West Virginia Army National Guard,
Construction and Facilities Management Office
Camp Dawson

AECOM

Camp Dawson Pierce Lake Dam Repair Design

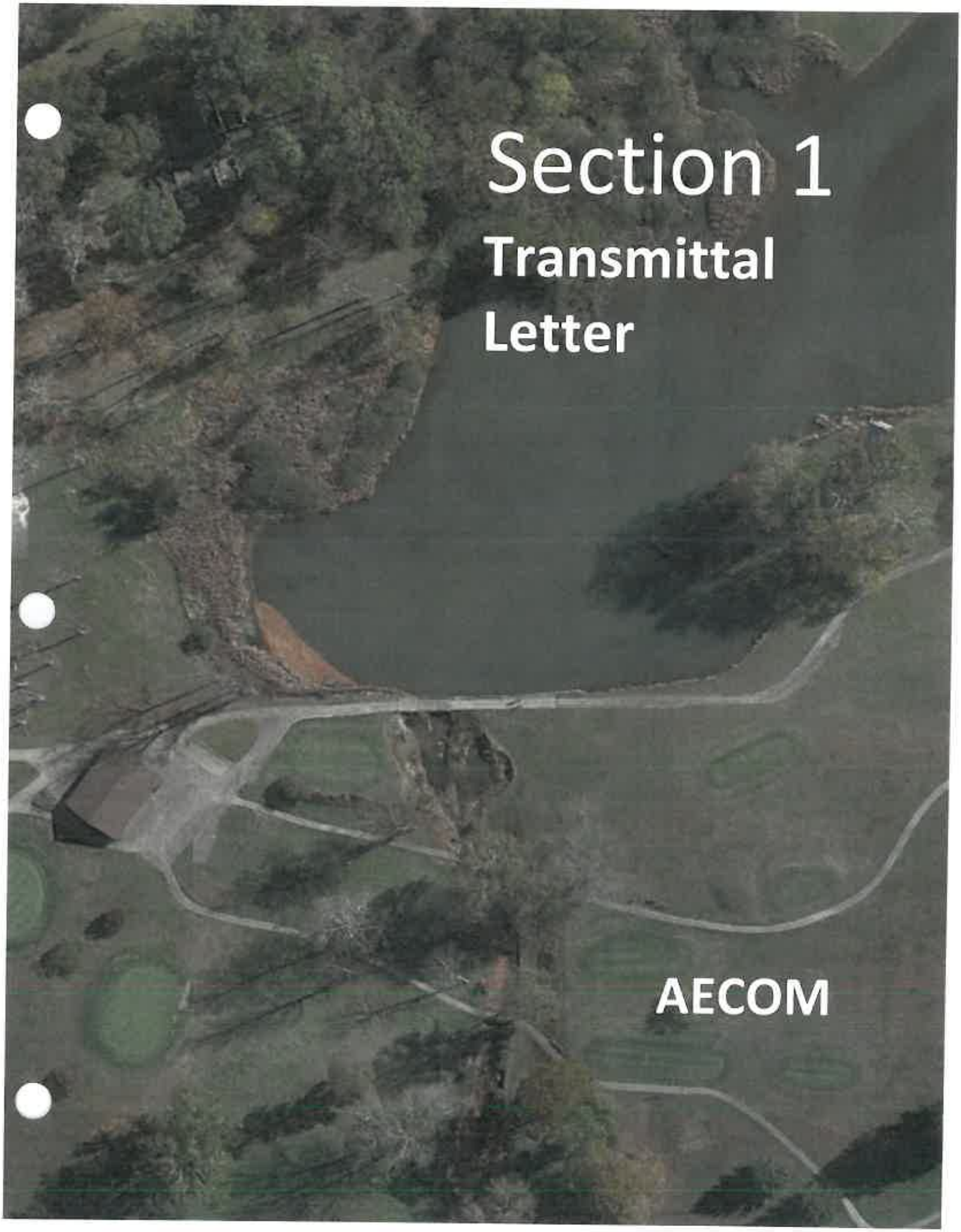
Expression of Interest CEOI ADJ20*10

May 14, 2020

WEST VIRGINIA NATIONAL GUARD
JOINT BASE MORGANTOWN, WEST VIRGINIA

Table of Contents

Tables and Figures



Section 1

Transmittal Letter

AECOM

AECOM
150 Clay Street
Suite 410
Morgantown, WV 26501
www.aecom.com

304.292.8145 tel
304.292.8146 fax

May 13, 2020

Ms. Tara Lyle
Buyer Supervisor
West Virginia Department of Administration
Purchasing Division
2019 Washington Street East
Charleston, West Virginia 25305-0130
Delivered via Courier

Re: Expression of Interest: Camp Dawson Pierce Lake Dam Repair Design
Solicitation Number: ADJ2000000010

Dear Selection Committee:

As recognized experts in all aspects of dam engineering, AECOM Technical Services, Inc. (AECOM) has the expertise, staff, and passion to successfully provide professional services to provide design services for the Pierce Lake Dam. We are pleased to respond to the above referenced EOI.

AECOM is recognized as an expert in dam, reservoir and hydropower engineering, having worked on tens of thousands of dams and water resources projects around the globe. We offer solutions in every facet of dam engineering from planning and feasibility through design and construction, commissioning, operation, ongoing dam safety monitoring, maintenance, rehabilitation and decommissioning. Our team has extensive experience in delivering dam engineering projects for public- and private-sector clients. We combine our connected expertise across multiple disciplines to solve our client's most complex challenges. This integrated approach allows us, when required, to pair local knowledge with global expertise to deliver the best project outcomes for our clients. To strengthen our team, AECOM is joined by Triad Engineering, Inc. (Triad) for topographic survey and geotechnical drilling services. We have maintained a successful working relationship with Triad on very similar projects for more than 10 years.

- ☑ **Our eastern US Center of Excellence for Dam Engineering is supported by our local West Virginia Civil Engineers located in Morgantown, West Virginia, 40 minutes from Camp Dawson. Our Professional Engineers focus primarily on earth embankment dams similar to Lake Pierce.**
- ☑ **AECOM has experience and on-going expertise in analyzing and remediating seepage issues in earth embankment dams.**
- ☑ **Our Engineers and local AECOM office has extensive experience working in and around Camp Dawson.**

As you will see in the following pages, we have assembled a quality team of dam experts dedicated to the Pierce Lake Dam Repair Design Project. We stand out as a leader in the dams' industry and pride ourselves in supporting some of the world's largest dam projects while also meeting the needs our of smaller dam owner clients. We have a well-rounded team of nationally recognized experts as well local engineers with specific site and geologic experience. I think you will find that our proposed team will meet your expectations in working to rehabilitate Pierce Lake Dam. We understand that Pierce Lake Dam is not included in the United States Army Corps of Engineers (USACE) National Inventory of Dams (NID). Also, based on the limited information available Pierce Lake Dam most likely does not meet the definition of a dam per the West Virginia Department of Environmental Protection (DEP). Pierce Lake Dam is a small earthen structure with very limited hazard potential. Our response to the EOI will show that we have strong experience with far riskier dams with greater hazard potential, but also show that we are well suited to efficiently resolve the issues at Lake Pierce Dam for the WVARNG. Our experience shows that we have solid knowledge of Camp Dawson (where team personnel have completed at least 6 previous projects) and a robust local presence of Civil Engineers that can efficiently and effectively prepare the contract bid set of construction documents for this project.

On behalf of our team, we appreciate the opportunity to be considered for this project. We give you our personal commitment to produce quality work, on time and within budget, and to your satisfaction. We look forward to finalizing the project scope and fee under mutually agreeable terms for this contract. If you have any questions or require additional information, please see my contact information below. We look forward to the next stage in your selection process.

Sincerely,

AECOM Technical Services, Inc.

Sawitzki, David
Digitally signed by Sawitzki, David
DN: cn=Sawitzki, David, ou=USGRM2
Date: 2020.05.13 16:05:40 -04'00'

David G. Sawitzki, PE
Vice President/Authorized Signatory

P: 301-944-2631
david.sawitzki@aecom.com

Attachments:
1. Certification and Signature Page
2. Purchasing Affidavit

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Dams Practice Leader
(Name, Title)
G. Michael McIntyre, Dams Practice Leader
(Printed Name and Title)
12420 Milestone Center Drive, Germantown, MD 20876
(Address)
301.302.1470 / 937.998.1115
(Phone Number) / (Fax Number)
gmichael.mcintyre@aecom.com
(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

AECOM Technical Services, Inc.
(Company)
Sawitzki, David Digitally signed by Sawitzki, David DN: cn=Sawitzki, David, ou=USGRM2 Date: 2020.05.13 16:07:17 -04'00' Vice President/Authorized Representative
(Authorized Signature) (Representative Name, Title)

David G. Sawitzki,Vice President/Authorized Representative
(Printed Name and Title of Authorized Representative)

May 13, 2020
(Date)

301-944-2631 / 937.998.1115
(Phone Number) (Fax Number)

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

CONSTRUCTION CONTRACTS: Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

ALL CONTRACTS: Under W. Va. Code §5A-3-10a, no contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: AECOM Technical Services, Inc.

Authorized Signature: Sawitzki, David Digitally signed by Sawitzki, David DN: cn=Sawitzki, David, ou=USGRM2 Date: 2020.05.13 15:08:10 -04'00' Date: May 13, 2020

State of _____

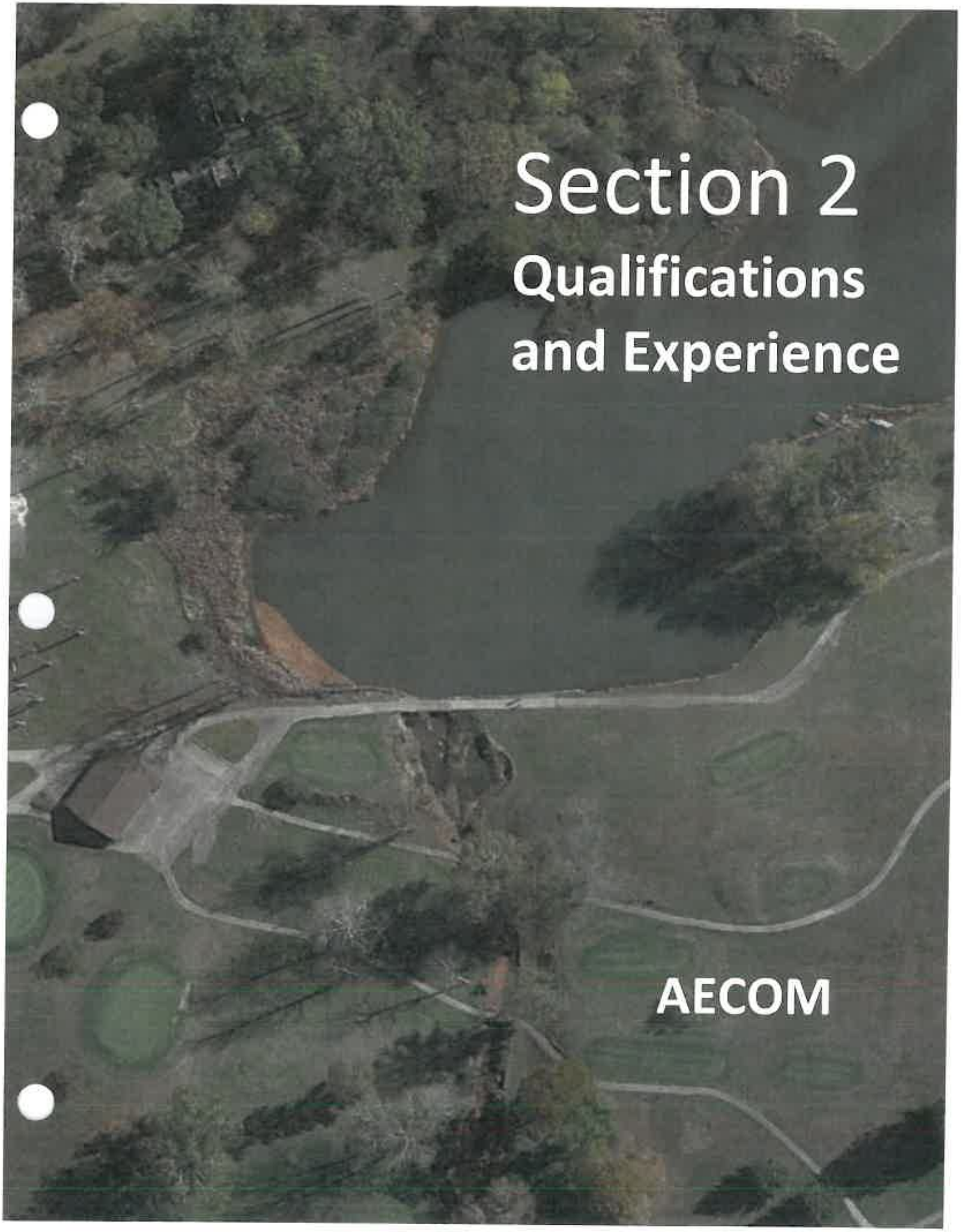
County of _____, to-wit:

Taken, subscribed, and sworn to before me this ___ day of _____, 20___.

My Commission expires _____, 20___

AFFIX SEAL HERE

NOTARY PUBLIC _____



Section 2
Qualifications and Experience

AECOM

Introduction

With more than 85 years in the industry, AECOM Technical Services, Inc. (AECOM) is recognized as an expert in dam and reservoir engineering, having worked on tens of thousands of dams and water resources projects around the globe. We have also performed more than 100 projects for the State of West Virginia. We offer solutions in every facet of dam engineering from planning and feasibility through design and construction, commissioning, operation, ongoing dam safety monitoring, maintenance, rehabilitation and decommissioning.

Our team has extensive experience in delivering dam engineering projects for public-and private-sector clients. We combine our connected expertise across multiple disciplines to solve our clients most complex challenges. This integrated approach allows us to pair local knowledge with global expertise to deliver the best project outcomes for our clients.

We develop specialized procedures and computer models that simulate past, present and future water system operations. Our high-caliber engineers and specialists excel in simulating surface and groundwater supply options, complex reservoir operations and instream flow requirements.

We assess and analyze alternative water resource management strategies. Our water resource specialists understand the complex institutional and regulatory aspects of federal and state-issued permits and water rights, and their interaction with environmental permitting and adaptive management programs.

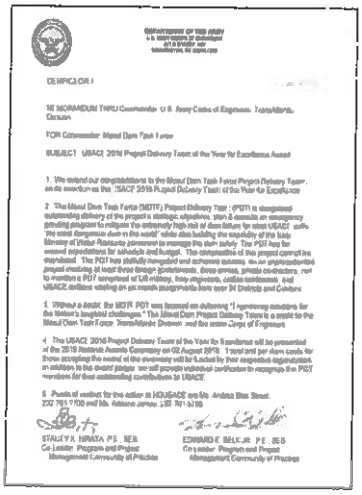
Our projects are varied and include greenfield projects as well as dam upgrade and augmentation projects. As a leader in upgrading and rehabilitating major dams, we have completed projects across the globe that reflect our global reach. Dedicated to delivering dependable, transformative projects, we come together to solve complex challenges.

We continue to successfully deliver award-winning dam engineering services that are innovative and cost-effective and are ranked No. 2 in Dams and Reservoirs in the Engineering News-Record (ENR) Top 500 Design Firms list for 2019.

Your local AECOM dam engineers work on the most high-profile dam projects around the world, in addition to dam projects in our region, state and local communities – like the Camp Dawson Pierce Lake Dam. While AECOM has truly unmatched depth in reach-back skills, experience and resources, we have been serving the state and local dam market here in West Virginia and the Mid-Atlantic States for decades. To provide the highest level of specialized dam consulting, AECOM maintains several centers of excellence for dam engineering. Our Germantown, Maryland office is one of 3 of these centers across the US, where we have over 50 staff in our dams engineering and design group. Beyond Germantown, this number is backed up by hundreds of dam safety professionals supporting every conceivable need in our discipline. Below is a partial list of dam projects that our Germantown dams group has supported in just the past couple of years:

- Dam Safety Modification Mandatory Center of Expertise (DSMMCX), Huntington District
- Bluestone Dam, Hinton, WV
- Greenbrier Dam, Boonsboro, MD
- Lake Needwood Dam, Rockville, MD
- Tom's Branch Dam, Augusta County, VA
- Beech Creek Dam, Manchester, KY
- Scenic Lake Dam, Henderson, KY
- Mosul Dam, Iraq USACE, Middle East District
- Various NRCS Dams, USDA-NRCS Nationwide
- Rocky Penn Run Reservoir, Stafford County, VA
- Riawalkin Pond Dam, Salisbury, MD
- TVA Boone Dam, Kingsport, TN
- Upper Dublin Flood Control Dams, Fort Washington, PA

Our specific project profiles can be found in the Relevant Project Experience section below and outline our proven performance on dam projects: on schedule, on budget, and meeting client cost expectations.



