- Using native and other adapted low-water-use plants.
- Efficient irrigation.

The acceptance and use of water efficient landscaping by County citizens is necessary for the long-term success of this Conservation Plan. To achieve widespread use of water efficient landscape practices, JCSA/JCC will:

- Use all available educational resources to ensure public awareness of the fundamentals, long-term benefits, and cost-effectiveness of the Water Smart concept.
- Require all new developments requiring a special use or rezoning permit to include water conservation proffers in their plans, including Water Smart landscaping practices, and develop specific water conservation guidelines for each development.
- Design and properly maintain demonstration landscapes in highly visible areas within James City County such as County buildings.
- Encourage the use of automatic underground drip irrigation systems for both turf areas and landscaped beds.

(i) Leak Detection and Water Audits

Good construction standards for public water systems and a water main replacement program for areas where leaks recur will result in fewer leaks. The JCSA established and maintains **Standards and Specifications for Water Distribution Systems,** which defines material and construction standards for wells, water mains, storage and pumping facilities and appurtenances. These Standards are reviewed and updated routinely to ensure they accurately reflect the best engineering practices, materials,

construction standards, and inspection techniques. The JCSA also has an active ongoing program for leak detection and repair.

Ground elevations in James City County range from sea level to nearly 120 feet. This represents a pressure variation of approximately 50 pounds per square inch (psi) between the high and low areas of the County. In order to provide for adequate, but not excessive, system pressure in both the high and low areas the system is divided into main and secondary pressure zones. The secondary pressure zones are separated from the main pressure zone through a series of pressure reducing valves (PRV's).

Using PRVs to reduce system pressure aids conservation in two (2) ways. The first is by reducing losses from leaks or faulty fixtures that might go undetected for long periods. Secondly, PRVs will also reduce the amount of water consumed in "time dependent" uses such as showers.

Water audits offer a way to identify and eliminate excessive use of public water. Public water purveyors routinely compare the metered amount of water they produce with the metered consumption of their customers to determine the amount and percentage of unaccounted for water in their system(s). The last audit of the JCSA system was done in 1990 and concluded the unaccounted for water equaled 6% of system demand. This is very favorable when compared to the national average of 10-15%.

The JCSA systems will be audited during the first two years of each groundwater withdrawal permit. The results of these audits will be used to identify areas for the JCSA's active ongoing leak detection and repair program. Areas of recurring leaks will be included in the capital improvement program for line replacement.

(j) Wastewater Reuse and Recycling as a Conservation Measure

The RRWSG evaluated wastewater reuse as a long-term alternative supply to meet the water demands on the York-James Peninsula. In light of strong opposition to this alternative from the Virginia Department of Health, the consultant's report concluded, "it is highly unlikely that the Commonwealth of Virginia would approve a Lower Peninsula wastewater reuse project for potable use." This report went on to state that wastewater reuse to meet non-potable demands such as industrial cooling, irrigation and car washes might be more viable. The Federal agencies reviewed the scope of the study performed for the Regional Raw Water Study Group and concurred with the consultant's recommendation that further evaluation of wastewater reuse is needed to meet non-potable demands only.

"Wastewater reuse" is a general term applied to any process in which a wastewater stream is employed for any beneficial use. Wastewater recycling is a subclass of wastewater reuse and refers to a situation where the same water is used over and over to satisfy the same demand. For the purpose of this discussion, wastewater reuse is

defined as a deliberate strategy of directly reusing wastewater effluent, treated to the degree appropriate for the intended reuse, to satisfy non- potable demands.

The JCSA Regulations require process water reuse in certain commercial/industrial operations, i.e., car washes. The water connection fees based on the size of the water meter, and also the associated sewer connection fees, encourage wastewater reuse by all commercial/industrial customers. Correct sizing of water meters to accurately register consumption has already been addressed in item 5, Universal Metering, above.

Sewage treatment in the Hampton Roads area is provided by the Hampton Roads Sanitation District who recently initiated a regional effort to develop a plan for permitting and implementing a program to satisfy non-potable demands through wastewater reuse. James City County is represented by staff from the JCSA and is dedicated to maximizing the effectiveness of this initiative.

(k) Outdoor Water-Use Ordinance

In order to encourage a reduction in Outdoor Water Use and better manage water supply, the Board of Supervisors of James City County approved an Ordinance regulating the day of week and time of day that property owners/occupants can use water outdoors. The Ordinance provides that between May 1 and September 30 of each year, structures with even street numbers can use water outdoors on Tuesday, Thursday, and Saturday; structures with odd street numbers can use water outdoors on Wednesday, Friday, and Sunday. No water is allowed to be used outdoors on Monday's or between the hours of 9 a.m. and 5 p.m., except with a hand-held hose with an automatic cutoff.

B. Drought Contingency Plan

1. <u>Water System Background</u>

The JCSA draws water from numerous wells located throughout James City County. The wells are interconnected to improve reliability and provide fire flows. These wells form the Central Water System.

The water withdrawn from these wells is pumped into distribution systems and storage facilities to provide water service to the Primary Service Area (PSA). The PSA is the part of James City County identified in the County's Comprehensive Land Use Plan as receiving urban-level services such as public water and sanitary sewer.

The JCSA also operates several independent water systems that are not connected to the Central System.

Within the PSA, the JCSA provides water service to approximately 13,500 (2002) customers (9,100 after 1997), all public schools (2002), and over 1,000 commercial and industrial customers. The number of JCSA water customers increased by approximately 600 per year over the last several years. This trend is expected to continue.

2. Normal Water Demands and Flows

The Central System has a Virginia Department of Health (VDH) Operating Permit which establishes a system capacity based on a formula that includes water production capacity, storage, pump and well capacity, etc.

Groundwater withdrawals to support system demands are permitted by the Department of Environmental Quality (DEQ). The permit establishes maximum monthly and annual limits.

Fire flow standards at any point in the distribution system are established at a minimum of 1,000 gallons per minute (gpm) by Camp Dresser and McKee during the 1998 update of the Master Water Plan.

There is limited data for maximum day and maximum hour demands in the JCSA water systems. However, during moderate droughts experienced in 1998 and 1999, daily peak demands exceeded average daily demands by 50%. This plan is intended to assist in managing and lowering peak water demands. Extended peak demands can be detrimental to the water system.

3. Water Emergency Ordinance

A Drought Management Ordinance has been adopted to give the County standby emergency powers. The ordinance provides for the following:

- Declaration of a water emergency, each stage, and authority to impose water conservation methods.

- Enforcement authority with penalties for above-normal, and incentives for below-normal, water consumption as defined in each stage of the ordinance.

- Stiffer penalties for noncompliance with conservation directives as listed above after due public notice. Similar restrictions, penalties, and incentives will also be imposed upon all County industrial and commercial users.

- These regulations only apply to water customers of the James City Service Authority.

4. Proposed Emergency Water Sources

During a drought situation, the JCSA General Manager will designate certain Central System wells as emergency water sources, if necessary, to provide domestic water for groundwater users whose wells have failed.

5. Parameters for Drought Declaration

(a) Stage I: A drought declaration will be issued when:

- the average daily demand for the Central System exceeds 80% of the DEQ groundwater withdrawal permit daily equivalent for 30 consecutive days or;
- by mutual agreement among the water purveyors in James City County or;
- a water emergency is declared by the Executive Director of the Department of Environmental Quality in accordance with the Groundwater Management Act.

The declaration is described in Paragraph 6, Drought Declaration. The Stage I emergency plan will then be initiated as outlined in Paragraph 7, Emergency Actions.

(b) Stage II: Emergency actions will start when:

- the average daily demand for the Central System exceeds 85% of the DEQ groundwater withdrawal permit daily equivalent for 45 consecutive days, or;
- by mutual agreement among the water purveyors in James City County, or;
- a water emergency is declared by the Executive Director of the Department of Environmental Quality in accordance with the Groundwater Management Act.

The declaration is described in Paragraph 6, Drought Declaration, and will be carried out in accordance with that section. The Stage II emergency plan will then be initiated as outlined in Paragraph 7, Emergency Actions.

(c) Stage III: Emergency actions will start when:

- the average daily demand for the Central System exceeds 85% of the DEQ groundwater withdrawal permit capacity daily equivalent for 60 consecutive days, or;
- Stage II has been in effect for 15 days and demand has not stabilized at the Stage II trigger level or has not declined, or;

- by mutual agreement among the water purveyors in James City County, or;

- a water emergency is declared by the Executive Director of the Department of Environmental Quality in accordance with the Groundwater Management Act.

The declaration is described in Paragraph 6, Drought Declaration, and will be carried out in accordance with that section. The Stage III emergency plan will then be initiated as outlined in Paragraph 7, Emergency Actions.

(d) Stage IV Emergency Actions will start when:

- the average daily demand for the system exceeds 85% of the DEQ groundwater withdrawal permit daily equivalent for 75 consecutive day, or

- by mutual agreement of water purveyors in James City County, or

- a water emergency is declared by the Executive Director of the Department of Environmental Quality in accordance with the Groundwater Management Act.

6. Drought Declaration

Once the parameters for drought determination are met, as listed in Paragraph 5 above, the County will issue an emergency declaration that will initiate conservation measures as defined in Paragraph 7 below. The declaration will be issued to the public, and to commercial and industrial customers through local newspapers and cable television public access Channels and any other means of communication deemed appropriate. The declaration will state specific conservation efforts to be taken.

7. Emergency Actions

(a) Stage 1

Once a drought declaration is issued, the following emergency actions for Stage I will be put into effect:

- Voluntary water conservation measures will be encouraged.

- A public awareness and information process will be implemented to distribute additional water-conservation information and other special notices to JCSA customers. Industrial and commercial users will be asked to initiate internal conservation plans.

- New construction under County's Landscaping Ordinance may delay landscape installation with a bond when drought declaration is evoked. This is in lieu of voluntary water conservation measures.

(b) Stage II

If Stage I fails to bring about necessary water savings, or when a parameter described in Paragraph 5 for Stage II is reached, Stage II will be put into effect. The following emergency actions will occur in Stage II:

- The watering of shrubbery, trees, lawns, grass, plants, or any other vegetation is not permitted, except indoor plantings, greenhouse, or nursery stocks, or from a bucket or other container not exceeding three (3) gallons in capacity and except watering by commercial nurseries of plants freshly planted and once a week for five weeks following planting or until the drought emergency declaration is revoked.

- Washing of automobiles, trucks, trailers, boats, airplanes, or other types of mobile equipment is not permitted except in facilities operating with a water recycling system approved by the General Manager of the JCSA, or except from a bucket or other container not exceeding three (3) gallons in capacity; provided, however, that any facility operating with an approved water recycling system shall prominently display in public view a notice stating that such system is in operation. In lieu of the provision hereof the County Administrator may curtail the hours of operation of commercial enterprises offering such services or washing their own equipment.

- Washing of streets, driveways, parking lots, service station aprons, office buildings, the exterior of homes or apartments, or other outdoor surfaces by commercial washing/cleaning services is not permitted except from a bucket or other container not exceeding three (3) gallons of capacity.

- The operation of any ornamental fountain or other structure making similar use of water is not permitted.

- The filling of swimming and/or wading pools, or the refilling of swimming and/or wading pools that were drained after the effective date of the declaration is not permitted.

- The use of water from fire hydrants for any purpose other than fire suppression or other emergency is not permitted except as authorized by the General Manager of the JCSA.

- Serving of water in restaurants, except upon request of customers, will not be permitted.

(c) Stage III

If Stage II fails to bring about necessary water savings, Stage III will be put into effect. The following emergency actions will occur in Stage III:

- The General Manager of the JCSA shall allocate water to customers based on a reduction of either the average consumption of their last twelve months billing or water consumption data available from similar activities of equal intensity.

  a. Residential, Industrial, commercial, and school use of water shall be reduced by 25% of normal consumption.

  b. The amount of water allocated shall not be less than fifty (50) gallons per person per day per household.

- Increased water rates of 300% will be charged for water use in excess of the conservation goal.

- Installation of new water service connections will be suspended.

- Application for appropriate state or federal drought emergency grants will be submitted.

(d) Stage IV

- The Board of Supervisors, County Administrator or his designee, may implement additional restrictions determined prudent to reduce water demand.

- No new water service connections will be sold, and permits for the installation of new wells will not be issued, except for replacement of failed private domestic wells where public water service is not available.

8. Revocation of Drought Declaration

When the average daily demand for the Central System has fallen below the trigger levels for each increased stage of water conservation and has remained below that level for 15 consecutive days, or by mutual agreement of the water purveyors in James City County, or when the declaration of a water emergency is lifted by the Executive Director of the Department of Environmental Quality in accordance with the Groundwater Management Act, the drought management requirements for that stage may be lifted. All customers will be notified in accordance with Paragraph 6. It should be emphasized that personal conservation efforts shall be maintained to avert other emergency situations.

ATTACHMENT H

Water Supply Plan Information

Water Supply Plan

The water supply plan for the James City Service Authority (JCSA) is included in the *Hampton Roads Regional Water Supply Plan* (HRRWSP) prepared by the Hampton Roads Planning District Commission (HRPDC), dated July 2011. Information on the projected demands, alternatives analysis, and water conservation measures included in the HRRWSP follows.

Projected Demands

Water demand projections developed by JCSA for the HRRWSP are presented in Table G-1. The projections were estimated assuming a water usage of 106 gallons per capita per day (gpcd) based on JCSA's 2004 to 2008 historical data. The peak water demand was estimated based on a peaking factor of 1.5. JCSA indicated that the projections reflect a pre-2008 booming economy which is not indicative of the current situation.

Table G-1 Hampton Roads Regional Water Supply Plan JCSA Water Demand Projections

Year	County Population	Estimated Public Water Service Area Population	Percentage of County Population Served	Average Water Demand (mgd)	Peak (Maximum Day) Water Demand (mgd)
2020	80,722	63,370	79%	6.7	10.1
2030	100,757	81,401	81%	8.6	12.9
2040	125,764	103,908	83%	11.0	16.5
2050	156,978	132,000	84%	14.0	21.0

Source: Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Attachment 1, Supply vs Demand 2011Final2_Jul2011.xlsx

JCSA updated their water demand projections since the completion of the HRRWSP in 2011. The updated projections are presented in the *James City Service Authority Water & Sewer Rate Study Final Report* completed by Burton and Associates on January 29, 2015. The updated water demand projections were based on a review of the following information:

- Historical data for each customer class from fiscal year (FY) 2009 through FY 2014
- Neighborhood buildout data provided by the James City County Planning Division
- Reasonable growth trends discussed with JCSA staff to determine annual growth based on local environmental and economic conditions

JCSA estimates an increase of 412 connections per year which represents a growth rate slightly less than 2 percent per year. A summary of the updated water demand projections is presented in Table G-2.

Kurt Stephenson of Virginia Tech, in conjunction with Abt Associates Inc., also evaluated water projections for JCSA in their report titled "*An Investigation of the Economic Impacts of Coastal Plain Aquifer Depletion and Actions that may be Needed to Maintain Long-Term Availability and Productivity*", completed in August 2014 (VT study). The projections are presented on Figure G-1. The JCSA projections based on the growth rate of 412 connections per year appear to follow a reasonable growth pattern similar to the VT study demand projection based on the HRPDC

population estimate and HRRWSP per capita usage and was used to determine the minimum water supply needs for JCSA. The water demand projections in the HRRWSP were more conservative and was used to determine the high end of the range of the water supply needs should aggressive growth occur.

Table G-2 JCSA Water Demand Projections Based on Growth of 412 Connections Per Year

Year	Number of Connections	Estimated Population	Average Day Withdrawal (mgd)	Peak Month Withdrawal (mgd)	Maximum Day Withdrawal (mgd)	Finished Water Average Day Demand (mgd)	Finished Water Maximum Month Demand (mgd)	Finished Water Peak Day Demand (mgd)
2020	23,204	56,850	6.64	8.71	9.96	5.80	7.71	8.70
2022	24,028	58,869	6.88	9.02	10.32	6.01	7.98	9.01
2030	27,324	66,944	7.82	10.26	11.73	6.83	9.08	10.24
2040	31,444	77,038	9.00	11.81	13.50	7.86	10.45	11.79
2050	35,564	87,132	10.18	13.36	15.27	8.89	11.81	13.33

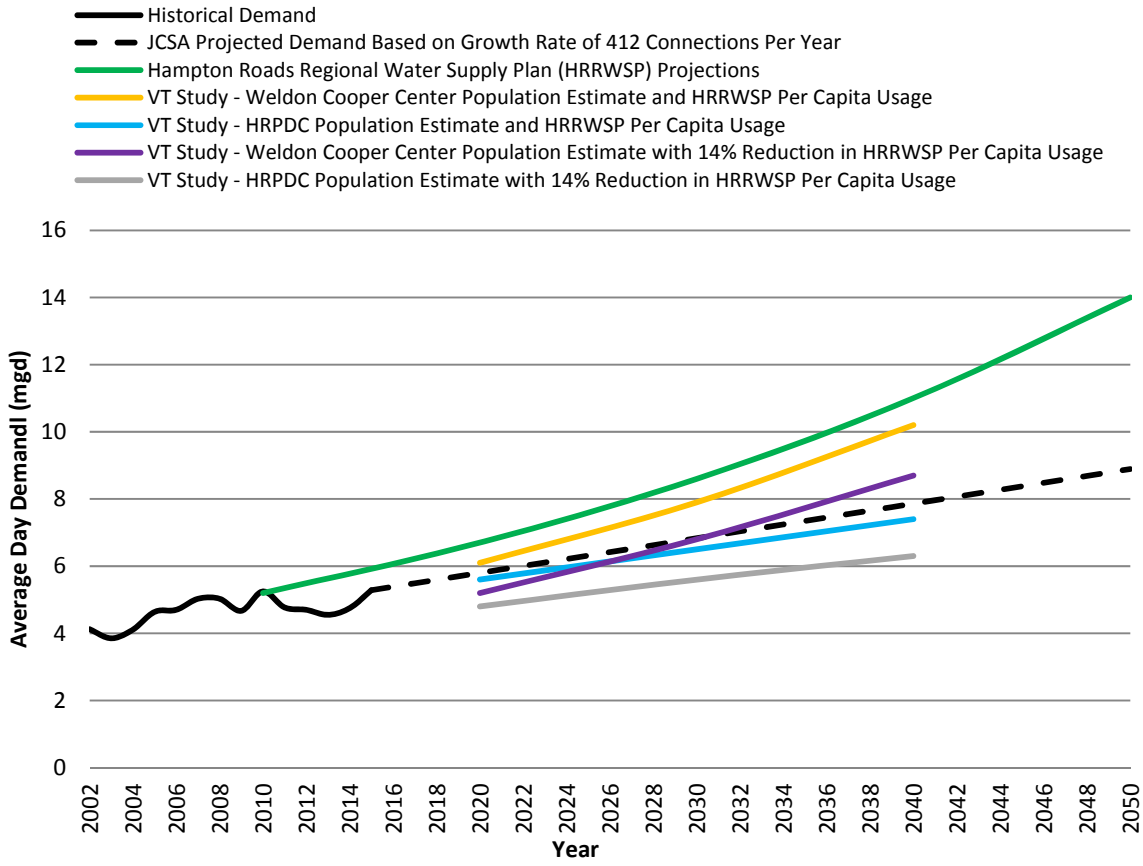

Figure G-1
JCSA Historical and Projected Average Day Demand

Analysis of Alternatives

Surface Water Storage

The Ware Creek Reservoir and King William Reservoir had been evaluated in the past as regional water supply alternatives for JCSA. Both projects were abandoned. The HRRWSP states:

> *"There are no on-going projects to create new reservoirs or develop new surface water intakes to support the York-James Peninsula public water systems. Given the history of proposed reservoir projects and comprehensive searches for viable options, it is not likely that a new reservoir or surface water source will be approved in the foreseeable future. The communities of the York-James Peninsula must consider other approaches to meet future water demands."*[1]

Groundwater

The HRRSWP assumed that JCSA would still have their existing groundwater supply available to meet their projected demands with a deficit projected by 2041. However, the HRRWSP cautions that

> *"Under the current regulations, new groundwater permits and reapplications requesting increases in many aquifers that yield higher quality water cannot be granted and DEQ is also having difficulty approvaing re-applications for permits that request the same withdrawal amount as the previous term."*[2]

The HRRWSP states that "expanding deep groundwater supplies in the Coastal Plain may not be a viable alternative" but that "some limited expansion could possibly occur in the Lower Potomac Aquifer, as it is currently less utilitized"; however, the water is not of the highest quality and will likely require treatment.

On July 15, 2014, DEQ informed JCSA that their requested groundwater withdrawal of 8.4 mgd would not be approved and that a target reduced permit withdrawal of 3.8 to 4.0 mgd was preferred but subject to negotiations with DEQ. Hence, JCSA may have an immediate deficit in groundwater supply based on DEQ's desired withdrawal in contrast to the projected deficit by 2041 indicated in the HRRWSP.

Surface Water Desalination

The HRRWSP identifies the James River and York River as potential sources for desalination.[3] The James River and York River as well as the Chickahominy River were evaluated as potential water supply sources for JCSA in the Water Supply Study conducted by CDM Smith, dated April 2015 (refer to Attachment A of this JPA). The alternatives evaluated are summarized in Attachment I of this JPA.

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[1] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 7-3.

[2] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 7-4.

[3] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 7-6.

Southside – York-James Peninsula Interconnect

The HRRWSP indicates

> *"…the Western Tidewater and Southside sub-regions are projected to have approximately 8 mgd of excess water supply in 2050. This excess water could be utilized by the York-James Peninsula to alleviate demand if it could be transported across the James River.*[4]

The alternative was not evaluated further due to the transmission challenge.

Water Conservation Measures

JCSA implements the following water conservation measures as stated in the HRRWSP:[5]

- Conservation program
- Conservation ordinance (policies on car wash, continuous flow equipment, leak repairs, waste of water, violation)
- Install low water use fixtures
- Irrigation Management[6]
  - 2003 ordinance states that customers are limited to three water days a week throughout the summer season
  - 2005 ordinance states any automatic irrigation system installed after March 8, 2005 shall include an automatic rain sensor gauge that cuts off water use after one-quarter inch of rain
- Rebate programs[6]
  - Rain Sensor Rebate Program – implemented July 28, 2005
  - Rain Barrel Rebate Program – implemented January 1, 2008
  - Rebate programs for Water Smart landscapes, cisterns, "on-demand" hot water re-circulators, and high-efficiency toilet, washing machine, and dishwasther replacements – implemented August 1, 2008
- Public education

A copy of JCSA's water conservation policy is included in Attachment G of the JPA.

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[4] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 7-9.

[5] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 5-8, Table 5-5.

[6] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 5-10,

ATTACHMENT I

Alternatives Analysis

Alternatives Analysis

Water supply alternatives were evaluated for JCSA in the 2015 Water Supply Study included in Attachment A of this JPA. A list of the alternatives and the sections of the report that provide the details of the evaluation results of each alternative is listed in Table I-1.

Table I-1 JCSA Water Supply Alternatives

Water Supply Alternative	Type	Attachment A Water Supply Study Discussion Reference
Groundwater	Local	Section 10
Ware Creek Reservoir	Local/Regional	Section 5
King William Reservoir	Regional	Section 6
Newport News Waterworks	Purchase Agreement	Section 4
York River	Local	Section 7
James River	Local	Section 8
Chickahominy River at Chickahominy Riverfront Park	Local	Section 9
Expansion of the existing Five Forks Water Treatment Facility (FFWTF) from 5 to 6 mgd with riverbank filtration of the James River	Local	Section 10

JCSA relies solely on groundwater as its primary water supply source. DEQ proposes to reduce the amount of groundwater that JCSA is permitted to withdraw due to declining groundwater levels, advancing saltwater intrusion, and land subsidence in the Eastern Virginia Groundwater Management Area. Hence, continued reliability and expansion of JCSA's groundwater withdrawal to meet their water supply needs in not a viable option at this time. A discussion of the alternatives evaluated follows.

No Action Alternative

If DEQ reduces JCSA's permitted groundwater withdrawal, JCSA will not have adequate supply to meet their projected public water supply needs without a surface water supply source. The water supply deficit will be immediate if DEQ implements their proposed reduction of JCSA's permitted annual groundwater withdrawal to 4.0 mgd.

Water Conservation Only Alternative

JCSA currently implements water conservation measures in their water use regulations. Hence, with DEQ's proposed permitted groundwater withdrawal reduction, JCSA will still have a water supply deficit with water conservation efforts without a surface water supply source.

Water Supply Alternatives with Water Conservation

Regional Water Supply Efforts

Regional water supply efforts for JCSA involved the Ware Creek Reservoir and King William Reservoir projects. The Ware Creek Reservoir was initially pursued by JCSA as a local water supply source. Both reservoir projects have been abandoned as regional water supply sources.

Short-Term Alternatives

Expansion of the existing Five Forks Water Treatment Facility from 5 to 6 mgd with riverbank filtration of the James River was also evaluated as an option. Although the primary water source

is surface water from the James River, it is uncertain how DEQ will relate the riverbank filtration to the groundwater withdrawal permit since water withdrawn from the wells would include both river water induced to flow to the well and groundwater. This alternative would only be viable as a near-term supply if the permit approval is not delayed and if the riverbank filtration does not affect the permitted groundwater withdrawal. It should be noted that the local soils are not typical for locations where riverbank filtration is used and extensive testing and piloting would be required to determine if the option is feasible.

JCSA has an agreement with Newport News Waterworks to purchase supplemental water at an average of 4 mgd during drought conditions; a second payment must be made to Newport News by 2019 to retain the right. If the second payment is not made, JCSA's right will be reduced to 2 mgd during drought conditions. Even if JCSA makes the second payment, the quantity of water available from Newport News Waterworks will still be inadequate if DEQ reduces JCSA's permitted withdrawal to 4 mgd.

Surface Water Supply Alternatives (Long-Term)

Alternative surface water supply sources evaluated for JCSA focused on the bordering water bodies:

- Chickahominy River
- James River
- York River

For the Chickahominy River, the 2015 Water Supply Study focused on the Chickahominy Riverfront Park location. Since the completion of the study, the Brickyard Landing site was also evaluated as an alternative. The Brickyard Landing evaluation is included in Attachment J of the JPA.

The general location of each alternative is shown in Figure I-1. Table I-2 presents a summary of the evaluation results of each alternative.

The York, James, and Chickahominy rivers all have brackish water with tidal influence and require reverse-osmosis treatment. Of the four surface water supply alternatives, the Chickahominy River Brickyard Landing site has the lowest estimated salinity, followed by the Chickahominy Riverfront Park; the York River alternative has the highest salinity.

The available flow at the Chickahominy River Brickyard Landing area is less than the Chickahominy Riverfront Park, James River, and York River locations. The available flow in the Chickahominy River may also be limited during drought conditions based on the limits stipulated in the NNWW surface water supply agreement, which restricts their flow during drought conditions. This limitation is on the fresh water side of the Chickahominy River, however, and may not be applicable to the tidal section of the proposed intake.

In comparison to the Chickahominy Riverfront Park alternative, the brine discharge location for the Chickahominy River Brickyard Landing facility may have to be located further downstream from the plant to avoid recirculating the brine into the raw water intake. With the Chickahominy Riverfront Park alternative, the higher flow in the James River facilitates mixing and dilution.

The impact of changes to the salinity gradient on the ecosystems will also be of greater concern for the Brickyard Landing location in comparison to the Chickahominy Riverfront Park location due to the lower flows.

For the Chickahominy Riverfront Park alternative, the County has property for the treatment facility. For the Chickahominy River Brickyard Landing, York River, and James River alternatives, the County will have to purchase additional property. It should be noted that the treatment facility must be located above the 100-year floodplain with sufficient area for future expansion.

The Chickahominy River and James River alternatives have more potential environmental concerns than the York River alternative due to the presence of significant ecological communities, such as tidal bald cypress forests and woodlands. Potential impacts to tidal fluvial terrace woodlands, coastal plain/piedmont swamp forests, and tidal freshwater and oligohaline aquatic beds, as well as freshwater emergent and riverine wetlands will also be of concern for the Chickahominy River. The James River segment considered for the raw water intake is a designated DCR Virginia Scenic River and identified as having historic significance in the National Park Service (NPS) National Rivers Inventory. The proposed Chickahominy River intake locations are in a segment classified as having botanic and geologic outstanding remarkable values according to the NPS.

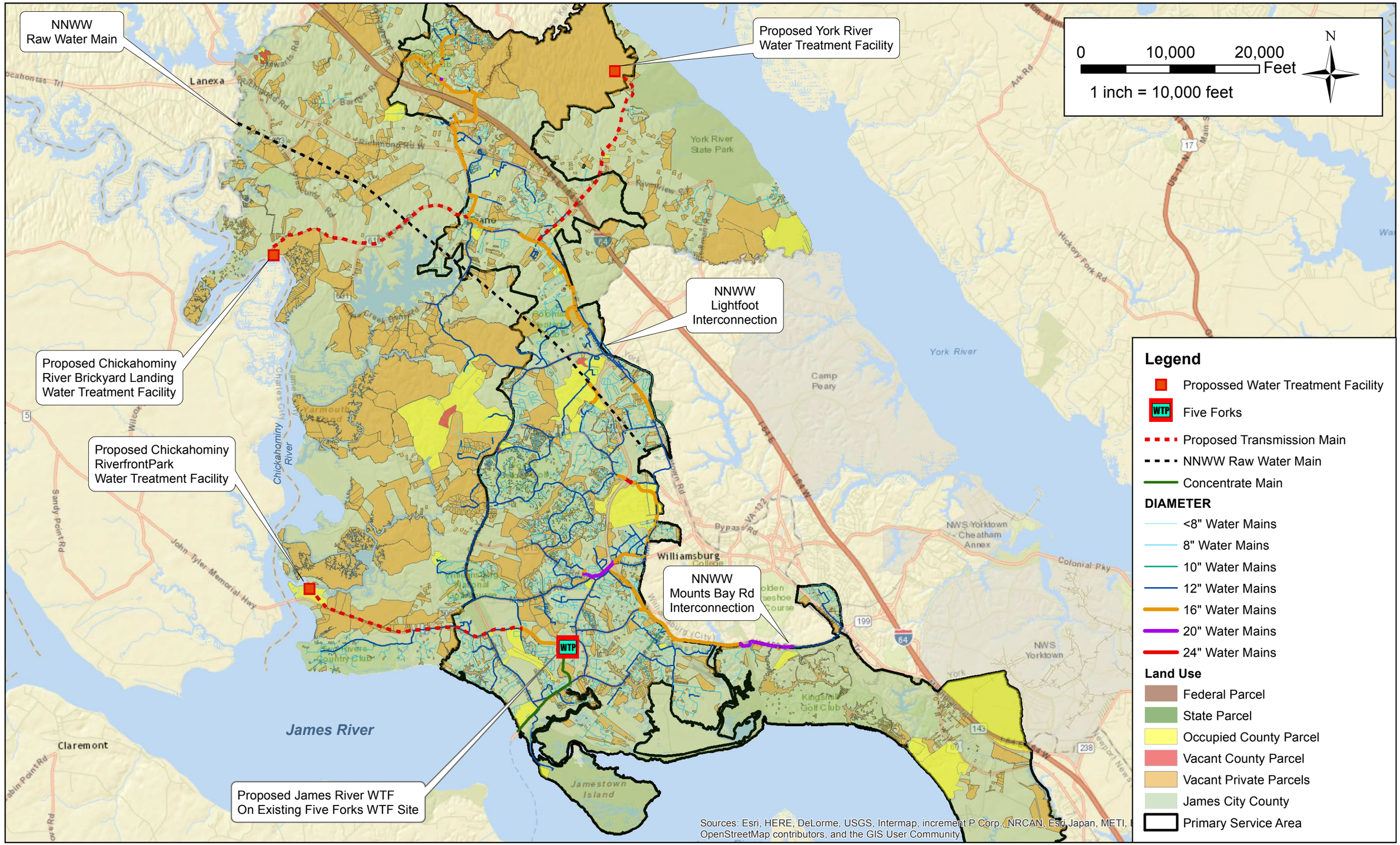
The James River and Chickahominy Riverfront Park sites have more potential water quality impacts that may be of concern to the public than the York or the Chickahominy River Brickyard Landing sites. There are six dischargers with VPDES permits in close proximity to the proposed raw water intake location on the James River and at its confluence with the Chickahominy River. The potential presence of kepone trapped in the sediments that may be disturbed during construction is of concern; it is uncertain if kepone could be present at the Chickahominy Riverfront Park location due to the tidal influence. With the York River alternative, discharges approximately 10 miles upstream in West Point may be of concern. Potential spills from transportation vehicles on major highway crossings across the James River, a bridge crossing and petroleum pipeline crossing near Chickahominy Riverfront Park, and boat traffic on each river present concerns.

From a water distribution standpoint, the Chickahominy River Brickyard Landing and York River alternatives are located in more strategic areas for projected growth than the James and Chickahominy Riverfront Park options. In general, the ground elevations in the service area decrease from north to south. The Chickahominy River Brickyard Landing site is at a higher ground elevation than the Chickahominy Riverfront Park site. It therefore requires lower pumping head requirements to feed into the system.

A summary of the planning-level cost estimates for the proposed surface water supply sources and the O&M costs for an 8-mgd facility are presented in Table I-3. The James River option has the lowest costs of the surface water supply alternatives, pending the additional costs of the raw water and concentrate discharge mains once a site is identified. The Chickahominy Riverfront Park and Brickyard Landing cost estimates are similar, pending the location of the concentrate discharge main; the costs assume the same pretreatment requirements for each site since historical water quality data is not available to support differentiation. The Chickahominy River

Brickyard Landing water treatment facility membrane and pressure vessel costs are slightly lower than the Chickahominy Riverfront Park membrane and pressure vessel costs.

Table I-4 presents a summary of the advantages and disadvantages of the water supply alternatives. Based on the obstacles identified and prior history in its consideration as a water supply source, it is anticipated that permit approval of the James River alternative will be difficult to obtain. The Chickahominy Riverfront Park and York River alternatives were presented to DEQ at the pre-application meeting on August 31, 2016.



CDM Smith

Figure I-1
Potential Water Supply Alternatives

Table I-2 Evaluation Results of Potential Water Supply Alternatives

	Newport News Water Works Purchase Agreement	York River	James River	Chickahominy River at Chickahominy Riverfront Park	Chickahominy River at Brickyard Landing	Expansion of Five Forks Water Treatment Facility
Description	Increase in purchase agreement from 2 mgd to 4 mgd	RO facility with intake close to Croaker Road	Intake located upstream of FFWTF concentrate discharge; site to be determined	RO facility located on County-owned Chickahominy River Front Park	RO facility with intake off Brickyard Landing	Expansion of FFWTF from 5 to 6 mgd with 1 mgd obtained from riverbank filtration of James River
Planning-Level Capital Cost Estimate	MB = Mounts Bay Road Interconnection LT = Lightfoot Connection Scenario A: MB=2 mgd Infrastructure = $6M Scenario B: MB = 2mgd, LT = 2 mgd 2nd Payment w/debt service $60M Infrastructure Improvements 15M Disinfection Improvements 2M Total $77M Scenario C: LT = 4 mgd 2nd Payment w/debt service $60M Infrastructure Improvements 17M Disinfection Improvements 2M Total $79M	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake $ 20M / $ 22M / $ 23M WTF 45M / 60M / 76M Transmission 12M / 12M / 12M Contingencies 19M / 24M / 28M Engineering, Testing, Permitting, Land Acquisition 17M / 20M / 23M Total Project Cost $113M / $138M / $162M	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake[1] 19M / 20M / 22M WTF[2] 43M / 57M / 71M Transmission 5M / 5M / 5M Contingencies 17M / 21M / 24M Engineering, Testing, Permitting, Land Acquisition 16M / 19M / 22M Total Project Cost 99M / 122M / 144M Note: Refine cost for raw water transmission, concentrate discharge main, and finished water main after site is identified	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake $ 19M / $ 20M / $ 22M WTF 41M / 55M / 68M Transmission 13M / 13M / 13M Contingencies 18M / 22M / 26M Engineering, Testing, Permitting 15M / 18M / 20M Total Project Cost $106M / $128M / $149M	4-mgd Capacity / 8-mgd Capacity / 12-mgd Capacity Intake $ 19M / $ 20M / $ 22M WTF 41M / 55M / 68M Transmission 12M / 12M / 12M Contingencies 18M / 22M / 25M Engineering, Testing, Permitting' Land Acquisition 16M / 18M / 21M Total Project Cost $106M / $127M / $148M	Riverbank Filtration Wells $ 1M 1-mgd plant expansion 10M Contingencies 3M Engineering, Testing, Permitting 4M Total Project Cost $18M
O&M Cost Estimate	Per NNWW PDA $1.22/1000 Gallons in 2014	$2.00/1,000 Gallons	$1.88/1,000 Gallons	$1.76/1,000 Gallons	$1.74/1,000 Gallons	$0.72/1,000 Gallons
Land availability (above 100-yr floodplain)	---	Vacant property available	Limited availability	County-owned property available	Vacant property available	Area available on existing FFWTF site
Capacity Limitations in meeting supply needs	Capacity limited to 4 mgd annual average	None	None	None	Unknown – further investigation required	Limited to 1 mgd
Existing Public Water Supply Withdrawals	Newport News		• Henrico County • Hopewell • Lynchburg • Richmond	Newport News	Newport News	
Existing Commercial and Industrial Withdrawals		Yorktown Fossil Power Plant	• James River Correctional Center, Goochland County • Honeywell International, Inc., Hopewell • Dupont E. E. DeNemours & Co., Chesterfield County • Dominion Generation Surry Nuclear Plant • Dominion Generation Chesterfield Power Station • Dominion Generation Bremo Bluff Power Plant, Fluvanna County			
Downstream users that may be impacted		Yorktown Fossil Power Plant	Dominion Generation Surry Nuclear Plant			

Table I-2 Evaluation Results of Potential Water Supply Alternatives (continued)

	Newport News Water Works Purchase Agreement	York River	James River	Chickahominy River at Chickahominy Riverfront Park	Chickahominy River at Brickyard Landing	Expansion of Five Forks Water Treatment Facility
Existing VPDES discharges		• Rocktenn CP LLC - West Point • HRSD West Point Sewage Treatment Plant	• BASF Corporation – Williamsburg • Colonial Pipeline Company – Yorktown • Colonial Pipeline Surry • Dominion Yorktown • Grays Creek Marina and Restaurant, Surry • HRSD - Williamsburg Sewage Treatment Plant • JCSA – FFWTF Concentrate Discharge	Hideaway Sewage Treatment Plant – Mount Airy	Hideaway Sewage Treatment Plant – Mount Airy	
Potential Environmental Concerns		• 12-mile section of York River from Almondsville to Plum Point designated as having hydrologic significance in National Park Service, National Rivers Inventory • York River shellfish management area from Clay Bank Wharf to Gloucester Point • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal on the ambient water quality. • Impact of changes to salinity gradient on ecosystems • Impact of construction on bald eagle nests potentially located in close proximity to the site • Impact on anadromous fish (time of year restriction for instream work will be imposed by DGIF to reduce impact) • Impact on endangered Atlantic Sturgeon	• 25-mile segment of James River from 1.2 miles east of Trees Point to Lawnes Creek designated as Scenic River by Virginia DCR • Presence of tidal bald cypress forests and woodlands along James River near Swanns Point, Surry County, listed in DCR Natural Heritage Inventory • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal on the ambient water quality • Impact on anadromous fish (time of year restriction for instream work will be imposed by DGIF to reduce impact) • Impact on endangered Atlantic Sturgeon	• 30-mile segment from Providence Forge to James River classified as having botanic and geologic significance in National Park Service, National Rivers Inventory • Presence of fluvial terrace woodlands, Coastal Plain/Piedmont swamp forests, tidal bald cypress forests and woodlands, and tidal freshwater and oligohaline aquatic beds as identified in DCR Natural Heritage Inventory • Presence of riverine wetland areas • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal on the ambient water quality • Impact of changes to salinity gradient on ecosystems • Impact of construction on bald eagle nests potentially located in close proximity to the site • Impact on anadromous fish (time of year restriction for instream work will be imposed by DGIF to reduce impact) • Impact on endangered Atlantic Sturgeon	• 30-mile segment from Providence Forge to James River classified as having botanic and geologic significance in National Park Service, National Rivers Inventory • Presence of fluvial terrace woodlands, Coastal Plain/Piedmont swamp forests, tidal bald cypress forests and woodlands, and tidal freshwater and oligohaline aquatic beds as identified in DCR Natural Heritage Inventory • Presence of riverine, freshwater emergent, and freshwater forested/shrub wetland areas • Impingement and entrainment of fish eggs and fish larvae • Impact of the concentrate disposal on the ambient water quality. • Impact of changes to salinity gradient on ecosystems • Impact on anadromous fish (time of year restriction for instream work will be imposed by DGIF to reduce impact) • Impact on endangered Atlantic Sturgeon	Impact on declining aquifer levels - riverbank withdrawal wells would be constructed in the same stratum that comprises the surficial water system and would likely be regulated by DEQ under the EVGMA. Water withdrawn from wells would include both river water induced to flow to the well and groundwater. Amount of groundwater withdrawn and impact on aquifer depends on local stratigraphy and natural groundwater flow gradients. Naturally occurring groundwater flow direction would be towards the river with groundwater levels being higher than river levels. If there were a nearby significant existing groundwater withdrawal, natural gradient could be away from the river into the aquifer. It would likely not be possible to design and construct a riverbank withdrawal that would not affect the localized groundwater aquifer. DEQ may also raise concerns regarding the riverbank filtration system inducing saltwater intrusion into the local aquifer system.
Potential Water Quality Concerns		Impact of upstream VPDES discharges	• Presence of kepone (pesticide discharged upstream in 1970s), trapped in bottom sediments of the river. • Impact of VPDES discharges • Potential for spills upstream from major highway crossings	• Potential presence of kepone at confluence due to James River tidal influence • Impact of upstream VPDES discharge • Potential spill from automotive bridge crossing and Colonial Petroleum pipeline crossing	• Impact of upstream VPDES discharge	• Salt water intrusion • Potential presence of kepone

Table I-2 Evaluation Results of Potential Water Supply Alternatives (continued)

	Newport News Water Works Purchase Agreement	York River	James River	Chickahominy River at Chickahominy Riverfront Park	Chickahominy River at Brickyard Landing	Expansion of Five Forks Water Treatment Facility
Potential Cultural Resources and Recreational Concerns		Impact on boaters	Impact on boaters	• Impact on onsite archaeological resources • Impact on existing park and recreational use, including boat use	Impact on existing boat launch users	
Permitting and Approval Concerns			• JPA Permit Application approval anticipated to be difficult due to environmental impacts • VDH approval as water supply source may be difficult based on historical opposition due to potential raw water quality impact concerns from existing environmental conditions	Issuance of permits from regulatory agencies may be difficult due to environmental impact concerns	Issuance of permits from regulatory agencies may be difficult due to environmental impact concerns	May not be approved if DEQ Office of Water Supply determines riverbank filtration affects Groundwater Withdrawal Permit

Table I-3 Planning-Level Cost Estimate Summary for Surface Water Supply Alternatives (Dollars)[1,5]

Surface Water	4-mgd Capacity	8-mgd Capacity	12-mgd Capacity
		Intake	
Chickahominy River at Brickyard Landing	18,860,000	20,360,000	21,670,000
Chickahominy River at Chickahominy Riverfront Park	18,860,000	20,360,000	21,670,000
James River[2]	18,920,000	20,420,000	21,730,000
York River	20,180,000	21,780,000	23,180,000
		Treatment Facility	
Chickahominy River at Brickyard Landing[2]	40,990,000	54,570,000	67,800,000
Chickahominy River at Chickahominy Riverfront Park	41,140,000	54,820,000	68,150,000
James River[2]	42,640,000	57,120,000	71,250,000
York River[2]	45,070,000	60,490,000	75,730,000
		Transmission[4]	
Chickahominy River at Brickyard Landing[2]	11,500,000	11,500,000	11,500,000
Chickahominy River at Chickahominy Riverfront Park	13,000,000	13,000,000	13,000,000
James River[2]	5,000,000	5,000,000	5,000,000
York River[2]	12,000,000	12,000,000	12,000,000
		Contingencies	
Chickahominy River at Brickyard Landing	17,850,000	21,610,000	25,250,000
Chickahominy River at Chickahominy Riverfront Park	18,260,000	22,050,000	25,710,000
James River	16,640,000	20,640,000	24,490,000
York River	19,320,000	23,570,000	27,730,000
		Engineering, Testing, Permitting	
Chickahominy River at Brickyard Landing[3]	15,610,000	18,440,000	21,160,000
Chickahominy River at Chickahominy Riverfront Park	14,690,000	17,530,000	20,280,000
James River[3]	15,760,000	18,760,000	21,650,000
York River[3]	16,720,000	19,910,000	23,030,000
		Total Project Cost	
Chickahominy River at Brickyard Landing	104,810,000	126,480,000	147,380,000
Chickahominy River at Chickahominy Riverfront Park	105,950,000	127,760,000	148,810,000
James River	98,960,000	121,940,000	144,120,000
York River	113,290,000	137,750,000	161,670,000
		O&M Cost Estimate per 1000 Gallons	
Chickahominy River at Brickyard Landing		$1.74	
Chickahominy River at Chickahominy Riverfront Park		$1.76	
James River		$1.88	
York River		$2.00	

Notes:

1. All costs expressed in 2016 dollars with an ENR Construction Cost Index of 10,182 for February 2016.
2. Refine cost for raw water transmission main, concentrate discharge, and finished water transmission main after site has been identified.
3. Includes land acquisition cost.
4. Existing distribution system should be evaluated to determine if the flow will require additional infrastructure improvements.
5. Costs for Chickahominy Riverfront Park, James River, and York River alternatives are based on Table 12-2 of the *Water Supply Study Final Draft Report* prepared by CDM Smith for JCSA dated April 2015.

Table I-4 Advantages and Disadvantages of Potential Water Supply Alternatives

Water Supply	Advantages	Disadvantages
NNWW	• Agreement in place	• Capacity limitations – inadequate to meet future water demands if DEQ permitted groundwater withdrawal is reduced to 4 mgd • Disinfection compatibility concerns • Cost for 4 mgd share = $33.7 million based on 2nd payment of $25 million subject to inflation; actual cost for JCSA to finance estimated to be $60 million • Agreements do not meet long-term water needs of James City County
York River	• Strategically located in area of County where growth is anticipated. • Vacant property available adjacent to proposed intake • Fewer environmental concerns than James River and Chickahominy River that could affect permittability	• Fluctuations in brackish water quality • Potential environmental concerns – impact to hydrologic significant section designated by National Park Service and to shellfish management area • Highest anticipated cost for new surface water source ($113M for 4 mgd; $138M for 8 mgd; $162M for 12 mgd) • Additional plant staff required for water treatment facility operation
James River	• Available flow • No extensive finished water transmission main likely since WTF would be located within existing system if property is available, but costs may be offset by likely transmission upgrades required to deliver water to the northern growth area; transmission upgrade costs are not included in this study.	• Limited availability of vacant property in the vicinity of the river • Fluctuations in brackish water quality • Potential environmental concerns - impact to Scenic River, tidal bald cypress forests, and woodlands • Impact of potential presence of kepone in bottom sediments of the river on water quality • Potential negative public perception of VDPES discharges in close proximity to intake • Difficulty in obtaining USACE, DEQ, and VMRC permit application and VDH approval • High costs ($99M for 4 mgd; $122M for 8 mgd; $144M for 12 mgd) • Higher number of VPDES discharges and potential chemical spills within the James River Basin • Additional plant staff required for water treatment facility operation
Chickahominy River at Chickahominy Riverfront Park	• County-owned property available	• Fluctuations in brackish water quality • Potential flow limitations during drought conditions • Potential environmental concerns - impact to fluvial terrace woodlands, Coastal Plain/Piedmont swamp forests, tidal bald cypress forests and woodlands, tidal freshwater and oligohaline aquatic beds, riverine wetlands areas, and botanic and geologic significant segment of the river • Potential impact to salinity gradient • Potential presence of kepone due to tidal influence of James River • High costs ($106M for 4 mgd; $128M for 8 mgd; $149M for 12 mgd) • Higher number of NPDES discharges and chemical spills within the James River Basin • Additional plant staff required for water treatment facility operation
Chickahominy River at Brickyard Landing	• Lower salinity in comparison to Chickahominy Riverfront Park, James River, and York River alternatives • Strategically located in area of County where growth is anticipated. • Vacant property available adjacent to proposed intake • Strategically located in the water service area at higher elevation thus reducing pumping requirements to the service area in comparison to other alternatives	• Fluctuations in brackish water quality • Potential flow limitations during drought conditions • Potential environmental concerns - impact to fluvial terrace woodlands, Coastal Plain/Piedmont swamp forests, tidal bald cypress forests and woodlands, tidal freshwater and oligohaline aquatic beds, freshwater emergent wetlands, riverine wetlands and forested/shrub wetlands, and botanic and geologic significant segment of the river • Potential impact on salinity gradient changes to the ecosystems • High costs ($106M for 4 mgd; $127M for 8 mgd; $148M for 12 mgd) • VPDES discharge upstream • Additional plant staff required for water treatment facility operation
Expansion of FFWTF from 5- to 6-mgd with riverbank filtration		• Uncertainty in how riverbank filtration will be addressed by DEQ in the groundwater withdrawal permit resulting in potential difficulty in obtaining DEQ approval • Local soils are not typical for locations where riverbank filtration is used and extensive testing and piloting would be required to determine if this option is feasible • Additional plant staff will be required due to higher capacity • Potential presence of kepone • Short-term solution

ATTACHMENT J

Chickahominy River at Brickyard Landing

Surface Water Supply Alternative

Section 2

Chickahominy River at Brickyard Landing

The Chickahominy River flows along the northwestern boundary of James City County and feeds into the James River along the southern boundary. Brickyard Landing is located on the Chickahominy River, approximately 10.4 miles upstream of its confluence with the James River.[1] Brickyard Landing is a public access site for launching motorized boats and non-motorized kayaks, located on a 0.33-acre parcel owned by James City County.[2,3] The Brickyard Landing ramp is shown in Figure 2-1.

Figure 2-1
Brickyard Landing Ramp

CDM Smith conducted a site visit to Brickyard Landing on January 7, 2016. The adjacent parcels east and west of Brickyard Landing are owned by Watertown LLC and have a combined area of 119 acres.[4] The western parcel is undeveloped and wooded. The eastern parcel is located on higher ground and contains various structures as shown in Figure 2-2; approximately 9 acres of the property is above the 100-year

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[1] Richmond Regional Planning District Commission. 2007. *Chickahominy River Recreational Access Study*, Appendix B.

[2] Richmond Regional Planning District Commission. 2007. *Chickahominy River Recreational Access Study*, Appendix B, page 5.

[3] http://property.jamescitycountyva.gov/JamesCity/ (Map No. 1920100018A; last accessed January 26, 2016)

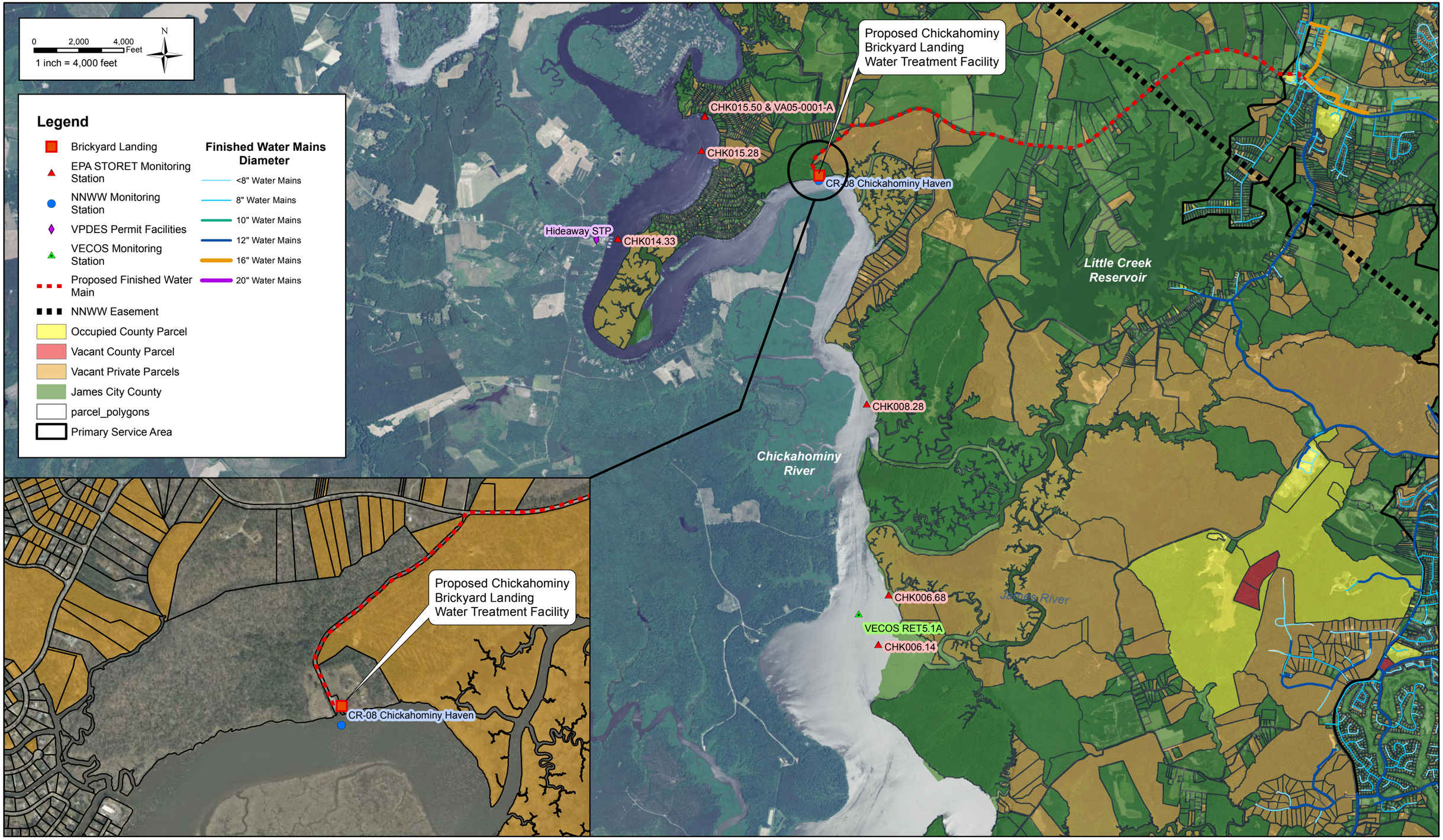
[4] http://property.jamescitycountyva.gov/JamesCity/ (Map No. 1920100018; last accessed January 26, 2016)

flood level based on Federal Emergency Management Agency (FEMA) data. Figure 2-3 provides an aerial view of the site.

Figure 2-2
Brickyard Landing East Property

CDM Smith investigated the Chickahominy River at Brickyard Landing as a potential water supply source for JCSA using information from the following sources:

- Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.*
- Newport News Waterworks (NNWW) water quality monitoring data.
- National Oceanic and Atmospheric Administration (NOAA). 2016. *James River – Jamestown Island to Jordan Point, NOAA Chart 12251*.
- Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*.
- Rice, K.C., Bennett, M.R., and Shen, J. 2011. *Simulated changes in salinity in the York and Chickahominy Rivers from projected sea-level rise in Chesapeake Bay: U.S. Geological Survey Open-File Report 2011–1191*, 31 p.
- Richmond Regional Planning District Commission. 2007. *Chickahominy River Recreational Access Study.*
- U.S. Environmental Protection Agency. 2016. STORET database.



CDM Smith

Figure 2-3
Chickahominy River at Brickyard Landing
Water Quality Monitoring Stations & VPDES Discharge Locations

- Virginia Department of Environmental Quality. 2013. *Status of Virginia's Water Resources, A Report on Virginia's Water Resources Management Activities.*
- Virginia Institute of Marine Sciences, Virginia Estuarine and Coastal Observing System (VECOS).

2.1 Existing Withdrawals

The Chickahominy River provides approximately 70 percent of the water supply for NNWW.[5] In 1942, Walker's Dam was constructed on the Chickahominy River to form an impoundment to supply drinking water for military personnel. The impoundment, which is known as Chickahominy Lake, was purchased by Newport News. The raw water intake is located above Walker's Dam. Water is pumped from the Chickahominy River above Walker's Dam into reservoirs: Lee Hall and/or Harwood's Mill, Little Creek, Skiffes Creek, Waller Mill, or Big Bethel. NNWW also uses groundwater as a secondary source. The surface water and groundwater are treated separately and then combined prior to distribution.

The Chickahominy River intake of NNWW has a drainage area of 301 square miles and an average river flow of 180 million gallons per day (mgd). A minimum flow of 10 cubic feet per second (cfs) (6.5 mgd) must be maintained downstream of Walker's Dam.[6] NNWW maintains the 10-cfs minimum instream flow (MIF) requirement by controlling the openings in the dam through a supervisory control and data acquisition (SCADA) system.

NNWW's surface water withdrawal permit restricts pumping when the river stage at Walker's Dam is below elevation 3 feet mean sea level. NNWW indicated that the pumping restriction is tied to their Little Creek Reservoir permit; they are not allowed to pump to Little Creek Reservoir when the river is below that level. To avoid drawing high chloride water, withdrawals may also be suspended when tidal influences occur and downstream chlorides are elevated, such as during drought conditions.[7] NNWW indicated that the withdrawal suspension is not stipulated in a permit, but is part of their operational strategy to stay within the treatment capabilities of their plant. Raw water from the Chickahominy River is sometimes blended with the reservoir waters to reduce the chloride concentration. During the 2002 drought, NNWW had to suspend withdrawal from the Chickahominy River on some occasions to stay within their treatment capabilities.

2.2 Existing VPDES Discharge

The Hideaway Sewage Treatment Plant (STP) in Mount Airy discharges into the Chickahominy River as regulated by Virginia Pollution Discharge Elimination System (VPDES) Permit No. VA0080233.[8] The discharge location is on the west bank of Chickahominy River, approximately 2.2 miles upstream of Brickyard Landing as shown in Figure 2-3. DEQ indicated that the current design flow of the Hideaway STP is 0.02 mgd, but the VPDES permit allows for a possible expansion to a design flow of 0.039 mgd.[9]

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[5] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan. Page 6-4*.

[6] Norfolk District Army Corps of Engineers. 1997. *Final Environmental Impact Statement (EIS), Main Report - Volume I, Regional Raw Water Study Group Lower Virginia Peninsula Regional Raw Water Supply Plan*. Page 2-3.

[7] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 1-6.

[8] http://watersgeo.epa.gov/mwm/ (Interactive website; last accessed January 26, 2016)

[9] S. Weimer (Personal communication, February 19, 2016).

2.3 Previous Studies

The Chickahominy River upstream of Walker's Dam was evaluated as a potential water supply source in the Lower Virginia Water Supply Plan EIS (published by the Norfolk District Army Corps of Engineers in 1997) through increased withdrawals. Three alternatives were considered based on existing and future potential projects identified at the time the EIS was written:

- Increase in Chickahominy River pump station capacity from 61 to 81 mgd (EIS Alternative No. 11)—An expansion of NNWW's Walker pump station to 81 mgd was considered when pumping to Little Creek and/or Ware Creek reservoirs. The Walker pump station is located on the northern bank of the river in southeastern New Kent County. Approximately 41 mgd would be discharged 7.5 miles downstream to Little Creek Reservoir in James City County and 40 mgd would flow 1.8 miles further to Ware Creek Reservoir. Flow would only go to NNWW's terminal reservoirs if Ware Creek and Little Creek reservoirs were full and at a lower rate. The diversion would require 1.5 miles of pipe from the existing NNWW raw water main to Ware Creek reservoir and replacement or parallel installation of a portion of the old Chickahominy main from the Walkers pump station to Little Creek outfall.

- Increase in Chickahominy River pump station capacity to 61 mgd when pumping to Little Creek Reservoir only (EIS Alternative No. 17)—An expansion of NNWW's Walker pump station to 61 mgd was also considered when pumping to Little Creek and/or Ware Creek reservoirs. The flow from Chickahominy River would be pumped to either Little Creek or Ware Creek reservoirs and no flow would be transferred directly to the terminal reservoir when 61 mgd was discharged to Little Creek and/or Ware Creek reservoir.