Mosul Dam received the USACE Project of the Year Award.

"This group has led the way to undertake various methods and procedures to achieve success on our project. They care about our concerns and understand our objectives. They work very well with our stakeholders and they have the knowledge to demonstrate superior ability and expertise to undertake all of our project goals." – Gary Wells, PE, Kentucky Division of Water - Dam Safety Section

Firm Qualifications

We have assembled a quality team of dam experts dedicated to the Pierce Lake Dam Repair Design Project. We stand out as a leader in the dams' industry and pride ourselves in supporting some of the world's largest dam projects while also meeting the needs our of smaller dam owner clients. We have a well-rounded team of nationally recognized experts as well local engineers with specific site and geologic experience.

We understand that Pierce Lake Dam is not included in the United States Army Corps of Engineers (USACE) National Inventory of Dams (NID). Also, based on the limited information available Pierce Lake Dam most likely does not meet the definition of a dam per the West Virginia Department of Environmental Protection (DEP). Pierce Lake Dam is a small earthen structure with very limited hazard potential. Our qualifications show that we have strong experience with far riskier dams with greater hazard potential, but also that we are well suited to efficiently resolve the issues at Lake Pierce Dam for the WVARNG.

Our qualifications and experience show that we have solid knowledge of Camp Dawson (where team personnel have completed at least 6 previous projects) and a robust local presence of Civil Engineers that can efficiently and effectively prepare the contract bid set of construction documents for this project.

Embankment Dams

Specific to Embankment Dams, we have internationally recognized experience in the design and upgrade of embankment dams and levees for flood management and water storage across the United States and around the world. We specialize in the design and rehabilitation of embankments, including the assessment of suitable construction materials, the design of seepage controls, foundation treatments and design of embankment zoning.

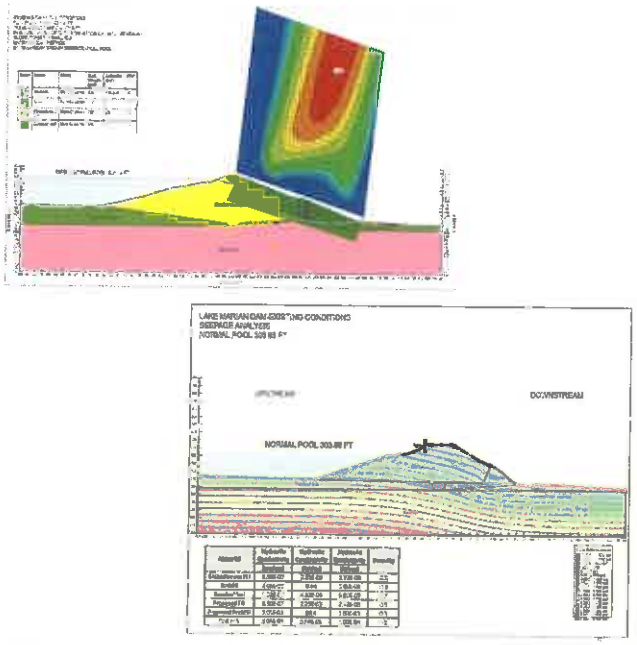
We use risk informed decision making and implement defensive design measures within the embankments and foundations that are appropriate for the risk classification. Our embankment designers work corroboratively with our geotechnical specialists to manage geohazards and geological engineering risks. We have acclaimed expertise within a broad range of specialized geotechnical defensive design measures including:

- The evaluation and design of engineered filter zones, one of the critical defensive design measures for modern embankment dams (e.g. Rocky Penn Run Reservoir, Beech Creek Dam, Scenic Lake Dam, Upper Dublin Flood Control Dams and Greenbrier Dam, Lake Needwood Dam, and Riawalkin Pond Dam)
- Seepage control measures including foundation barrier walls (e.g. Mosul Dam, Rocky Penn Run Reservoir, Upper Dublin Flood Control Dams, Lake Needwood Dam, Beech Creek Dam)
- Foundation treatment measures including stone columns, deep soil mixing, and grouting to improve the performance of poor foundations (e.g. Boone Dam, Scenic Lake Dam, Mosul Dam and Rocky Penn Run Reservoir)
- Hydrology and Hydraulics dam analysis including the evaluation of undersized spillways and design of remediation measures (e.g. Upper Dublin Flood Control Dams, Scenic Lake Dam, Beech Creek Dam, Tom's Branch Dam and Rocky Penn Run Reservoir)

Our key skills related to the Pierce Lake Dam include as exemplified by most of our project experience examples:

- Civil design preparation of contract documents
- Permitting of dam modifications
- Embankment zoning and filter design
- Material selection and characterization
- Internal erosion risk analysis
- Slope stability modelling
- Seepage analyses
- Foundation treatment
- Instrumentation

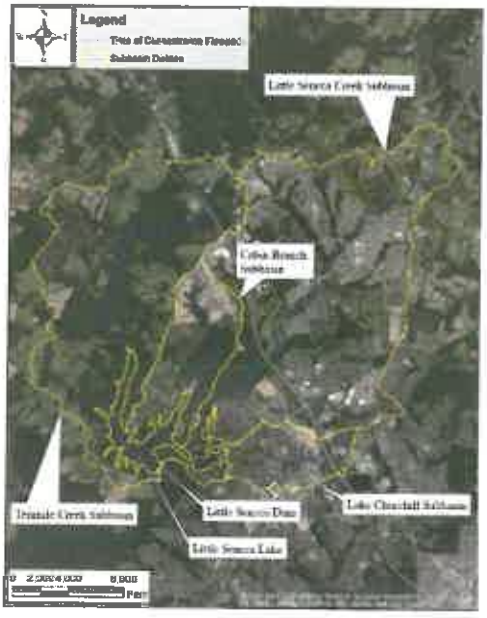
While we have expertise in the design of many different facets of embankment dams, we recognize that Pierce Lake Dam is a smaller embankment that may not necessarily require all the design measures listed above. We are prepared to tailor our analyses to what is needed at Pierce Lake dam in a cost-effective manner.



Seepage and Slope Stability Outputs for Earth Embankment Similar to Pierce Lake Dam.

Hydrology and Hydraulics

The hydrology and hydraulics (H&H) analysis for dams is a critical element. We specialize in hydrologic and hydraulic assessment and design of river basins, reservoir systems and flood management projects. This includes modeling of extreme rainfall events; sizing and optimizing hydraulic structures to permit safe passage of flows, including spillways, outlet structures, and appurtenant works such as energy dissipation, flow training, and erosion protection features; upstream and downstream fish passage; and hypothetical dam failures.



Watershed Model Example for an Earth Embankment Dam similar to Pierce Lake Dam.

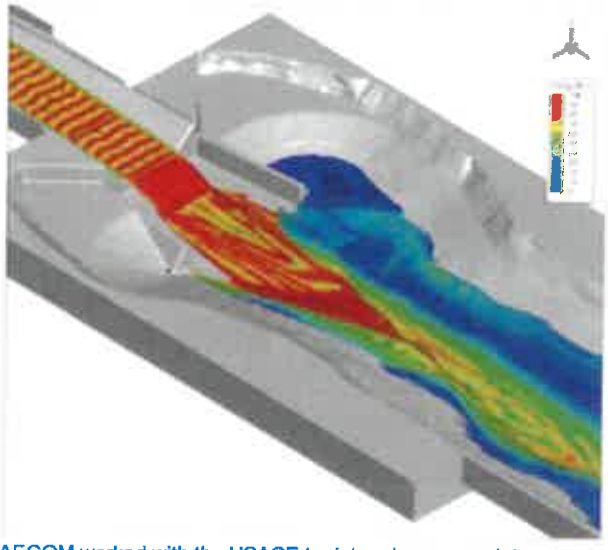
Our assessments are undertaken based on the expert experience of our engineers and by utilizing an array of state-of-the-art computer programs and assessment techniques. These include the use of complex numerical modeling software, such as 1D, 2D and 3D hydrodynamic modeling and computational fluid dynamics (CFD), as well as physical hydraulic modeling techniques. Through our knowledge, understanding and experience of industry leading assessment techniques, we implement the most appropriate H&H modeling tool to the specific problem to deliver innovative designs that have led to significant savings in capital costs during the construction and operation of client facilities.

Our in-depth knowledge of dam safety rules and requirements across the United States allows us to offer clients comprehensive hydrological and hydraulic design solutions through the various stages of the project life cycle, utilizing skills and techniques that are appropriate to the size and complexity of the project.

Our key skills include:

- Extreme flood hydrology
- Computational fluid dynamics modelling
- Physical hydraulic model investigations
- Hydraulic structure design

- Spillway optimization
- Spillway erosion assessment
- Outlet works design
- Environmental flow releases
- Modeling (HEC Suite, etc.)



AECOM worked with the USACE to determine appropriate enhancement of the modeling procedure to more realistically predict spillway erosion progression and geometry by incorporating 10 hydrographs into the model at Fort Peck.

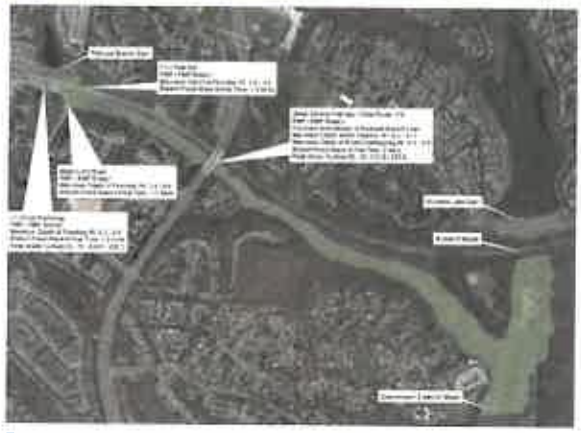
Although we are experienced using complex H&H modeling software, we anticipate that the H&H analysis for Pierce Lake Dam can be completed using HEC-HMS and HEC-RAS software and will not likely require CFD modeling.

Hydraulic Structures

We have significant experience in assessment, remediation and design of structural components of dams and hydraulic structures. Our assessment capabilities range from simple analysis techniques to complex 3D finite element analyses.

We specialize in structural review and assessment of new and existing structures including concrete gravity dams, concrete arch dams, spillways, intake towers, retaining walls, outlet works, parapet walls, conduits, bridges and other appurtenant structures.

Our assessments are undertaken based on the extensive experience of our engineers and range from simple analyses to state-of-the-art computer modeling to suit the complexity of the structure and project, including 3D finite element analyses using programs such as ANSYS.



Recent dam break analysis and inundation mapping performed by AECOM.

Through our in-depth understanding of the performance of these structures, we have delivered innovative designs that have led to significant savings in capital costs during construction.

Of particular importance is our ability to not just deliver on the detailed designs, but to work with our clients and their contractors during the construction stage of the works. Our engineers have significant experience in current material specifications, such as concrete mix designs. We are leaders in construction supervision and have a deep understanding of advanced industry construction techniques. This provides substantial benefits as we deliver our projects. Our key skills include:

- Spillway buttress design
- Outlet works design
- Finite element modeling
- Control structure design

We recognize that the hydraulic structures at Pierce Lake Dam are relatively small in size and the degree of modeling and design will be largely dependent of the conditions of such structures at the time of the dam inspection.

Qualifications Summary

Our team organization for the Pierce Lake Dam Repair Design project reflects our local, expert resources as well as our broad range of disciplines available for the project. We completed our team with dam engineering experts and specific disciplines that AECOM knows will be critical to proper execution. Our Key Personnel presented in the Proposed Staffing Plan below reflects the collaborative project experience of our key dam engineers that will be part of the Pierce Lake Dam team. Key staff resumes and relevant certifications are provided below as well.

We have picked this team to not only meet the requirements requested in the RFP and our assessment of the Pierce Lake Dam repair needs, but also to be a dedicated extension of the West Virginia Purchasing Division (Purchasing) as well as the West Virginia Army National Guard (WVARNG). Our team will complete tasks keeping stakeholders informed throughout the process as we understand our investigations and recommendations. Communication will be paramount to our teamwork and consulting to the project team. Our team is completed with our subcontractor Triad Engineering, Inc. (Triad) who will assist in the subsurface field investigation and topographic survey portions of the project.

We are uniquely qualified for this assignment, and we bring the following strengths:

- ☑ **Our eastern US Center of Excellence for Dam Engineering is supported by our local West Virginia Civil Engineers located in Morgantown, West Virginia, 40 minutes from Camp Dawson. Our Professional Engineers focus primarily on earth embankment dams similar to Lake Pierce.**
- ☑ **AECOM has experience and on-going expertise in analyzing and remediating seepage issues in earth embankment dams.**
- ☑ **Our Engineers and local AECOM office has extensive experience working in and around Camp Dawson.**

"AECOM has done a really good job keeping the Greenbrier Dam project moving forward, and your design team is also highly regarded by DNR and park staff." – Chris Elnicki, AIA, Maryland Department of General Services

Table 1. Proposed Staffing Plan

PROPOSED STAFF	EXPERIENCE	PROJECT RELEVANCE
 David Weaver, PE Program Manager	32 years	• Site Manager of AECOM's Morgantown, West Virginia office. Licensed West Virginia PE. • Experienced program manager who oversees and develops planning studies, engineering design, design-build and construction management for a variety of project types and disciplines. • Extensive experience working on projects throughout West Virginia including Camp Dawson.
 **David Sawitzki, PE** Principal Dam Engineer	30+ years	• Extensive experience as a Principal Dams Engineer for many dam rehabilitation projects. • Directed the completion of at least six geotechnical, groundwater and engineering designs in support of projects at Camp Dawson through the Army National Guard developing a strong understanding of the geotechnical and groundwater seepage conditions in the Cheat River valley.
 **Michael McIntyre, PE** Senior Project Manager	16 years	• Dams Practice Leader for AECOM. Leads a complex team of Geotechnical, H&H, Structural, and Civil Design Engineers. Licensed West Virginia Professional Engineer. • Extensive experience in the investigation, design and construction management of dam projects including earth embankment dams with seepage issues.
 **Bob Pinciotti, PE** Senior Geotechnical Engineer	40+ years	• Served as Senior Geotechnical Engineer for a variety of dam projects including numerous major earth embankment dam rehabilitations needing emergency repairs due to seepage issues. • Served as the Responsible Design Professional for the design and construction oversight of several new dams and modifications to existing dams.
 **Timothy King, PG** Principal Geologist	34 years	• Experience includes engineering geology, engineering geophysics, and hydrogeology applied to site investigations to evaluate subsurface conditions related to dams. • Responsible for investigations at hundreds of sites across the US including West Virginia. • Subject Matter Expert in geology and geophysical services.
 **Scott Jones, PhD, PE** Senior Structural Engineer	21 years	• Experience working on the design and evaluation of dams as well as evaluation of appurtenant structures, such as principal spillway pipes, control structures and intake towers. • Subject Matter Expert for evaluating seismic loading and fracture mechanics evaluations of structural systems.
 **Jeff Blass, PE** Senior H&H Engineer	17 years	• Experience performing dam inspections, H&H analysis, dam breach and floodplain analyses, environmental permitting, design for new dam, dam repair, and rehabilitation dam projects. • Recent experience managing final design rehabilitation of an embankment dam with spillway capacity issues.
 **Brian Boose** Principal Environmental Engineer	32 years	• Exhibits technical expertise in National Environmental Policy Act (NEPA) compliance, natural and cultural resources management, and environmental due diligence assessments. • Extensive experience serving as program manager for various ARNG projects in West Virginia, including Camp Dawson.
 **Roy Watts** Construction Cost Estimator	47 years	• Experienced professional in construction cost estimating/scheduling and claims management and avoidance. Recent experience with many earth embankment dams. • Extensive experience in construction implementation and quality control, scheduling all levels of project development, conceptual and final design cost estimates.
 **Michael Greer, PG** Senior Geophysicist	20 years	• Experience managing geophysical surveys for environmental and engineering geophysics, engineering geology, and hydrogeology applied to site investigations for subsurface conditions. • Skill set includes the following geophysical methods: Pipe and Cable Locators and Tracers, Electrical Resistivity Imaging (ERI), Seismic Refraction, Multi-channel Analysis of Surface Waves (MASW), Electromagnetics, Magnetics, and Ground Penetrating Radar (GPR), Bathymetry.
 **Kris Wachtel, PhD** Geotechnical Engineer	5 years	• Geotechnical Engineer responsible for performing slope stability analysis, seepage analysis, developing geotechnical subsurface investigation plans and laboratory testing procedures on earth embankment dams. Former West Virginia NRCS dam engineer. PhD from WVU. • Recent experience on earth embankment dam projects in West Virginia.
 **Richard Walker, PE** Structural Engineer	12 years	• Structural engineer specializing in design and evaluation of dams, hydraulic, and site civil structures. • Structural design experience with reinforced concrete, masonry, steel, wood, and light gauge metal framing structures.
 **Jennifer Warf** Senior Environmental Engineer	18 years	• Experience preparing natural resources management plans and NEPA documents, coordinating with regulatory agencies, obtaining Section 404/401 permits), and conducting ecological surveys. • Extensive experience working on environmental permitting projects in West Virginia and ARNG projects, including Camp Dawson.
 **Wes Hollenbach, PE** H&H Engineer	8 years	• Dams Engineer specializing in Hydrologic and Hydraulic analysis of dam watershed models and dam breach modeling, performing dam inspections, and designing final rehabilitations of embankment dams. • Recent experience on earth embankment dams projects in West Virginia.

Key Staff Resumes

David L. Weaver, PE
Associate Vice President

Education

MS, Civil Engineering, University of Washington, 1988

BS, Civil Engineering, Clemson University, 1986

Licenses/Registrations

Professional Engineer, West Virginia, [redacted], Issued 01/01/1993, Exp. 12/31/2018

Engineer In Responsible Charge, West Virginia, COA [redacted], AECOM Technical Services, Inc., Exp. 12/31/2019

AECOM Americas Project Manager Accreditation – Level 3, Senior Project Manager, 2012-present

Years of Experience

With AECOM: 21

With Other Firms: 11

Professional Associations

National Society of Professional Engineers,

- President, West Virginia Society of Professional Engineers, 2009-2011; 2017-present
- Board of Directors, West Virginia Society of Professional Engineers, 2009-present
- Board of Directors, West Virginia Construction and Design EXPO, 2009-present
- President, Morgantown, WV Chapter, 2005-present
- Chapter Coordinator, MATHCOUNTS, 2005-present

American Council of Engineering Companies, West Virginia,

- Legislative Committee, 2009-present
- Bylaws Committee, 2011
- Chair, Policy Committee, 2004 - 2005
- Bridge Design Manual Review Committee, 2001-2002
- WVDOH/WVACE QA/QC Subcommittee, 2000-2001

American Institute of Steel Construction, Professional Member

Mr. Weaver is an experienced program manager who oversees and develops planning studies, engineering design, design-build and construction management for a variety of project types and disciplines. As Transportation Market Sector Lead and Site Manager of the Morgantown, WV office, he supervises the operations in that office and coordinates with other AECOM offices around the country. Mr. Weaver also has an extensive background in structural rehabilitation and forensic investigations.

Project Experience

Friends of the Cheat, Cheat River Trail, Preston County, West Virginia. Program Manager responsible for the development of plans, specifications, and cost estimates for a 8.7-mile section of the Cheat River Trail from Manheim to Caddell, in Preston County. AECOM engineers are currently developing: Environmental Studies, Trail Design, Structure design, Trailhead conceptual design, Drainage systems, and Agency coordination. The project includes the rehabilitation of eight existing steel girder and timber bridge structures for re-use as part of the trail. [2018-2020, AECOM]

FHWA Eastern Federal Lands, Canaan Valley Wildlife Refuge, Reconstruct Camp 70 Road, Reconstruct Parking Area with Additional Parking, and Reconstruct Rivers Edge Trail to ADA Accessible Trail. Tucker County, WV. Program Manager responsible for the development of preliminary engineering, environmental permitting, and final design services, including Plans, Specifications, and Estimates. Project scope was to improve Camp 70 Road by re-grading, resurfacing with gravel, and realigning a portion to provide improved access of the road, improvements to an existing parking lot and a Americans with Disabilities Act (ADA)-grade compliant trail to the Blackwater River. [2019-2020]

West Virginia Department of Transportation - Division of Highways, NBIS Inspection of the Fort Henry Bridge (I-70) over the Ohio River, Ohio County, West Virginia. Project Director responsible for a 6-year (2014-2019) inspection project in compliance with the National Bridge Inspection Standards. The project includes a complete hands-on, in-depth periodic and two periodic visual inspections and three interim inspections for the Fort Henry Bridge, carrying I-70 across the Ohio River. The bridge consists of 10 spans with a steel tied arch main span of 577 feet-6 inches and an overall length of 1,660 feet. [2014-2019, AECOM]

West Virginia Department of Transportation - Division of Highways, McDonalds/Upper Plaza (WV 2), Moundsville, Marshall County, West Virginia. Project Director responsible for Design Study, Contract Plans, Traffic Analysis, and Environmental (NEPA). This project consists of widening WV Route 2 in Moundsville to five lanes, realignment of the WV 2/US 250 intersection, traffic signalization, and the replacement/widening of two bridges. Project also includes public involvement, utility coordination, and right-of-way acquisition plans. [2014-2015, AECOM]

West Virginia Department of Transportation - Division of Highways, NBIS Inspection of the Rubles Run Bridge (WV-43) over Rubles Run, Monongalia County, West Virginia. Project Manager responsible for a 6-year (2013-2018) inspection project in compliance with the National Bridge Inspection Standards. The project includes a complete hands-on, in-depth periodic and two periodic visual inspections for the Rubles Run Bridge on the Mon-Fayette Expressway. The dual, curved, six-span continuous weathering steel plate girder bridge, constructed in 2003, consists of plate girders and has an overall length of 1,387 feet. The superstructure is supported by high level reinforced hollow concrete piers and reinforced concrete abutments. [2013-2018, AECOM]

West Virginia Department of Transportation - Division of Highways, NBIS Inspection of the Colonel Zackquill Morgan Memorial Bridge (WV-43) over Morgan Run and CR 71, Monongalia County, West Virginia. Project Manager responsible for a 6-year (2013-2018) inspection project in compliance with the National Bridge Inspection Standards. The project includes a complete hands-on, in-

American Society of Civil Engineers,
- Member
- Pittsburgh Section Structures Group – Member, 1988-1992 Program Director, 1991 - 1992

American Society of Highway Engineers

Main Street Morgantown
- Board of Directors, 2010-2015
- Economic Restructuring, Economic Development Committee, 2001-present

Morgantown Area Chamber of Commerce,
- Monongahela River Recreation and Commerce Committee (MRRCC), 2009-present
- Transportation and Infrastructure Committee, 2000; 2012-present

Upper Monongahela River Association, Board of Directors; 2008-present

2007 World Steel Bridge Symposium, Conference Committee

Conference on Polymer Composites (sponsored by West Virginia University, WVDOT, FHWA)
- Steering Committee, 1999 Conference
- Steering Committee, 2001 Conference

Toastmasters International, Charter Member, Downtown Morgantown Chapter, 2004

Washington Area Council of Engineering Laboratories, Structural Steel Certification Program - Chairman, 1997

depth periodic and two periodic visual inspections for the Morgan Run Bridge on the Mon-Fayette Expressway. The dual, curved, six-span continuous weathering steel plate girder bridge, constructed in 2008, consists of plate girders and has an overall length of 1,400 feet. The superstructure is supported by high level reinforced solid concrete piers and reinforced concrete abutments. [2013-2018, AECOM]

Monongalia County Commission, NBIS Inspection of the County Sheriff Sgt. Michael Todd May Memorial Bridge (Hartman Run Bridge) Carrying Sabraton Avenue Over Cr 857 (Hartman Run Road) and Hartman Run, Morgantown, Monongalia County, West Virginia. Project Manager responsible for a Special Inspection project in compliance with the National Bridge Inspection Standards and the West Virginia Division of Highways Bridge Inspection Manual. The project included a Special Inspection to provide an independent review and to monitor the severely deteriorated deck, T-Beams, and bents identified in prior inspections of this 372 foot concrete arch bridge constructed in 1951. [2013, AECOM]

Arch Coal, Inc., Tygart Complex Railroad Siding Crash Wall, Thornton, West Virginia. Project Manager responsible for development of plans, specifications, cost estimates, and construction phase services for this railroad crash wall to protect the US 50 Bridge crossing Three Fork Creek in Taylor County. [2012, AECOM]

West Virginia Department of Transportation - Division of Highways, NBIS Inspection of the Corporal Thomas Bennett Memorial Bridge (I-79) over the Monongahela River, Monongalia County, West Virginia. Project Manager responsible for a 6-year (2012-2017) inspection project in compliance with the National Bridge Inspection Standards. The project includes a complete hands-on, in-depth periodic and two periodic visual inspections and three interim inspections for the Corporal Thomas Bennett Memorial Bridge, carrying I-79 across the Monongahela River. The bridge consists of nine spans, a three span continuous deck truss, three continuous deck girder spans and three continuous deck stringer spans with an overall length of 1,550 feet. [2012-2017, AECOM]

Maryland Transportation Authority, Evaluation and Rehabilitation of the Governor Harry W. Nice Memorial Bridge, (US 301) over Potomac River, Newburg MD and Dahlgren, VA. Structural Engineer responsible for the evaluation protective sealer options to extend the serviceability of the bridge deck on this 1.7-mile, two-lane bridge structure comprised of thru-truss, deck truss, continuous girder, and simple girder spans. Performed analysis and design, and developed specifications for crack repair and application of a high-performance silane sealer on the bridge deck. [2010-2011, AECOM]

CSXT Transportation, Inc. National Gateway Project (Stuart, Randolph, Carothers Tunnels, Morgan County, WV; Graham Tunnel, Alleghany County, MD). Engineer in responsible charge for the site work design, track plans, drainage design, erosion and sediment pollution control plans, and the post construction stormwater management design/plan preparation for four CSXT tunnel lining modification project locations in West Virginia and Maryland. Overall project involves clearance improvements and infrastructure enhancements along the CSXT track system in Ohio, Pennsylvania, Maryland, West Virginia, Virginia, and Washington DC. [2010-2011, AECOM]

West Virginia Department of Transportation - Division of Highways, Twilight Bridge (CR 39), Ohio County, West Virginia. Project Manager responsible for development of plans, specifications, and cost estimates for superstructure replacement and substructure rehabilitation for a 102-foot bridge over Middle Wheeling Creek, including approach roadway, temporary detour, utility coordination, and right-of-way acquisition plans. [2010-2012, AECOM]

US Route 35 Design-Build P3 Project, from WV 869 to Mason Cr 40, Putnam and Mason Counties, WV. AECOM's Project Manager during the design and construction phases, which involved the design of 14.6 mi. of new expressway, local roads, and four mainline bridges. AECOM's services have included environmental permitting, geotechnical engineering, erosion and sedimentation design, maintenance of traffic design, local roadway design, hydraulic studies, design of two mainline bridges, utility coordination and relocation, and ROW acquisition services. [2015-2019, AECOM]

West Virginia Department of Transportation - Division of Highways, I-79 TIF District Interchange Design-Build, Monongalia County, WV. Project Manager during the tender, design, and construction phases which involved the design of a new diamond interchange, 1.4 miles of new or reconstructed interstate, ramps, local roads, and overpass bridge, box culverts, and Reinforced Soil Slopes (RSS) structures. [2014-2016, AECOM]

West Virginia Department of Transportation - Division of Highways, Mon Fayette Expressway (WV 43), Monongalia County, WV. Project Manager for Construction Inspection services for this project which involved the design of 1.5 miles of 4-lane controlled access mainline, two interchanges, and multiple bridge, and box culvert structures. Services included inspection, quality assurance, materials testing, and documentation for clearing and grubbing, erosion and sediment control, earthwork, storm drainage, and three mainline bridge structures. [2009-2010, AECOM]

West Virginia Department of Transportation - Division of Highways, NBIS Inspection of the Fort Henry Bridge (I-70) over the Ohio River, Ohio County, West Virginia. Project Manager responsible for a 6-year (2008-2013) inspection project in compliance with the National Bridge Inspection Standards. The project includes a complete hands-on, in-depth periodic and two periodic visual inspections and three interim inspections for the Fort Henry Bridge, carrying I-70 across the Ohio River. The bridge consists of 10 spans with a steel tied arch main span of 577 feet-6 inches and an overall length of 1,660 feet. [2008-2013, AECOM]

WVU Morgantown Personal Rapid Transit, Creation and Implementation of a Fixed Guideway Structural Maintenance Program, Morgantown, West Virginia. Project Manager responsible for the creation and implementation of a structural maintenance program. The WVU-MPRT is a completely automated transit system having passenger stations on each of the three University campuses and in the Morgantown central business district and provides passenger transport service for University students, staff, faculty, city residents and visitors. Initially conceived and constructed as an Urban Mass Transit Administration demonstration project, it was built in three phases between 1971 and 1979. Of the system's 8.7 miles of single lane guideway, about 54% of the guideway is elevated. The project also included inspection of all guideway structural components. [2008-2009, AECOM]

West Virginia Department of Transportation - Division of Highways, Mon Fayette Expressway (WV 43), Monongalia County, West Virginia. Structural Project Engineer during the design phase and as Project Manager during the bidding and construction phases which involved the design of 1.5 miles of 4-lane controlled access mainline, two interchanges including a high-speed, tri-level connection with I-68, 1.9 miles of new or reconstructed local roads, and multiple bridge, box culverts, and retaining wall structures. [1998-2011, AECOM]

Federal Bureau of Prisons, FCI McDowell, McDowell County, West Virginia. Project Engineer for the design-build contract for the $225 million facility. Services included drainage, stormwater management, and erosion and sedimentation control. [2005-2009, AECOM]

West Virginia Department of Transportation - Division of Highways, Elkins Bypass from Aggregates to Sullivan Junction, Randolph County, West Virginia. Project Manager responsible for development of plans, specifications, and cost estimates for the Elkins bypass project. The project involved design of three miles of partially controlled access highway, two interchanges, and eight bridge structures. [1998-2006, AECOM]

County of Los Angeles Department of Beaches and Harbors, Marina del Rey Seawall Refurbishment, Marina del Rey, California. Project Structural Engineer responsible for structural analysis and design, repair plans and specifications for the refurbishment of 7.5 miles of reinforced concrete seawall. [1995-1996, WDP]

David Sawitzki, M.A.Sc.,PE

Principal Geotechnical/Dams Engineer

Professional summary

Mr. Sawitzki is a Principal Geotechnical Engineer and Program Development Manager with over 30 years of multi-disciplinary engineering experience. Prior to joining AECOM in May 2013, he spent 15 years in the Midwest as a Principal Geotechnical Engineer and Midwest Engineering Manager for a major consulting company and before that, he spent 8.5 years in Central Florida as a design geotechnical engineer and project manager. Mr. Sawitzki has been the Program Manager for large multi-million dollar client contracts with major private and public sector clients. He has worked on numerous projects covering the geotechnical and hydraulic and hydrologic aspects of large scale dam and waste disposal facilities. He has developed subsurface exploration plans to define subsurface conditions and laboratory testing programs to evaluate soil properties for various types of projects. He has performed slope stability analyses using multiple slope stability programs including UTEXAS and SEEP/W, seepage analyses using two-dimensional finite difference and finite element programs including SEEP2D and SEEP /W and three dimensional seepage analyses using FEFLOW.

Mr. Sawitzki has completed and directed the completion of at least six geotechnical, groundwater and engineering designs in support of projects at Camp Dawson through the Army National Guard developing a strong understanding of the geotechnical and groundwater seepage conditions in the Cheat River valley.

Mr. Sawitzki acted as been Program Manager for more than 10 significant USACE projects including the Construction QA oversight of Mosul Dam in Iraq as well as geotechnical investigation and engineering and risk evaluations for USACE dams including Wolf Creek Dam, Rough River Dam, Nolin Lake Dam, Green River Lake Dam. Other earth dam/levee design work Mr. Sawitzki has conducted include raising the Metro Center Levee along the Cumberland River in Nashville, TN, final design and construction of the Whipps Mill Roller Compacted Concrete (RCC) dam/emergency spillway in Louisville, KY, evaluation and inspection of 16 dams owned by the City of Louisville Metro Parks system.

Professional qualifications

Professional Engineer, Florida 1993 [redacted] lapsed

Professional Engineer, Kentucky 1999 [redacted]

Education

B.S.E, Civil Engineering, Geological Engineering Program, Princeton University, 1988

M.A.Sc., Civil Engineering, Geotechnical Engineering Program, University of Waterloo, 1989

Memberships

American Society of Civil Engineers (ASCE)

Association of State Dam Safety Officials (ASDSO)

Society of American Military Engineers (SAME)

Detailed Project List – Earth Dam and Levee Experience

USACE Louisville District, Preliminary Design, Rough River Dam Conduit Cutoff Wall Construction, Falls of Rough, Kentucky, 2017 – Project manager responsible for team of subject matter experts in risk assessment, geology, geotechnical engineering, construction field techniques, construction cost estimating and hydrology/hydraulics to develop construction designs to construct the planned dam cutoff wall around and below the primary dam spillway conduit. AECOM's experts evaluated the infrastructure risk associated with construction on a critical dam, developing various construction alternatives to address short and long-term risk, evaluated and ranked the various alternatives, determined construction cost estimates, developed

a 30% design, prepared a detailed presentation and presented the results to communicate findings to the USACE project team. Rough River Dam consists of an earthen embankment about 1,600 feet long and 130 feet high and the primary spillway conduit is a 12-foot by 12-foot semi-elliptical conduit cast-in-placed on bedrock that transitions from limestone to a geologically overlying layer of shale. Poor layers of rock beneath the conduit including a large number of connected karst features indicated a need to evaluate various options to close the "window" around and beneath the conduit to effectively complete the cutoff. The objective of this task order was to provide preliminary design alternatives that address the failure modes in and around the conduit and evaluate risk and cost for each. Completed on time and within budget with Very Good CPARS ratings for Quality, Cost Control, Schedule and Management.