- Increase in Chickahominy River pump station capacity to 61 mgd and raise Diascund and Little Creek Dams (EIS Alternative No. 18).

It should be noted that the Ware Creek Reservoir referenced in the alternatives listed above was a potential water supply source identified by JCSA in the 1980s. JCSA abandoned their consideration of Ware Creek Reservoir as a water supply source due to difficulty in securing construction permits affected by wetland impacts. Ware Creek Reservoir was also reconsidered as a potential water supply for the Regional Raw Water Study Group (RRWSG). The RRWSG formed in 1987 to evaluate water supply needs of the Lower Peninsula area of southeast Virginia and to develop a plan for a regional water supply. The RRWSG eliminated the Ware Creek Reservoir from further evaluation for similar reasons as JCSA.

With regards to the Chickahominy River, the EIS concluded that increasing the withdrawal upstream of Walker's Dam to 61 mgd or greater was infeasible for the following reasons:

- Increases in the maximum withdrawal from the Chickahominy River would likely trigger more restrictive MIF requirements above the current 10-cfs requirement.

- Reliance on the single river source that is already a major water supply for the Lower Peninsula would not be prudent and would not provide a backup source should water quality excursions or extreme low flows limit the withdrawal.

- Increasing the withdrawal to 61 mgd would raise the maximum withdrawal to 30 percent of average streamflow at the intake.

2.4 Evaluation of Treatment Options

2.4.1 Water Quality Evaluation

Brickyard Landing is located in the brackish section of the Chickahominy River downstream of Walker's Dam. It is assumed that the raw water intake would be located in the river, adjacent to the County-owned property. The NOAA data indicates that the river is approximately 23 feet deep at this location, which is reasonable for a raw water intake.[10]

Water quality data from the following sources were reviewed to determine treatment requirements:

- NNWW historical raw water quality data for the Chickahominy River
- U.S. Environmental Protection Agency. 2016. STORET
- Rice, Karen C., Mark R. Bennett, and Jian Shen. *USGS Open File Report 2011-1191*, *Simulated Changes in Salinity in the York and Chickahominy Rivers from Projected Sea-Level Rise in Chesapeake Bay.*
- Virginia Institute of Marine Sciences (VIMS), Virginia Estuarine and Coastal Observing System (VECOS)

A summary of the available water quality data from the NNWW monitoring station closest to Brickyard Landing, CR-08 Chickahominy Haven, is presented in Table 2-1. Water quality data for monitoring station CR-11, which is adjacent to Chickahominy Riverfront Park, is also included in Table 2-1.

Table 2-1 Chloride and Conductivity for NNWW Chickahominy River Monitoring Stations (1997-2014)

Monitoring Station	Chloride (mg/L)			Conductivity (x1000, uS/cm)		
	Minimum	Maximum	Average	Minimum	Maximum	Average
CR-08	8	3620	493	0.06	10.96	1.73
CR-11	10	4600	824	0.05	13.85	2.82

The VIMS VECOS database provides the following values for samples collected from April 18, 1988, to May 5, 2015, for monitoring station RET5.1A (identified as "Chickahominy River above Shipyard") and shown in Figure 2-1:[11]

- Salinity = 0.9 parts per thousand (ppt) average, 7.92 ppt maximum
- Temperature = 17.6 degrees Celsius (64 degrees Fahrenheit) average
- Turbidity = 58 Nephelometric Turbidity Units (NTU) average

The salinity values were based on 357 sampling events over the sampling time period, with typically one or two sampling events per month. Several data points from January through July are reported as "0" or blanks; hence, the data set does not appear to be reliable for average values since zero readings tend to skew the average lower, while blank cells tend to skew the average higher. The maximum salinity of

[10] National Oceanic and Atmospheric Administration (NOAA). 2016. *James River – Jamestown Island to Jordan Point, NOAA Chart 12251*. Pages 6-7.

[11] http://web2.vims.edu/vecos/Longterm.aspx?param=RET5.1A&program=TRIB

7.92 ppt was reported on October 22, 2002. Note that the maximum chloride concentration for NNWW monitoring station CR-08 was reported on October 4, 2002, which is fairly close to the date of the VECOS maximum salinity sampling event.

The VECOS database also has Chickahominy River Oligohaline (CHKOH) dataflow monitoring data. The dataflow cruises occurred monthly from April to October 2005, April to October 2006, April to October 2007, and April to October 2008.[12] In the CHKOH data results from 2005 through 2008, the salinity of the Chickahominy River at Brickyard Landing was reported for each year in the 0 to 2.5 ppt range from April to end of June, with the range approaching 2.5 to 5.0 ppt in August, and reaching 5 to 7.5 ppt in September.

STORET Data from Virginia Department of Environmental Quality (DEQ) monitoring stations in close proximity to Brickyard Landing is provided in the Appendix. The location of the monitoring stations is shown in Figure 2-3. The DEQ monitoring data was based on limited sampling events and does not include the higher salinity event in 2002 reported in the NNWW and VECOS database. Hence, for the purposes of this study, CDM Smith used the NNWW and VECOS data to establish the design criteria for the Brickyard Landing water treatment facility.

To augment the limited amount of water quality data available for the Chickahominy River, CDM Smith drew on its data from pilot testing for the Haverstraw reverse osmosis (RO) treatment facility in New Jersey, which draws water from the Hudson River. This project had similar brackish water quality as the Chickahominy River. The pilot test results indicated that a chloride concentration of 4,600 mg/L (the maximum value observed at NNWW monitoring station CR-11, as listed in Table 2-1) corresponds with a TDS concentration of 8,800 mg/L.[13] The average chloride concentration of 824 mg/L corresponds with a TDS concentration of 1,650 mg/L. In CDM Smith's opinion, it is reasonable to use the same chloride to TDS ratio for Brickyard Landing until site-specific data is collected. Using this correlation, the maximum TDS concentration for NNWW monitoring station CR-08 is estimated to be 6,920 mg/L based on the maximum chloride concentration of 3,620 mg/L listed in Table 2-1. The average TDS concentration is estimated to be 1,100 mg/L. The maximum TDS of VECOS monitoring station RET5.1A is estimated to be 7,920 mg/L based on the salinity of 7.9 ppt; the estimated maximum VECOS TDS concentration is in range of the CR-08 and CR-11 estimated maximum TDS concentrations. Hence, the NNWW and VECOS data are consistent.

In developing the design concept for the Brickyard Landing water treatment facility, CDM Smith employed the following design criteria:

- Maximum TDS of 7,000 mg/L and average TDS of 1,100 mg/L
- Temperature range of 2 to 28 degrees Celsius (36 to 82 degrees Fahrenheit)
- Total suspended solids (TSS) concentrations similar to the York River and James River sites

The average feed TDS concentration of 1,100 mg/L is only about 16 percent of the maximum feed TDS of 7,000 mg/L for the Chickahominy River Brickyard Landing site in contrast to the James and York River

[12] http://web2.vims.edu/vecos/SegmentDetail.aspx?param=CHKOH&program=DFLO

[13] While salinity values are typically reported in ppt, total dissolved solids (TDS) and ionic concentrations are usually reported in mg/L or ppm (parts per million). For clean water that does not have high concentrations of dissolved organics, TDS values in mg/L or ppm should be approximately equal to salinity values in ppt times one thousand.

sites where the ratios of average to maximum feed TDS values are 45 and 60 percent, respectively. It was anticipated that the database on chloride concentrations collected by NNWW, which includes more than 350 data points covering a 17-year period, would give a fairly accurate average chloride concentration value; however, in reviewing the data, there does appear to be a disproportionately higher number of readings in 2003 and 2004, which have low chloride values that may be skewing the average. The reason for the higher number of readings during lower chloride periods is unknown. The concern is that if there is a very large difference between the average feed TDS and the maximum TDS, as in this case where the average TDS is more than five times lower than the maximum, it may be harder to develop a design that is efficient at both the average and maximum feed conditions.

2.4.2 Recommended Treatment

Based on the water quality evaluation results, RO treatment is recommended for the Chickahominy River Brickyard Landing water treatment facility to reduce the level of TDS from estimated values ranging up to 7,000 mg/L to drinking water quality levels of less than 350 mg/L to meet JCSA's established water quality goal.[14] The proposed treatment schematic is shown in Figures 2-4 and 2-5. The capacity and treatment process requirements for the Chickahominy River Brickyard Landing site are similar to the capacity and treatment process discussed in Section 9.4.2 of the 2015 Water Supply Study for the James River. The footprint of an 8-mgd treatment facility is estimated to require approximately 7 acres. At 0.33 acres, the Brickyard Landing property is inadequate and JCSA will need to purchase additional property.

In the proposed scheme, water from the Chickahominy River would be drawn through wedge wire screens into a raw water pump wet well. The intake screens will remove suspended particles greater than a few millimeters in size and prevent the impingement or entrainment of fish and other water fauna. To remove the relatively high levels of suspended solids and turbidity ahead of the RO system, a robust pretreatment system consisting of coagulation, flocculation and sedimentation followed by either microfiltration (MF) or ultrafiltration (UF) is recommended. In addition to the removal of suspended solids, the MF/UF system will also provide an effective barrier for the removal of water borne pathogens such as Giardia lamblia, Cryptosporidium, and viruses. Low turbidity feed water from the MF/UF system will be fed to the suction side of the high pressure pumps for the RO system.

The RO treatment process for the Chickahominy River Brickyard Landing and Riverfront Park sites are similar, although the Brickyard Landing site does have lower maximum and average feed TDS concentrations, which reduce the feed pressure requirements. A membrane feed pressure of 393 psi is proposed for the Brickyard Landing site with a maximum feed TDS of 7,000 mg/L in comparison to a membrane feed pressure of 440 psi for the Riverfront Park site with a maximum feed TDS of 8,800 mg/L.

The RO system design concept for the Brickyard Landing site is based on a typical brackish surface water flux rate of 12 gallons per square foot per day (gfd) with 40 vessels in the first stage and 20 vessels in the second stage, similar to the Riverfront Park concept. With the maximum feed TDS in the range of 7,000 mg/L, high rejection CPA5-LD brackish RO membrane can be used in both the first stage and second stages and reduce the permeate concentration to less than 250 mg/l. In contrast, the

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[14] Movahed, Ben, "Five Forks RO plant in Virginia after 1 year of successful operation" American Membrane Technology Association. 2006. New Facilities Solutions. Table 1. Page 5. (http://www.amtaorg.com/wp-content/uploads/AMTA_Summer06.pdf (Last accessed February 12, 2015American Membrane Technology Association. 2006. *New Facilities Solutions*. "Five Forks RO plant in Virginia after 1 year of successful operation". Table 1. Page 5. [http://www.amtaorg.com/wp-content/uploads/AMTA_Summer06.pdf (Last accessed February 12, 2015)]

Riverfront Park design treating a maximum concentration of 8,800 mg/l used high rejection CPA5-LD brackish in the first stage and ultra-low pressure SWC6 SWRO membranes in the second stage to achieve JCSA's finished water TDS goal of less than 350 mg/l. The use of all brackish water membrane elements in the Brickyard Landing design reduces the operating pressure compared to the use of a hybrid design with brackish water elements in the first stage and SWRO membrane elements in the second stage for the Riverfront Park concept. The lower operating pressure indicates that the Chickahominy River Brickyard Landing power consumption and operating costs should be somewhat lower than the Chickahominy Riverfront Park case.

An interstage turbocharger energy recovery system is included in this design concept, similar to the Chickahominy Riverfront Park and the York and James River concepts. An RO system recovery of 75 percent was used for this site. With more information on the scaling potential at the site, it may be possible to increase the system recovery to 80 percent. The raw water databases that were reviewed to determine the design basis for the RO system did not include sufficient data for the primary ions that are used to determine the scaling potential.

The brine concentrate discharge location on the Chickahominy River must be a sufficient distance downstream of the intake to avoid recirculation. The location of the brine concentrate discharge is of greater concern for Brickyard Landing than the Chickahominy Riverfront Park due to the lower flows upstream in comparison to the higher volume of the James River at its confluence downstream. A detailed evaluation of concentrate disposal options should be considered during design.

2.4.3 Flow Availability

The Virginia Department of Health (VDH) Waterworks Regulations, 12VAC5-590-830 states that the safe yield of a free-flowing stream is "the minimum withdrawal rate available during a day and recurring every 30 years (30 year – one day low flow)." The proposed definition by DEQ for 9VAC25-210-300 states:

> *"Public water supply safe yield" means the highest volumetric rate of water that can be withdrawn by a surface water withdrawal during the drought of record since 1930, including specific operational conditions established in a Virginia Water Protection permit, when applicable.*[15]

The public comment period for the draft regulation ended on January 29, 2016.

DEQ indicated that available flow data for the Chickahominy River at Brickyard Landing is limited to the United States Geological Survey (USGS) StreamStats data, which does not take into account tidal effects. DEQ is working with VIMS to quantify the flow with consideration on the impact of tidal effects. DEQ noted that they typically receive recommendations from the Virginia Department of Game and Inland Fisheries (VDGIF) that no more than 10 percent of instantaneous stream flow be diverted. DEQ commented further "the concerns of other agencies regarding the movement of the salinity gradient upstream will intensify given the freshwater tidal marsh ecosystems that stretch of the river supports."[16] Additional studies will be required to quantify the available flow at Brickyard Landing for a water treatment facility.

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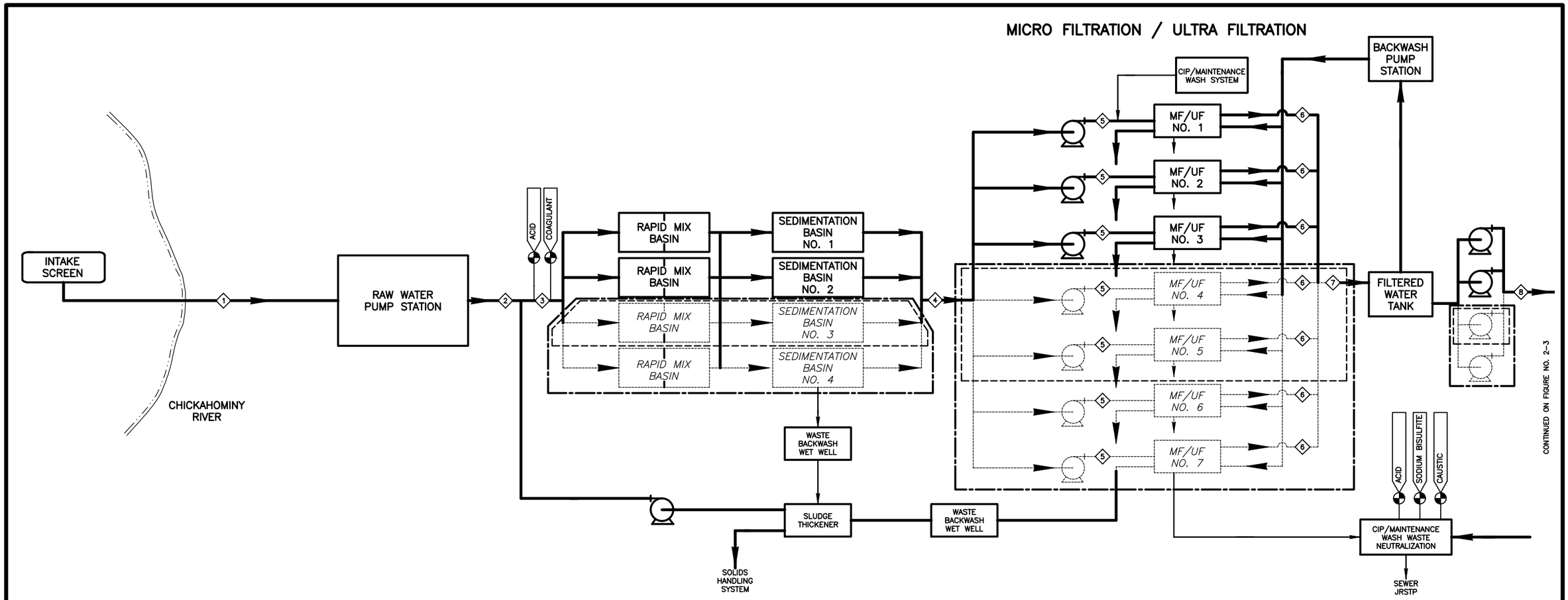
[15] http://townhall.virginia.gov/L/ViewXML.cfm?textid=10010

[16] M. Links (Personal communication, January 29, 2016).



PROCESS DATA

	1	2	3	4	5	6	7	8
FLOWS:								
Phase 1 MGD	5.72	5.72	5.72	5.61	2.81	2.67	5.33	5.33
Build-out MGD	17.17	17.17	17.17	16.84	2.81	2.67	16.0	16.0
CONSTITUENTS:								
TDS, Avg. mg/L	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
TDS, Max. mg/L	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000
TSS, Avg. mg/L	58	58	58	12	12	0.5	0.5	0.5
TSS, Max. mg/L								
PRESSURES:								
Avg. psi	atm	45	atm	atm	15	4	4	45
Max. psi	atm	45	atm	atm	35	4	4	45

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis

12 - STREAM NUMBER

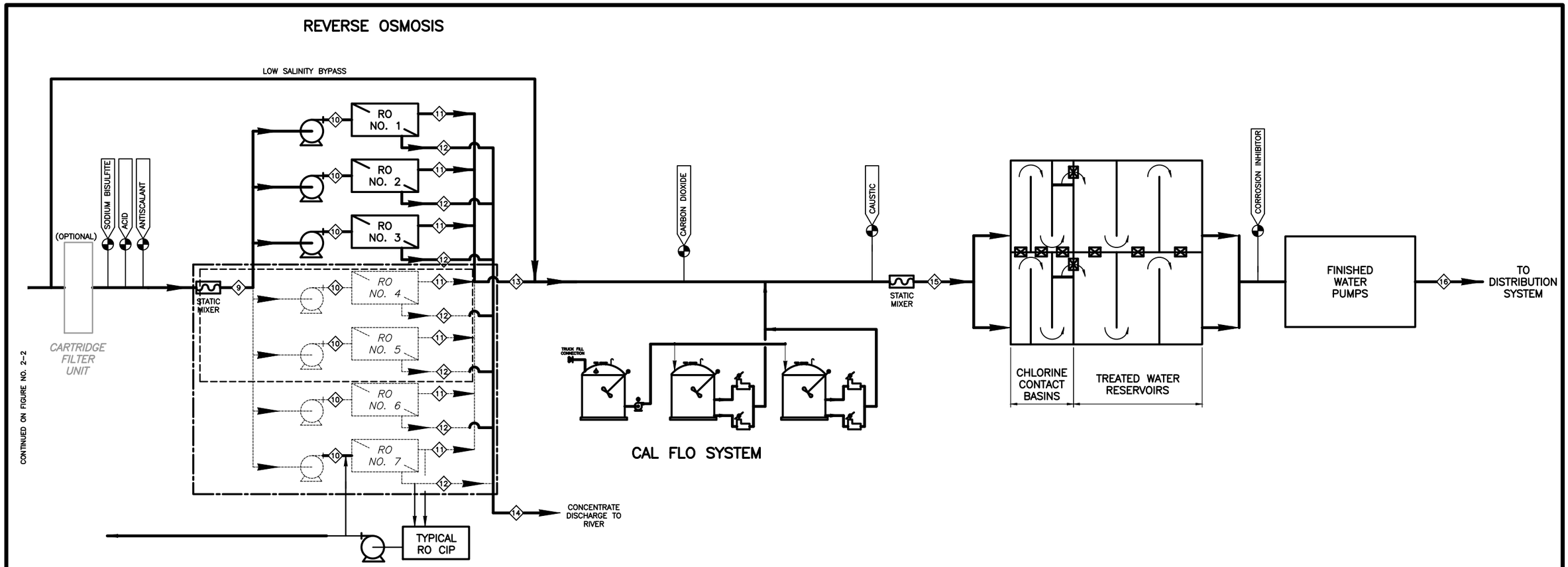
LEGEND:

---- 8 MGD

—·— 12 MGD

CDM Smith

Figure No. 2-4
James City Service Authority
Chickahominy River Brickyard Site Process Flow Diagram I - Clarification and MF/UF



PROCESS DATA

	9	10	11	12	13	14	15	16
FLOWS:								
Phase 1 MGD	5.33	2.67	2.0	0.67	4.0	1.34	4.0	4.0
Build-out MGD	16	2.67	2.0	0.67	12.0	4.0	12.0	12.0
CONSTITUENTS:								
TDS, Avg. mg/L	1,100	1,100	15	4,350	100	4,350	<100	<100
TDS, Max. mg/L	7,000	7,000	240	27,376	240	27,376	<300	<300
TSS, Avg. mg/L								
TSS, Max. mg/L	0.5	0.5	-	3	-	3	-	-
PRESSURES:								
Avg. psi	30	185	10	222	10	15	8	50
Max. psi	30	393	10	534	10	15	8	50

Column Numbers = Stream ID Numbers
(*) - Denotes Intermittent Flow on a Daily Basis
1 AT MAX TDS MIN TEMP
2 AT MAX TDS MAX TEMP
12 - STREAM NUMBER

LEGEND:
---- 8 MGD
—·— 12 MGD

CDM Smith

Figure No. 2-5
James City Service Authority
Chickahominy River Brickyard Site Process Flow Diagram II - Desal & Post-Treatment

2.5 Physical Infrastructure Impacts

Based on the location of an 8- or 12-mgd water treatment facility at the Brickyard Landing site, approximately 23,000 feet of 36-inch-diameter main will be required to convey finished water to the existing 16-inch-diameter main on Church Lane and in the easement north and parallel to Route 60. Additional infrastructure improvements may also be required within the existing system to transmit the flow to the demand centroid. It is recommended that JCSA conduct simulations on their hydraulic water model to define the infrastructure needs for the Chickahominy River Brickyard Landing water treatment facility.

It should be noted that ground elevations in the JCSA service area generally decrease from north to south. Hence, pumping requirements will likely be less from the Brickyard Landing site in comparison to Chickahominy Riverfront Park. Brickyard Landing is also closer to the projected growth in the northern service area than Chickahominy Riverfront Park.

2.6 Financial Impacts

Planning-level cost estimates for the Chickahominy River Brickyard Landing water treatment facility are presented in Table 2-2. The planning-level cost estimate includes costs to purchase 7 acres adjacent to Brickyard Landing. The planning-level cost estimate includes a cost to install a transmission main to connect the water treatment facility to the existing system, but does not include costs for infrastructure improvements necessary to distribute the flow in the system. Planning-level cost estimates were developed for 4-, 8-, and 12-mgd plant capacities. For all capacities, the raw water intake facility, raw water transmission main, and finished water transmission main were assumed to be constructed for the ultimate capacity of 12 mgd.

The Chickahominy Riverfront Park and Brickyard Landing alternatives are based on the same pretreatment requirements; historical water quality data is not available to establish any differentiation. In comparison to the Chickahominy Riverfront Park water treatment facility, there is a slight reduction in the membrane and pressure vessel costs and associated electrical costs for the Chickahominy River Brickyard Landing water treatment facility.

Planning-level operations and maintenance (O&M) costs are presented in Table 2-3. The O&M costs were developed in a similar manner as the O&M costs for the surface water supply alternatives discussed in the 2015 Water Supply Study. The O&M cost for the Chickahominy River Brickyard Landing water treatment facility is slightly lower than the O&M cost for the Chickahominy Riverfront Park water treatment facility primarily due to a reduction in power costs associated with the lower membrane feed pressure.

2.7 Potential Environmental Concerns

Implementation of the Chickahominy River water supply option at Brickyard Landing presents the following potential environmental concerns:

- Impacts on the following ecological communities as identified in the Virginia Department of Conservation and Recreation (DCR) natural heritage inventory and defined as "habitat of rare,

threatened, or endangered plant and animal species, rate or state significant natural communities or geologic sites, and similar features of scientific interest"[17]:

- Fluvial terrace woodlands
- Coastal plain/piedmont swamp forests
- Tidal bald cypress forests and woodlands
- Tidal freshwater and oligohaline aquatic beds

- Impacts on freshwater emergent wetlands, particularly on the southern and northeast banks of the Chickahominy River at Brickyard Landing and along both sides of the river downstream to James River[18]
- Impacts on riverine and freshwater forested/shrub wetland areas[17]
- Impacts on salinity gradient changes to the ecosystems
- Impacts on the 30-mile segment from Providence Forge to the James River classified in the National Park Service Nationwide Rivers Inventory (NRI) as having Outstanding Remarkable Value designations of Botanic ("an extensive, well developed cypress-gum swamp forest and bottomland hardwood forest which includes three rare, endemic and possibly endangered species of plants)" and Geologic ("extreme topographic diversity including cliffs up to 100 feet high at Fish Hole Landing").[19]

It should be noted that the VDGIF review comments received by DEQ on the Pre-Application Meeting for the Chickahominy Riverfront Park and York River alternatives held on August 31, 2015 indicate:

> *To best inform our assessment of impacts the proposed project may have on instream habitat and resident aquatic species, we recommend that the applicant and/or DEQ provide for our review the results of spatio/temporal modeling of the salinity changes resulting from the proposed intake. We recommend modeling of at least two scenarios (full withdrawal and something less than full withdrawal) be performed to determine if/at what point switching from the surface water intake back to groundwater may be necessary to protect water quality/fish and wildlife habitat.*[20]

CDM Smith anticipates that VDGIF's modeling requirements to demonstrate salinity changes at the Chickahominy Riverfront Park site will also apply to the Chickahominy River Brickyard Landing site.

These potential environmental and public concerns may impact the ability to obtain permits and approval requirements identified in Section 3. In addition, the potential impact of boat traffic may also be of concern to the public.

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[17] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan*. Page 3-13.

[18] National Wetlands Inventory Map (https://vanhde.org/content/map)

[19] http://www.nps.gov/ncrc/programs/rtca/nri/states/va.html

[20] A. Ewing, (Personal communication, October 26, 2015 regarding JCSA Pre-Application Meeting Comments (ESSLog#35985))

Table 2-2 Planning-Level Cost Estimate for Chickahominy River Brickyard Landing WTF (dollars)

Description	4-mgd Capacity		8-mgd Capacity		12-mgd Capacity	
Intake Facilities						
Intake	13,450,000		13,450,000		13,450,000	
Intake Pump Station	2,000,000		3,000,000		3,900,000	
Raw Water Pipeline	2,440,000		2,440,000		2,440,000	
Instrumentation – Intake Pump Station	570,000		860,000		1,100,000	
Electrical – Intake Pump Station	400,000		610,000		780,000	
Subtotal for Prime Contractor		18,860,000		20,360,000		21,670,000
Construction Contingency		4,720,000		5,090,000		5,420,000
Intake Facilities		23,580,000		25,450,000		27,090,000
Water Treatment Plant						
Yard Piping	1,850,000		2,070,000		2,300,000	
Site	4,460,000		5,310,000		6,160,000	
Pretreatment Basins	2,380,000		3,570,000		4,760,000	
Chemical Systems	3,480,000		4,050,000		4,620,000	
Administration Building	3,060,000		3,060,000		3,060,000	
Process Building	14,730,000		23,260,000		31,790,000	
CCT/Finished Water Storage	1,270,000		1,270,000		1,270,000	
Finished Water Pump Station	2,230,000		3,310,000		4,010,000	
Sludge Processing	950,000		1,420,000		1,890,000	
Instrumentation – WTP	1,280,000		1,420,000		1,570,000	
Electrical – WTP	4,300,000		4,830,000		5,370,000	
Concentrate Discharge Main	1,000,000		1,000,000		1,000,000	
Subtotal for Prime Contractor		40,990,000		54,570,000		67,800,000
Construction Contingency		10,250,000		13,640,000		16,950,000
Water Treatment Plant		51,240,000		68,210,000		84,750,000
Transmission Main						
Approximately 23,000 feet of 36-inch diameter main	11,500,000		11,500,000		11,500,000	
Subtotal for Prime Contractor		11,500,000		11,500,000		11,500,000
Construction Contingency		3,250,000		3,250,000		3,250,000
Transmission Main		14,380,000		14,380,000		14,380,000
Total Construction Cost in 2015 dollars	**91,260,000**		**110,230,000**		**128,530,000**	
Engineering, Legal, and Financial Fees	13,690,000		16,530,000		19,280,000	
Pilot Testing	500,000		500,000		500,000	
Permitting	500,000		500,000		500,000	
Land Acquisition (7 acres at $175,000/acre)	1,230,000		1,230,000		1,230,000	
Total Project Costs in 2016 dollars	**$104,810,000**		**$126,480,000**		**$147,380,000**	
Total Project Costs in 2016 dollars per million gallons treated	**$ 26,202,500**		**$ 15,810,000**		**$ 12,281,700**	

Notes:

1. All costs expressed in 2016 dollars.
2. Existing distribution system should be evaluated to determine if the flow will require additional infrastructure improvements.

Table 9-3 Planning-Level O&M Cost Estimate for 8-mgd Chickahominy River Brickyard Landing WTF

Description	Annual O&M Cost $
Chemical Usage	1,250,000
Energy Consumption	1,240,000
Sludge Disposal	210,000
Labor	640,000
Equipment Maintenance/Repairs, annualized	1,290,000
Subtotal	4,630,000
Contingency	460,000
Total O&M Cost	5,090,000
	$ 1.74/1000 gal

Note: All costs expressed in 2016 dollars.