Dam Safety Risk Assessments, USACE Louisville District, 2009. Task order manager and senior engineer responsible for support of a task order to complete Seepage and Piping Toolbox risk analyses. Work completed for four major Corps flood control projects including Rough River Dam, Nolin Dam, Green River Dam and Brookville Dam. Acted in the role of senior engineer or ITR for risk analyses for 3 of 4 dam studies including participation on two Probable Failure Mode Analyses (PFMA) sessions and one Expert Elicitation (EE) session. Prepared or reviewed fragility curves for risk analysis in accordance with the seepage and piping methodologies established by the Corps. Completed sections of the Issue Evaluation Study (IES) reports as well as Dam Safety Modification Study (DSMS) reports. Task order included completion of stability analyses using Computer program SLOPE /W and coordination of a second additional EE session.

Nolin Lake Dam Investigation and Risk Assessment, USACE Louisville District, Bee Spring, KY, 2009. Task order manager and ITR engineer responsible for support of two task orders to support the Louisville District in the evaluation of dam condition and risk. Investigation work included 25 individual borings, 1,324 LF of soil drilling, over 637 SPT samples and 39 undisturbed samples, 1,294 LF of vertical and 1,414 LF of angled rock coring, 586 LF of piezometer installation, 122 hydraulic pressure tests and hundreds of soils tests as well as geophysical resistivity and ground penetrating radar to provide field and laboratory data to evaluate existing conditions of concern. The second task order involved being the senior engineer and ITR for a risk assessment that included attendance on a PFMA team, analysis and development of fragility curves for 5 seepage and piping failure modes and preparation of Issue Evaluation Study write-ups documenting our results. Performed toolbox analyses to develop system response (fragility) curves using, "Risk Analysis for Dam Safety – A Unified Method for Estimating Probabilities of Failure of Embankment Dams by Internal Erosion and Piping Guidance Document," Version: Delta, July 2008 for specific potential failure modes (PFM). Each failure mode was evaluated for multiple pool levels.

Wolf Creek Dam Seepage Analysis, Nashville District USACE, Russell County, Kentucky, 2006. Project Manager/Sub-Task Order Manager to review and summarize 20 years of piezometric data, created and executed several seepage scenarios using a 3D finite element program (FEFLOW) and coordinated results with other task results to identify trends and likely failure modes for this dam which has an earthen embankment length of approximately 3,700 feet and height of 200 feet. Over 300 piezometers and other groundwater pressure monitoring points were reviewed, cleaned to remove erroneous and/or incorrect data and combined into groups to evaluate sections through the dam, the rolled embankment materials and/or the foundation materials. Trends and areas of concern were identified and graphically presented through use of graphs and 3D visualization software (EVS). Completed a 3D ground water seepage model of the earthen embankment portion of the dam using FEFLOW software to evaluate the potential for seepage around an existing diaphragm cut-off wall through the earthen embankment and foundations soils. Results of these analyses were similarly added to a 3D visualization software and compared with the piezometric date to evaluate seepage scenarios. Subsequently completed review of laboratory rock test data obtained as part of characterization program for bedrock beneath the dam foundations likely contributing to documented seepage problems.

Detailed Project List – Camp Dawson Experience

MRF Range Geotechnical Study, WVARNG, Camp Dawson, West Virginia, 2007. Project manager responsible for geotechnical study in support of a new Modified Record Fire (MRF) Range. Project included site assessment and providing site preparation, pavement and foundation recommendations for a 30+ acre range, supporting buildings and an approximately 1/5-mile long access road to be located on rough, hilly

terrain. Provided layout support, completing geotechnical borings, laboratory testing, and geotechnical engineering recommendations for civil and structural design. Work completed to optimize rock and soil bearing foundations.

Multi-Purpose Building, WVARNG, Camp Dawson, West Virginia, 2008, $24,000. Geotechnical principal-in-charge responsible for geotechnical study for a planned 2-story Multi-Purpose Training Building. The planned building will have a footprint of approximately 75,000 square feet and structural loads of 150 Kips for column loads were considered. To develop recommendations for a foundation system to support this building on the relatively soft alluvial soils of the Cheat River Floodplain, 8 borings were advanced to bedrock. A design report was prepared with recommendations for careful site preparation and construction of a shallow spread footing foundation system which saved significant costs over other deep foundation options.

South Gate Road Geotechnical Slope Repair, WVARNG, Camp Dawson, West Virginia, 2008, $68,829. Geotechnical principal-in-charge responsible for geotechnical study in support of a slope repair to prevent South Gate Road from sliding into the Cheat River at Camp Dawson, WV. Project included advancing 10 borings to top of bedrock and into bedrock within a 300-foot failed slope area, surveying of the failed road and slope, completion of a thorough laboratory testing program and developing a typical cross section that described the failing slope conditions. Computer program SLOPE /W was used to back-calculate soil and rock properties given the surveyed slope and road geometry. Subsequently, a series of slope repair design concepts were evaluated geotechnically and structurally and presented to the Owner for selection of the repair approach. Finally, complete civil and structural plans and specifications were prepared for the selected repair option and prepared for Contractor bidding.

Hydrogeologic Groundwater Assessment, WVARNG, Camp Dawson, West Virginia, 2008, $51,900. Geotechnical principal-in-charge responsible for hydrogeologic groundwater assessment of portions of Camp Dawson, WV. This study was performed to aid in understanding the surficial/groundwater interaction at Camp Dawson within the 410-acre cantonment area. Relatively high groundwater levels have caused challenges for various development projects. Six borings and six monitor wells were installed to investigate subsurface conditions and measure subsurface transmissivity of the alluvial soils as well as bedrock beneath the site. Field and laboratory data was used to develop a computer model of the area using three dimensional model MODFLOW. Once calibrated to the site conditions the model was used to evaluate several potential solutions to control high groundwater levels. A French drain system proved to be the most effective.

JITC Geotechnical Study, WVARNG, Camp Dawson, West Virginia, 2008, $30,888. Geotechnical principal-in-charge responsible for geotechnical study for a planned 3- to 4-story Joint Interagency Training Center (JITC). The planned building will have a footprint of approximately 150,000 square feet and structural loads of 300 Kips and 4.0 KLF for column and wall loads were considered. To develop recommendations for a foundation system to support this building on the relatively soft alluvial soils of the Cheat River Floodplain, 12 borings were advanced to bedrock and 6 were advanced up to 10 feet into bedrock, while an additional 6 borings were completed in parking areas. A deep foundation system consisting of auger cast-in-place piles was recommended to support the planned structure within the dense sands and gravels beneath the site.

Guest House Residence Building, WVARNG, Camp Dawson, West Virginia, 2009, $15,000. Geotechnical principal-in-charge responsible for geotechnical study for a planned Guest Visitor Residence Building. The planned building is to be constructed over a large filled area and, while this is to be a relatively lightly loaded structure, construction on the relatively significant fill depths represents a significant potential risk. Structural loads will be on the order of 50 Kips for column loads. To develop recommendations for a foundation system to support this building on the deep fills, 4 borings were advanced through the fill to bedrock. A design report was prepared with recommendations for site preparation and construction of a shallow spread footing foundation system.

AECOM

G. Michael McIntyre, PE
Geotechnical Engineer
Dams Practice Team Lead

Education
MEng, Geotechnical, Construction and Structural Engineering, George Mason University, 2013
MBA, Finance, Florida State University, 2003
BS, Mechanical Engineering, Florida State University, 2002

Registrations & Certifications
PE, West Virginia [redacted]
PE, Florida, [redacted]
PE, Virginia, [redacted]
PE, Maryland, [redacted]
PE, New York, [redacted]
PE, Georgia, [redacted]
AECOM Certified Project Manager

Years of Experience
With AECOM: 10
With Other Firms: 6

Affiliations
Association of State Dam Safety Officials (ASDSO)
Society of American Military Engineers (SAME)
American Society of Civil Engineers (ASCE)
United States Society on Dams (USSD)

Mr. McIntyre has over 16 years of experience in design and construction quality control of Civil projects. Since joining AECOM he has focused his practice on the inspection, investigation, design and construction, as well as management, of dam projects. This has included design calculations, assessment reports, design reports, geotechnical analysis reports, basis of design reports, emergency action plans, O&M manuals, foundation recommendations, subsurface investigations, dam inspections, slope stability and seepage analysis for existing dams and dam modifications, seismic failure analysis, reviewing third-party inspection reports for construction materials testing, materials selections, design of dam modifications, and review of technical plans and specifications, the review of construction documents such as submittals and requests for information, and engineering support during construction. He has been responsible for the preparation of geotechnical engineering analysis for existing dams and dam modifications, responsible for providing technical input such as design calculations and analysis for dam rehabilitation projects, the oversight of geotechnical subsurface exploration, provided technical assistance to design team members, clients, contractors, and other team members during design and construction. Currently he serves as the Dams Practice Lead for the Southeast Region.

Projects

Greenbrier Dam, Maryland Department of General Services, Boonsboro, Maryland Served as Project Manager and Engineer in Charge of design and construction. This project consists of the investigation, analysis, design and rehabilitation construction oversight for Greenbrier Dam. The dam is 445 feet long earth embankment dam and 64 feet high and impounds an approximately 27-acre lake.

Mosul Dam, United States Army Corps of Engineers, Iraq. Provided support to the Project Manager as the Deputy Project Manager for client coordination with the USACE, and general project management including coordination with the USACE staff and other AECOM support both inside and outside of the continental United States. Support included participation in multiple weekly coordination meetings, supporting clearance and background requirements for staff, health and safety support, assisting in project deliverables, aiding in procurement of equipment for delivery to the project site. Additionally, provided office support for the drilling, characterization and grouting operations. Also, managed the AECOM reachback support for the contractor derived construction submittals and RFIs as well as deliverables to the USACE.

Beech Creek Dam, Kentucky Division of Water, Manchester, Kentucky. Provided engineering support to the local Kentucky office during the construction phase of the rehabilitation. Performed engineering analysis and interpretation of field test results to evaluate the in-place material density, and the suitability of on-site soils and materials. Performed engineering review of technical submittals and reviews of testing and inspection reports. Also, assisted the local project manager with client relations and general project management.

Johns Creek #1, #2, #3 and #4, Upper Blackwater #4, and South River #6, #7, #11 and #27 Dam Assessments, NRCS – Virginia, various locations in Virginia. Assisted in the preparation of the dam rehabilitation reports. This included a site inspection of the embankment crest, upstream slope, intake structure, abutment contacts, earthen emergency spillway or concrete emergency spillway, downstream slope, outlet pipe, stilling basin, gates, reservoir/watershed, monitoring instruments, and downstream hazard issues. Also, performed engineering support during the preparation of the Dam Rehabilitation Reports. This included O&M (operation and maintenance) review, determination of rehabilitation needs, hazard classification, rehabilitation alternatives analysis with cost estimates and estimated durations, and inundation mapping analysis. Additionally, provided engineering support during the preparation of the risk evaluation. This included evaluation of the consequences of dam failure (loss of life estimates, infrastructure impacts estimates, environmental impacts estimates), static failure analysis (principal spillway system analysis, seepage and deformation analysis, embankment monitoring), hydrologic failure analysis, and seismic failure analysis.

Rough River Dam, United States Army Corps of Engineers, Falls of Rough, Kentucky. Provided support to the Project Manager, as the Assistant Project Manager, for financial management, client coordination with the USACE, and general project management including coordination with other AECOM office support (e.g. Structural Engineer – Denver, Colorado). Aided in managing tasks performed locally and coordinating overall work efforts by the project team. Also, coordinated with AECOM federal procurement to contract subcontractors.

Fort A.P. Hill Dam Rehabilitation, United States Army Corps of Engineers, Bowling Green, Virginia. Responsible for the coordination of subsurface exploration and preparation of the geotechnical engineering analysis report. This included material characterization, developing material properties (friction angle, cohesion, strength properties), seepage, slope stability analysis, filter compatibility analysis and alternatives analysis for the three dams. Seepage and slope stability analysis were performed using finite element CAD software; specifically Geo-Slope International GeoStudio 2007 SEEP/W and SLOPE/W.

College Lake Dam, City of Lynchburg, Lynchburg, Virginia, Served as Project Manager in the final stages of the contract. AECOM prepared preliminary engineering designs, conceptual

plans, cost estimates, and schedules for the two proposed alternatives to provide the City with the data necessary to move forward on a course of action to bring the College Lake Dam into full compliance with the Virginia DCR Dam Safety regulations. Specifically, AECOM performed surveys, a geotechnical investigation, wetlands identification, low-level outlet (control structure) repair, sediment removal analysis, traffic management, preliminary construction schedules, and preliminary construction cost estimates. A sediment transportation evaluation was also performed. This included a geomorphic assessment of channel areas and an analysis of sediment trapping efficiency of the lake. AECOM also developed a strategic communications plan to provide the City of Lynchburg, along with the City's partner, Lynchburg College, with a "roadmap" for conducting outreach activities during the engineering and investigation work at the College Lake Dam site. This included a significant public outreach effort composed of media communications, stakeholder meetings, a technical workshop, and a public Open House meeting.

Walkers Dam Rehabilitation, Newport News Waterworks, Newport News, Virginia. Performed geotechnical analysis including material characterization, developing material properties (friction angle, cohesion, strength properties), seepage analysis for the proposed rehabilitation conditions, and sheetpile analysis. Seepage analysis was performed using finite element CAD software, specifically Geo-Slope International GeoStudio 2007 SEEP/W. Also, performed technical edits of the technical specifications for construction. Additionally, assisted the resident engineer and project manager by performing engineering oversight and support during the construction phase including submittal reviews and reviews of testing and inspection reports.

Lake Marian Dam, Lake Linganore Association, Inc., New Market, Maryland, Senior technical support responsible for the QA/QC of the rehabilitation design. This included slope flattening, principal spillway extension, a new head wall, and a filter diaphragm.

Crumps Mill, Lake I, Lake F Dams, City of Suffolk, Suffolk, Virginia Responsible for various dam safety and permitting related tasks for these three City dam assets. This included conceptual level design of labyrinth spillway for Crumps Mill Dam as well as preliminary estimates of construction costs associated with the design.

Western Basins Flow Stabilization Reservoir 2 Levees, South Florida Water Management District, West Palm Beach, Florida Senior technical support responsible for the QA/QC and Engineer of Record for the geotechnical analysis of embankments on this project. Responsible for the analysis and design of approximately 50,700 linear feet of perimeter containment levee, 54,908 linear feet of inflow canal, 20,939 linear feet of discharge canal, and 10,039 linear feet of seepage management canals.

AECOM

Brian W. Boose, CEP

Environmental Impact Assessment & Planning Regional Lead

Areas of Expertise

National Environmental Policy Act (NEPA) Compliance

Natural/Cultural Resources Management

Environmental Due Diligence

NEPA Training & Workshop Facilitation

Preparation of Federal Energy Regulatory Committee (FERC) 7(c) Environmental Reports

Wetland delineation and assessment

Wetland mitigation and mitigation monitoring plan development and implementation

Section 404 and 401 permit acquisition assistance

Vegetation and wildlife habitat characterization and mapping

Water quality and fisheries analyses

Aerial photograph interpretation

Geological, soils, noise, and air quality analyses

Botanical and wildlife surveys, including threatened and endangered species surveys

Ecological baseline and impact/risk assessments, including natural resource damage assessments

Integrated Natural Resource Management Plans (INRMPs)

Integrated Cultural Resource Management Plans (ICRMPs)

Phase I cultural resource surveys

Regulatory agency consultation and coordination

Radiological testing and screening of contaminated properties

Hazardous waste site remediation and demolition

Phase I ESAs, EBSs, and ECOP documents

Education

Summary

Mr. Boose has over 29 years of continuous, progressive experience in the engineering and environmental services industry, both nationally and globally. He is technically proficient in National Environmental Policy Act (NEPA) compliance, natural and cultural resources management, and environmental due diligence assessments. He has demonstrated success in managing (and performing) large, multi-million dollar projects; global Federal programs; staff and teams ranging in size from two to over 500 personnel; Federal clients; Federal proposals; and virtually all aspects within the industry. His capabilities include comprehensive technical, business management, business development, and vision-setting and attainment skill sets.

Mr. Boose has experience working with Federal clients to include the US Army Corps of Engineers (USACE), the National Guard Bureau (NGB), US Navy (USN), US Air Force (USAF), Federal Emergency Management Agency (FEMA), Veterans Administration (VA), National Park Service (NPS), National Aeronautics and Space Administration (NASA), Department of Housing and Urban Development (HUD), US Coast Guard (USCG), Federal Communications Commission (FCC), Federal Energy Regulatory Commission (FERC), and Department of Energy (DOE), as well as an array of other Federal, state, local, and commercial clients. His work inciudes managing and developing 20 Environmental Impact Statements (EIS), 500 Environmental Assessments (EA), and 50 NEPA training courses nationally to include developing NEPA compliance handbooks and tools. Mr. Boose has worked in all 54 states and US territories, including preparing NEPA documents for Federal clients in over 48 states and US territories.

Experience

DOE, AEP Mountaineer CCS II EIS/ROD, West Virginia, Senior Quality Control/Quality Assurance Manager (as an independent third-party reviewer on behalf of DOE). Responsible for a large, complex EIS evaluating American Electric Power Service Corporation's (AEP) proposed Mountaineer Commercial Scale Carbon Capture and Storage Project (Mountaineer CCS II Project) under the CCPI Program. Project involved a proposed a new CO_2 capture facility, approximately 12 miles of transport pipeline, and deep injection of CO_2. Reviewed all portions of the document for technical accuracy, consistency, readability, homogeneity, and compliance with applicable DOE NEPA requirements.

West Virginia ARNG, Modified Record Fire Range (MRFR) at Briery Mountain EA/FNSI, Camp Dawson, West Virginia, Program Manager. Program Manager of an EA/FNSI for proposed training range. Field work included biological assessments for stream habitats using

AECOM

Timothy J. King, PG

Department Head, Geophysical Services

Education

BS, Geology, University of Maryland
1988

Licenses/Registrations

Professional Geologist, Pennsylvania, [redacted]

Years of Experience

With AECOM	33
With Other Firms	2

Training and Certifications

1989/40-Hour HAZWOPER
2014/8-Hour HAZWOPER Refresher
2000/Confined Space Entry Trained

Areas of Expertise

Engineering Geophysics
Geologic Hazards
Karst
Dams
Mines
Pipelines
Tunnels
HDD
Highways
Marine Facilities
Oil and Gas Facilities
Power Plants
NDT Testing
Geotechnical Instrumentation
Engineering Geology

Mr. King has built and is the leader of a geophysical services team in the Germantown, Maryland office. The team consists of eight staff ranging with experience levels ranging from junior to senior-level. As team leader Mr. King's management responsibilities include hiring, mentoring, technical oversight, scheduling and performance reviews. Mr. King's experience includes geohazards assessment and engineering geophysics, engineering geology, and hydrogeology applied to site investigations to evaluate subsurface conditions related to pipelines, storage tanks, terminals, processing facilities, well pads, tunnels, mines, highways, bridges, dams, and other civil infrastructure. He has been responsible for technical and management aspects of investigations at hundreds of sites across the United States. Mr. King has expertise in the application of geophysics to engineering and environmental problems. Geophysical and nondestructive testing methods he routinely utilizes include seismic refraction, multichannel analysis of surface waves, seismic reflection, tomography, microgravity ground penetrating radar, marine geophysics, vibration monitoring, electromagnetics, resistivity, geophysical borehole logging, and crosshole and downhole seismic surveying.

Experience

Principal Geologist/Geophysicist, Amistad Dam Joint Exploration/Investigation for Support of Dam Safety Modification Study, International Boundary and Water Commission, Texas/Mexico, 2015, $1,000,000. Provide senior technical support for the design and implementation of a comprehensive geophysical investigation to assess geologic, hydrogeologic and geotechnical conditions related to preferential seepage paths as part of the dam safety evaluation of a large dam founded on Karst terrain. The geophysical study included microgravity, electrical resistivity imaging survey, and multichannel analysis of surface wave survey (MASW). Downhole geophysics was completed in each boring to confirm the boring logs and provide additional data on the faults, fractures, and flow paths for the groundwater.

Principal Geologist/Geophysicist, Rocky Pen Run Dam Design Investigation and Construction Phase Services, Stafford County, Virginia 2003-2014. Designed, managed and conducted extensive engineering geology investigations for the design of a 130-foot high, 1,200 feet long earth dam, and ancillary structures including pump station, intake pipeline, saddle dikes and spillways. The investigation included geologic mapping, soil borings, test pits, rock coring, pressuremeter testing, seismic refraction, multichannel analysis of surface waves

AECOM

Scott L. Jones, PE, PhD
Principal Dams Engineer

Professional History

2004 - Ongoing, AECOM
2001 - 2004, Cornell University
2000 - 2001, University of Notre Dame
2000 - 2000, Cornell University
1996 - 2000, Texas A&M University
1995 - 1996, EQE International
1995 - 1995, Texas A&M University
1995 - 1995, Geomatrix Consultants

Education

PhD, Civil Engineering, Texas A&M University, 2000
MS, Civil Engineering, Texas A&M University, 1997
BS, Civil Engineering, University of California, Davis, 1994

Registrations/Certifications

P.E. Civil, California, [redacted]
P.E. Civil, Colorado, [redacted]
P.E. Civil, Connecticut, [redacted]
P.E. Civil, Delaware, [redacted]
P.E. Civil, Georgia, [redacted]
P.E. Civil, Idaho, [redacted]
P.E. Civil, Kentucky, [redacted]
P.E. Civil, Maryland, [redacted]
P.E. Civil, Montana, [redacted]
P.E. Civil, New Mexico, [redacted]
P.E. Civil, New York, [redacted]
P.E. Civil, Ohio, [redacted]
P.E. Civil, Oregon, [redacted]
P.E. Civil, Pennsylvania, [redacted]
P.E. Civil, Tennessee, [redacted]
P.E. Civil, Texas, [redacted]
P.E. Civil, Vermont, [redacted]
P.E. Civil, Virginia, [redacted]
P.E. Civil, Washington, [redacted]
P.E. Civil, Wyoming, [redacted]

Years of Experience

With AECOM: 15
With Other Firms: 5

Professional Affiliations

Association of State Dam Safety Officials

Training

Confined Space Training
OSHA 10-Hour Construction Safety

Dr. Jones has over 20 years of experience working primarily on the design and evaluation of concrete dams, and with structural design, as well as evaluation of appurtenant structures, such as radial gates and intake towers. He has extensive expertise evaluating the structural integrity of pipeline systems for seismic loading and fracture mechanics evaluations of structural systems.

Experience

Structural Design/Evaluation of Dams and Appurtenances

Principal Structural Engineer; Phase 1 Condition Assessments of Three Dams; Howard, Montgomery, and Prince George Counties, MD; Washington Suburban Sanitary Commission; May 2019-Present: Led inspections of and document review for structural features at Little Seneca Dam (99-foot high earth and rockfill dam with reinforced concrete principal spillway, rock cut auxiliary spillway, and reinforced concrete lined outlet tunnel), Duckett Dam (147-foot high reinforced concrete slab-and-buttress dam with central radial-gated spillway), and Brighton Dam (82-foot high reinforced concrete slab-and-buttress dam with central radial-gated spillway). Developed recommendations for additional studies to confirm the dams meet current dam safety criteria.

Principal Structural Engineer; Vail Dam Replacement Design; Riverside County, CA; Rancho California Water District; April 2019: Reviewed three-dimensional finite element analysis of new 155-foot high RCC gravity dam to replace a 145-foot high mass concrete arch dam. Review thermal analysis of RCC dam to design contraction joint spacing.

Principal Structural Engineer; Oneida Dam Concrete Rehabilitation Design; Franklin County, ID; February 2019-Present: Reviewed design to rehabilitate concrete at the 111-foot high mass concrete gravity dam. The design included selective demolition of the concrete on the downstream face of the dam to restore the dam to its original appearance.

Senior Structural Engineer; Bluestone Dam Safety Modifications; Summers County, WV; U.S. Army Corps of Engineers; September-October 2016: Performed QCC review of design to stabilize Bluestone Dam for the inflow design flood. The design included post-tensioned anchors and construction of a new stilling basin with super-cavitating baffles to replace an existing stilling basin that was deemed inadequate to pass the inflow design flood.

Principal Structural Engineer, Big Sandy Spillway Design; Lawrence County, KY; AEP; December 2019-Present: Reviewed spillway and stilling basin design in light of recent Oroville Dam spillway incident. Led redesign of spillway and stilling basin to address issues discovered in review.

Principal Structural Engineer; Ashokan Reservoir Dividing Weir and Spillway Replacement Project; NYC DEP; July 2018-Present: Leading studies to increase spillway capacity at the dividing weir separating the west and east basins of the Ashokan Reservoir and the Askokan Spillway, the principal spillway for the reservoirs. Developing alternatives to safely pass the design flood and extend the service life of these structures.

Jeff Blass, PE
Dams Engineering Project Manager

Education

Master of Business Administration (MBA), Loyola University Maryland, 2019

Master of Science (MSc), Civil Engineering, University of Maryland-College Park, 2007

Bachelor of Science (BSc), Civil Engineering, University of Maryland-College Park, 2005

Registrations

Professional Engineer
District of Columbia [redacted], 2013
Virginia [redacted], 2013
Maryland [redacted], 2010

Years of Experience

With AECOM: 1
With Other Firms: 16

Professional Affiliations

American Society of Civil Engineers (ASCE)
Association of State Dam Safety Officials (ASDSO)

Training

OSHA 10-Hour Construction Industry (Site Management) Outreach Training

Maryland Erosion and Sediment Control Certification

AECOM Certified Project Manager

Summary

Mr. Blass is experienced in the design, review, and analysis of a variety of civil engineering projects. He has extensive experience in dam inspections, hydrologic and hydraulic analysis, dam breach and floodplain analyses, environmental permitting, design for new dam, dam repair, and rehabilitation and dam retrofit projects, as well as construction inspection and oversight thereof. He has completed projects for low, significant, and high hazard dams, as well as numerous other types of water resources-related projects.

Experience

Washington Suburban Sanitary Commission, Dam Condition Assessments, Montgomery and Prince George's Counties, Maryland. Lead author for condition assessment reports of three dams (two Ambursen-style slab and buttress, one earth embankment) and their appurtenant structures. Project included review and catalogue of approximately 36,000 pages of documents, visual inspections, and preparation of assessment reports documenting the condition of each dam and providing recommendations for further dam safety-related analyses and modifications. Coordinated work among project team consisting of structural, hydraulic, and geotechnical engineers and geographic information systems professionals and with client representatives.

Carroll County Bureau of Resource Management, Piney Run Watershed Study, Sykesville, Maryland. Task Manager for comprehensive study of Piney Run Dam in compliance with Natural Resource Conservation Service Watershed Study guidelines. Study objectives are to assess the dam's spillway capacity and integrity as well as evaluate the dam for raw water supply. Coordinated work between engineers, scientists, technicians, and with the client to conduct investigations and prepare technical reports.

Montgomery County, Maryland Department of Environmental Protection, Railroad Branch Dam, Germantown, Maryland. Deputy Project Manager for evaluation and design of repairs for a slope failure on an existing embankment dam. Project included completion of hydrologic and hydraulic analyses including breach analysis, spillway integrity analysis and incremental damage assessment, geotechnical investigations including slope and seepage analysis, and development of repair design.

Howard County, Maryland Department of Public Works, Strawberry Fields Dam Repair, Ellicott City, Maryland. Lead engineer and project manager for a multi-disciplinary water resources project including major rehabilitation of a 17-foot-high significant hazard embankment dam. The

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Michael Greer, P.G

Senior Geophysicist

Areas of Expertise

Engineering Geophysics

Engineering Geology

Environmental Investigation and Remediation

Geologic Mapping

Biohazard Emergency Response

Education

MS, Geology, Geophysics, Wright State University, 2000

BS, Geology, Wright State University, 1998

Licenses/Registrations

Professional Geologist/2006/TN – [redacted] (inactive)

Professional Geoscientist/2014/LA-License [redacted]

Years of Experience

With AECOM	5
With Other Firms	1
With URS	14

Professional Associations

Environmental and Engineering Geophysical Society

Society of Exploration Geophysicist

Training and Certifications

Safety Trained Supervisor

OSHA 1910.120, 40 Hour Training/1998

OSHA 1910.120, 8 Hour Refresher, 2019

OSHA 1910.146, Confined Space Training, 2003

MSHA 30 CFR, New Miner Training, 2008

FAA Certified Remote Pilot

Summary

Mr. Greer is a Senior Geophysicist with 19 years of experience working on multidiscipline construction, infrastructure, superfund, and environmental projects for government and private sector clients. Experience includes managing field operations of geophysical surveys for environmental and engineering geophysics, engineering geology, and hydrogeology applied to site investigations for subsurface conditions related to hazardous waste sites, military facilities, power generating facilities, archeology, dams, and industrial facilities. Other experience includes numerous environmental and geologic investigations for air and bacteriological sampling, geologic mapping, and aquifer testing. Mr. Greer's skill set includes the following geophysical methods: Electrical Resistivity Imaging (ERI), Seismic Refraction, Multi-channel Analysis of Surface Waves (MASW), Electromagnetics, Magnetics, Ground Penetrating Radar (GPR), Bathymetry, and Pipe and Cable Locators and Tracers.

Experience

Seepage Evaluation, Department of Natural Resources (Maryland DNR), Greenbrier State Park Dam, Boonesboro, Maryland, Senior Geophysicist, 2019. Conducted extensive geophysical investigation to delineate seepage pathways beneath an earthen embankment dam. Investigations included bathymetry and land based electrical resistivity imaging, and seismic refraction. Project roles included data collection, processing and interpretation.

Inglis Dam Seepage Evaluation, Florida Department of Environmental Protection, Crystal River, FL, Senior Geophysicist, 2005. Assisted in conducted extensive geophysical investigation to delineate seepage pathways beneath an earthen embankment dam underlain by karstic carbonate bedrock. Investigations included bathymetry and land and marine based electrical resistivity imaging enhanced by injection of brine into a sinkhole in the reservoir bottom. Project roles included data collection and interpretation.

Dam Design, Black and Veatch Corporation, Fredericksburg, VA, Senior Geophysicist, Geophysics. Conducted seismic refraction and electrical resistivity surveys to determine depth and condition of subsurface materials. This information along with soil boring and coring logs was used to aid in the dam construction design for a reservoir located in Stafford County Virginia. Project roles included data collection and processing.

Dam Spillway Alternative Analysis, T. Nelson Elliott Dam, Black and Veatch Corporation, Manassas, VA, Staff Geophysicist. Conducted extensive seismic refraction survey to evaluate subsurface conditions regarding seismic velocities and layering of the subsurface materials. The information was compared to published tables correlating seismic

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Jennifer (Pyzoha) Warf

National DoD IAP Leader / DC Metro+ Department Manager
Impact Assessment & Permitting

Areas of Expertise

Project Management

NEPA Compliance

Natural Resources Surveys and Management Plans

Programmatic Biological Assessments

Wetland Delineations and Waterways Permitting

Fisheries

Education

MS, Environmental Studies, The University of Charleston, SC, 2003

BA, Zoology, Miami University, OH, 1999

Years of Experience

With AECOM	3
With Other Firms	15

Professional Associations

Society of Wetland Scientists

Training and Certifications

2017, Certified Project Manager (AECOM)

2015, Capture Management, AOC Key Solutions, Atlanta, GA

2015, VASS Executive Sales Training, Atlanta, GA

2015, Federal Energy Regulatory Commission (FERC) Environmental Review and Compliance for Natural Gas Facilities Workshop, Providence, RI

2014, Indiana Department of Transportation NEPA Training Refresher, Indianapolis, IN (5-day course, 2006)

Summary

Ms. Warf serves as the DC Metro Department Manager for AECOM's Impact Assessment & Permitting practice, and oversees approximately 40 full-time and 70 part-time NEPA, Natural Resources, and Cultural Resources Specialists in Maryland, Virginia, and Washington DC. In addition, she serves as AECOM's National Department of Defense (DoD) Lead for these services. She is a Senior Environmental Planner / Natural Resources Specialist with over 18 years of experience in preparing large-scale natural resources management plans and National Environmental Policy Act (NEPA) documents, leading coordination and consultation with regulatory agencies, obtaining waterways permits (e.g., Clean Water Act [CWA] Section 404/401 permits), and conducting ecological surveys. Ms. Warf is notably experienced with natural resources surveys, management, regulations, and issues specifically on DoD installations.

She has served as a project manager, author, or technical reviewer on 7 Environmental Impact Statements (EISs) and more than 50 Environmental Assessments (EAs) pertaining to the First Responder Network Authority (FirstNet), military training and testing, construction of new facilities, flood damage reduction, and natural resources management. She has served in a similar capacity on more than 50 documents/studies focusing on installation-level planning and natural resources management: Integrated Natural Resources Management Plans (INRMPs); endangered species management plans (ESMPs); biological assessments (BAs); Integrated Wildland Fire Management Plans (IWFMPs); Forest Management Plans (FMPs); and planning level surveys including topography, soils, surface waters, wetlands, flora, fauna, and protected species. Furthermore, Ms. Warf has worked in 50 states/territories across the U.S.