Appendix - STORET Water Monitoring Stations on Chickahominy River

Station ID		VA05-0001-A				CHD015.50				2CCHK015.28				21VASWCB-2-CHK014.33			
Monitoring Period		August 31, 2005				August 31, 2005				July 1, 2013				1992 - 2014			
Parameter	Units	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples
Alkalinity, total	mg/l													18.2	18.2	18.2	1
Ammonia	mg/l	0.015	0.015	0.015	1					0.053	0.053	0.053	1	0.04	0.04	0.04	7
Biochemical oxygen demand, standard conditions	mg/l																
Carbon	mg/l									1.29	5	3.145	2				
Chloride	mg/l													19.2	19.2	19.2	1
Chlorine	mg/l																
Chlorophyll a	ug/l	6.942	6.942	6.942	1												
Chlorophyll a, corrected for pheophytin	ug/l									15.9	15.9	15.9	1				
Chlorophyll a, uncorrected for pheophytin	ug/l									20	20	20	1				
Chlorophyll b	ug/l									0.1	0.1	0.1	1				
Chlorophyll c	ug/l									1.37	1.37	1.37	1				
Colored dissolved organic matter (CDOM)	None																
Depth, Secchi disk depth	m	0.3	0.3	0.3	1	0.3	0.3	0.3	1	0.8	0.8	0.8	1				
Dissolved oxygen (DO)	mg/l	9.34	9.34	9.34	2	9.34	9.34	9.34	1	5.76	6.2	5.95	5	4.94	13.49	8.85	120
Enterococcus	cfu/100ml									20	20	20	1	25	300	118	26
Escherichia coli	cfu/100ml									10	10	10	1				
Fecal Coliform	cfu/100ml									25	25	25	1	100	100	100	1
Fixed suspended solids	mg/l									7	7	7	1	7	7	7	1
Hardness, Ca, Mg	mg/l													15.3	21	18.15	2
Inorganic nitrogen (nitrate and nitrite)	mg/l	0.003	0.003	0.003	1					0.025	0.025	0.025	1	0.04	0.19	0.07	6
Kjeldahl nitrogen as N	mg/l																
Mercury	ug/g	0.054	0.054	0.054	1									0.5	5.1	1.79	14
Nitrate	mg/l	0	0	0	1					0.024	0.024	0.024	1	0.04	0.04	0.04	1
Nitrite	mg/l	0	0	0	1					0.002	0.002	0.002	1	0.01	0.01	0.01	1
Nitrogen	mg/l	4.62	4.62	4.62	1					0.17	3	1.26	3	0.1	0.81	0.62	14
Organic carbon	%	6.76	6.76	6.76	1	67.63	67.63	67.63	1	23	23	23	1				
Orthophosphate	mg/l	0.016	0.016	0.016	1									0.02	0.02	0.02	1
pH	None	8.8	8.8	8.8	2	8.8	8.8	8.8	1	6.82	6.95	6.87	5	5.57	7.85	6.82	121
Pheophytin a	ug/l									5.78	5.78	5.78	1				
Pheophytin ratio	%									1.51	1.51	1.51	1				
Phosphorus	mg/l	0.11	0.11	0.11	1					0.01	0.33	0.13	3	0.01	0.09	0.06	15
Phosphorus, Particulate Organic	mg/l									0.06	0.06	0.06	1				
Salinity	ppth	0.34	0.34	0.34	2	0.34	0.34	0.34	1	0.05	0.05	0.05	5	0	2.4	0.65	52
Silica	mg/l									4.8	4.8	4.8	1				
Specific conductance	umho/cm					71400	71400	71400	1	100	100	100	5	56	4340	755	112
Sulfate	mg/l													9	9	9	1
Temperature, water	deg C	28.8	28.8	28.8	2	28.8	28.8	28.8	1	28.01	28.16	28.07	5	1.67	31.87	17.40	120
Tide Stage										0	0	0	6	0	0	0	105
Total fixed solids	mg/l													52	52	52	1
Total solids	mg/l													86	86	86	1
Total suspended solids	mg/l	43.8	43.8	43.8	1					12	12	12	1	10	24	15.57	7
Total volatile solids	mg/l									5	5	5	1	3	34	18.5	2
Turbidity	NTU													7	17.5	11.10	7

Source: Environmental Protection Agency. 2016. STORET (http://watersgeo.epa.gov/mwm/)

Appendix - STORET Water Monitoring Stations on Chickahominy River (continuation)

Station ID		21VASWCB-2-CHK008.28				2CCHK006.68				CHK006.14			
Monitoring Period		1983-1987				July 7, 2014				1978 - 2015			
Parameter	Units	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples	Min	Max	Avg	No. of Samples
Alkalinity, total	mg/l									27.7	44.8	37.1	3
Ammonia	mg/l					0.012	0.012	0.012	1	0.003	0.494	0.032	358
Biochemical oxygen demand, standard conditions	mg/l									2	2	2	3
Carbon	mg/l					2.11	5.79	3.95	2	0.02	9.83	2.09	354
Chloride	mg/l									23.1	169	77.7	3
Chlorine	mg/l	0	0	0	1								
Chlorophyll a	ug/l												
Chlorophyll a, corrected for pheophytin	ug/l					14.4	14.4	14.4	1	0.5	54.6	11.6	184
Chlorophyll a, uncorrected for pheophytin	ug/l					18.1	18.1	18.1	1	0.5	61.9	15.3	184
Chlorophyll b	ug/l					0.1	0.1	0.1	1	0.1	2.7	0.4	184
Chlorophyll c	ug/l					1.31	1.31	1.31	1	0.1	8.2	1.3	184
Colored dissolved organic matter (CDOM)	None									-0.0824	7.3	0.9	31
Depth, Secchi disk depth	m	0.2	7.8	0.80	62	0.7	0.7	0.7	1	0.2	0.9	0.5	329
Dissolved oxygen (DO)	mg/l	4.4	14	8.2	125					3.8	13.9	8.9	972
Enterococcus	cfu/100ml					10	10	10	1	10	2000	95	102
Escherichia coli	cfu/100ml					10	10	10	1	10	100	29	40
Fecal Coliform	cfu/100ml					25	25	25	1	25	600	66	139
Fixed suspended solids	mg/l					11	11	11	1	3	314	32	357
Hardness, Ca, Mg	mg/l									10	8580	304	71
Inorganic nitrogen (nitrate and nitrite)	mg/l					0.005	0.005	0.005	1	0.002	0.628	0.116	358
Kjeldahl nitrogen as N	mg/l												
Mercury	ug/g												
Nitrate	mg/l					0.002	0.002	0.002	1	0.002	0.62	0.11	358
Nitrite	mg/l					0.004	0.004	0.004	1	0.002	0.095	0.01	358
Nitrogen	mg/l					0.305	3	1.216	3	0.004	1.78	0.36	706
Organic carbon	%					48.8	48.8	48.8	1	3.47	6.12	4.78	6
Orthophosphate	mg/l									0.002	0.03	0.01	237
pH	None	5.8	8.9	7.2	70	7.75	7.75	7.75	1	5.66	8.62	7.15	908
Pheophytin a	ug/l					5.11	5.11	5.11	1	0.5	43.97	5.47	184
Pheophytin ratio	%					1.517	1.517	1.517	1	0	2.018	1.44	180
Phosphorus	mg/l					0.009	0.325	0.117	3	0.002	0.13	0.02	493
Phosphorus, Particulate Organic	mg/l					0.044	0.044	0.044	1	0.0016	0.2614	0.06	353
Salinity	ppth	0	25	0.971186	59	0.13	0.13	0.13	1	0	7.92	1.13	796
Silica	mg/l					0.8	0.8	0.8	1	0.1	8.2	4.16	167
Specific conductance	umho/cm	60	50000	1798	68	279	279	279	1	0.97	13741	1969	1072
Sulfate	mg/l									8.9	33.4	19.9	3
Temperature, water	deg C	1	30	19.9	73	27.4	27.4	27.4	1	1.67	38.6	17.3	997
Tide Stage		0	0	0	0	0	0	0	1	0	0	0	511
Total fixed solids	mg/l									5	7260	1343	81
Total solids	mg/l									5	8580	1772	83
Total suspended solids	mg/l					18	18	18	1	0.77	370	39	369
Total volatile solids	mg/l					7	7	7	1	2	1550	55	438
Turbidity	NTU									0.1	172	28	357

Source: Environmental Protection Agency. 2016. STORET (http://watersgeo.epa.gov/mwm/)

ATTACHMENT K

Flow-Dependent Beneficial Uses

Flow-Dependent Beneficial Uses

Aesthetic Quality

Chickahominy Riverfront Park is located in the tributary section of the James River classified by the Virginia Department of Conservation and Recreation (DCR) as a scenic river from Trees Point to Lawnes Creek.[1] To preserve the river view, the intake screens and raw water pipes will be submerged in the river and buried.

Aquatic life

DGIF has indicated that the site is documented as an Anadromous Fish Use Area; instream work may be restricted to between February 15 and June 30 to protect the Anadromous Fish.[2] Working outside of the restricted window will benefit anadromous fish by eliminating the potential for disturbance during sensitive spawning and development life stages.

DGIF also indicated that the endangered Atlantic sturgeon is known to exist in the drainage area and that they are likely to recommend restrictions on instream work in the fall, when reproduction generally occurs.[3] Adhering to recommended time-of-year restrictions on instream work will benefit the endangered Atlantic sturgeon by eliminating the potential for disturbance during sensitive spawning and development life stages.

The Mid-Atlantic Fishery Management Council (FMC) and NOAA Fisheries designate Essential Fish Habitat (EFH) in Virginia. The FMC has designated EFH for at least one life stage for nine fish species in the Lower Chickahominy River (Table 2). For those species with mapped EFH for the project area, the Mid-Atlantic FMC's fishery management plans (FMPs) for the species listed should be consulted and coordination with NOAA Fisheries is recommended.

Table 2. Essential Fish Habitat (EFH) Designations for Species in the Chickahominy Riverfront Park Area

Common Name	Scientific Name
Windowpane Flounder	*Scophthalmus aquosus*
Bluefish	*Pomatomus saltatrix*
Atlantic Butterfish	*Peprilus triacanthus*
Summer Flounder	*Paralichthys dentatus*
Black Sea Bass	*Centropristis striata*
King Mackerel	*Scomberomorus cavalla*
Spanish Mackerel	*Scomberomorus maculatus*
Cobia	*Rachycentron canadum*
Red Drum	*Sciaenops occelatus*

[1] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 3-17, Table 3-7.

[2] Attachment L of the JPA, DGIF Pre-Application Review Comment dated October 26, 2015.

[3] Attachment L of the JPA, DCR Pre-Application Review Comment dated October 30, 2015.

Bald eagle nests and concentration zones have been documented in the vicinity of the project area. The project will be implemented in accordance with state and federal guidelines for protection of bald eagles. Additionally, the measures described below that will be put in place for the benefit of all aquatic life will indirectly benefit bald eagles, colonial waterbirds, and other piscivorous predators by protecting primary food sources.

VMRC also indicated that there is a blue crab commercial harvest in the vicinity of the site.[4] To protect blue crabs and all other aquatic organisms from impingement, entrapment, and/or entrainment, the intake will be designed with 1.0 mm mesh size and a flow-through velocity of 0.25 fps. This mesh size and flow-through velocity was recommended by DGIF and the Virginia Institute of Marine Science (VIMS) for the protection of resident aquatic species. Additionally, withdrawal volume will not exceed 10 percent of instantaneous flow.

Release of brine from the desalination process into the estuary causes concern for aquatic life. As a component of Phase 2 of the project (i.e. design and permitting of discharge and outfall), salinity modeling is being conducted concurrent with this submittal to determine the impact of the withdrawal on the salinity gradient and to locate the concentrate discharge in an area downstream that will provide adequate dilution and mixing necessary to reduce adverse impact to aquatic life. Understanding the salinity and volume of the effluent, the location of the effluent pipe, spatial expanse of the dilution plume, and the salinity regime of the receiving waters will allow project elements that protect aquatic life to be incorporated into design.

Archaeological Resources

The Virginia Department of Historic Resources (DHR) has identified archaeological resources on the project site. The water treatment facility is proposed to be located on the east side of the property to reduce the impact to archaeological findings which are primarily on the west side of the property and in the open field. Construction activities and facility operations were selected to protect historical and cultural resources and are not expected to affect water levels to the extent that archaeological resources would be exposed or inundated.

Botanical Significance

Chickahominy Riverfront Park is located in the segment of the Chickahominy River classified as having botanic significance in the National Park Service, National Rivers Inventory:[5] Botanic significance is defined as having "an extensive, well developed cypress-gum swamp forest and bottom land hardwood forest which includes rare and endemic species of plants."

The intake was placed in a location that would not directly impact the mature cypress-gum swamp forests and bottomland hardwood forests located primarily along the south shore of Gordon Creek. In addition, construction activities and facility operations were selected to protect botanical features and are not expected to affect water levels to the extent that erosion rates and water regimes would change and adversely impact these resources.

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[4] Attachment L of the JPA, VMRC Pre-Application Review Comment dated October 27, 2015.

[5] Hampton Roads Planning District Commission. 2011. *Hampton Roads Regional Water Supply Plan.* Page 3-20, Table 3-9.

Groundwater

DEQ proposes to reduce the amount of groundwater that JCSA is permitted to withdraw due to declining groundwater levels, advancing saltwater intrusion, and land subsidence in the Eastern Virginia Groundwater Management Area (EVGMA). The use of the Chickahominy River as a surface water supply will benefit the groundwater resources in the EVGMA by slowing the rate of groundwater withdrawals and allowing for aquifer recharge. Replenishing the aquifer would improve the baseflow for perennial streams in the Chickahominy River watershed.

Navigation

The Chickahominy River is used by recreational boaters. The raw water pipe and intake will be located closer to the shore rather than midstream to reduce impact to boaters. The in-water structures will also be installed at a depth to reduce boating hazards. The intake velocities have been designed to be extremely low compared to normal discharge and will have no noticeable effect on navigation due to changes to river flows in the area.

Parks and Recreation

Chickahominy Riverfront Park has over 120 campsites, fishing pier, boat ramp, swimming pool, and playground. The fishing pier and boat ramp are accessible 24 hours each day. Canoe, kayak and paddleboard rentals are available during the warmer-weather season. Fishing tournaments are also held at the park. The park is also used by the William and Mary Rowing Team. The park is located along the Virginia Capital Trail from Richmond to Williamsburg.

The proposed water treatment facility is located on the eastern side of the property to try to preserve its recreational use including the boat launch and open field. To preserve the recreational use of the park, the flow-through velocities at the intake will be low to avoid being a hazard to swimmers, fishermen, and personal watercraft. The intake screens will also prevent accidental entrapment of park users and recreational equipment.

Waste Assimilation

Existing VPDES discharges to the Chickahominy River will not be affected because none are located in the vicinity of the proposed project. The flow-through intake velocity of 0.25 fps is a small fraction of the average flow velocity recorded for the Chickahominy River. Additionally, withdrawal volume will not exceed 10 percent of instantaneous flow. Due to relatively low-velocity, low-volume withdrawals, the proposed project will not result in pollution loads from upstream sources within the watershed being appreciably higher than the existing condition.

Water Supply

The proposed water withdrawal will be beneficially used as a public water supply to meet the projected demands of residents in James City County. With DEQ's plan to reduce JCSA's groundwater supply, a surface water supply alternative such as this project will be necessary for JCSA to meet their projected demands. DEQ proposes to reduce JCSA's permitted annual withdrawal amount from 8.83 million gallons per day (mgd) to 3.8 to 4.0 mgd; DEQ has not finalized the reduction amount nor the date when the reduction would be implemented. If DEQ reduces the permitted annual withdrawal to 4.0 mgd, JCSA will have an immediate deficit in their water supply. The 2015 average day withdrawal was 5.39 mgd with a peak day withdrawal of 8.09 mgd. The 2015 average day demand was 4.72 mgd with a peak day demand of 7.23 mgd. The difference between the demand and the water withdrawal is attributed to the

process water used for reverse osmosis at the Five Forks Water Treatment Facility. The projected 2050 average day and peak day demands are 8.89 and 13.33 mgd, respectively.

ATTACHMENT L

Aquatic Life

Describe the aquatic life known to be present along the affected stream reach. Describe aquatic life that may be impacted by the proposed water withdrawal. Include the species' habitat requirements.

The project area is located in a freshwater-tidal river system. These areas are in the uppermost part of the estuarine zone where there is a tidal influence bringing saltwater into a larger volume of freshwater. Typically, the salt concentrations in freshwater are less than 0.5 parts per trillion, but will have larger concentrations depending on the tidal flow, or low river discharge. These tidal freshwater beds are home to many floating and submerged plants that provide breeding and foraging habitat for insects, crustaceans, amphibians, birds, and fish. Figure 1 provides the locations of mapped submerged aquatic vegetation (SAV) beds in the vicinity of the proposed project area. While no SAV beds have been identified at the intake location (i.e. east bank of the Chickahominy River downstream of the confluence of Gordon Creek) since 2013, SAV beds were identified there in 2012.

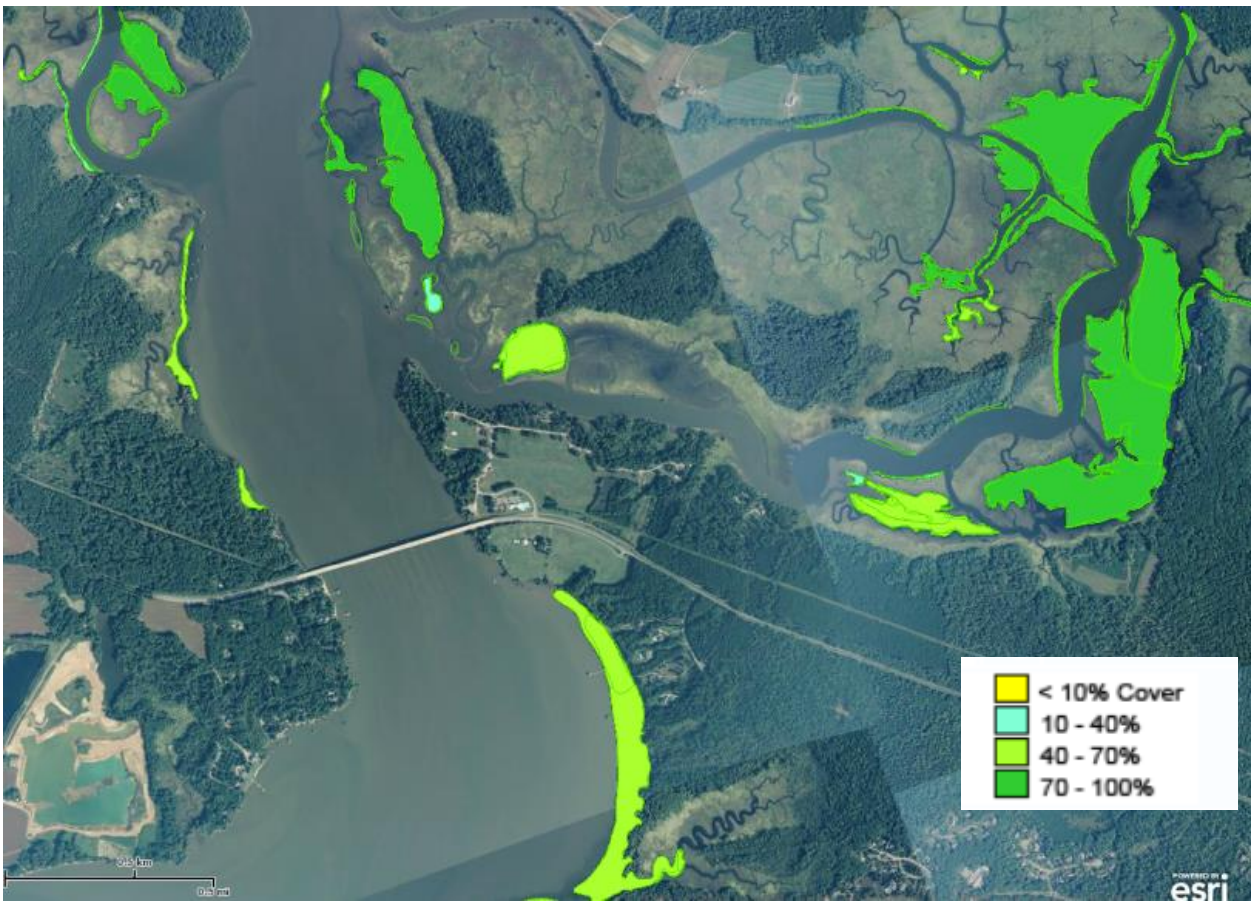

Figure 1. Submerged aquatic vegetation beds 2013-2015 (Virginia Institute of Marine Science)

The proposed project area is located within the Virginia Department of Conservation and Recreation (DCR)-designated Gordon Creek Conservation Site, which consists of DCR-classified Tidal Freshwater Marsh (Arrow-arum-Pickerelweed). Conservation sites are mapping polygons located around one or more rare species or natural communities to include areas of biodiversity significance. The Gordon Creek Conservation Site has been given a significance rating of B2, which represents a site of very high

significance. In comments included as part of this attachment (Attachment L), DCR recommends implementation and strict adherence to applicable erosion and sediment control/storm water management laws and regulations. Additionally, DCR recommends a hydrologic study to determine water quality issues due to changes in salinity from water withdrawal (Phase 1), downstream brine discharge (Phase 2), and sedimentation increases (Phase 1 & Phase 2). JCSA is committed to avoiding SAV beds to the extent practicable during project design and implementing erosion and sediment control best management practices (BMPs) in accordance with state and local laws. JCSA has also commissioned the Virginia Institute of Marine Science (VIMS) to prepare a water quality study to investigate potential changes in salinity as a result of both Phase 1 and Phase 2 of the project.

The unique ecosystems supported by freshwater-tidal river systems provide habitats for a variety of aquatic species, some of which are designated as rare or are state or federally listed as threatened or endangered. A list of aquatic species of concern that are known to be within a 2-mile radius of the project area and could possibly be affected by project activities as identified by the Virginia Department of Game and Inland Fisheries (DGIF) Fish and Wildlife Information Service (VaFWIS) is provided in Table 1.

Table 1. VaFWIS aquatic species of status concern or critical conservation need known or likely to occur within a 2-mile radius of the Chickahominy Riverfront Raw Water Supply project area

Common Name	Scientific Name	Conservation Status	VA Wildlife Action Plan Tier*
Atlantic Sturgeon	*Acipenser oxyrinchus*	Federal Endangered; State Endangered	II
Blueback Herring	*Alosa aestivalis*	Federal Species of Concern	None Listed
Alewife	*Alosa pseudoharengus*	Federal Species of Concern	IV
Mabee's Salamander	*Ambystoma mabeei*	State Threatened	II
Spotted Turtle	*Clemmys guttata*	Collection Concern	III
Northern Diamond-backed Terrapin	*Malaclemys terrapin terrapin*	Collection Concern	II
Bridle Shiner	*Notropis bifrenatus*	None Listed	I

*****Tier I - Critical Conservation Need; Tier II - Very High Conservation Need; Tier III - High Conservation Need; Tier IV - Moderate Conservation Need

Of the species listed in Table 1, anadromous river herring (i.e. blueback herring and alewife) and the endangered Atlantic sturgeon are of particular concern. The Chickahominy and James rivers are documented Anadromous Fish Use Areas. Therefore, the area in the vicinity of the intake is a known river herring migration route and/or spawning site. To protect anadromous fish, it is recommended that any instream work associated with this project be restricted from February 15 through June 30 of any year.

As a federally and state listed endangered species, the Atlantic sturgeon could also be potentially affected by the proposed project. The Atlantic sturgeon can weigh up to 800 pounds, can grow up to 14 feet long, and has a life span of about 60 years. Its diet consists of crustaceans, worms, and mollusks. Sturgeon eggs are highly adhesive and are deposited on hard surfaces. Cold, clean water is likely to be important for proper larval development. As the larvae migrate downstream, they use the gravel in the benthic structure for protection. Juveniles remain in estuarine waters, while sub-adults and adults live between estuaries and coastal waters. Water withdrawal is currently one of the listed threats to the population. To protect sturgeon, DGIF is likely to recommend instream work restrictions during the autumn. Coordination with National Oceanic and Atmospheric Administration (NOAA) Fisheries regarding potential impacts on Atlantic sturgeon will also be undertaken.

According to the Virginia Marine Resources Commission (VMRC) Fisheries Department, there is a healthy commercial harvest of blue crab (*Callinectes sapidus*) and American eel (*Anguilla rostrata*) in the immediate vicinity of the project area. In addition to its commercial value, blue crabs are important components of the estuarine ecosystem. In the post-larval and juvenile stages, blue crabs provide food for eel, drum, bass, and other fish. The crabs are omnivorous, feeding off bivalves, crustaceans, plants, and even partake in cannibalism on juvenile crabs. Grass beds are used for nursery areas and are used by crabs of all sizes to forage. The loss of submerged aquatic vegetation habitat poses the biggest threat to this species survival. VMRC is also concerned about the water quality effects of water withdrawal and brine discharge on the crab and eel fisheries in the vicinity of the project.

The American eel is a nocturnal fish that spends most of its life in fresh and brackish waters. The eels depend on rock crevices or bury themselves under sediment for protection during the day. American eels feed on worms, small fish, mollusks, and soft-shelled crabs, while providing food for larger fish and birds. The American eel has experienced population decline over the past century, and was considered for status protection through the Endangered Species Act in 2007 and 2015. However, both times it was found that protection was not warranted.

The eastern oyster (*Crassostrea virginica*) is an important species both to the Chesapeake Bay economy and water quality. Once widely abundant, its population is in decline due to overharvesting, disease, and habitat loss. Oysters are generally found on hard bottom areas and on the edges of channels. They provide ecosystem benefits by filtering water and forming reefs, the latter of which provides habitat for other aquatic life. While the Lower Chickahominy River does not have preferred oyster habitat due to low salinity levels, downstream of the project area on the James River is the Wreck Shoals-James River Oyster Sanctuary. However, in a review of the project by VIMS, it was determined that due to the highly stochastic ecological and physical dynamics of the project area, the level of concern for oysters will be inconsistent throughout the project lifecycle. While concern is warranted, effects on oysters are expected to be minimal.

As a component of the federal permitting actions (e.g. Section 404 permitting) associated with the project, federal agencies are required to assess the potential impacts that proposed actions and alternatives may have on Essential Fish Habitat (EFH). EFH is institutionally significant due to the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The MSA provides a critical role in sustaining various life stages of fisheries and the persistence of the species. It places a high priority on the aesthetic, recreational, and commercial value of fishery resources that are dependent on EFH. The Mid-Atlantic Fishery Management Council (FMC) and NOAA Fisheries designate

EFH in Virginia. The FMC has designated EFH for at least one life stage for nine fish species in the Lower Chickahominy River (Table 2).

Table 2. Species with Essential Fish Habitat (EFH) Designations in the Chickahominy Riverfront project area

Common Name	**Scientific Name**
Windowpane Flounder	*Scophthalmus aquosus*
Bluefish	*Pomatomus saltatrix*
Atlantic Butterfish	*Peprilus triacanthus*
Summer Flounder	*Paralichthys dentatus*
Black Sea Bass	*Centropristis striata*
King Mackerel	*Scomberomorus cavalla*
Spanish Mackerel	*Scomberomorus maculatus*
Cobia	*Rachycentron canadum*
Red Drum	*Sciaenops occelatus*

Potential project impacts and conservation measures for birds that are dependent on the aquatic ecosystem, such as bald eagles and colonial waterbirds, are discussed in Attachment B.

To protect resident aquatic species from impingement and entrainment at the intake site, design features such as small-diameter mesh intake screens will be used according to recommendations from state and federal wildlife protection agencies. The intake will be fitted with a 1 mm mesh screen and the intake velocity will not exceed 0.25 fps. Additionally, the withdrawal volume will not exceed 10% of instantaneous flow. For those species with mapped EFH for the project area, the Mid-Atlantic FMC's fishery management plans (FMPs) for the species listed should be consulted and coordination with NOAA Fisheries is recommended.

Link, Matthew (DEQ)

From: Ewing, Amy (DGIF)
Sent: Monday, October 26, 2015 5:21 PM
To: Link, Matthew (DEQ)
Cc: Greenlee, Bob (DGIF); Smith, Scott (DGIF)
Subject: RE: JCSA Pre-Application Meeting Comments (ESSLog# 35985)

Matthew,
You heard from us during the pre-app conference call, but to reiterate our comments and to provide additional information, I offer the below. Please note that these are preliminary only as we are currently unsure of the exact intake locations and are unsure about the route any pipes must take to move water from the intake/treatment plant locations to existing dispersal systems.

Potential Intake on Chickahominy River:
We document bald eagle nests and the James River/Chickahominy River Eagle Concentration Zone from the project area (approximate intake location) . Significant habitat alteration, location of water-dependent facilities within concentration zones, or other recreational and commercial activities may result in adverse impacts upon eagles. Therefore, we recommend that the applicant ensure that this project is consistent with state and federal guidelines for protection of bald eagles; and that he coordinate as indicated with us or with the U.S. Fish and Wildlife Service regarding possible impacts upon bald eagles or the need for a federal bald eagle take permit.

The Chickahominy River and James River at this site have been documented Anadromous Fish Use Areas. To best protect these important fisheries, we recommend that any instream work associated with the project adhere to a time of year restriction from February 15 through June 30 of any year. In addition, federally Endangered Atlantic sturgeon are known from this drainage. They are known to also engage in reproductive behaviors in Fall. Data are still coming in, we are still learning about the behaviors of this species within our waters. We are likely to recommend some restrictions on instream work during Fall and will provide that guidance as we can. We recommend coordination with NOAA Fisheries Service regarding possible impacts upon Atlantic sturgeon.

Potential Intake on York River:
We document bald eagle nests from the project area (approximate intake location). Therefore, we recommend that the applicant ensure that this project is consistent with state and federal guidelines for protection of bald eagles; and that he coordinate as indicated with us or with the U.S. Fish and Wildlife Service regarding possible impacts upon bald eagles or the need for a federal bald eagle take permit.

The York River at this site has been designated an Anadromous Fish Use Area. To best protect this important fishery, we recommend that any instream work associated with the project adhere to a time of year restriction from February 15 through June 15 of any year. In addition, federally Endangered Atlantic sturgeon are known from this drainage. They are known to engage in reproductive behaviors in Fall in addition to those in Spring. Data are still coming in and we are still learning about the behaviors of this species within our waters. We are likely to recommend some restrictions on instream work during Fall and will provide that guidance as it becomes available. We recommend coordination with NOAA Fisheries Service regarding possible impacts upon Atlantic sturgeon.

We document colonial waterbird colonies from the project area. We typically recommend that these colonies be identified and a 500-ft no-disturbance, naturally vegetated buffer be maintained on the colony. We also may recommend adherence to time of year restrictions within some distance of the colony depending on the timing and scope of project work.

Both intake locations:
This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend coordination with VDCR-DNH regarding the protection of these resources.

We recommend coordination with the USFWS regarding potential impacts upon federally Threatened northern long-eared bats associated with tree removal, if such is proposed.

To protect resident aquatic species from impingement and entrainment, we recommend that the intake be fitted with a 1mm mesh screen and that the intake velocity not exceed 0.25 fps. Further, we recommend that the withdrawal volume not exceed 10% of instantaneous flow.