Experience

West Virginia ARNG, EA for Construction and Operation of Training Facilities on the Pringle Tract Training Area, CDCTC, Preston County, WV, QA/QC Reviewer, 2009-2011, $110.5K. Responsible for reviewing the EA. The Proposed Action involved development of improved training facilities for the WVARNG to facilitate training tasks necessary to operate within a built-up/urban area (e.g. Military Operations on Urban Terrain [MOUT]), Medium and Heavy Equipment Training, Tactical Training Base (TTB) training, and Vehicle Maneuver and Convoy training. The project allowed the client to remain in compliance with NEPA and other federal, state, and local laws and regulations.

DoD, INRMP Revisions and Updates, Various DoD Clients and Locations, Nationwide and International, 2004 – 2016. Served as Project Manager, Author, and/or Technical Reviewer on over 30 INRMPs and their associated NEPA documentation for the ARNG, Air National Guard, Asset Management Division, Environmental Branch (ANG/A7AN), U.S. Navy, U.S. Air Force (USAF) installations in the U.S. as well as one U.S. Navy and one U.S. Army Corps of

AECOM

Richard F Walker Jr., PE

Structural Engineer

Areas of Expertise

Structural Engineering
Dam/Hydraulic Structures
Forensics Engineering
Building Sciences
All-Hazard Mitigation
Risk and Vulnerability Assessment
Infrastructure Resilience

Education

MS/Civil (Structural) Engineering/May 2017/University of Maryland

BS/Civil Engineering, Minor: Mathematics/2009/Syracuse University

Licenses/Registrations

2014/Professional Engineer, MD, [redacted]
2016/Professional Engineer, NY, [redacted]

Years of Experience

With AECOM/URS:	10 years
With Other Firms:	2 years

Professional Associations

American Society of Civil Engineers
Structural Engineering Institute
American Institute of Steel Construction
American Concrete Institute

Trainings and Certifications

2017/OSHA Aerial Work Platform
2015/OSHA Confined Space
2014/OSHA 10-Hour Safety

Summary

Richard Walker is a Structural Engineer with 10 years of experience in the AECOM Water Business Line in the DC Metro Area. His experience includes structural design and evaluation of concrete dams, hydraulic, and site civil structures including appurtenant structures. His structural design experience includes reinforced concrete, masonry, steel, wood, and light gauge metal framing structures. He also has experience performing structural condition assessments, stability analysis of environmental structures, all-hazard risk and vulnerability assessments of infrastructure, security engineering, infrastructure resiliency and research, post-disaster forensic engineering studies, building code research, and building mitigation against man-made threats and natural hazards. Mr. Walker also has experience performing construction phase services including performing structural quality assurance/control checks, reviewing submittals, and responding to RFIs.

Relevant Project Experience

PacifiCorp, Cutler Surge Tank Inspection and Anchorage Design Project, Box Elder County, Utah. November 2019 – Present. Performed a limited visual inspection and obtained steel thickness measurements via NDT methods of the interior of the surge tank at Cutler Hydroelectric Plant. Project technical lead for providing a design for replacing/rehabilitating the surge tank and upgrading anchorage. Prepared alternatives evaluation at the concept level prior to detailed design to inform PacifiCorp decision.

Georgia Power, Plant Scherer AP-1 Ash Basin Closure, Monroe County, GA. June 2019-Present. Structural engineer responsible for the structural design of spillway and appurtenant structures for the Ash Basin Closure design. Structures included reinforced concrete design of a triple box culvert, culvert headwall and wingwalls, pavement for auxiliary spillway overtopping protection, drop-inlet structures, bolster sump structures, and transformer containment pads.

City of Reading, Bernhart Dam Proposed Construction Breach, Reading, PA. January 2020 – February 2020. Evaluated the structural stability of the proposed construction breach of the primary spillway at Bernhart Dam.

Phase 1 Condition Assessments of Three Dams; Howard, Montgomery, and Prince George Counties, MD; Washington Suburban Sanitary Commission; May 2019-Present. Staff level structural engineer on a multi-disciplinary team tasked with conducting a phased engineering and safety investigation of the dams and its

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T. Kristopher Wachtel, Ph.D., EIT

Associate Dams Engineer
Geotechnical Engineer

Education

Doctor of Philosophy, Civil Engineering, West Virginia University, 2016
Master of Science, Civil Engineering, West Virginia University, 2012
Bachelor of Science, Civil Engineering, West Virginia University, 2011

Years of Experience

With AECOM: 3 years
With Other Firms: 2 years

Computer Experience

AutoCAD®
GeoStudio®
Precision Tree®
SoilVision®
ArcGIS®
Microsoft Office®

Mr. Wachtel is an associate dams/ geotechnical engineer with over 5 years of experience working for the USDA Natural Resources Conservation Service-West Virginia (NRCS-WV) and AECOM. Kris concentrated his studies and work experience on dam rehabilitation and inspection. He has performed seepage and slope stability analyses, assisted in creating design alternatives for existing dams, created new and revised existing Emergency Action Plans for domestic water supply dams, and developed geotechnical investigation plans and laboratory testing procedures for embankment dam projects.

Project Experience

South Florida Water Management District, Western Basins Flow Stabilization Reservoir 2, West Palm Beach, FL (AECOM). AECOM is finalizing the design for the expansion 2 project, which will be constructed on approximately 1,800 acres of land located southwest of STA-1W. AECOM has completed the preliminary studies, including topographic and boundary surveys, geotechnical exploration, testing and analysis, and H&H modeling and is currently completing the design.

Maryland Dept. of General Services, Greenbrier Dam Repairs, Boonsboro, MD (AECOM). Project consists of the investigation, analysis, design, and rehabilitation construction oversight for Greenbrier Dam. The dam is a 445 feet long earth embankment dam and 64 feet high and impounds an approximately 27-acre lake.

Lake Linganore Association, Inc, Lake Marian Dam Design Services During Construction, Frederick, MD (AECOM). AECOM performed geotechnical investigation of Lake Marian for slope repair. Project consisted of investigation, analysis and oversight of construction.

City of Manassas, Micron Pond Investigation, Manassas, VA (AECOM). AECOM performed investigation and analysis for potential modifications to an existing dry pond.

Montgomery County Department of Environmental Protection, Railroad Branch Dam Emergency Repair, Germantown, MD (AECOM). Project consists of investigation, analysis and development of design alternatives for repair of an embankment dam.

West Virginia Conservation Agency, Upper Deckers Creek Site 1 Dam, Arthurdale, WV (NRCS-WV). NRCS-WV provided oversight on analysis, design, and construction for rehabilitation of an embankment dam. Rehabilitation included construction of

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Wesley Hollenbach
Dams Engineer

Professional History

2018 - Present
AECOM Dams Engineer

2014 - 2018
Gannett Fleming, Inc.
Hydrologic and Hydraulic Engineer

2013 - 2014
BL Companies
Staff Engineer

Education

BSE, Environmental Engineering
Messiah College, 2012

Registrations

PE, Maryland, [redacted]
PE, Pennsylvania, [redacted]
PE, Georgia, [redacted]
PE, Virginia, [redacted]
Certified Floodplain Manager (CFM)

Years of Experience

With AECOM: 2 years
With Other Firms: 6 years

Professional Affiliations

Association of State Dam Safety Officials (ASDSO)

Training

OSHA 10-Hour Construction Safety

Wesley is a dams engineer located in the Germantown, Maryland office. He has 8 years of experience working on dam related projects specializing in hydrologic and hydraulic analyses.

Experience

Maryland Department of General Services, Greenbrier Dam, Boonsboro, MD. Completed a detailed hydrologic model using HEC-HMS software to evaluate the contributing watershed to the dam and a detailed HEC-RAS dam break model. Created inundation mapping and wrote a technical a dam breach analysis report. Flood routing results were used to determine the hazard potential of the dam and resulting spillway design flood. Performed field work included drilling inspection, overall dam condition inspection, survey of hydraulic structures downstream of the dam and construction of sandbag weirs to capture and monitor seepage on the downstream slope of the dam. Implemented a remote instrumentation alarm system to notify parties of the current conditions at the dam. Designed the rehabilitation of two access roads leading to the dam totaling over one mile in length.

Railroad Branch Dam, Montgomery Country, MD. Completed a detailed hydrologic model using HEC-HMS software to evaluate the contributing watershed to the dam and a detailed HEC-RAS dam break model. Performed an incremental damage assessment of the dam to aid in the selection of an appropriate spillway design flood for the dam. Created inundation maps based on the revised spillway design flood and wrote a technical a dam breach analysis report. The flood routing results were used to determine the hazard potential of the dam and drive the rehabilitation alternatives for the emergency repairs of a slope failure of the embankment.

Lake Linganore Association, Marian Dam, Frederick Country, MD. Designed a dam rehabilitation for an embankment dam that required emergency repairs due to a slope failure on the downstream slope. The rehabilitation included flattening the downstream slope, designing a multistage filter system including a filter diaphragm, and designing a new impact basin to provide energy dissipation at the outlet of the principal spillway pipe.

Confidential Client, Confidential Dam Condition Assessment, Eastern, MD. Conducted a comprehensive safety evaluation and condition assessment of the dam by completing a visual dam inspection, a detailed review of the original engineer design of the dam, a detailed hydrologic model using HEC-HMS software to evaluate the contributing watershed to the dam, and a detailed HEC-RAS dam break model. Created inundation mapping and wrote a technical a dam breach analysis report. Flood routing results were used to determine the hazard potential of the dam and resulting spillway design flood.

Relevant Project Experience

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER	**1**	
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
Architectural and Engineering Services for Dam Safety Modification Mandatory Center of Expertise (DSM MCX), USACE (Nationwide Indefinite Delivery Indefinite Quantity Contract) Various Locations, Nationwide	2020	N/A

PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER & ADDRESS
US Army Corps of Engineers (USACE), Huntington District	Stephen Spoor	304-399-5204 502 8th Street, Huntington, WV 25701

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

Project Overview

This contract demonstrates our experience in providing high-end engineering consulting and design services to the USACE National Dam Safety Modification Mandatory Center of Expertise (DSM MCX). The work includes support to the USACE on dam, levee, and navigation projects, including inflow design flood updates, technical reviews, dam study support, risk analysis, computational fluid dynamics (CFD) modeling, instrumentation database management, and Dam Safety Modification Study support. We have also executed flood damage reduction designs under this contract providing full plans and specifications, value engineering study and engineering services during construction of this 4-year construction project.

Through this contract AECOM has provided National and International consultants to the USACE mission to solve unique and challenging problems.

AECOM was awarded the USACE five-year nationwide IDIQ in 2015 and the master contract was closed in early 2020. We have successfully re-competed to win the subsequent contract to serve the same Center through 2024. Under the completed contract, AECOM successfully executed 23 task orders with a total value of $7.265M

Services include a full range of architectural/engineering for assessment and design of dams, levees and flood protection projections including dam rehabilitation/modification, design review, and construction management services. The overall goal of the DSM MCX is to manage and reduce the overall Risk represented by the portfolio of dams owned by the USACE through consistent and focused modifications using the latest techniques and design approaches. Services included site inspections, hydrology and hydraulic assessments, conceptual designs, risk review, subsurface investigations, design, preparation of technical reports, plans and specifications, drawing review, value engineering, technical analysis, engineering evaluations, construction QA oversight, and surveys associated with evaluation, modification, and design of USACE projects throughout the US.

Project Features:

- ☑ Final Design Analyses
- ☑ Final Rehabilitation Design Documents
- ☑ Nationwide IDIQ
- ☑ Dam Assessment
- ☑ Design & Design Review

Duration: 2015-2020

Cost (fee): $7.265M

Schedule: All projects were completed in accordance with contract schedule over several task orders.

Key Personnel: G. Michael McIntyre, John D. Bowers, David Sawitzki, Bob Pinciotti

Representative Projects Under this Contract Include:

Inflow Design Flood (IDF) Hydrograph updates for 3 USACE Dams (Mohawk, Bolivar and Dover Dams), Ohio. The purpose of this project was to update the Inflow Design Floods (IDFs) for Mohawk, Bolivar, and Dover Dams located in Ohio with other upstream USACE flood control dams that will be considered in the development of the IDFs. These Dams are part of a system of 16 dams built in the Muskingum Watershed to provide flood control and flood risk management in the Muskingum River Basin. All three dams are "dry dams" and do not retain a permanent pool during any season of the year. AECOM performed following tasks for Mohawk, Boliver and Dover dams:

- Review Prior Studies / Literature Review / Data Compilation
- Review of Supplied Hydrology/Routing Model
- Development of Calibrated Observed Events
- Selection of Hydrologic Parameters for IDF Application
- Validation of Calibrated Events

- Modification of Hydrologic Model Application to IDF based on validated parameters
- Development of Probable Maximum Precipitation
- Develop Required IDF Scenarios and Evaluate Sensitivity of hydrologic parameters
- Develop Wind Setup / Wave Run-up Heights
- Prepare Final Report

Bluestone Dam Bar Anchor Failure Evaluation, Hinton WV 2015 – Used senior subject matter experts in the evaluation of a failed high tensile (150ksi) steel anchor bar that failed prematurely. The evaluation included review of mill certifications and tensile properties reported for multiple heats to confirm conformance with ASTM A722, conducting physical and metallurgical tensile testing of failed bar including tensile testing, X-Ray Spectrometry, Scanning electron microscope fractography, hardness testing and chemical analyses. The bar was found to have been improperly heat-treated resulting in low tensile strength which led to failure. Receive Exceptional CPARS ratings for Cost Control, Management and Utilization of Small Businesses and Very Good ratings for Quality and Schedule. Cost $50k.

Dover Dam Foundation Modification Draft Final Report, Dover, OH 2015 – A team of geotechnical engineers gathered all the final construction completion date and QA/QC construction documentation and prepared a Draft Finai Foundation Report documenting the completion of various Dam afety Assurance (DSA) construction project. Project included the installation of 137 multi-strand anchors, drilled shaft foundation elements, cast-in-place concrete parapet walls and pre-cast concrete wall panels, stop log closure structure and installation of stone slope protection. Report was prepared in accordance with ER 1110-1-1901. Project was completed on time, quality completed in accordance with the task order specific Quality Plan, and within budget. Received Exceptional CPARS ratings for Quality, Schedule, Cost Control and Management. Cost $250k

Mosul Dam Safety Modification Study Subject Matter Expertise, 2016. AECOM provided a team of 5 geotechnical, geology and construction risk experts along with a professional facilitator to conduct a series of meetings to review the history of Mosul Dam in Iraq and develop Quantitative Risk Estimates presented by the dam to the several million residents living in the Tigris River floodplain downstream. Serious dissolution of the foundation bedrock beneath the dam (consisting of gypsum, anhydrite and limestone) had led to significant increased seepage below the dam through enlarging voids and the concern for internal erosion compromising the dam core, leading to failure, was significant. Cost $382K

Bluestone Dam, Hinton, WV. Foundation Stabilization

Failed High Tensile (150ksi) Steel Anchor Bar

Dover Dam, OH. Foundation Stabilization 2014

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER	**2**	
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
USACE Huntington, 2016/2017 ADAS Support for Bluestone Dam, Hinton, WV W91237-12-D-0008, Delivery Order 0008	PROFESSIONAL SERVICES: 2017	CONSTRUCTION (if applicable): 2012

PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
USACE Huntington District	Stephen Spoor	304-399-5024

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

This project demonstrates AECOM's ability to design, install and maintain an ADAS for use in monitoring during construction modifications to a high risk dam.

PROJECT OVERVIEW: USACE is currently upgrading Bluestone Dam to meet modern design standards. Phase 3 of this upgrade included construction of a concrete scour pad in the penstock discharge area and adjacent downstream areas. USACE retained AECOM to **design**, **install**, **operate** and **maintain** an **ADAS** used to monitor the dam during Phase 3 construction. Installation of the ADAS was completed in 2012 under Contract W912P9-10-D-0501, DO CG01. In 2016, USACE retained AECOM to provide O&M for the ADAS under contract W91237-12-D-0008, Delivery Order 0008.

INSTRUMENTATION AND ADAS: AECOM **designed** and **installed** the following instrumentation at Bluestone Dam:

- 36 existing **uplift cells** in the lower gallery were automated using **vibrating wire pressure transducers**.
- 12 **vibrating wire crackmeters** were installed at each of the 12 monolith joints in the lower gallery.
- 2 **V-notch weirs** were installed in the gallery and automated using **vibrating wire weir monitors**.
- 8 **vibrating wire tiltmeters** were installed along the easternmost side of the right training wall.

Relevance to This Contract

- ❒ **Instrumentation System and ADAS**
  - ✓ Design
  - ✓ Assembly
  - ✓ Installation
  - ✓ Hosting
  - ✓ Monitoring
  - ✓ Maintaining
  - ✓ Troubleshooting
  - ✓ Integrating Manual & Automated Data
- ❒ **USACE Infrastructure**
  - ✓ High Risk Dam (DSAC II)
- ❒ **Rock Drilling, Sampling, & Recovery**
- ❒ **Early Warning System for use during Construction of Modifications**
- ❒ **Data Analysis for Risk Management**
- ❒ **Access to Near Real-Time Data**
- ❒ **USACE Cyber Security & Firewall Systems**
- ❒ **Instrumentation Software**
- ❒ **Programming of Data Analysis & Reporting**
- ❒ **SQL Database & WinIDP**
- ❒ **Safety Engineering**

Cost

Total $1.4 M, $124K (fee for ADAS O&M in 2017)

Key Personnel

J.Hummert, B.Rogers, R.Torrini, M.Liu, J.Zimmer, J. Shannon, R. Frazey

Benefit to the Client

The ADAS provided USACE with near real-time information regarding potential deformation of the rock foundation beneath the penstocks during the blasting operations for the new scour pad.

USACE Huntington, 2016/2017 ADAS Support for Bluestone Dam (continued) 2

- 40 **terrestrial positioning system (TPS) prisms** were installed. The prisms were read using an **automated motorized total station** (AMTS) device located in a dedicated hut constructed by AECOM.
- 5 **in-place inclinometers (IPIs)** and 3 **time domain reflectometry (TDR) cables** were installed in the penstock area. These installations involved **drilling, sampling and recovery of concrete and bedrock.**
- 12 **vibrating wire tiltmeters** were installed along the crest and on the assembly platform of the dam.
- 4 **IP-based cameras** were installed on the assembly platform on the downstream side of the dam.

The ADAS consists of an onsite Central Network Monitor (CNM) computer; four Local Monitoring Units; 23 Remote Input-Output units; seven Remote Multiplexers, a local radio telemetry network, and a **warning beacon and horn** for use as an **early warning system** for construction workers. VPN-over-internet was used as the primary WAN connection.

DATA ANALYSIS FOR RISK MANAGEMENT: AECOM configured the Bluestone ADAS to automatically send email and text messages to USACE and contactor staff when an instrument threshold level was exceeded. First responders could view the latest instrument readings and camera images on a web portal. The ADAS was configured for automatic or manual activation of the warning beacon and horn.

ACCESS TO NEAR REAL-TIME DATA: AECOM developed a project web portal to provide USACE with remote access to near real-time alarm status, instrument data and camera images. The camera images were updated every 5 minutes, and the instrument data was updated every 15 minutes. Prior to construction, the latest readings were displayed on the web portal within 2 hours of collection. During construction, readings were updated within 1 hour of collection.

USACE CYBER SECURITY & FIREWALL SYSTEMS: To comply with USACE information assurance policies, the CNM computer at Bluestone Dam and the AECOM web server were located outside of the USACE firewall. USACE prohibits automated transfer of data through the USACE firewall. Therefore, USACE staff in the Huntington District office manually downloaded data files from the CNM computer at Bluestone Dam via sFTP.

INSTRUMENTATION SOFTWARE: AECOM **programmed the Campbell Scientific data loggers** and configured the **datalogger control software** (LoggerNet) to retrieve instrument readings and camera images at predetermined frequencies.

PROGRAMMING OF DATA ANALYSIS AND REPORTING: AECOM developed a Bluestone Dam project web portal that displayed alarm status, instrument data tables, and camera images. The portal was created by **web application programming** using the Microsoft .NET Framework.

SQL DATABASE AND WINIDP: AECOM configured the ADAS to **automatically import data into a SQL database** for use with USACE's **WinIDP** software. The **WinIDP** software was configured to automatically create long-term trend plots for download from the project web portal.

SAFETY ENGINEERING: The AECOM design included the installation of steel steps at inclinometer riser locations, where the casings extended 9 feet above grade. This made for safe access to inclinometers and related ADAS equipment.

EVALUATION RATINGS:

Cost: Exceptional **Schedule: Very Good** **Quality: Exceptional**

"Excellent communication with contract and technical points of contact resulting in excellent end products and customer satisfaction." – Steve Spoor, Senior Civil Engineering Technician

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	AECOM	St. Louis, MO	Prime. ADAS O&M
b.	Terracon	Cincinnati, OH	Subconsultant under Contract W912P9-10-D-0501, Delivery Order CG01. Drilling and installation of inclinometers and TDR cables in penstock area.

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER		**3**
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
Greenbrier State Park Dam Washington County, MD	PROFESSIONAL SERVICES: Current	CONSTRUCTION (if applicable): Est. 2021
PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER: Maryland Department of General Services	b. POINT OF CONTACT NAME: Chris Elnicki	c. POINT OF CONTACT TELEPHONE NUMBER: 410.767.4379

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

Project Overview

Greenbrier State Park Dam, owned and operated by the Maryland Department of Natural Resources, is a 64-foot tall High Hazard earthen embankment dam located in Boonsboro, Maryland. The dam impounds a 30-acre public lake as part of the Maryland State Park system. The dam, constructed in 1965, has a history of seepage issues including incidents in 1996 and 2008 that warranted emergency response. On February 13, 2018, a small sinkhole was reported at the downstream toe, though no other indications of distress were observed. On April 16, 2018 multiple boils were observed along the downstream face and toe of the dam. These two incidents warranted activating the Emergency Action Plan (EAP) to Level 2 (potential failure). During the incident response, the Maryland Department of the Environment, Dam Safety Division directed that the reservoir be lowered, and four temporary sandbag rings be constructed around the seepage areas to monitor and control the seepage.

AECOM was contracted by the Maryland Department of General Services to investigate the condition at the dam and design a long-term rehabilitation of the dam. To investigate the condition at the dam, topographic and bathymetric surveys were performed, thirteen soil borings were drilled in the embankment, abutments and auxiliary spillway, seven vibrating wire piezometers (VWP) were installed, and various geophysical testing was performed. Additionally, AECOM designed and installed an automated instrumentation system to collect real-time monitoring data at the dam and send out text and email alerts to report changing conditions at the dam. The system collects data from weir monitors and turbidity meters at the four sandbag rings, a rain gauge on the crest of the dam, and 21 VWPs installed in the dam, abutments and reservoir. With the automated instrumentation data in place and the installation of a new slide gate to replace the malfunctioning lake drain valve, the reservoir level was could be safely raised back to the normal pool elevation.

AECOM performed a hydrologic and hydraulic analysis of the dam and generated new breach inundation maps to be used to update the Emergency Action Plan (EAP). Additionally, an integrity analyses of the auxiliary spillway was performed using the SITES model. Slope stability and seepage analyses were evaluated for the dam embankment to inform the final rehabilitation design of the dam. Final design plans and specifications of the access road repairs to the dam were completed to allow the contractor to safely access the dam for the final rehabilitation. AECOM also conducted environmental investigations and prepared required permits including a wetland delineation report, a Joint Federal/State Permit Application (JPA), Forest Conservation Plan, and a cultural resources assessment of the proposed project to satisfy Maryland Historical Trust (MHT) requirements.

Project Features:

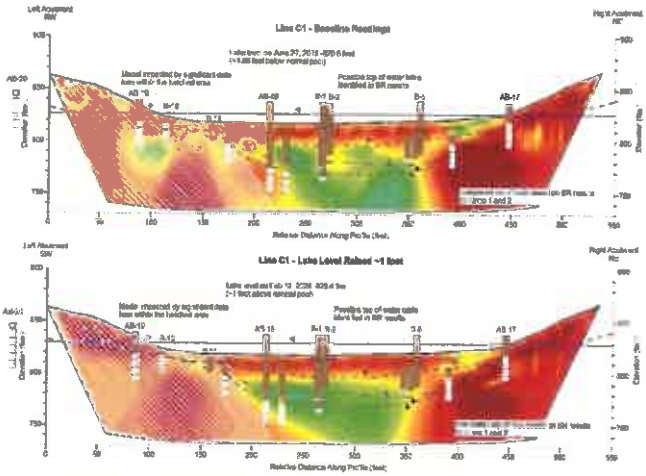
- ☑ Subsurface Exploration Program
- ☑ Geotechnical and Geophysical Analyses
- ☑ Hydrologic and Hydraulic Analyses
- ☑ SITES Auxiliary Spillway Integrity Model
- ☑ Automated Instrumentation System
- ☑ Lake Drain Slide Gate Replacement
- ☑ Underwater and Structural Inspection
- ☑ Environmental Investigations and Permitting
- ☑ Access Road Repairs
- ☑ Final Dam Rehabilitation Design

Cost (fee): $1,321,000

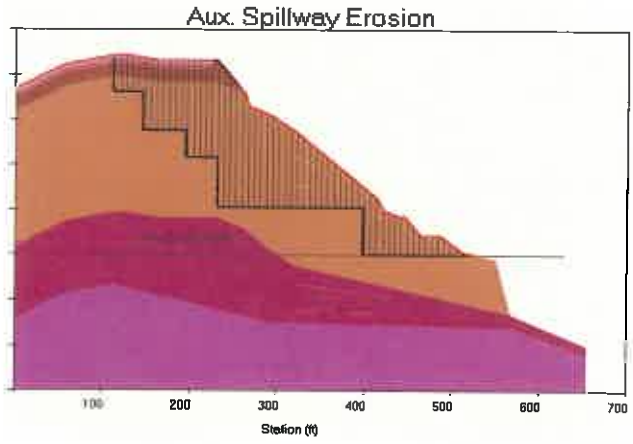
Schedule: Project has been proceeding on schedule

Key Personnel: G. Michael McIntyre, Bob Pinciotti, Dennis Hogan, David Sawitzki, Wesley Hollenbach

An unmanned aircraft survey (UAS) was performed of the dam, dike, spillway, reservoir and access roads.

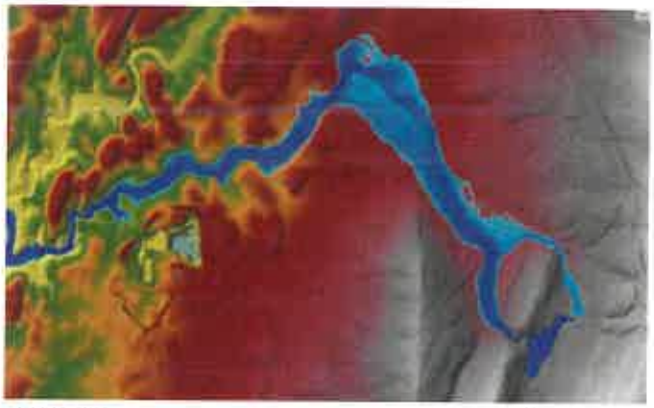


A seismic refraction geophysical survey was used to analyze seepage through the embankment by modeling the geologic profile based on compressional wave velocities.



An integrity analysis of the auxiliary spillway was performed using the SITES model to evaluate the spillway's ability to withstand erosional headcutting during passage of the PMF.

AECOM staff regularly visited the dam to inspect the overall condition of the embankment, principal spillway, slide gate, reservoir level, and remote instrumentation data collection system.



A two-dimensional HEC-RAS model was utilized to develop the inundation area downstream of the dam and map the PMF, Half PMF, 100-year and sunny day breach events.

The sandbag rings at the known seepage locations were reconstructed weir and turbidity monitors in place as part of the remote instrumentation data collection system

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION *(City and State)*	(3) ROLE
a.	AECOM	Germantown, MD	Prime
b.	Alvi	Towson, MD	Subconsultant

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER	**4**	
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
Lake Needwood Dam Forensic Evaluation and Rehabilitation Rockville, MD	PROFESSIONAL SERVICES 2006	CONSTRUCTION (if applicable) 2010

PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
Maryland National Capitol Park and Planning Commission (MNCPPC)	Mr. Andrew Frank, Chief Watershed Projects Evaluation Branch	(703) 324-5500

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

Project Description:

Lake Needwood Dam is designed to discharge the 100-year flood water through the 42-inch principal spillway over the course of 10 days, thereby significantly reducing the level of flooding downstream. The dam was designed by the US Department of Agriculture, Natural Resources Conservation Service (NRCS) and constructed in 1964-1965. It is currently owned and operated by the MNCPPC. The dam is an approximately 65 foot high zoned embankment (silty sand shell and sandy silt core materials) with 3:1 (Horizontal: Vertical) side slopes. The dam was constructed with a partial core and a cutoff trench upstream of the dam centerline. A single line of vertical grout holes was installed on the right third of the dam during original construction.

Services Provided:

- Emergency Assistance
- Alternatives Analysis
- Construction Observation and Administration
- Geologic Reconnaissance
- Geophysical Survey

During the week of June 26, 2006 heavy rains resulted in a 23- foot rise of the water level in Lake Needwood. On June 28th, MNCPPC personnel observed uncontrolled, concentrated seepage originating from the downstream left groin area. The flow rate was estimated at about 200 gallons per minute. Further examination revealed soil particles in the discharge water; thus, the potential for piping failure of the embankment was judged significant. As a result, nearly 2,200 downstream residents were evacuated. Emergency operations at the dam ensued including construction of a reverse filter at the seepage site to minimize potential for continued soil migration; construction of a temporary weir to estimate changes in flow rate; and around-the-clock visual monitoring of the embankment.

MNCPPC commissioned a study to evaluate potential causes for the observed seepage and to develop remedial measure. The forensic investigations included detailed review of as-built drawing and piezometric data; geologic reconnaissance; test borings with insitu testing; and a geophysical survey.

The geologic reconnaissance indicated the schist and gneiss bedrock contained two high angle to near vertically dipping major joint sets. Review of boring logs indicated the bedrock contained open joints and fractures exhibiting hydraulic conductivity values between 18 and 322 lugeons. The subsurface exploration within the dam embankment did not reveal significant defects or other distress that would account for the amount of seepage observed during the June storm event. Therefore, the forensic evaluation concluded that the seepage occurred through the fractured rock beneath the dam rather than through the embankment itself; and the existing internal drain system did not operate as designed and was overwhelmed by the seepage.

Various alternatives for remediation of the dam were considered. The final rehabilitation configuration included a double line grout curtain and new chimney/blanket drain on the downstream slope. URS prepared the detailed design documents, plans and specifications. The grout curtain consists of two rows of greater than 80-foot deep holes, drilled 15 degrees to the vertical, generally aligned parallel with the dam axis, and located so as to intersect the bottom of the cut-off trench. The blanket drain consists of ASTM C-33 sand layers surrounding a drainage layer of ASTM Coarse Aggregate No. 67 with 12-inch diameter perforated drain pipes. The entire blanket drain was installed within the upper two feet of the downstream slope and was covered with the excavated soil, resulting in a balanced cut-fill soil project. Construction of the

grout curtain occurred over the spring and summer of 2007 and the construction of the blanket drain occurred in the fall and winter of 2007/2008.

URS also designed and oversaw the installation of an automatic data collection system on both Lake Needwood dam and Lake Frank dam. The systems monitored the water levels in the existing piezometers though the use of new vibrating wire piezometers installed in each open stand pipe as well as monitoring the lake level, rainfall and barometric pressure. All of the data is collected each hour, stored on site as well as collected into an off site server. The data can be observed at anytime through the use of a third-party web-based system.

Finally, URS was also responsible for observation and documentation of structural repairs to the principal spillway intake tower.

Estimated Project Cost: Construction of the grout curtain cost on the order of $2,000,000. The construction of the drain of the downstream blanket drain cost on the order of $1,000,000. URS total fee for services rendered, including the cost of the automated data collection system and the structural repairs was on the order of $850,000.

Estimated Cost of Project: Construction of the grout curtain cost on the order of $2,000,000. The construction of the drain of the downstream blanket drain cost on the order of $1,000,000. URS total fee for services rendered, including the cost of the automated data collection system and the structural repairs was on the order of $850,000.

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER	**5**	
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
Kentucky Division of Water, Civil Engineering Services for Beech Creek Dam Manchester, KY	PROFESSIONAL SERVICES 2015	CONSTRUCTION (if applicable) 2019

PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER & ADDRESS
Kentucky Division of Water	Gary Wells, PE	502.782.7128 300 Sower Blvd Frankfort, KY 40601

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size and cost)

The lake is the primary water supply facility for the City of Manchester, Kentucky. Our team performed a study that includes acquisition of LiDAR data, survey of riverine cross sections and Lake Bathymetry, development of in-depth hydrologic and hydraulic models, mapping of dam breach inundation zones, geotechnical investigation, geophysics, and design alternatives analysis, and design services for channel modifications and extension of the foundation drains.

Collection of geotechnical data was conducted to facilitate the understanding of potential seepage issues at the dam and allow for a greater understanding of potential mitigation measures. In addition, data gathered in the geotechnical investigation was supplemented by the collection of data through geophysics and commercial diving services.

Geophysics tests conducted at the site included electrical resistivity imaging (ERI) and self-potential (SP). LiDAR data was also collected for the watershed contributing to the lake, and a sizable portion of the area designated as relevant to the downstream study of breach inundation.