To best inform our assessment of impacts the proposed project may have on instream habitat and resident aquatic species, we recommend that the applicant and/or DEQ provide for our review the results of spatio/temporal modeling of the salinity changes resulting from the proposed intake. We recommend modeling of at least two scenarios (full withdrawal and something less than full withdrawal) be performed to determine if/at what point switching from the surface water intake back to ground water may be necessary to protect water quality/ fish and wildlife habitat.

Thanks, Amy

Amy Ewing
Environmental Services Biologist/FWIS Manager
VA Dept. of Game and Inland Fisheries
7870 Villa Park Dr., Henrico, VA 23228
804-367-2211 DGIF.virginia.gov

From: Link, Matthew (DEQ)
Sent: Wednesday, October 21, 2015 10:03 AM
To: Ewing, Amy (DGIF)
Subject: JCSA Pre-Application Meeting Comments

Amy,

Just a friendly reminder that the comments for the JCSA Pre-Application Review Panel should be submitted to DEQ by next Friday 10/30. Since this project is of critical importance to DEQ programs and initiatives, any additional insight into possible concerns of DGIF would be highly valued and appreciated. Please contact me at any time if you have questions or concerns. Thanks!

Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218
804-698-4078
matthew.link@deq.virginia.gov
www.deq.virginia.gov

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VIRGINIA INSTITUTE OF MARINE SCIENCE

Office of Research and Advisory Services

October 19, 2015

Mr. Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218

Dear Mr. Link:

The Virginia Institute of Marine Science has reviewed the information provided to the pre-application review panel by the James City Service Authority (JCSA) for alternative water withdrawal strategies either from the Chickahominy or York river. If the JCSA has sufficiently justified the need for additional water sources, and if it has been determined by DEQ that additional groundwater withdrawal is not a viable or reasonable alternative, then we offer the following comments for moving forward with a surface water withdrawal strategy.

The VIMS review of the potential environmental impacts resulting from construction and operation of a riverine surface water intake will require information on intake design and flow rate, characterization of the estuarine environment in the vicinity of each proposed intake, and the physical and chemical metrics associated with the effluent. Existing data will be valuable to the applicants for environmental characterization, but may not be sufficient to address the suite of issues associated with water withdrawal. Each targeted area has unique ecological aspects that may be influenced or affected by surface water withdrawal, especially larval fish and shellfish. Intake design, including flow rate, can mitigate many potential adverse impacts to nekton, and we recommend that the JCSA plan to use intake screens with no greater than one millimeter slot size and operate at a maximum flow rate of 0.25 cubic feet per second.

Fouling may be problematic for intakes and outfalls placed in estuarine environments, especially those intakes designed to be protective of aquatic living resources. When the method for managing fouling has been determined, we recommend that the JCSA provide a profile of all chemicals that may be used in the cleaning/defouling process and estimates of treatment schedules and chemical volumes.

Release of brine from the desalination process into the estuary causes concern with respect to how it may permanently alter ambient conditions within the zone of influence of the outfall. Before these potential effects can be analyzed properly it is necessary to have a detailed understanding of the salinity and volume of the effluent, the location of the effluent pipe, and the salinity regime of the receiving waters. Hydrodynamic modeling may be necessary to understand the spatial expanse of the dilution plume unless the effluent is planned for release in waters of like salinity.

PO Box 1346 • 1375 Greate Road • Gloucester Point, Virginia 23062-1346 USA
804.684.7482 • www.vims.edu

As more detailed information becomes available, we will be able to provide advice beyond the general concepts presented above. To facilitate the review and permitting process, we are available to work directly with DEQ staff and the applicant throughout this process. Thank you for the opportunity to comment and please do not hesitate to contact me if you have questions or require additional information.

Sincerely,

Lyle Varnell
Associate Director for Advisory Services

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Joe Elton
Deputy Director of Operations

Rochelle Altholz
Deputy Director of Administration and Finance

David Dowling
Deputy Director of Soil and Water and Dam Safety

October 30, 2015

Matthew Link
DEQ
P.O. Box 1105
Richmond, VA 23218

Re: James City Service Authority Surface Water Supply

Dear Mr. Link:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

York River Site

Biotics documents the presence of natural heritage resources within two miles of the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

James River Site

According to the information currently in our files, the Atlantic sturgeon (*Acipenser oxyrinchus,* G3/S2/LE/LT) has been documented downstream from the project site. Atlantic sturgeon is a large fish that reaches a maximum length of about 4.3 meters and may live for several decades. The adults migrate between fresh water spawning areas and salt water non-spawning areas. They feed primarily on benthic invertebrates and small fishes as available.

Stocks on the Atlantic slope have been severely reduced by overfishing (mainly late 1800s and early 1900s), pollution, sedimentation, and blockage of access to spawning areas by dams (Gilbert 1989, Burkhead and Jenkins 1991, Marine and Coastal Species Information System 1996). In Chesapeake Bay and elsewhere in the range, hypoxic events have increased and may degrade nursery habitat for Atlantic sturgeon (Secor and Gunderson 1997). Habitat loss due to dam construction and water pollution are thought to be major factors impeding full recovery of populations (Smith 1985, cited by Johnson et al. 1997; Gilbert 1989). A late maturation age and use of estuaries, coastal bays, and upstream areas of rivers for spawning and juvenile development make stocks vulnerable to habitat alterations in many areas (NatureServe 2012). Please note that this species is currently classified as endangered by the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Please note this project is within a section of the James River, which has been designated as a scenic river in the state of Virginia. Due to this designation, DCR recommends you contact Lynn Crump of the DCR-Division of Planning and Recreation at 804-786-5054 or Lynn.Crump@dcr.virginia.gov.

Chickahominy River Site

According to the information currently in our files, this site is located within the Gordon Creek Conservation Site and within two miles of the Morris Creek Conservation Site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Gordon Creek Conservation Site has been given a biodiversity significance ranking of B2, which represents a site of very high significance. The natural heritage resource of concern at Gordon Creek Conservation Site is:

Tidal Freshwater Marsh (Arrow-arum – Pickerelweed Type) G3G4/S3S4/NL/NL

This Tidal Freshwater Marsh community, the Arrow-arum - Pickerelweed Type, is codominated by leafy forbs arrow arum and pickerelweed. Associated species can include wild rice, duck potato, sweet leaf, halberdleaf tearthumb, swamp smartweed, arrowleaf tearthumb, and begger ticks spp. Species occurring less frequently can include cattail spp. and jewelweed. (NatureServe, 2011)

Morris Creek Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at Morris Creek Conservation Site is:

Tidal Freshwater Marsh (Common Spatterdock – Arrow-arum Mudflat Type) G3G4/S3S4/NL/NL

At the southern end of the range of Tidal Freshwater Marsh (Arrow-arum – Pickerelweed Type) in Virginia, there is a well-marked variant in which spatterdock is codominant with arrow arum and pickerelweed in variable mixtures. This Spatterdock – Arrow Arum Mud Flat Type community occurs low within freshwater tidal marshes on muck substrates of variable depth. There is a long duration of tidal flooding, and the community is exposed only for a short period of time each day when the tide is out, supporting higher mean species richness and containing a number of taxa absent from the low intertidal portions of mudflats. (NatureServe, 2012)

Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary. They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. (NatureServe, 2011)

To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. Due to the legal status of the Atlantic sturgeon, DCR also recommends coordination with NOAA Fisheries and Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with endangered species legislation. Finally, DCR recommends a hydrologic study be prepared to determine water quality issues due to changes in salinity regimes from water withdrawal, downstream brine discharge and sedimentation increases.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

Should you have any questions or concerns, feel free to contact me at (804) 692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

Cc: Amy Ewing, VDGIF
Christine Vaccaro, NOAA
Lynn Crump, DCR-DPRR

Literature Cited

Burkhead, N. M., and R. E. Jenkins. 1991. Fishes. Pages 321-409 in K. Terwilliger (coordinator). Virginia's Endangered Species: Proceedings of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

Gilbert, C. R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight) Atlantic and shortnose sturgeons. U.S. Fish and Wildlife Service Biological Report. 82(11.22). U.S Army Corps of Engineers TR EL-82-4. 28 pp.

Johnson, J. H., D. S. Dropkin, B. E. Warkentine, J. W. Rachlin, and W. D. Andrews. 1997. Food habits of Atlantic sturgeon off the central New Jersey coast. Transactions of the American Fisheries Society 126(1):166-170.

Marine and Coastal Species Information System. 1996. October 1-last update. Fish and Wildlife Information Exchange-VA Tech. Online. Available: http://www.fw.vt.edu/fishes/macsis.html.

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Secor, D. H., and T. E. Gunderson. 1997. Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon, Acipenser oxyrinchus. Fisheries Bulletin 96:603-613.

Link, Matthew (DEQ)

From: Eversole, Mark (MRC)
Sent: Tuesday, October 27, 2015 3:15 PM
To: Link, Matthew (DEQ)
Cc: Lyle M Varnell; Emily A. Hein; Eversole, Mark (MRC)
Subject: FW: JCSA Pre-Application Meeting Comments
Attachments: Chickahominy River at Barrets Ferry.jpg; York River at Sycamore Landing.jpg

Matthew, in response to your request, VRMC offers the following comments concerning a proposal to install a municipal water intake structure in either the York River near Sycamore Landing, or in the Chickahominy River, immediately upstream of the Route 5 bridge, both in James City County.

Our Fisheries Division reports that there is a healthy commercial harvest in the immediate vicinity of both locations, including blue crab harvest by crab pot; eel harvest; public oyster harvest by tong and dredge (near the York River site); and gillnet harvest of striped bass, spot and croaker. In addition to any impacts associated with the withdrawal of water including effects of the withdrawal at the intake structure, the return of a concentrated saline solution could have an impact to fisheries in the vicinity.

Our Engineering/Surveying Department reports that there are numerous oyster ground leases immediately offshore of the proposed intake location in the York River. The installation of an intake in this location could present issues with impacts to those leases. There are no oyster ground leases in the vicinity of the proposed location in the Chickahominy River. I have attached copies of our oyster lease maps for both locations. Privately leased oyster grounds are shown in yellow and are prevalent in the York River near the proposed intake. Again, the introduction of a concentrated saline solution in this area could impact the oyster industry in this portion of the York.

We look forward to working with the applicant, and we will provide additional comments as they develop more definitive plans.

Mark Eversole
Virginia Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, Virginia 23607
Office: (757)-247-8028
email: mark.eversole@mrc.virginia.gov

Petty, Matthew

From: Hull, Karina
Sent: Thursday, March 17, 2016 10:11 AM
To: Petty, Matthew
Cc: Burbage, Laura
Subject: FW: JCSA - Chickahominy River Flow - 3/11/16 Meeting Summary

FYI

From: Lyle M Varnell [mailto:lyle@vims.edu]
Sent: Thursday, March 17, 2016 9:58 AM
To: Hull, Karina <HullKS@cdmsmith.com>; Doug Powell <Doug.Powell@jamescitycountyva.gov>; Michael Vergakis (Michael.Vergakis@jamescitycountyva.gov) <Michael.Vergakis@jamescitycountyva.gov>; Bruce Capps <Bruce.Capps@jamescitycountyva.gov>; scott.kudlas@deq.virginia.gov; Link, Matthew (DEQ) (Matthew.Link@deq.virginia.gov) <Matthew.Link@deq.virginia.gov>; Craig.Nicol@deq.virginia.gov; Emily A. Hein <eahein@vims.edu>; mark.eversole@mrc.virginia.gov; tony.watkinson@mrc.virginia.gov
Cc: St John, Gary <StJohnGA@cdmsmith.com>; Mark W Luckenbach <luck@vims.edu>
Subject: RE: JCSA - Chickahominy River Flow - 3/11/16 Meeting Summary

Karina:

Thank you for providing meeting minutes. As a follow-up from here, I would like to address the oyster larvae issue. It appeared that the mention of potential adverse effects to oyster larvae near the mouth of the Chickahominy River had a concerning effect on many. I have since consulted with our oyster biologists and ecologists. Although the concern for losses are warranted at that proposed site, highly stochastic ecological and physical dynamics will result in a highly inconsistent level of concern, and at a general lower level of concern. Therefore, we advise that you consider these potential effects minimal with respect to oyster resources.

Let me know if you have questions.

Lyle

Lyle M. Varnell (804) 684-7764 (office)
Associate Director for Advisory Services. (804) 684-7097 (fax)
Virginia Institute of Marine Science. lyle@vims.edu
College of William and Mary
1375 Greate Road, P.O. Box 1346
Gloucester Point, VA 23062

From: Hull, Karina [mailto:HullKS@cdmsmith.com]
Sent: Tuesday, March 15, 2016 4:02 PM
To: Doug Powell <Doug.Powell@jamescitycountyva.gov>; Michael Vergakis (Michael.Vergakis@jamescitycountyva.gov)

<Michael.Vergakis@jamescitycountyva.gov>; Bruce Capps <Bruce.Capps@jamescitycountyva.gov>; scott.kudlas@deq.virginia.gov; Link, Matthew (DEQ) (Matthew.Link@deq.virginia.gov) <Matthew.Link@deq.virginia.gov>; Craig.Nicol@deq.virginia.gov; Emily A. Hein <eahein@vims.edu>; Lyle M Varnell <lyle@vims.edu>; mark.eversole@mrc.virginia.gov; tony.watkinson@mrc.virginia.gov
Cc: St John, Gary <StJohnGA@cdmsmith.com>
Subject: JCSA - Chickahominy River Flow - 3/11/16 Meeting Summary

All,

Attached for your review is a summary of the discussions at our meeting on March 11, 2016 at James City Service Authority (JCSA) regarding flow determination for the Chickahominy River at Brickyard Landing and the Chickahominy Riverfront Park. These two sites were identified as potential surface water supply sources for JCSA, pending flow availability. Please let us know is you have any review comments.

Thanks,
Karina

Karina S. Hull, P.E., BCEE, LEED®AP|Environmental Engineer|CDM Smith|2104 West Laburnum Avenue, Suite 203 | Richmond, VA 23227 | T: 804.377.2297 | Fax: (804) 367-5795 |hullks@cdmsmith.com

EFH Data Notice: Essential Fish Habitat (EFH) is defined by textual descriptions contained in the fishery management plans developed by the regional Fishery Management Councils. In most cases mapping data can not fully represent the complexity of the habitats that make up EFH. This report should be used for general interest queries only and should not be interpreted as a definitive evaluation of EFH at this location. A location-specific evaluation of EFH for any official purposes must be performed by a regional expert. Please refer to the following links for the appropriate regional resources.

NMFS Greater Atlantic Regional Office
NMFS Atlantic Highly Migratory Species Management Division

Query Results

Map Scale = 1:72,224
Degrees, Minutes, Seconds: Latitude = 37º16'2" N, Longitude = 77º7'40" W
Decimal Degrees: Latitude = 37.27, Longitude = -76.87

The query location intersects with spatial data representing EFH and/or HAPCs for the following species/management units.

*** W A R N I N G ***

The list provided below is incomplete due to current data limitations. For a complete list of EFH designated at this location you must go to the following links:

HAPCs

No Habitat Areas of Particular Concern (HAPC) were identified at the report location.

EFH Areas Protected from Fishing

No EFH Areas Protected from Fishing (EFHA) were identified at the report location.

Spatial data does not currently exist for all the managed species in this area. The following is a list of species or management units for which there is no spatial data. ****For links to all EFH text descriptions see the complete data inventory:** **open data inventory -->**
New England Council EFH, Atlantic Salmon, **New England Council HAPCs**, Rivers in Maine for Atlantic Salmon

Summary of Essential Fish Habitat (EFH) Designations

10' x 10' Square Coordinates:

Boundary	North	East	South	West
Coordinate	37° 30.0' N	76° 50.0' W	37° 20.0' N	77° 00.0' W

-

Square Description (i.e. habitat, landmarks, coastline markers): James River waters within the square affecting the following: northern Chickahominy River, Howard Creek, Shipyard Creek, Diascund Creek, Chickahominy Cove, Old Neck, Big Marsh Pt., Watts Pt., Wilcox Neck, Graves Landing, Turner Neck, Cypress bank Landing, and Osborn Landing, up to the Chickahominy River's end.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic cod *(Gadus morhua)*				
haddock *(Melanogrammus aeglefinus)*				
pollock *(Pollachius virens)*				
whiting *(Merluccius bilinearis)*				
red hake *(Urophycis chuss)*				
white hake *(Urophycis tenuis)*				
witch flounder *(Glyptocephalus cynoglossus)*				
winter flounder *(Pseudopleuronectes americanus)*				
yellowtail flounder *(Limanda ferruginea)*				
windowpane flounder *(Scophthalmus aquosus)*				X
American plaice *(Hippoglossoides platessoides)*				
ocean pout *(Macrozoarces americanus)*				
Atlantic sea scallop *(Placopecten magellanicus)*				
Atlantic sea herring *(Clupea harengus)*				
monkfish *(Lophius americanus)*				
bluefish *(Pomatomus saltatrix)*			X	X
long finned squid *(Loligo pealeii)*	n/a	n/a		

short finned squid *(Illex illecebrosus)*	n/a	n/a		
Atlantic butterfish *(Peprilus triacanthus)*	X	X	X	X
Atlantic mackerel *(Scomber scombrus)*				
summer flounder *(Paralichthys dentatus)*		X	X	X
scup *(Stenotomus chrysops)*	n/a	n/a		
black sea bass *(Centropristis striata)*	n/a		X	X
surf clam *(Spisula solidissima)*	n/a	n/a		
ocean quahog *(Artica islandica)*	n/a	n/a		
spiny dogfish *(Squalus acanthias)*	n/a	n/a		
tilefish *(Lopholatilus chamaeleonticeps)*				
king mackerel *(Scomberomorus cavalla)*	X	X	X	X
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
cobia *(Rachycentron canadum)*	X	X	X	X
red drum *(Sciaenops occelatus)*	X	X	X	X

Summary of Essential Fish Habitat (EFH) and General Habitat Parameters for Federally Managed Species

Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
American plaice	Eggs	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass. Bay to Cape Cod Bay, MA	<12	(32)	30 - 90	All year in GOME Dec - June on GB Peaks April & May both	Surface waters	
	Larvae	GOME, GB, Southern NE and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<14	(32)	30-130	Between January and August, with peaks in April and May	Surface Waters	
	Juveniles	GOME and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<17	(32)	45-150		Bottom habitats with fine-grained sediments or substrate of sand or gravel	(Strong concentrations inside and around 100m isobath in Western GOME; Major Prey: echinoderms, arthropods, annelids)
	Adults	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<17	(34-20)	45-175		Bottom habitats with fine-grained sediments or a substrate of sand or gravel	
	Spawning Adults	GOME, GB and estuaries from Passamaquoddy Bay to Saco Bay, ME and from Mass Bay to Cape Cod Bay, MA	<14	(32)	<90	March through June	Bottom habitats of all substrate types	
Atlantic cod	Eggs	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<12	32 - 33 (10 - 35)	<110	Begins in fall, peaks in winter and spring	Surface Waters	
	Larvae	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Penobscot Bay; Sheepscot R., Casco Bay, Saco Bay, Great Bay, Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	32 - 33	30-70	Spring	Pelagic waters	
	Juveniles	GOME, GB, eastern portion of continental shelf off southern NE and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<20	30 - 35	25 - 75		Bottom habitats with a substrate of cobble or gravel	HAPC - An area approximate of 300sq. nautical miles along the northern edge of GB and the Hague line containing gravel cobble substrate.
	Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Passamaquoddy Bay to Saco Bay; Mass Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	<10	(29 - 34)	10-150		Bottom habitats with a substrate of rocks, pebbles, or gravel	(Major prey: fish crustaceans, decapods, amphipods)

This table was complied by NMFS Northeast Regional Office, Habitat Conservation Division. All information presented is part of the Regional Fishery Management Council's EFH designations except for that contained within ( ) which is provided as important additional ecological information. Definitions: GOME - Gulf of Maine; GB - George's Bank; HAPC - Habitat Area of Particular Concern; YOY - Young-of-Year Please note: This Table does not contain EFH info on Highly Migratory Species (sharks, tunas, billfish).

Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Delaware Bay and following estuaries: Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Mass Bay, Boston Harbor, Cape Cod Bay, MA	<10	(10 - 35)	10-150	spawn during fall, winter, and early spring	Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel	
Atlantic halibut	Eggs	GOME, GB	4 - 7	<35	<700	Between late fall and early spring, peak Nov and Dec.	Pelagic waters to the sea floor	
	Larvae	GOME, GB		30 - 35			Surface waters	
	Juveniles	GOME, GB	>2		20 - 60		Bottom habitats with a substrate of sand, gravel, or clay	
	Adults	GOME, GB	<13.6	30.4-35.3	100-700		Bottom habitats with a substrate of sand, gravel, or clay	(Major prey: crustaceans, fish, cod, squid)
	Spawning Adults	GOME, GB	<7	<35	<700	Between late fall and early spring, peaks in Nov. and Dec.	Bottom habitats with a substrate of soft mud, clay, sand, or gravel; rough or rocky bottom locations along slopes of the outer banks	
Atlantic herring	Eggs	GOME, GB and following estuaries: Englishman/ Machias Bay, Casco Bay,& Cape Cod Bay	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, shell fragments & aquatic macrophytes. .	Eggs adhere to bottom forming extensive beds. Eggs most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots (Egg beds can range from 4500 to 10,000 Km^2 on GB. Eggs susceptible to suffocation from high densities and siltation)
	Larvae	GOME, GB, Southern NE and following estuaries: Passamaquoddy Bay to Cape Cod Bay, Narragansett Bay, & Hudson R./ Raritan Bay	<16	32	50 - 90	Between August and April, peaks from Sept. - Nov.	Pelagic waters	
	Juveniles	GOME, GB, Southern NE and Middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay	<10	26 - 32	15-135		Pelagic waters and bottom habitats	
	Adults	GOME, GB, southern NE and middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay to Delaware Bay; & Chesapeake Bay	<10	>28	20-130		Pelagic waters and bottom habitats	(major prey: zooplankton)
	Spawning Adults	GOME, GB, southern NE and middle Atlantic south to Delaware Bay and Englishman/ Machias Bay Estuary	<15	32 - 33	20 - 80	July through November	Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, also on aquatic macrophytes	Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
White hake	Eggs	GOME, GB, southern NE and the following estuaries: Great Bay to Cape Cod Bay				August to September	Surface waters	
	Larvae	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Mass Bay, to Cape Cod Bay				May - mid-Atlantic area Aug. & Sept. - GOME, GB area	Pelagic waters	
	Juveniles	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay	<19		5 - 225	May-Sep - pelagic	Pelagic stage - pelagic waters; Dermersal stage - Bottom habitat with seagrass beds or substrate of mud or fine-grained sand	
	Adults	GOME, southern edge of GB, southern NE to middle Atlantic and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Cape Cod Bay	<14		5 - 325		Bottom habitats with substrate of mud or fine-grained sand	(major prey: small fish, shrimp and other crustaceans)
	Spawning Adults	GOME, southern edge of GB, southern NE to middle Atlantic	<14		5 - 325	April to May - southern part of range; August - Sept.- northern part of range	Bottom habitats with substrate of mud or fine-grained sand in deep water.	
Whiting (Silver hake)	Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Merrimack R. to Cape Cod Bay	<20		50-150	All year, peaks June to October	Surface waters	
	Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay to Cape Cod Bay	<20		50-130	All year, peaks July to September	Surface waters	
	Juveniles	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	<21	>20	20-270		Bottom habitats of all substrate types	
	Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Casco Bay, Mass Bay to Cape Cod Bay	<22		30-325		Bottom habitats of all substrate types	
	Spawning Adults	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Mass Bay and Cape Cod Bay	<13		30-325		Bottom habitats of all substrate types	
Window-pane flounder	Eggs	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Surface waters	

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Larvae	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<20		<70	February to November, peaks May and October in middle Atlantic July - August on GB	Pelagic waters	
	Juveniles	GOME, GB, southern NE, middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	<25	5.5 - 36	1 - 100		Bottom habitats with substrate of mud or fine grained sand	
	Adults	GOME, GB, southern NE, middle Atlantic south to Virginia - NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Chesapeake Bay	<26.8	5.5 - 36	1 - 75		Bottom habitats with substrate of mud or fine grained sand	(major prey: polychaetes, small crustaceans, mysids, small fish)
	Spawning Adults	GOME, GB, southern NE, middle Atlantic south to Virginia -NC border and the following estuaries: Passamaquoddy Bay to Great Bay; Mass Bay to Delaware Inland Bays	<21	5.5 - 36	1 - 75	February - December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine grained sand	
Winter flounder	Eggs	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<10	10 - 30	<5	February to June, peak in April on GB	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel	* On GB, eggs are generally found in water temp < 8EC, and < 90m deep.
	Larvae	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<15	4 - 30	<6	March to July, peaks in April and May on GB	Pelagic and bottom waters	* On GB, larvae are generally found in water temp < 8EC, and < 90m deep.
	Juveniles (age 1+)	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	<25	10 - 30	1 - 50		Bottom habitats with a substrate of mud or fine grained sand	* Young-of-year exist where water temp <28, depths 0.1 - 10m, salinities 5 - 33 (major prey: amphipods, copepods, polychaetes, bivalve siphons)
	Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	<25	15 - 33	1 - 100		Bottom habitats including estuaries with substrate of mud, sand, gravel	(major prey: amphipods, polychaetes, bivalve siphons, crustaceans)
	Spawning Adults	GB, inshore areas of GOME, southern NE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware Inland Bays	<15	5.5 - 36	<6*	February to June	Bottom habitats including estuaries with substrate of mud, sand, gravel	*except on GB where they spawn as deep as 80m
Witch flounder	Eggs	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	<13	High	Deep	March to October	Surface waters	
	Larvae	GOME, GB, continental shelf off southern NE, middle Atlantic south to Cape Hatteras	<13	High	Deep	March to November, peaks in May - July	Surface waters to 250m	

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	GOME, outer continental shelf from GB south to Cape Hatteras	<13	34 - 36	50-450 to 1500m		Bottom habitats with fine-grained substrate	(the upper slope is nursery area; major prey: crustaceans, polychaetes, mollusks)
	Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	<13	32 - 36	25-300		Bottom habitats with fine-grained substrate	(major prey: polychaetes, echinoderms, crustaceans, mollusks, squid)
	Spawning Adults	GOME, outer continental shelf from GB south to Chesapeake Bay	<15	32 - 36	25-360	March to November, peaks in May-August	Bottom habitats with fine-grained substrate	
Yellowtail flounder	Eggs	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Cape Cod Bay	<15	32.4 - 33.5	30 - 90	Mid-March to July, peaks in April to June in southern NE	Surface waters	
	Larvae	GB, Mass Bay, Cape Cod Bay, southern NE continental shelf, middle Atlantic south to Chesapeake Bay and the following estuaries: Passamaquoddy Bay to Cape Cod Bay	<17	32.4 - 33.5	10 - 90	March to April in New York bight; May to July in south NE and southeastern GB	Surface waters	(largely an oceanic nursery)
	Juveniles	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	<15	32.4 - 33.5	20 - 50		Bottom habitats with substrate of sand or sand and mud	
	Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Sheepscot R., Casco Bay, Mass Bay to Cape Cod Bay	<15	32.4 -33.5	20 - 50		Bottom habitats with substrate of sand or sand and mud	(major prey: annelids, arthropods, mollusks)
	Spawning Adults	GB, GOME, southern NE continental shelf south to Delaware Bay and the following estuaries: Mass Bay to Cape Cod Bay	<17	32.4 - 33.5	10-125		Bottom habitats with substrate of sand or sand and mud	
Atlantic mackerel	Eggs	Continental Shelf from Maine through Cape Hatteras, NC also includes estuaries from Great Bay to Cape Cod Bay; Buzzards Bay to Long Island Sound; Gardiners Bay and Great South Bay	5-23	(18 - >30)	0 - 15		Pelagic waters	(peak spawning in salinities >30ppt)
	Larvae	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Great Bay to Cape Cod Bay; Narragansett Bay to Long Island Sound; Gardiners Bay and Great South Bay	6-22	(>30)	10-130		Pelagic waters	
	Juveniles	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Passamaquoddy Bay; Penobscot Bay to Saco Bay; Great Bay; Mass Bay to Cape Cod Bay; Narragansett Bay, Long Island Bay; Gardiners Bay to Hudson R./ Raritan Bay	4 - 22	(>25)	0 - 320		Pelagic waters	

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Adults	Continental Shelf from GOME through Cape Hatteras, NC also includes estuaries from Passamaquoddy Bay to Saco Bay; Mass Bay to Long Island Bay; Gardiners Bay to Hudson R./ Raritan Bay	4 - 16	(>25)	0 - 380		Pelagic waters	(opportunistic feeding: can filter feed or select individual prey. Major prey: crustaceans, pelagic mullosks, polychaetes, squid, fish)
Black sea bass	Eggs	Continental Shelf and estuaries from southern NE to North Carolina, also includes Buzzards Bay			0 - 200	May to October	Water column of coastal Mid-Atlantic Bight and Buzzards Bay	
	Larvae	Pelagic waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes Buzzards Bay	(11-26)	(30 - 35)	(<100)	(May - Nov, peak Jun - Jul)	Habitats for transforming (to juveniles) larvae are near coastal areas and into marine parts of estuaries between Virginia and NY. When larvae become demersal, found on structured inshore habitat such as sponge beds.	
	Juveniles	Demersal waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes estuaries from Buzzards Bay to Long Island Sound; Gardiners Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound and James River	>6	>18	(1 - 38)	Found in coastal areas (Apr - Dec , peak Jun - Nov) between VA and MA, but winter offshore from NJ and south; Estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, offshore clam beds and shell patches may be used during wintering	(YOY use salt marsh edges and channels; high habitat fidelity)
	Adults	Demersal waters over Continental Shelf from GOME to Cape Hatteras, NC, also includes estuaries: Buzzards Bay, Narragansett Bay, Gardiners Bay, Great South Bay, Barnegat Bay to Chesapeake Bay; Tangier/ Pocomoke Sound and James River	>6	(>20)	(20- 50)	Wintering adults (Nov. to April) offshore, south of NY to NC Inshore, estuaries from May to October	Structured habitats (natural & man-made) sand and shell substrates preferred	(spawn in coastal bays but not estuaries; change sex to males with growth; prey: benthic and near bottom inverts, small fish, squid)
Bluefish	Eggs	North of Cape Hatteras, found over Continental Shelf from Montauk Point, NY south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida	>18	>31ppt	Mid-shelf depths	April to August	Pelagic waters	*No EFH designation inshore
	Larvae	North of Cape Hatteras, found over Continental Shelf from Montauk Point, NY south to Cape Hatteras, South of Cape Hatteras, found over Continental Shelf through Key West, Florida, the slope sea and Gulf Stream between latitudes 29N and 40N; includes the following estuaries: Narragansett Bay	>18	>30ppt	>15	April to September	Pelagic waters	No EFH designation inshore for larvae

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	North of Cape Hatteras, found over Continental Shelf from Nantucket Island, MA south to Cape Hatteras,South of Cape Hatteras, found over Continental Shelf through Key West, Florida, the slope sea and Gulf Stream between latitudes 29N and 40N also includes estuaries between Penobscot Bay to Great Bay; Mass Bay to James R.; Albemarie Sound to St. Johns River, FL	(19-24)	(23 - 36) freshwater zone in Albemarie Sound		North Atlantic estuaries from June to October Mid-Atlantic estuaries from May to October South Atlantic estuaries from March to December	Pelagic waters	(use estuaries as nursery areas; can intrude into areas with salinities as low as 3 ppt)
	Adults	North of Cape Hatteras, found over Continental Shelf from Cape Cod Bay, MA south to Cape Hatteras,South of Cape Hatteras, found over Continental Shelf through Key West, Florida also includes estuaries between Penobscot Bay to Great Bay; Mass Bay to James R.; Albemarie Sound to Pamilco/ Pungo R., Bougue Sound, Cape Fear R., St. Helena Sound, Broad R., St. Johns R., & Indian R.	(14-16)	>25ppt		North Atlantic estuaries from June to October Mid-Atlantic estuaries from April to October South Atlantic estuaries from May to January	Pelagic waters	Highly migratory (major prey: fish)
Butterfish	Eggs	Over Continental shelf from GOME through Cape Hatteras, NC,also in estuaries from Mass Bay to Long Island Sound; Gardiners Bay, Great South Bay, and Chesapeake Bay	11 - 17	(25 - 33)	0-1829	(spring and summer)	Pelagic waters	
	Larvae	Over Continental shelf from GOME through Cape Hatteras, NC,also in estuaries from Boston Harbor, Waquoit Bay to Long Island Sound; Gardiners Bay to Hudson R./ Raritan Bay; Delaware Bay and Chesapeake Bay	9 - 19	(6.4 - 37)	10-1829	(summer and fall)	Pelagic waters	
	Juveniles	Over Continental shelf from GOME through Cape Hatteras, NC also in estuaries from Mass Bay, Cape Cod Bay to Delaware Inland Bays; Chesapeake Bay, York R. and James R.	3 - 28	(3 - 37)	10-365 (most <120)	(winter - shelf spring to fall - estuaries)	Pelagic waters (larger individuals found over sandy and muddy substrates)	(pelagic schooling - smaller individuals associated with floating objects including jellyfish)
	Adults	Over Continental shelf from GOME through Cape Hatteras, NC,also in estuaries from Mass Bay, Cape Cod Bay to Hudson R./ Raritan Bay; Delaware Bay and Inland Bays; York R. and James R.	3 - 28	(4 - 26)	10-365 (most <120)	(winter - shelf summer to fall - estuaries)	Pelagic waters (schools form over sandy, sandy-silt and muddy substrates)	(common in inshore areas and surf zone; prey: planktonic, thaliacians, squid, copepods)
Illex squid	Juveniles	Over Continental shelf from GOME through Cape Hatteras, NC	2 -23		0 - 182	(carried northward by Gulf Stream)	Pelagic waters	
	Adults	Over Continental shelf from GOME through Cape Hatteras, NC	4 - 19		0 -182	(late fall - offshore, spawn Dec- Mar)	Pelagic waters	(prey: fish, crustaceans, squid; die after spwaning)
Loligo	Eggs***	Over Continental shelf from GOME through Cape Hatteras, NC	(>8)	(30 - 32)	(<50)	(May - spawned, hatch in Jul)	(Demersal egg masses are commonly found on sandy/mud bottom, usually attached to rocks/boulders, pilings or algae such as fucus, ulva, laminaria, porphyra)	*** EFH is not currently designated for this life stage (Eggs are demersal, enclosed in gelatinous capsule containing up to 200 eggs. Laid in masses of hundreds of capsules from different females)

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
Summer flounder	Eggs	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida			30-70 fall; 110 winter; 9-30 spring	October to May	Pelagic waters , heaviest concentrations within 9miles of shore off NJ and NY	
	Larvae	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Waquoit Bay to Narragansett Bay; Hudson River/ Raritan Bay; Barnegat Bay, Chesapeake Bay, Rappahannock R., York R., James R., Albemarie Sound, Pamlico Sound, Neuse R. to Indian R.	(9 - 12)	(23-33) Fresh in Hudson R. Raritan Bay area	10-70	mid-Atlantic Bight from Sept. to Feb.; Southern part from Nov. to May at depths 9-30m	Pelagic waters, larvae most abundant 19 - 83km from shore; Southern areas 12 - 52 miles from shore	(high use of tidal creeks and creek mouths)
	Juveniles	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Waquoit Bay to James R.; Albemarie Sound to Indian R.	>11	10 -30 Fresh in Narrag. Bay, Albem/ Pamlico Sound, & St. Johns R.	(0.5-5) in estuary		Demersal waters, muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds	HAPC - All native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations, within adult and juvenile EFH. (Major prey: mysid shrimp)
	Adults	Over Continental Shelf from GOME to Cape Hatteras, NC; South of Cape Hatteras to Florida; also includes estuaries from Buzzards Bay, Narragansett Bay, Conn. R. to James R.; Albemarie Sound to Broad R.; St. Johns R., & Indian R.		Fresh in Albemarie Sound, Pamlico Sound, & St. Johns R.	(0 - 25)	Inhabit shallow coastal and estuarine waters during warmer months and move offshore on outer Continental Shelf at depths of 150m in colder months	Demersal waters and estuaries	HAPC - All native species of macroalgae, seagrasses and freshwater and tidal macrophytes in any size bed as well as loose aggregations, within adult and juvenile EFH. (Major prey: fish, shrimp, squid, polychaetes)
Surf clams	Juveniles	Eastern edge of GB and the GOME throughout Atlantic EEZ	(2-30)		0 -60 , low density beyond 38		Throughout substrate to a depth of three feet within federal waters. (Burrow in med. To coarse sand and gravel substrates. Also found in silty to fine sand, not in mud)	
	Adults	Eastern edge of GB and the GOME throughout Atlantic EEZ	(2-30)		0 -60 , low density beyond 38	(spawn-summer to fall at 19 - 30 ºC)	Throughout substrate to a depth of three feet within federal waters	
Tilefish	Eggs	US Canadian Boundary to VA/NC boundary (shelf break; GB to Cape Hatteras)	8 - 19	(34 - 36)	76-365	(Serial spawning March - November; peaks April - October)	Water column	
	Larvae	US Canadian Boundary to VA/NC boundary Outer continental shelf; (GB to Cape Hatteras)	8 - 19	(33 - 35)	76-365	(Feb - Oct; peaks July - Oct)	Water column	

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Species	Life Stage	Geographic Area	Temp (EC)	Salinity (‰)	Depth (m)	Seasonal Occurrence	Habitat Description	Comments
	Juveniles	US Canadian Boundary to VA/NC boundary (shelf break, submarine canyon walls and flanks; GB to Cape Hatteras)	8 - 18	(33 - 36)	76-365	(All year; may leave GB in winter)	Rough bottom, small burrows, and sheltered areas. (Substrate - rocky, stiff clay, human debris)	(Tilefish are shelter-seeking and habitat limited). HAPC is substrate between the 76 and 365m isobath, from U.S. / Canadian Boundary to the Virginia / North Carolina boundary within statistical areas 616 and 537 (intersection of isobaths east of Cape May, NJ and south of Provincetown, MA)
	Adults	US Canadian Boundary to VA/NC boundary (shelf break, submarine canyon walls and flanks; GB to Cape Hatteras)	8 - 18	(33 - 36)	76-365	(All year; may leave GB in winter)	Rough bottom, small burrows, and sheltered areas. (Substrate - rocky exposed ledges, stiff clay)	HAPC is substrate between the 250 and 1200 ft isobath, from U.S. / Canadian Boundary to the Virginia / North Carolina boundary within statistical areas 616 and 537 (intersection of isobaths east of Cape May, NJ and south of Provincetown, MA) (prey: crustaceans, fish, decapods, benthic epifauna)
Red drum	Larvae	Along the Atlantic coast from Virginia through the Florida Keys	2 - 33	Low salinity	<50		Estuarine wetlands especially important Flooded saltmarshes, brackish marsh, tidal creeks, mangrove fringe, seagrasses	Red drum are euryhaline
	Juveniles	Along the Atlantic coast from Virginia through the Florida Keys	2 - 33	20 - 40	<50	Found throughout Chesapeake Bay from Sept. - Nov.	Utilize shallow backwaters of estuaries as nursery areas and remain till they move to deeper water portions of the estuary associated with river mouths, oyster bars and front beaches	Red drum are eurythermal and larger juveniles and Adults more susceptible to effects of winter cold waves than small fish
	Adults	Along the Atlantic coast from Virginia through the Florida Keys	2 - 33	20 - 40	<50	Found in Chesapeake in Spring and Fall and also along Eastern Shore of VA	Concentrate around inlets, shoals, capes along the Atlantic coast - Shallow bay bottoms or oyster reef substrate preferred. Also nearshore artificial reefs.	HAPCs for red drum include all coastal inlets, all state-designated nursery habitats of particular importance to red drum (NC - all Primary and Secondary Nursery Areas), SAV extremely important, barrier islands in NC, SC, GA, FL and passes between barrier islands into estuaries
Spanish mackerel		South Atlantic and Mid-Atlantic Bights	>20	>30			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward;	All coastal inlets
Cobia		South Atlantic and Mid-Atlantic Bights	>20	>25			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward; high salinity bays, estuaries, seagrass habitat.	All coastal inlets
King mackerel		South Atlantic and Mid-Atlantic Bights	>20	>30			Sandy shoals of capes and offshore bars, high profile rock bottoms and barrier island ocean side waters from surf zone to shelf break but from the Gulf Stream shoreward;	All coastal inlets
Golden crab		Chesapeake Bay to the south through the Florida Straight (and into Gulf of Mexico)			290-570	(Gulf Stream EFH because it helps to disperse golden crab larvae)	Flat foraminifera ooze, distinct mounds of dead coral, ripple habitat, dunes, black pebble habitat, low outcrop, and soft bioturbated habitat	

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ATTACHMENT M

Pre-Application Review Panel Meeting/Comments and Public Notice/Information Meeting

Pre-Application Review Panel Meeting

A Pre-Application Review Panel meeting was held at the DEQ Central Office on August 31, 2015 to discuss the Chickahominy Riverfront Park water supply and treatment facility. A copy of the meeting summary provided by DEQ Office of Water Supply and the comments received from regulatory agencies follows.

Public Notice and Information Meeting

JCSA will provide a publication of notice regarding this project in *The Virginia Gazette* following the JPA submittal. A public information meeting will also be held; the date will be determined in coordination with DEQ Office of Water Supply.

MEMORANDUM

DATE: **SEPTEMBER 1, 2015**

PROJECT: **JAMES CITY SERVICE AUTHORITY**

REFERENCE: **PRE-APPLICATION REVIEW PANEL MEETING HELD ON AUGUST 31, 2015**

DEQ-CO, Office of Water Supply staff: MATTHEW T LINK

Meeting Attendees: See attached sign-in sheet

MEETING SUMMARY

A pre-application review panel meeting was held on August 31, 2015, to discuss the proposals put forth by James City Service Authority (JCSA) for a proposed new surface water withdrawal to reduce the Authority's dependence on groundwater, while meeting County water demand into the future. First, an overview providing context for the reduction of permitted groundwater withdrawal volumes and the Virginia Coastal Plain Groundwater Initiative was presented by Craig Nicol, Water Withdrawal Permitting Program Manager for the Virginia Department of Environmental Quality (see attached presentation). Then, a summary of the surface water supply alternatives, possible intake locations/designs, and the potential logistical issues was presented by CDM Smith (see attached summary and presentation). Following the presentation, the participants discussed the proposed project. A summary of the discussion is provided below.

- Virginia Marine Resources Commission (VMRC) questioned if the site proposed on the York River was still on the table, due to concerns with nearby property owners.
    - James City County replied that all locations discussed are still up for consideration and the purpose of this meeting was to focus their efforts on the most viable options for further study.
- Virginia Department of Conservation and Recreation (DCR) requested a description of the disposal of the Brine created from the Reverse Osmosis filtration process.
    - The consultant explained that the membrane filtration process results in approximately 20% of the brackish water withdrawn needing to be discharged as brine into Tidal waters.
- VMRC presented a few issues regarding the Shellfish Management Areas adjacent to potential intake locations. Specifically, depending on the proximity of the intake to these areas, that a time of year restriction for construction activities is probable. More concerns were raised regarding the intake site relative to the location of private leases and other shelling and aquaculture operations.
    - James City County replied that no project locations were finalized and that these areas would be investigated in order to not interfere with these operations.
- VMRC also mentioned that a Time of Year Restriction is likely due to the presence of Anadromous Fish. Also, the location of the intake should consider the actual spawning grounds of potentially impacted fish, rather than just if the fish pass by or not.
- VMRC expressed interest in the use of riverbank filtration and how that may reduce impacts to State owned bottomlands.
- The Virginia Department of Game and Inland Fisheries (DGIF) stated concerns regarding tidal withdrawals in certain locations such as creeks and the water quality implications each site might bring about.

- DGIF continued their comments regarding water quality concerns and stated that the easiest and likely most important variable to study would be changes in the salinity gradient.
- VIMS) followed up with suggesting that Spatial-Temporal Salinity Gradient Modeling in multiple inflow scenarios would help enhance operational capabilities and minimize upstream movement of the salinity gradient and the Virginia Department of Health (VDH) reiterated this suggestion. They also suggested possible alternation of surface water and groundwater withdrawals in order to mitigate salinity movement.
- DGIF commented on the known presence of the Atlantic Sturgeon in the James and York Rivers and that a fall Time of Year Restriction (TOYR) would be added to the normal Springtime migration TOYR, leaving a short period in the summer. Also recommended working in the dry as much as possible.
- DCR further reiterated the concerns regarding the salinity gradient and stated that the possible sites were known habitat locations of the Sensitive Joint Vetch, which could easily be affected by changes in salinity or discharges.
- VMRC inquired what the concern for Kepone was in the James and Chickahominy potential sites.
    - The consultant replied that Kepone was a concern not only during possible sediment disturbing activities during construction, but also a long term water quality issue with the regular maintenance dredging of a navigation channel on the James River by the U.S. Army Corps of Engineers (USACE).
    - VMRC noted that the presence of Kepone is not known to be at a harmful level currently.
    - The Virginia Institute of Marine Science (VIMS) commented that the Kepone spilled in the James River was currently believed to be "buried enough" and thus monitoring has ceased.
    - VDH had concerns related to Kepone near the intake, which they noted had been found in Hopewell, and that any large storm events could stir up swaths of older buried sediment.
- VIMS asked the applicant the timetable for completion of the project.
    - JCSA stated that with engineering concerns, obtaining applicable permits, budget, and construction, that it would be 10-12 years until operational capability would be achieved.
- VIMS asked about ambient monitoring and any modeling with biota to be done in preparation for site selection. Also mentioned the need for a contingency plan if riverbank filtration fails.
- VIMS stated that sedimentation buildup would be an operational concern in both the York and Chickahominy Rivers and that comprehensive Water Quality Data is widely available in the York River.
- VIMS further questioned the limit of salinity treatment ability by the Reverse Osmosis membranes and mentioned that further increases in salinity should be factored into the treatment process due to sea level rise.
- VMRC inquired where the location of the brine discharge is currently and where it would be with new possible intakes. Also mentioned the probability of different brine conditions with saltier water.
    - The consultant stated that the brine is currently discharged into the James River from a VPDES permitted facility. There would be new discharge points associated with the new withdrawal which would have to go through the VPDES permitting process as well.
- VDH inquired about the tidal fluctuation of the various possible sites and mentioned that how far downstream the tidal cycle moves will determine the quality of the source water of the different rivers depending on various types of discharge points
    - The consultant replied that they do not know yet, but studies will be done to determine site specific considerations for the intake site chosen.

At the conclusion of the meeting, DEQ reminded the agencies present that any additional comments they would like to provide would need to be submitted to DEQ within 60 days (October 30, 2015).

PRE-APPLICATION PANEL SIGN-IN SHEET

Project:	James City Service Authority	**Meeting Date:**	8/31/2015 at 10 AM
Facilitator:	Dept. of Environmental Quality, Office of Water Supply	**Place/Room:**	2nd Floor Conference Room A

Name	Organization	Phone	E-Mail
Scott Smith	VDGIF	434/525-7522	scott.smith@dgif.virginia.gov
Bob Greenlee	VDGIF	804 269-1407	bob.greenlee@dgif.virginia.gov
Emily Hein	VIMS	804-684-7482	eahein@vims.edu
Michael Vergakis	JCSA	757-603-1227	Michael.Vergakis@JamesCityCountyVA.gov
Jutta Schneider	DEQ	804-698-4099	jutta.schneider@deq.virginia.gov
Matthew Link	DEQ	804-698-4078	matthew.link@deq.virginia.gov
Craig R Nicol	DEQ	804 698-4204	craig.nicol@deq.virginia.gov
Alli Baird	DCR-DNH	804-692-0984	alice.baird@dcr.virginia.gov

PRE-APPLICATION PANEL SIGN-IN SHEET

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Facilitator:	Dept. of Environmental Quality, Office of Water Supply	**Place/Room:**	2nd Floor Conference Room A

Name	Organization	Phone	E-Mail
Bryan Hill	JCC	253-6603	Bryan.Hill@jamescitycountyva.gov
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Brian McGurk	DEQ - Office of Water Supply	804-698-4180	brian.mcgurk@deq.virginia.gov
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Name	Organization	Phone	E-Mail
MARK EVERSOLE	VMRC	757-247-8028	mark.eversole@mrc.virginia.gov
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LYLE VARNELL	VIMS	804-684-7764	lyle@vims.edu
KARINA HULL	CDM SMITH	804 377 2297	hullks@cdmsmith.com
GARY A. ST JOHN	CDM smith	757/597-2624	stjohnga@cdmsmith.com
Tammy Stephenson	VA DEQ	540-562-6828	tammy.stephenson@deq.virginia.gov

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Chickahominy River and York River Surface Water Supply Pre-Application Review Panel Meeting

August 31, 2015

CDM Smith

James City Service Authority

James City Service Authority

REGULATED WATER CAPACITY

Virginia Department of Environmental Quality

GROUNDWATER WITHDRAWAL PERMIT

ANNUAL AVG = 8.8 MGD

MAX MONTH = 11.8 MGD

Virginia Department of Health

Protecting You and Your Environment

WATERWORKS OPERATION PERMIT

MAX = 9.973 MGD

JCSA Water Supply

- Existing Supply

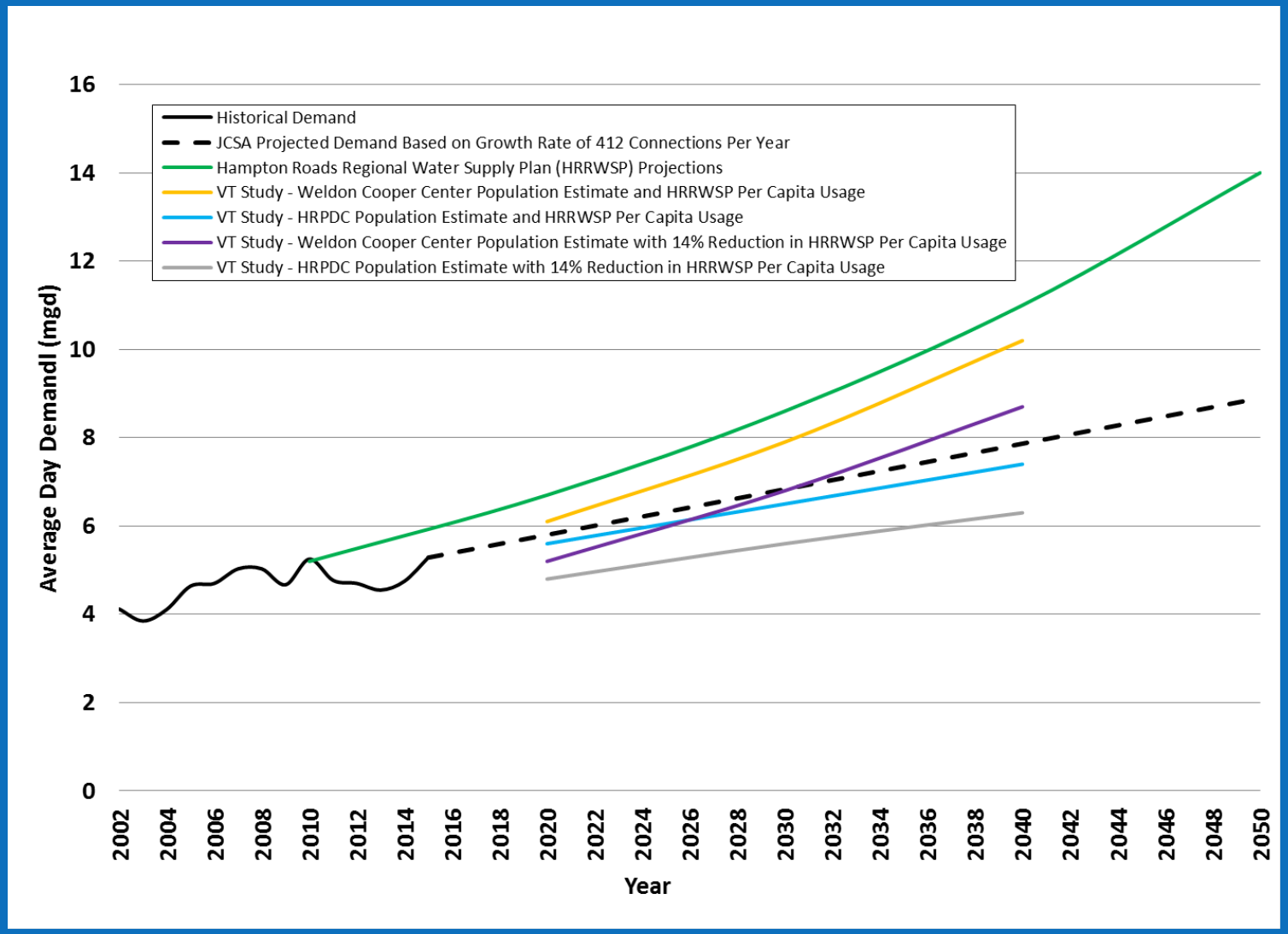
Production Facility	DEQ Annual Withdrawal (mgd)	VDH Capacity (mgd)
Five Forks WTP	5.9	5.000
7 Well Locations • Owens-Illinois • Stonehouse • Ford's Colony • Kristiansands • The Pottery • Canterbury Hills • Ewell Hall and Olde Towne Road	2.9	4.973
TOTAL	8.8	9.973

- Potential Future Supply

Newport News Waterworks (NNWW) Purchase Agreement = 2 mgd (drought condition)*

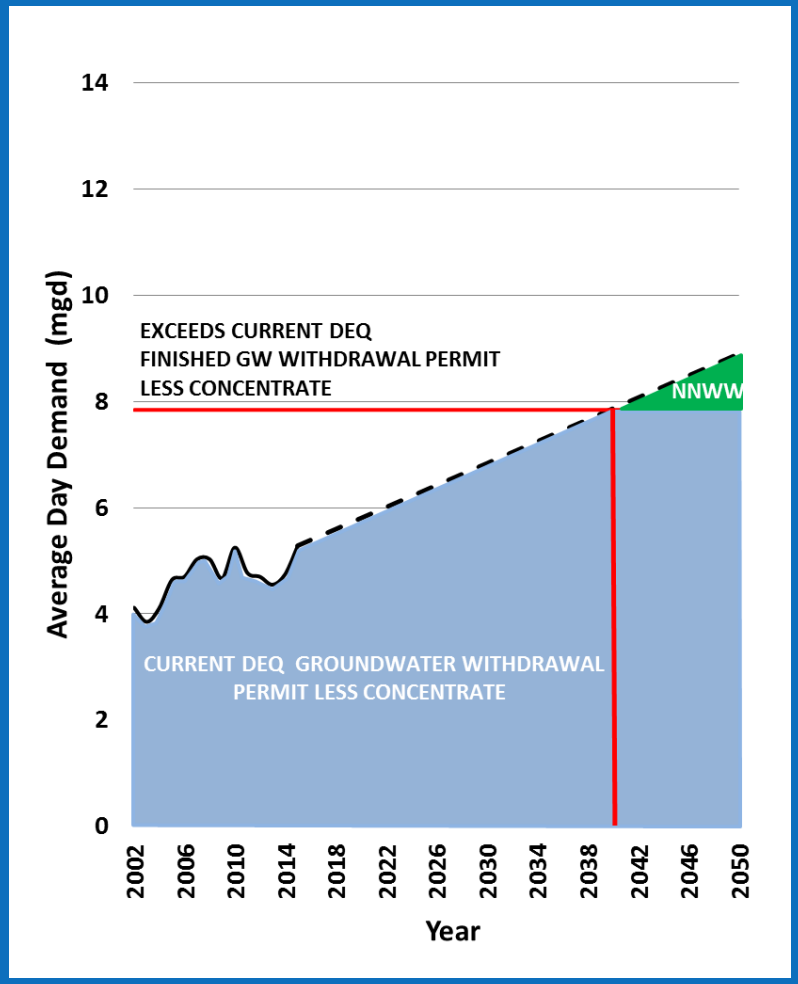
*JCSA infrastructure improvements required for delivery.

JCSA Historical and Projected Average Day Demand

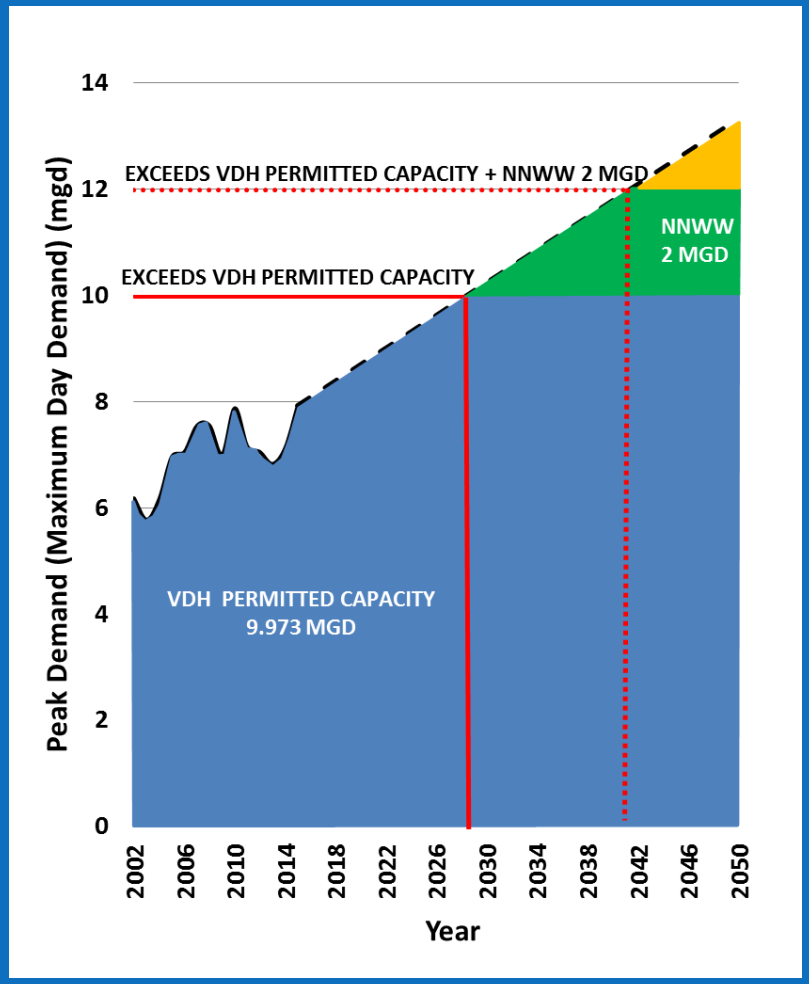


Existing Permitted Capacity vs. Demand

Average Day Demand

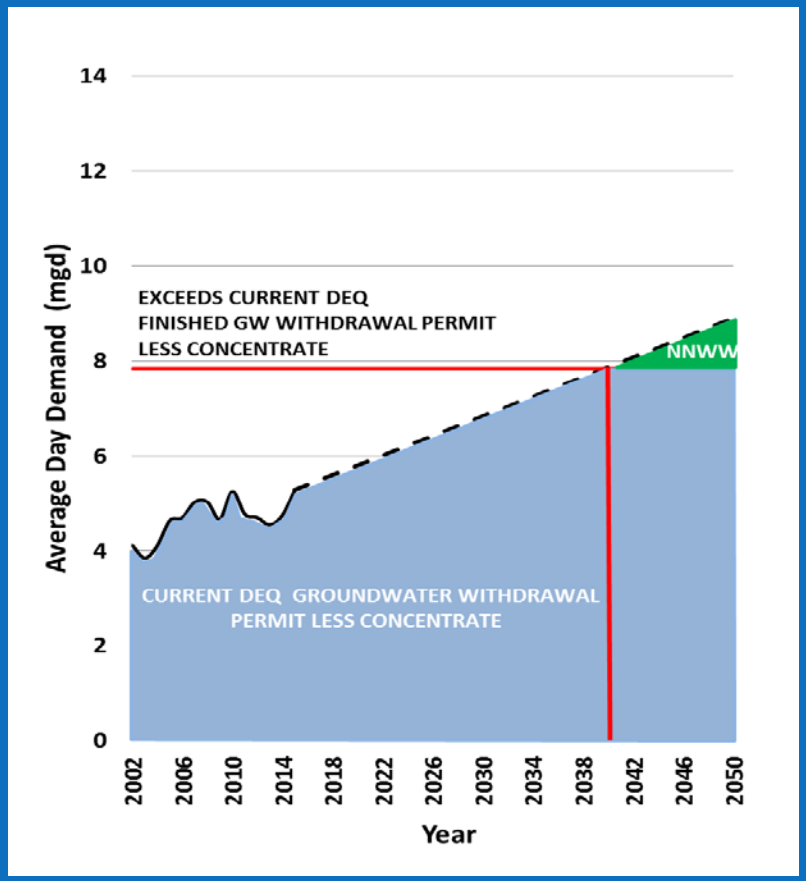


Maximum Day Demand

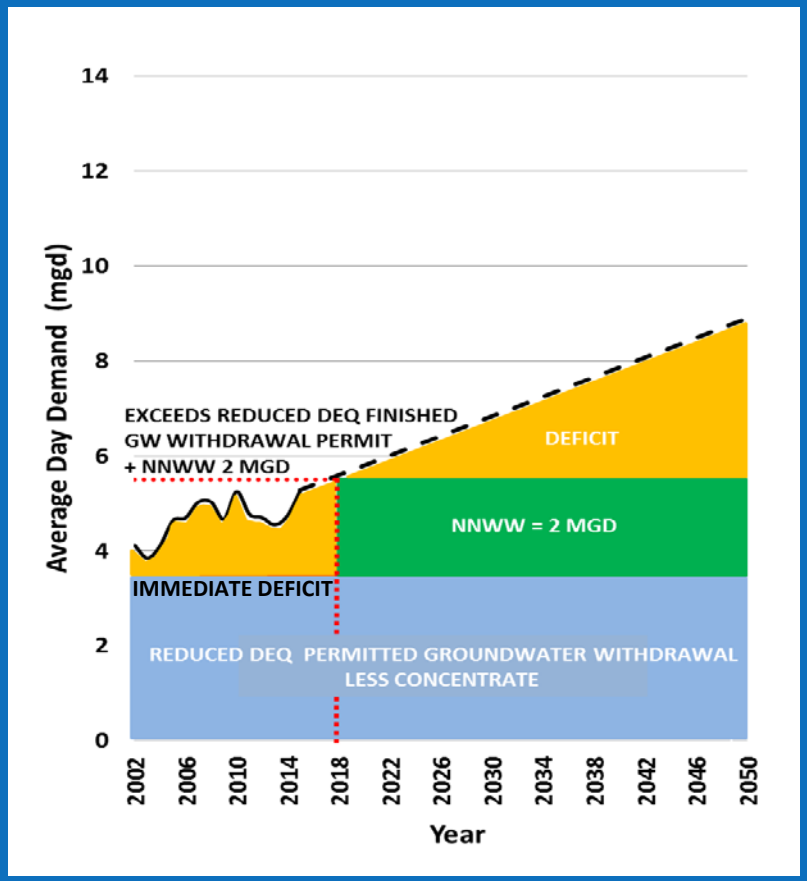


Impact of Reduction in DEQ Permitted Groundwater Withdrawal to 4.0 mgd on Average Day Demand

Current DEQ Groundwater Withdrawal

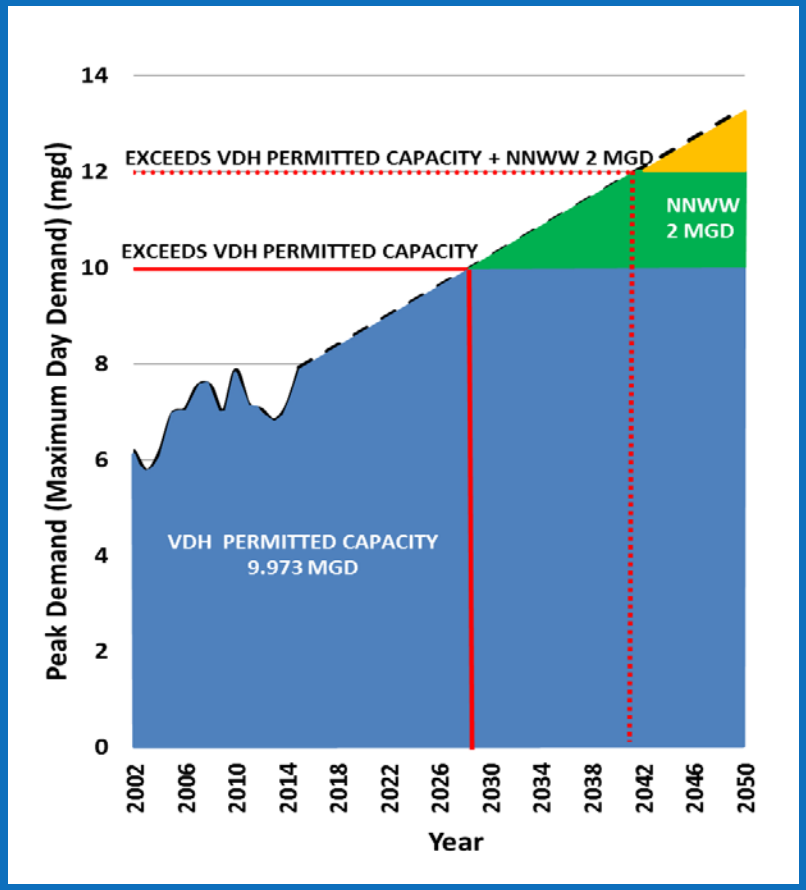


Reduced DEQ Groundwater Withdrawal

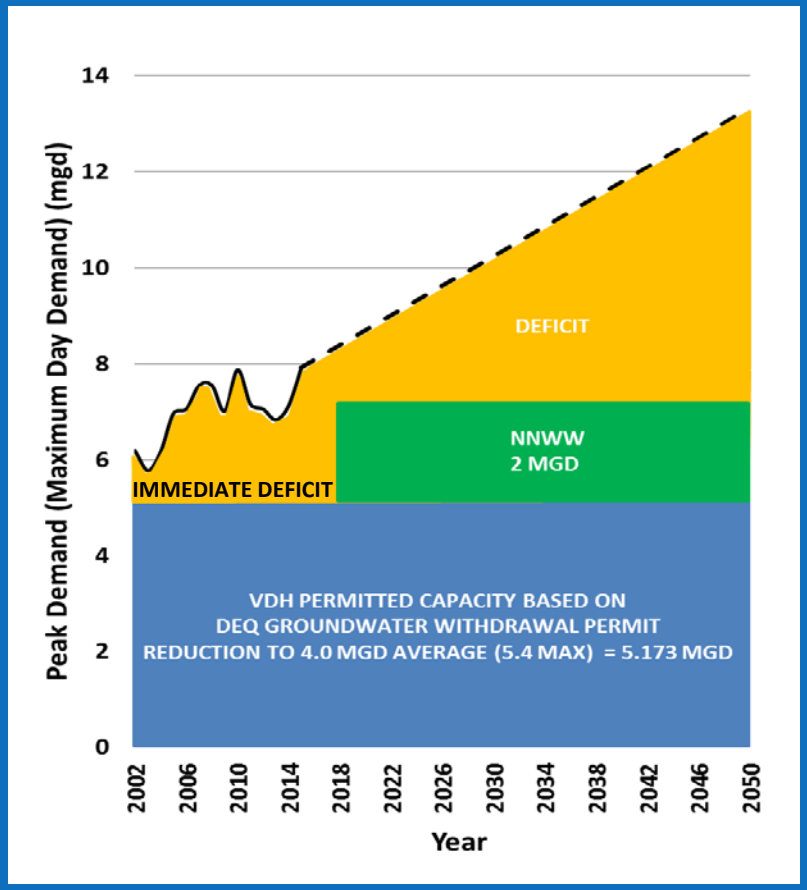


Impact of Reduction in DEQ Permitted Groundwater Withdrawal to 4.0 mgd on Peak Demand (Maximum Day Demand)

Current DEQ Groundwater Withdrawal



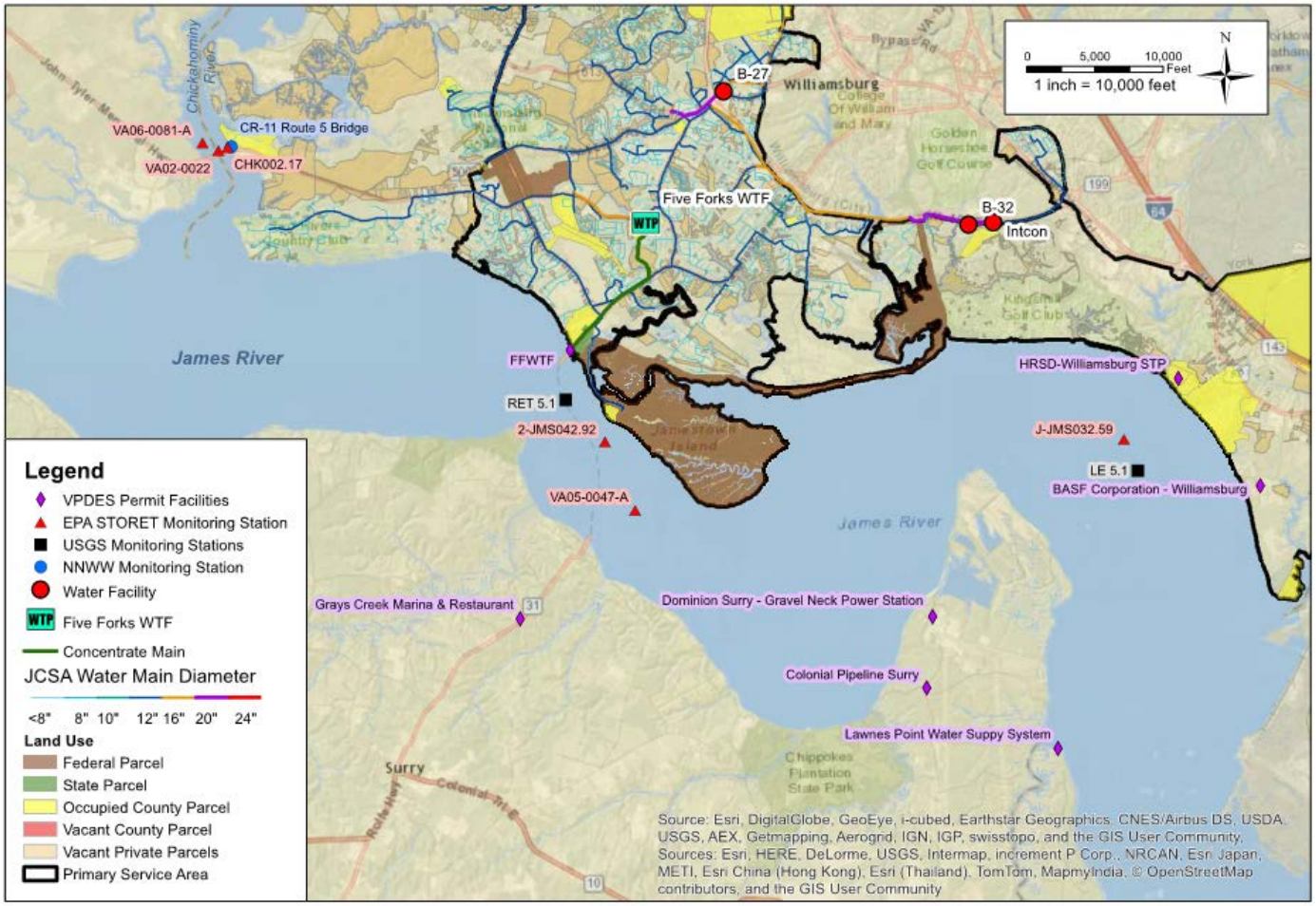
Reduced DEQ Groundwater Withdrawal



Surface Water Supply Alternatives

- James River
- Chickahominy River
- York River

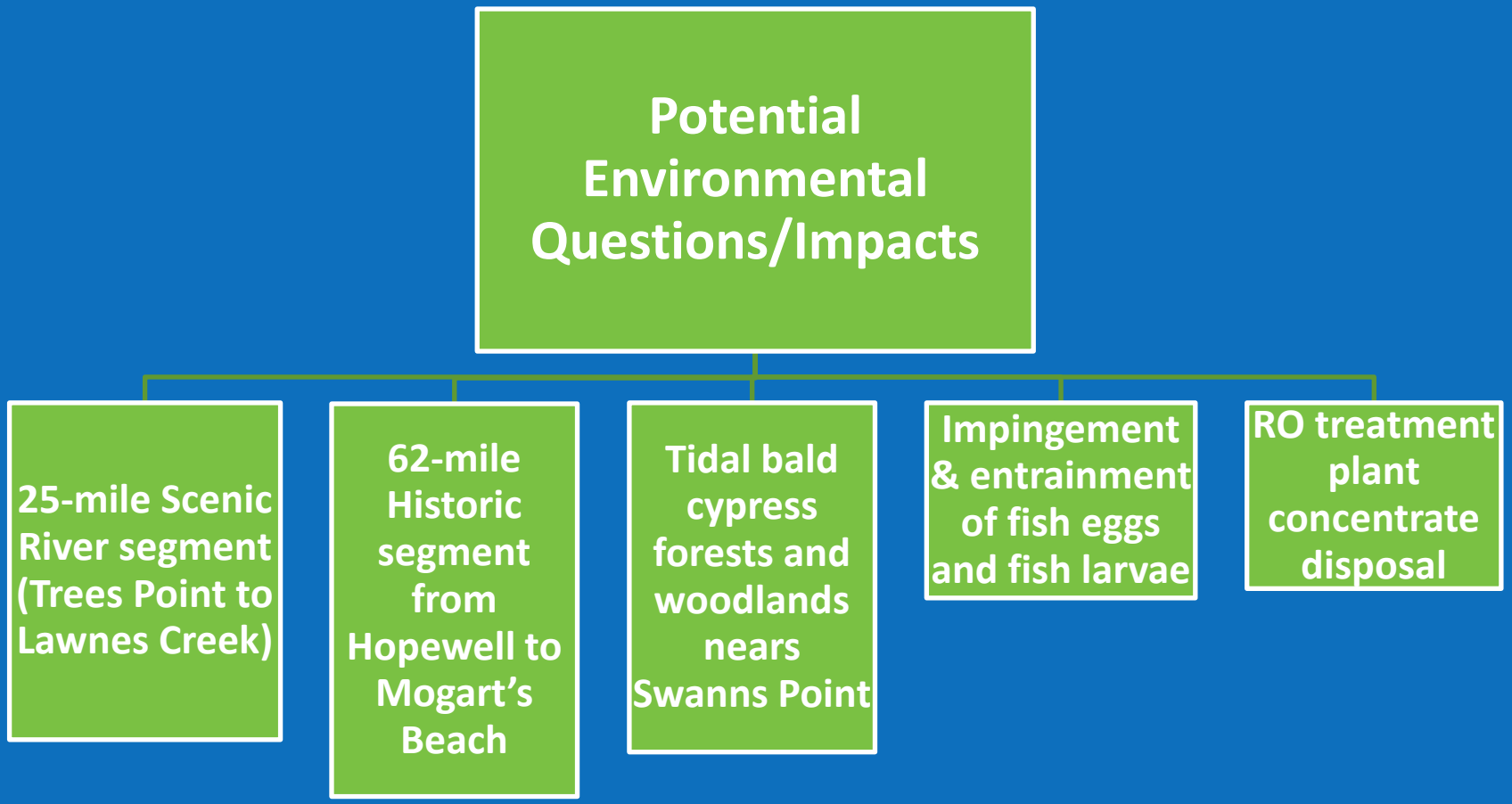
James River



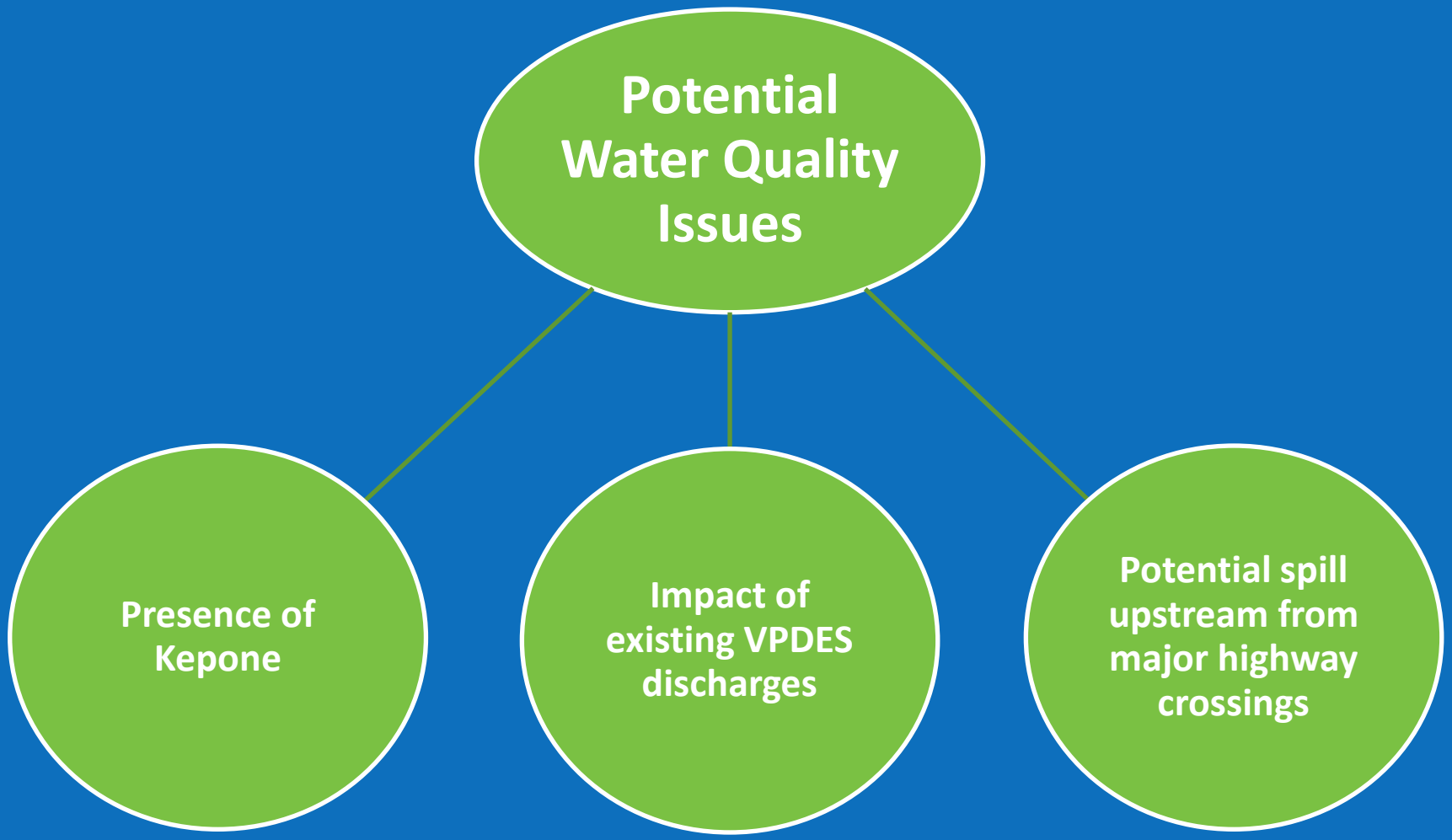
CDM Smith

Figure 8-1
James River
Water Quality Monitoring Stations and VPDES Locations

James River


Potential Environmental Questions/Impacts
25-mile Scenic River segment (Trees Point to Lawnes Creek)
62-mile Historic segment from Hopewell to Mogart's Beach
Tidal bald cypress forests and woodlands nears Swanns Point
Impingement & entrainment of fish eggs and fish larvae
RO treatment plant concentrate disposal

James River


Potential Water Quality Issues
Presence of Kepone
Impact of existing VPDES discharges
Potential spill upstream from major highway crossings

Chickahominy River

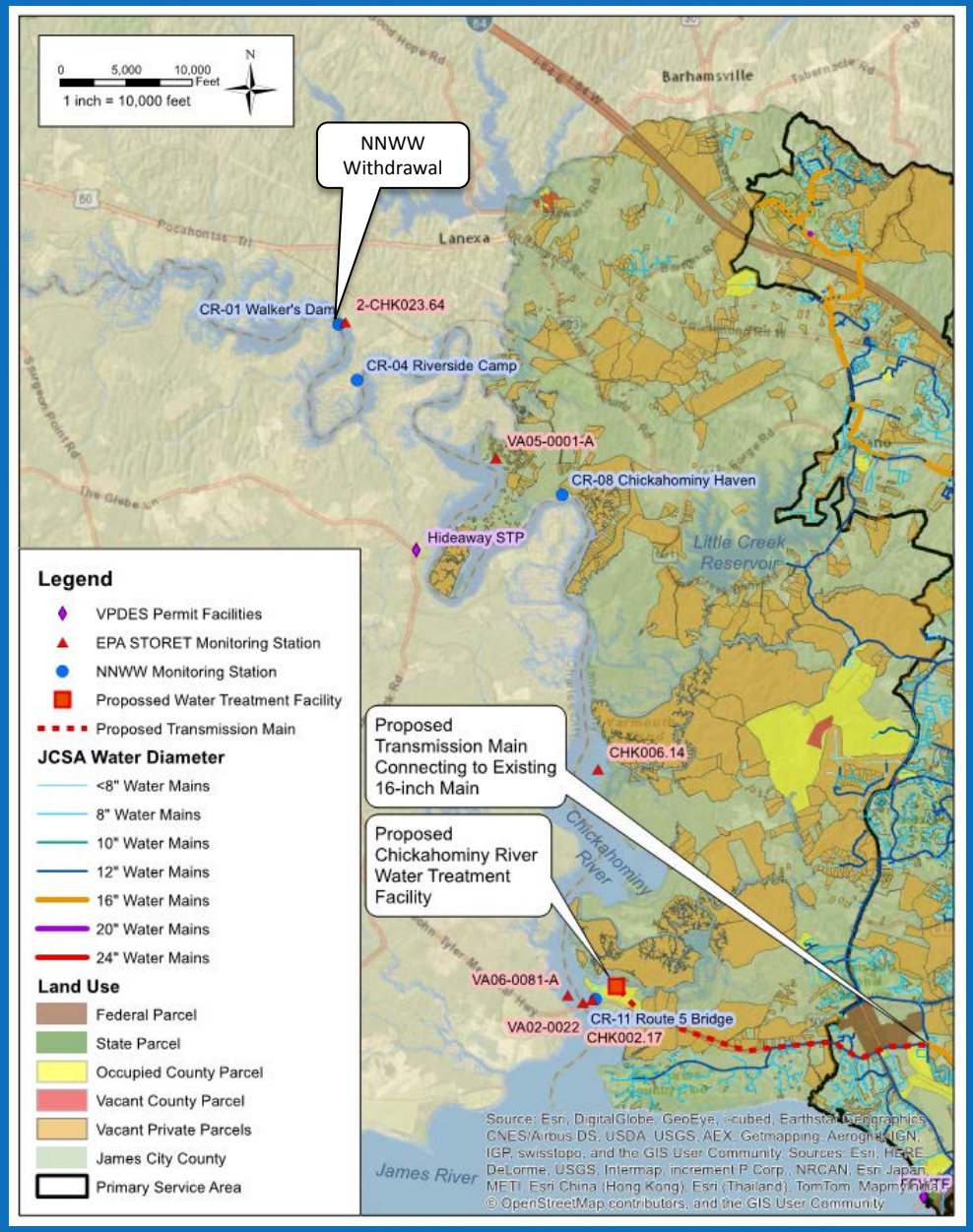
Existing Withdrawal

Newport News Waterworks (NNWW)

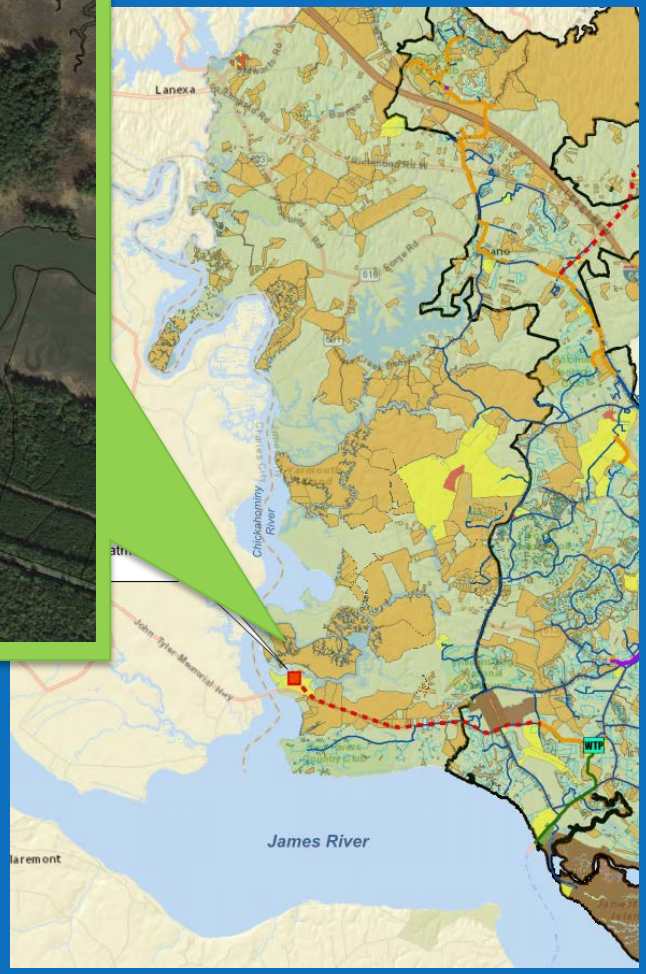
- Above Walker's Dam
- Drainage area = 301 sq mi
- Average river flow = 180 mgd
- MIF = 10 cfs (6.5 mgd)

Existing VPDES Discharge

Hideaway Sewage Treatment Plant (Mount Airy)



Chickahominy River



Chickahominy Riverfront Park
(County-owned property)

Chickahominy River

Potential Environmental Questions/Impacts

- **30-mile National Park Service, Botanic and Geologic significant segments (Providence Forge to James River)**
- **Ecological Communities**
  - Fluvial Terrace Woodlands
  - Coastal Plain/Piedmont Swamp Forests
  - Tidal Bald Cypress Forests and Woodlands
  - Tidal Freshwater and Ologohaline Aquatic Beds
- **Impingement & entrainment of fish eggs and fish larvae**
- **RO treatment plant concentrate disposal**

Chickahominy River

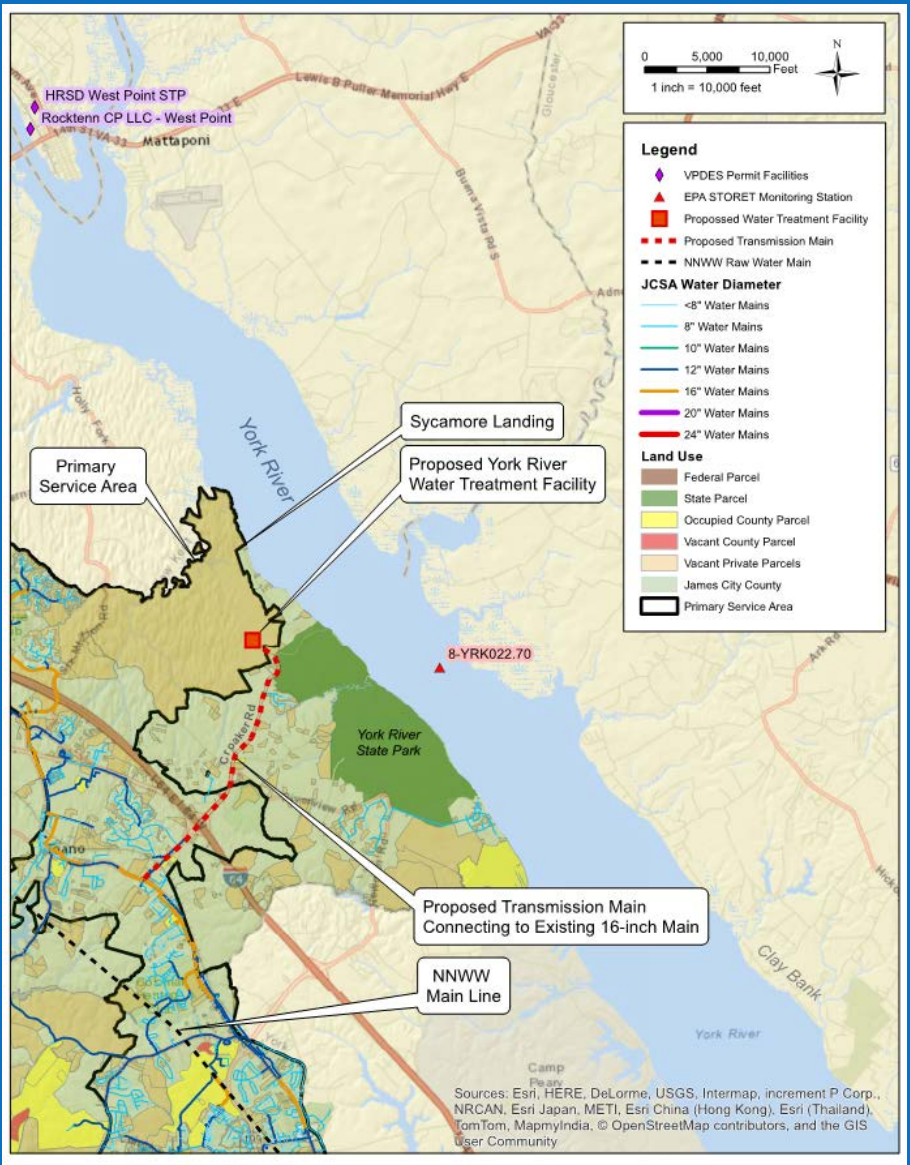
Potential Water Quality Issues

- **Potential presence of kepone at confluence with James River**
- **Potential spill:**
  - **Automotive bridge crossing**
  - **Colonial Pipeline crossing**
- **Boat traffic**

York River

Existing Withdrawal
Yorktown Fossil Power Plant (cooling water)

Existing VPDES Discharges (10 miles upstream of proposed intake)
Pulp mill owned by Rocktenn CD LLC – West Point
HRSD West Point sewage treatment plant

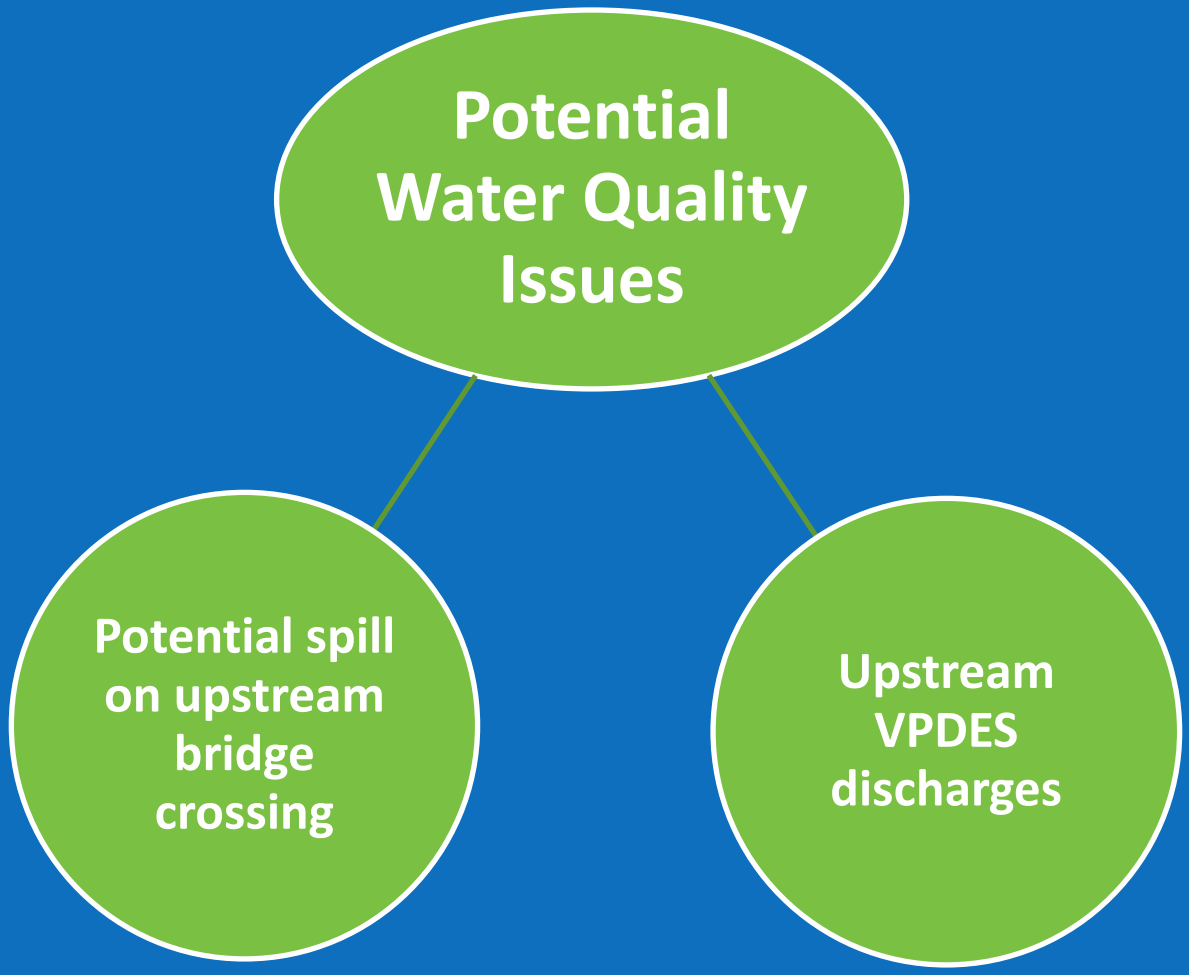


York River

Potential Environmental Questions/Impacts

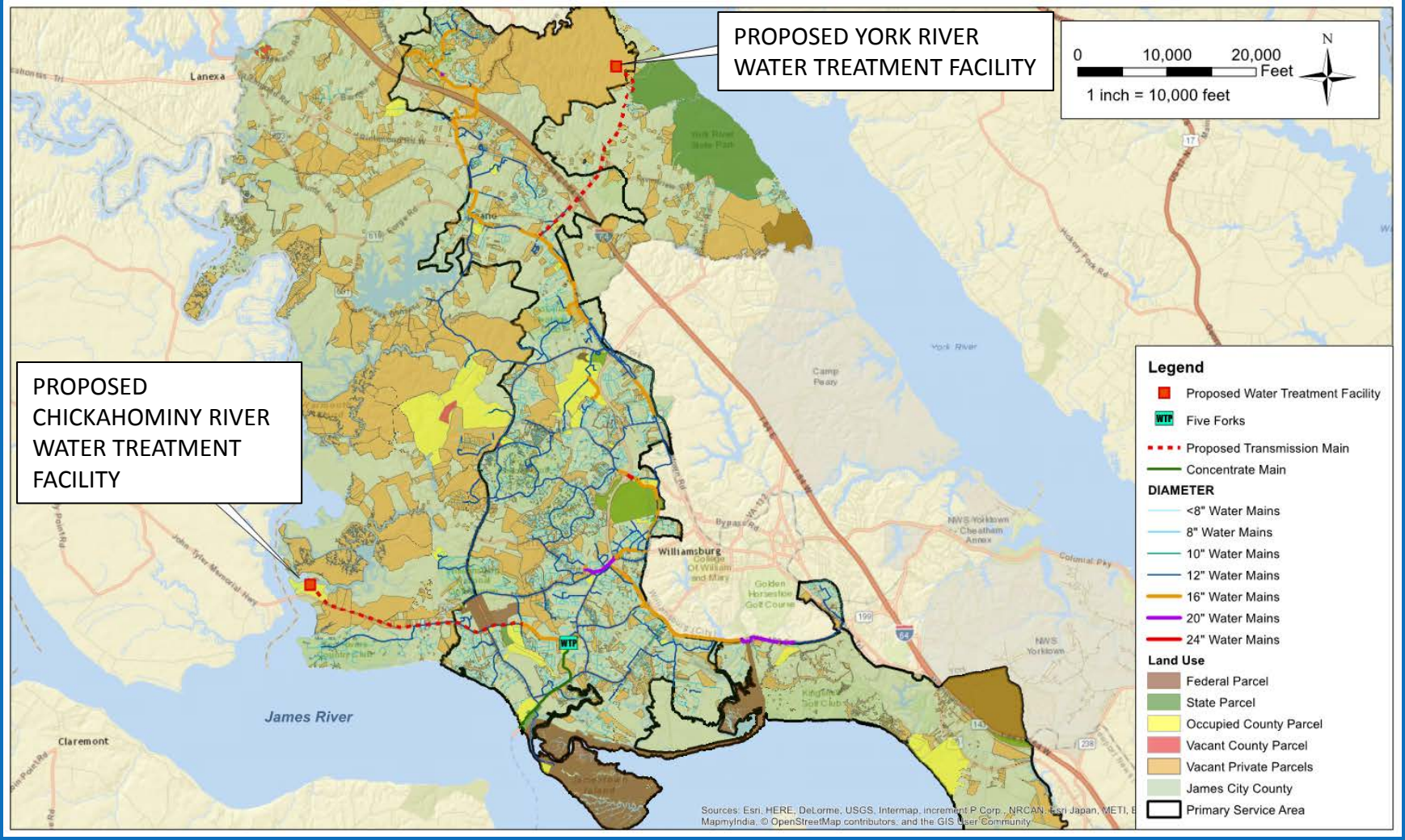
- **12-mile National Park Service, Hydrologic significant segment (Almondsville to Plum Point)**
- **VMRC Shellfish Management Area (Gloucester Point to Clay Bank Wharf)**
- **Impingement & entrainment of fish eggs and fish larvae**
- **RO treatment plant brine concentrate disposal**

York River


Potential Water Quality Issues
Potential spill on upstream bridge crossing
Upstream VPDES discharges

Surface Water Supply Alternatives

- ✓ Chickahominy River
- X James River
- ✓ York River



Where do we go from here?

More detailed study of Chickahominy River and York River

- Treatability Study
- Riverbank filtration vs. direct intake

Alternative sources to study

- Upper Chickahominy River
- Suggestions by the Review Panel

Discussion

Link, Matthew (DEQ)

From: Ewing, Amy (DGIF)
Sent: Monday, October 26, 2015 5:21 PM
To: Link, Matthew (DEQ)
Cc: Greenlee, Bob (DGIF); Smith, Scott (DGIF)
Subject: RE: JCSA Pre-Application Meeting Comments (ESSLog# 35985)

Matthew,
You heard from us during the pre-app conference call, but to reiterate our comments and to provide additional information, I offer the below. Please note that these are preliminary only as we are currently unsure of the exact intake locations and are unsure about the route any pipes must take to move water from the intake/treatment plant locations to existing dispersal systems.

Potential Intake on Chickahominy River:
We document bald eagle nests and the James River/Chickahominy River Eagle Concentration Zone from the project area (approximate intake location) . Significant habitat alteration, location of water-dependent facilities within concentration zones, or other recreational and commercial activities may result in adverse impacts upon eagles. Therefore, we recommend that the applicant ensure that this project is consistent with state and federal guidelines for protection of bald eagles; and that he coordinate as indicated with us or with the U.S. Fish and Wildlife Service regarding possible impacts upon bald eagles or the need for a federal bald eagle take permit.

The Chickahominy River and James River at this site have been documented Anadromous Fish Use Areas. To best protect these important fisheries, we recommend that any instream work associated with the project adhere to a time of year restriction from February 15 through June 30 of any year. In addition, federally Endangered Atlantic sturgeon are known from this drainage. They are known to also engage in reproductive behaviors in Fall. Data are still coming in, we are still learning about the behaviors of this species within our waters. We are likely to recommend some restrictions on instream work during Fall and will provide that guidance as we can. We recommend coordination with NOAA Fisheries Service regarding possible impacts upon Atlantic sturgeon.

Potential Intake on York River:
We document bald eagle nests from the project area (approximate intake location). Therefore, we recommend that the applicant ensure that this project is consistent with state and federal guidelines for protection of bald eagles; and that he coordinate as indicated with us or with the U.S. Fish and Wildlife Service regarding possible impacts upon bald eagles or the need for a federal bald eagle take permit.

The York River at this site has been designated an Anadromous Fish Use Area. To best protect this important fishery, we recommend that any instream work associated with the project adhere to a time of year restriction from February 15 through June 15 of any year. In addition, federally Endangered Atlantic sturgeon are known from this drainage. They are known to engage in reproductive behaviors in Fall in addition to those in Spring. Data are still coming in and we are still learning about the behaviors of this species within our waters. We are likely to recommend some restrictions on instream work during Fall and will provide that guidance as it becomes available. We recommend coordination with NOAA Fisheries Service regarding possible impacts upon Atlantic sturgeon.

We document colonial waterbird colonies from the project area. We typically recommend that these colonies be identified and a 500-ft no-disturbance, naturally vegetated buffer be maintained on the colony. We also may recommend adherence to time of year restrictions within some distance of the colony depending on the timing and scope of project work.

Both intake locations:
This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend coordination with VDCR-DNH regarding the protection of these resources.

We recommend coordination with the USFWS regarding potential impacts upon federally Threatened northern long-eared bats associated with tree removal, if such is proposed.

To protect resident aquatic species from impingement and entrainment, we recommend that the intake be fitted with a 1mm mesh screen and that the intake velocity not exceed 0.25 fps. Further, we recommend that the withdrawal volume not exceed 10% of instantaneous flow.

To best inform our assessment of impacts the proposed project may have on instream habitat and resident aquatic species, we recommend that the applicant and/or DEQ provide for our review the results of spatio/temporal modeling of the salinity changes resulting from the proposed intake. We recommend modeling of at least two scenarios (full withdrawal and something less than full withdrawal) be performed to determine if/at what point switching from the surface water intake back to ground water may be necessary to protect water quality/ fish and wildlife habitat.

Thanks, Amy

Amy Ewing
Environmental Services Biologist/FWIS Manager
VA Dept. of Game and Inland Fisheries
7870 Villa Park Dr., Henrico, VA 23228
804-367-2211 DGIF.virginia.gov

From: Link, Matthew (DEQ)
Sent: Wednesday, October 21, 2015 10:03 AM
To: Ewing, Amy (DGIF)
Subject: JCSA Pre-Application Meeting Comments

Amy,

Just a friendly reminder that the comments for the JCSA Pre-Application Review Panel should be submitted to DEQ by next Friday 10/30. Since this project is of critical importance to DEQ programs and initiatives, any additional insight into possible concerns of DGIF would be highly valued and appreciated. Please contact me at any time if you have questions or concerns. Thanks!

Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218
804-698-4078
matthew.link@deq.virginia.gov
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VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE

Office of Research and Advisory Services

October 19, 2015

Mr. Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218

Dear Mr. Link:

The Virginia Institute of Marine Science has reviewed the information provided to the pre-application review panel by the James City Service Authority (JCSA) for alternative water withdrawal strategies either from the Chickahominy or York river. If the JCSA has sufficiently justified the need for additional water sources, and if it has been determined by DEQ that additional groundwater withdrawal is not a viable or reasonable alternative, then we offer the following comments for moving forward with a surface water withdrawal strategy.

The VIMS review of the potential environmental impacts resulting from construction and operation of a riverine surface water intake will require information on intake design and flow rate, characterization of the estuarine environment in the vicinity of each proposed intake, and the physical and chemical metrics associated with the effluent. Existing data will be valuable to the applicants for environmental characterization, but may not be sufficient to address the suite of issues associated with water withdrawal. Each targeted area has unique ecological aspects that may be influenced or affected by surface water withdrawal, especially larval fish and shellfish. Intake design, including flow rate, can mitigate many potential adverse impacts to nekton, and we recommend that the JCSA plan to use intake screens with no greater than one millimeter slot size and operate at a maximum flow rate of 0.25 cubic feet per second.

Fouling may be problematic for intakes and outfalls placed in estuarine environments, especially those intakes designed to be protective of aquatic living resources. When the method for managing fouling has been determined, we recommend that the JCSA provide a profile of all chemicals that may be used in the cleaning/defouling process and estimates of treatment schedules and chemical volumes.

Release of brine from the desalination process into the estuary causes concern with respect to how it may permanently alter ambient conditions within the zone of influence of the outfall. Before these potential effects can be analyzed properly it is necessary to have a detailed understanding of the salinity and volume of the effluent, the location of the effluent pipe, and the salinity regime of the receiving waters. Hydrodynamic modeling may be necessary to understand the spatial expanse of the dilution plume unless the effluent is planned for release in waters of like salinity.

PO Box 1346 • 1375 Greate Road • Gloucester Point, Virginia 23062-1346 USA
804.684.7482 • www.vims.edu

As more detailed information becomes available, we will be able to provide advice beyond the general concepts presented above. To facilitate the review and permitting process, we are available to work directly with DEQ staff and the applicant throughout this process. Thank you for the opportunity to comment and please do not hesitate to contact me if you have questions or require additional information.

Sincerely,

Lyle Varnell
Associate Director for Advisory Services

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Joe Elton
Deputy Director of Operations

Rochelle Altholz
Deputy Director of Administration and Finance

David Dowling
Deputy Director of Soil and Water and Dam Safety

October 30, 2015

Matthew Link
DEQ
P.O. Box 1105
Richmond, VA 23218

Re: James City Service Authority Surface Water Supply

Dear Mr. Link:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

York River Site

Biotics documents the presence of natural heritage resources within two miles of the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

James River Site

According to the information currently in our files, the Atlantic sturgeon (*Acipenser oxyrinchus,* G3/S2/LE/LT) has been documented downstream from the project site. Atlantic sturgeon is a large fish that reaches a maximum length of about 4.3 meters and may live for several decades. The adults migrate between fresh water spawning areas and salt water non-spawning areas. They feed primarily on benthic invertebrates and small fishes as available.

Stocks on the Atlantic slope have been severely reduced by overfishing (mainly late 1800s and early 1900s), pollution, sedimentation, and blockage of access to spawning areas by dams (Gilbert 1989, Burkhead and Jenkins 1991, Marine and Coastal Species Information System 1996). In Chesapeake Bay and elsewhere in the range, hypoxic events have increased and may degrade nursery habitat for Atlantic sturgeon (Secor and Gunderson 1997). Habitat loss due to dam construction and water pollution are thought to be major factors impeding full recovery of populations (Smith 1985, cited by Johnson et al. 1997; Gilbert 1989). A late maturation age and use of estuaries, coastal bays, and upstream areas of rivers for spawning and juvenile development make stocks vulnerable to habitat alterations in many areas (NatureServe 2012). Please note that this species is currently classified as endangered by the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) and threatened by the Virginia Department of Game and Inland Fisheries (VDGIF).

Please note this project is within a section of the James River, which has been designated as a scenic river in the state of Virginia. Due to this designation, DCR recommends you contact Lynn Crump of the DCR-Division of Planning and Recreation at 804-786-5054 or Lynn.Crump@dcr.virginia.gov.

Chickahominy River Site

According to the information currently in our files, this site is located within the Gordon Creek Conservation Site and within two miles of the Morris Creek Conservation Site. Conservation sites are tools for representing key areas of the landscape that warrant further review for possible conservation action because of the natural heritage resources and habitat they support. Conservation sites are polygons built around one or more rare plant, animal, or natural community designed to include the element and, where possible, its associated habitat, and buffer or other adjacent land thought necessary for the element's conservation. Conservation sites are given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain; on a scale of 1-5, 1 being most significant. Gordon Creek Conservation Site has been given a biodiversity significance ranking of B2, which represents a site of very high significance. The natural heritage resource of concern at Gordon Creek Conservation Site is:

Tidal Freshwater Marsh (Arrow-arum – Pickerelweed Type) G3G4/S3S4/NL/NL

This Tidal Freshwater Marsh community, the Arrow-arum - Pickerelweed Type, is codominated by leafy forbs arrow arum and pickerelweed. Associated species can include wild rice, duck potato, sweet leaf, halberdleaf tearthumb, swamp smartweed, arrowleaf tearthumb, and begger ticks spp. Species occurring less frequently can include cattail spp. and jewelweed. (NatureServe, 2011)

Morris Creek Conservation Site has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resource of concern at Morris Creek Conservation Site is:

Tidal Freshwater Marsh (Common Spatterdock – Arrow-arum Mudflat Type) G3G4/S3S4/NL/NL

At the southern end of the range of Tidal Freshwater Marsh (Arrow-arum – Pickerelweed Type) in Virginia, there is a well-marked variant in which spatterdock is codominant with arrow arum and pickerelweed in variable mixtures. This Spatterdock – Arrow Arum Mud Flat Type community occurs low within freshwater tidal marshes on muck substrates of variable depth. There is a long duration of tidal flooding, and the community is exposed only for a short period of time each day when the tide is out, supporting higher mean species richness and containing a number of taxa absent from the low intertidal portions of mudflats. (NatureServe, 2012)

Freshwater tidal marshes are naturally dynamic systems that are best developed where there is a major input of freshwater, a daily tidal range of at least 0.5 m, and a geomorphology that tends to constrict and magnify tidal influence in the upper reaches of the estuary. They are subject to diurnal flooding by tides and seasonal and episodic flooding from river discharge. Plant composition of freshwater tidal marshes generally occurs as a mosaic of patches dominated by a few or a single species. Species composition is determined by species life history characteristics, especially lifeform, phenology and mode of regeneration in response to microhabitat conditions, and the frequency and duration of flooding. Plant composition has seasonal variation. (NatureServe, 2011)

To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. Due to the legal status of the Atlantic sturgeon, DCR also recommends coordination with NOAA Fisheries and Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with endangered species legislation. Finally, DCR recommends a hydrologic study be prepared to determine water quality issues due to changes in salinity regimes from water withdrawal, downstream brine discharge and sedimentation increases.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

Should you have any questions or concerns, feel free to contact me at (804) 692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

Cc: Amy Ewing, VDGIF
Christine Vaccaro, NOAA
Lynn Crump, DCR-DPRR

Literature Cited

Burkhead, N. M., and R. E. Jenkins. 1991. Fishes. Pages 321-409 in K. Terwilliger (coordinator). Virginia's Endangered Species: Proceedings of a Symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.

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Link, Matthew (DEQ)

From: Eversole, Mark (MRC)
Sent: Tuesday, October 27, 2015 3:15 PM
To: Link, Matthew (DEQ)
Cc: Lyle M Varnell; Emily A. Hein; Eversole, Mark (MRC)
Subject: FW: JCSA Pre-Application Meeting Comments
Attachments: Chickahominy River at Barrets Ferry.jpg; York River at Sycamore Landing.jpg

Matthew, in response to your request, VRMC offers the following comments concerning a proposal to install a municipal water intake structure in either the York River near Sycamore Landing, or in the Chickahominy River, immediately upstream of the Route 5 bridge, both in James City County.

Our Fisheries Division reports that there is a healthy commercial harvest in the immediate vicinity of both locations, including blue crab harvest by crab pot; eel harvest; public oyster harvest by tong and dredge (near the York River site); and gillnet harvest of striped bass, spot and croaker. In addition to any impacts associated with the withdrawal of water including effects of the withdrawal at the intake structure, the return of a concentrated saline solution could have an impact to fisheries in the vicinity.

Our Engineering/Surveying Department reports that there are numerous oyster ground leases immediately offshore of the proposed intake location in the York River. The installation of an intake in this location could present issues with impacts to those leases. There are no oyster ground leases in the vicinity of the proposed location in the Chickahominy River. I have attached copies of our oyster lease maps for both locations. Privately leased oyster grounds are shown in yellow and are prevalent in the York River near the proposed intake. Again, the introduction of a concentrated saline solution in this area could impact the oyster industry in this portion of the York.

We look forward to working with the applicant, and we will provide additional comments as they develop more definitive plans.

Mark Eversole
Virginia Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, Virginia 23607
Office: (757)-247-8028
email: mark.eversole@mrc.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Joe Elton
Deputy Director of Operations

Rochelle Altholz
Deputy Director of Administration and Finance

David Dowling
Deputy Director of Soil and Water and Dam Safety

October 30, 2015

Matthew Link
DEQ
P.O. Box 1105
Richmond, VA 23218

Re: James City Service Authority Surface Water Supply

Dear Mr. Link:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

York River Site York River Site Okay

Biotics documents the presence of natural heritage resources within two miles of the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

James River Site James has issues with Atlantic Sturgeon and is signated as a scenic River

According to the information currently in our files, the Atlantic sturgeon (*Acipenser oxyrinchus,* G3/S2/LE/LT) has been documented downstream from the project site. Atlantic sturgeon is a large fish that reaches a maximum length of about 4.3 meters and may live for several decades. The adults migrate between fresh water spawning areas and salt water non-spawning areas. They feed primarily on benthic invertebrates and small fishes as available.

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Chickahominy River Site

up stream on Charles City side

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Should you have any questions or concerns, feel free to contact me at (804) 692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

NEED TO UNDERSTAND Limitation of the site.

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

Cc: Amy Ewing, VDGIF
Christine Vaccaro, NOAA
Lynn Crump, DCR-DPRR

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Doug Powell

From: Eversole, Mark (MRC)
Sent: Tuesday, October 27, 2015 3:15 PM
To: Link, Matthew (DEQ)
Cc: Lyle M Varnell; Emily A. Hein; Eversole, Mark (MRC)
Subject: FW: JCSA Pre-Application Meeting Comments
Attachments: Chickahominy River at Barrets Ferry.jpg; York River at Sycamore Landing.jpg

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Mark Eversole
Virginia Marine Resources Commission
2600 Washington Avenue, 3rd Floor
Newport News, Virginia 23607
Office: (757)-247-8028
email: mark.eversole@mrc.virginia.gov

614
Plantation Heights
Bypass Rd
Parkway Estates
Colonial Pkwy
Colonial Pkwy
Gordon Creek
Greenspring Mobile Home Park
News Rd
321
Williamsburg
132
Monticello at Powhatan
5000
Monticello Ave
162
Williamsburg
James Terrace
John Tyler Memorial Hwy
Fairway Villas
Village Square
5
199
60
Busch Corporate Center
64
Shellbank
Greenspring Rd
31
Shibui Woods
Jamestown Rd
Kingsmill
Neck-O-Land Hundred
College Creek
Wynns
The Thorofare
Colonial National Historical Park
Jamestown
Jamestown Island
James River Commerce Center
Swanns Point Rd
Scotland
Hog Island Rd
Rolfe Hwy
Rolfe Hwy
Chippokes
Landing Dr
Surry
Alliance
Highgate
10
Colonial Trail E
Rolfe Hwy

14
Plain View
Gressitt
River Rd S
Tuckers Rd W
Plain View Ln S
Kingstown Rd S
Cherry Row Ln S
Tanyard Landing Rd
Bay
William Le
Stephen's Tra
Sycamore
Landing
st End
Island Rd
Ivey Dell
S Purton Ln
Ware Creek Manor
York River State Park
Woodland Farms

VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE

Office of Research and Advisory Services

October 19, 2015

Mr. Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218

Dear Mr. Link:

The Virginia Institute of Marine Science has reviewed the information provided to the pre-application review panel by the James City Service Authority (JCSA) for alternative water withdrawal strategies either from the Chickahominy or York river. If the JCSA has sufficiently justified the need for additional water sources, and if it has been determined by DEQ that additional groundwater withdrawal is not a viable or reasonable alternative, then we offer the following comments for moving forward with a surface water withdrawal strategy.

The VIMS review of the potential environmental impacts resulting from construction and operation of a riverine surface water intake will require information on intake design and flow rate, characterization of the estuarine environment in the vicinity of each proposed intake, and the physical and chemical metrics associated with the effluent. Existing data will be valuable to the applicants for environmental characterization, but may not be sufficient to address the suite of issues associated with water withdrawal. Each targeted area has unique ecological aspects that may be influenced or affected by surface water withdrawal, especially larval fish and shellfish. Intake design, including flow rate, can mitigate many potential adverse impacts to nekton, and we recommend that the JCSA plan to use intake screens with no greater than one millimeter slot size and operate at a maximum flow rate of 0.25 cubic feet per second.

For 20 Mgd That's 7000 ft3 open space 14,000 ft of screens 24 ft3

Fouling may be problematic for intakes and outfalls placed in estuarine environments, especially those intakes designed to be protective of aquatic living resources. When the method for managing fouling has been determined, we recommend that the JCSA provide a profile of all chemicals that may be used in the cleaning/defouling process and estimates of treatment schedules and chemical volumes.

Release of brine from the desalination process into the estuary causes concern with respect to how it may permanently alter ambient conditions within the zone of influence of the outfall. Before these potential effects can be analyzed properly it is necessary to have a detailed understanding of the salinity and volume of the effluent, the location of the effluent pipe, and the salinity regime of the receiving waters. Hydrodynamic modeling may be necessary to understand the spatial expanse of the dilution plume unless the effluent is planned for release in waters of like salinity.

PO Box 1346 • 1375 Greate Road • Gloucester Point, Virginia 23062-1346 USA
804.684.7482 • www.vims.edu

As more detailed information becomes available, we will be able to provide advice beyond the general concepts presented above. To facilitate the review and permitting process, we are available to work directly with DEQ staff and the applicant throughout this process. Thank you for the opportunity to comment and please do not hesitate to contact me if you have questions or require additional information.

Sincerely,

Lyle Varnell
Associate Director for Advisory Services

PO Box 1346 • 1375 Greate Road • Gloucester Point, Virginia 23062-1346 USA
804.684.7482 • www.vims.edu

Doug Powell

From: LaBudde, Gregory (DHR)
Sent: Friday, September 25, 2015 4:31 PM
To: Link, Matthew (DEQ)
Subject: RE: JCSA Pre Application Review Panel (DHR File No. 2015-0968)

Dear Mr. Link,

Thank you for inviting the Department of Historic Resources (DHR) to attend the JCSA Pre Application Review Panel. It is our understanding that the setting and scope of the project have not been determined. As such, DHR is unable to provide meaningful comments or recommendations at this time. Please continue to consult with us when plans for the project are developed.

On September 19, 2015, we received notification that notes and additional materials from the James City Service Authority Pre-Application Review Panel Meeting were uploaded to VITASHARE. According to the notification, the file package would be available for 14 days. However, the download link provided in the notification is no longer accessible. So that we may have a copy of the notes and materials for our files, please provide this information at your nearest convenience.

We look forward to working with the DEQ on this project as it develops.

Sincerely,

Greg LaBudde, Archaeologist
Review and Compliance Division
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
phone: 804-482-6103
fax: 804-367-2391
gregory.labudde@dhr.virginia.gov

From: Link, Matthew (DEQ)
Sent: Friday, August 28, 2015 10:46 AM
To: Watkinson, Tony (MRC); Lyle M Varnell; Smith, Scott (DGIF); Ewing, Amy (DGIF); Baird, Alice (DCR); Eversole, Mark (MRC); Bunch, Aaron (DGIF); Caruthers, Michelle (VDH); lynette.r.rhodes@usace.army.mil; Horne, Daniel (VDH); Soto, Roy (VDH); Michael Vergakis; Powell, Doug; bryan.hill@jamescitycountyva.gov;

LaBudde, Gregory (DHR); matt.m.wicks@usace.army.mil; Kimberly_Smith@fws.gov; wkatchmark@hrpdcva.gov; Rhur, Robbie (DCR); Lapp.Jeffrey@epamail.epa.gov; Douglas, Susan (VDH); Aulbach, John (VDH)
Cc: Nicol, Craig (DEQ); Kudlas, Scott (DEQ); Stephenson, Tammy (DEQ); Mackey, Heather (DEQ); McGurk, Brian (DEQ)
Subject: JCSA Pre Application Review Panel Documents

To: Pre-Application Review Panel Invitees

RE: Pre-Application Review Panel Meeting Documents
James City Service Authority

Attached are the available documents for your review prior to the meeting on Monday. Meeting notes and any additional materials will be distributed following the meeting. Please contact me at any time with any questions, comments, or concerns. Thank you.

Matthew Link
Water Withdrawal Permit Writer
Office of Water Supply
Department of Environmental Quality
P.O. Box 1105, Richmond, VA 23218
804-698-4078
matthew.link@deq.virginia.gov
www.deq.virginia.gov

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