- ☑ Structural Engineering
- ☑ Field Surveys
- ☑ Alternatives Analysis
- ☑ Dam Crest Earthfill
- ☑ Dam Breach Modeling
- ☑ Inundation Mapping
- ☑ Soils and Geotechnical Engineering
- ☑ Environmental Permitting
- ☑ Seismic Analysis
- ☑ Construction Administration/ Observation

Phase I Design
Our team designed modifications to the downstream channel, and the extensions to the foundation drains of the dam. Services also include permitting acquisition, bidding assistance, construction administration, and construction observation.

Phase II Design
Our team designed a seepage blanket to address seepage on the downstream face of the dam. Part of this design also included a new emergency spillway and chute to allow the dam to meet high hazard dam design requirements. Services also included permitting acquisition, bidding assistance, construction administration, and construction observation.

A blanket drain was installed on the downstream face of the dam to control seepage.

Drainage material and earthfill was placed and completed in accordance with the standard of practice for earth embankment dams.

Beech Creek Dam and the impounded lake are the primary water supply facility for the City of Manchester, Kentucky.

The blanket drain consisted of appropriately sized sand and drain stone.

New spillway weir, new sidewalls to channel the flow over the weir and concrete cutoff trenches to improve the resistance of the bottom of the spillway chute to erosional forces.

Trenching in the bedrock for the foundations of the walls.

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER	5	
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
Kentucky Division of Water, Civil Engineering Services for Scenic Lake Dam Henderson, KY	2020	Ongoing

PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER & ADDRESS
Kentucky Division of Water	Marilyn Thomas, PE	502.782.7128 300 Sower Blvd Frankfort, KY 40601

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

Scenic Lake Dam is an earth fill type structure that is 30 feet in height and 330 feet long. Our team performed a site- specific seismic evaluation and post-seismic stability of the materials compromising Scenic Lake Dam and its natural foundation soils. Due to liquefaction in the silt stratum that underlies the dam, we determined that the dam in its existing configuration did not have an adequate factor of safety in post-earthquake stability condition in conjunction with the Maximum Credible Earthquake (MCE). We recommended the condition be mitigated by constructing a stabilizing deep soil medium zone at the downstream slope of the dam. This deep mixing method (DMM) is Phase I of the Scenic Lake Dam Project. The DMM is an in-situ soil treatment which blends native soils with cementitious materials commonly referred to as binders. Compared to native soils, the zone of improved soils has enhanced engineering properties including higher shear strength, lower permeability, and enhanced resilience to the effects of cyclic (seismic) loading and strength loss.

Phase II of the dam design included improvements to the dam because the existing embankment does not satisfy Kentucky embankment guidelines (Engineering Memo #5). Some of these improvements include widening the crest width, constructing a spillway, converting the existing spillway to a low-level outlet, and addressing seepage concerns. The planned seepage modifications are to add a blanket drain, toe drain, and conduit seepage collar.

Phase I Design

Our team designed the DMM modifications to the downstream slope of the dam. We provided permitting and bidding services. Services also included construction administration and construction observation services for the modifications.

- ☑ Structural Engineering
- ☑ Field Surveys
- ☑ Alternatives Analysis
- ☑ Dam Breach Modeling
- ☑ Inundation Mapping
- ☑ Soils and Geotechnical Engineering
- ☑ Deep Soil Mixing
- ☑ Environmental Permitting
- ☑ Seismic Analysis
- ☑ Construction Administration/ Observation

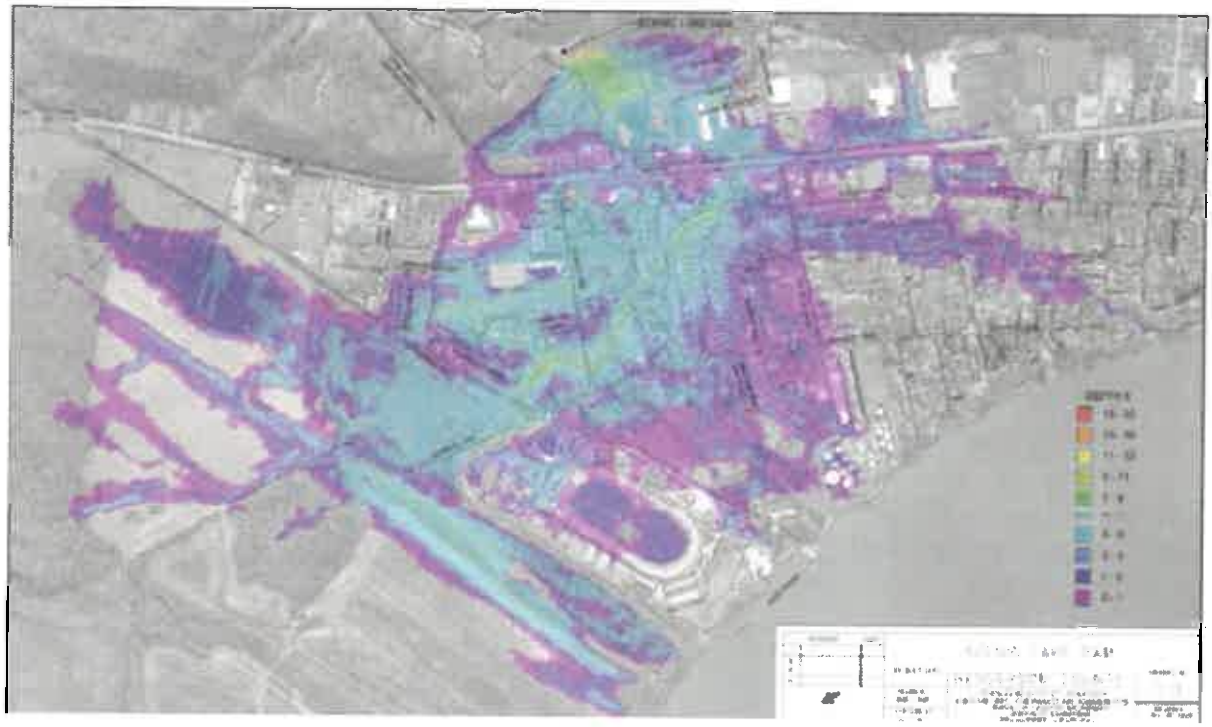
Phase II Design

AECOM designed a spillway, widened the dam crest, and addressed seepage concerns. Services will also include bidding assistance, construction administration and construction observation.

Existing principal spillway. To be modified into a new lake drain structure.

Liquefaction analysis resulted in the requirement for deep soil mixing to provide suitable liquefaction mitigation.

Overview of the John James Audubon State Park with the Scenic Lake in the center.



Scenic Lake Dam breach max flow depth plan.

EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT		
EXAMPLE PROJECT KEY NUMBER	**7**	
TITLE AND LOCATION (City and State)	YEAR COMPLETED	
Upper Dublin Flood Control Dams Fort Washington, PA	PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (if applicable) 2013

PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER
Upper Dublin Township	Steve Lester, PE	(215) 643-1600

BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost)

Project Description:
Upper Dublin Township has experienced flooding within the Ft. Washington Industrial Park since the park was developed in the 1960s. At this time the Township applied and received a Pennsylvania H2O grant, providing 11.8 million dollars to aid in the construction of flood mitigation measures.

The design of the two dams, each about 15-feet high, are on Rapp Run and Pine Run. The dams will be located near the downstream end of the property owned by the Township on the Rapp Run and the Pine Run. Due to the frequency of overtopping, the dams will consist of a concrete overflow spillway section for passing the larger flood flows and outlet works through the structure to pass normal flow and allow fish passage. The concrete spillway will be a labyrinth weir.

Relevant Services:
- Geotechnical Engineering
- Structural Engineering
- Mechanical Engineering
- Civil Engineering
- Electrical
- Cost Estimating
- Flood Control Measure
- H&H
- Public Outreach
- Construction Management
- Environmental
- Permitting

Specific preliminary tasks (prior to design include): Field Survey, Soils and Geological Engineering Investigation, Laboratory Investigation, Geotechnical Analyses, Hydrology and Hydraulics, and FEMA CLOMR Analyses. Design services include: Structural Dam Design, Sizing of Dam Hydraulic Structures, Site Drainage, and Landscape Design Services, Site Design and Right of Way Plans. Deliverables for the project include: Drawings, Specifications, Quantities and Estimated Construction Costs and Design Reports. Construction phase services for each dam include: Review of Submittals and RFI, full time oversight of earthwork and pile installation, review of payment applications, consultation, and Engineer-of-Record obligations.

Permitting
- **Dam Safety Wetland And Water Body Permit and USACE Permit**
  The construction of the dams required a permit from the Pennsylvania Department of Environmental Protection (PADEP) Division of Dam Safety. This permit addresses both dam safety as well as any permanent or temporary encroachments in the waterway, the floodplain, or wetlands regulated by Chapter 105 of the Pennsylvania code. A separate permit for waterway encroachment was be required from the U.S. Army Corps of Engineers (ACOE). This included an Environmental Investigation and Environmental Permitting. Permitting/approvals include: Stormwater & Floodplain Consistency Determinations (from Township, Cultural Resource Notice Form & PHMC Approval, Environmental Assessment Form & PNDI Clearances, Mitigation Proposal for losses to wetlands, and a U.S. Army Corps of Engineers Section 404 Individual Permit.

Rendering of Pine Run FRS

Estimated Cost of Project: $1.7M (Design)

Relevant Certifications

CERTIFICATE OF *Authorization*

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

The West Virginia State Board of Registration for Professional Engineers having verified the person in responsible charge is registered in West Virginia as a professional engineer for the noted firm, hereby certifies

AECOM TECHNICAL SERVICES, INC.
C00451-00

Engineer in Responsible Charge: DAVID L. WEAVER - WV PE 012015
has complied with section §30-13-17 of the West Virginia Code governing the issuance of a Certificate of Authorization. The Board hereby notifies you of its certification with issuance of this Certification of Authorization for the period of:

January 1, 2020 - December 31, 2021

providing for the practice of engineering services in the State of West Virginia.

IF YOU ARE REQUIRED TO REGISTER WITH THE SECRETARY OF STATE'S OFFICE, PLEASE SUBMIT THIS CERTIFICATE WITH YOUR APPLICATION.

IN TESTIMONY WHEREOF, THE WEST VIRGINIA STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS HAS ISSUED THIS COA UNDER ITS SEAL AND SIGNED BY THE PRESIDENT OF SAID BOARD.

BOARD PRESIDENT

Your **ACTIVE PE** renewal fee has been received...

Your ACTIVE PE renewal fee has been received. Your pocket card indicating you are entitled to practice engineering in West Virginia until the noted expiration date may be detached and used unless invalidated as a result of Board audit of your renewal form or formal disciplinary action.

IMPORTANT REMINDERS:

1. Please include your WV ACTIVE PE license number on any correspondence to this office.
2. To use this license as a pocket card, please cut along the dotted line and laminate if desired.
3. You are required to immediately notify the Board, in writing, of the following: loss or theft of license or seal, any name change, any address change, or any employment change.

West Virginia State Board of Registration for Professional Engineers

300 Capitol Street, Suite 910
Charleston, West Virginia 25301
304-558-3554 Phone
800-324-6170 Toll Free
www.wvpebd.org

THIS IS ONE FORM OF YOUR RENEWAL RECEIPT

PLEASE SAVE THIS FOR YOUR RECORDS

Date of Renewal: December 8, 2018
Amount Paid: $70.00

West Virginia State Board of Registration for Professional Engineers

DAVID L. WEAVER
WV [redacted]

This is to certify that the above named PROFESSIONAL ENGINEER has met the requirements of the law, is duly registered and is entitled to practice engineering in the State of West Virginia.

EXPIRES December 31, 2020

DAVID L. WEAVER
[redacted]

Your **ACTIVE PE** renewal fee has been received...

Your ACTIVE PE renewal fee has been received. Your pocket card indicating you are entitled to practice engineering in West Virginia until the noted expiration date may be detached and used unless invalidated as a result of Board audit of your renewal form or formal disciplinary action.

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West Virginia State Board of Registration for Professional Engineers

300 Capitol Street, Suite 910
Charleston, West Virginia 25301
304-558-3554 Phone
800-324-6170 Toll Free
www.wvpebd.org

THIS IS ONE FORM OF YOUR RENEWAL RECEIPT

PLEASE SAVE THIS FOR YOUR RECORDS

Date of Renewal: January 10, 2019
Amount Paid: $87.50

West Virginia State Board of Registration for Professional Engineers

GREGORY MICHAEL MCINTYRE
WV [redacted]

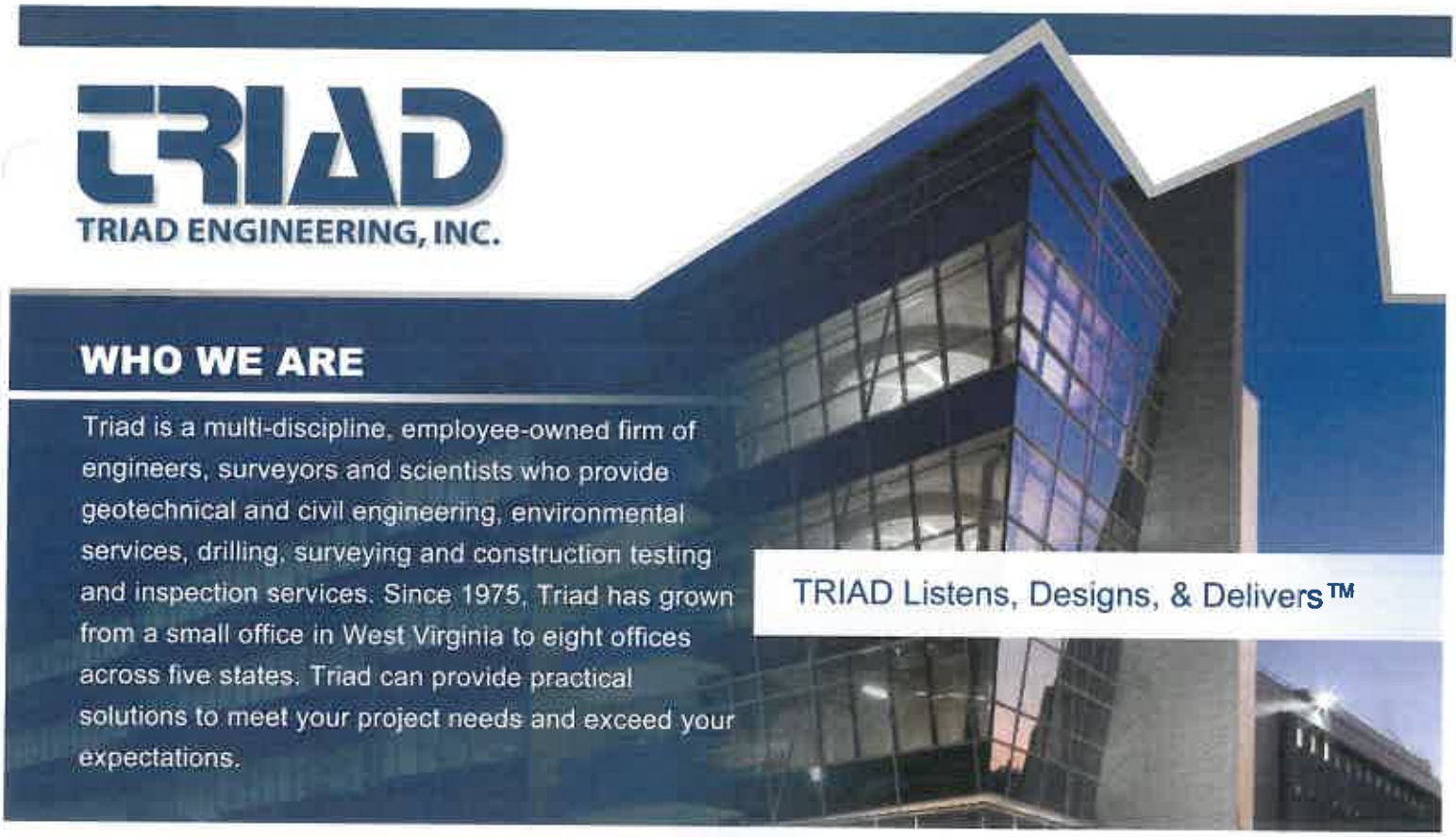
This is to certify that the above named PROFESSIONAL ENGINEER has met the requirements of the law, is duly registered and is entitled to practice engineering in the State of West Virginia.

EXPIRES December 31, 2020

GREGORY MICHAEL MCINTYRE
AECOM
12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MD 20876

Subcontractor Qualifications

TRIAD ENGINEERING, INC.



WHO WE ARE

Triad is a multi-discipline, employee-owned firm of engineers, surveyors and scientists who provide geotechnical and civil engineering, environmental services, drilling, surveying and construction testing and inspection services. Since 1975, Triad has grown from a small office in West Virginia to eight offices across five states. Triad can provide practical solutions to meet your project needs and exceed your expectations.

WHAT WE DO

GEOTECHNICAL ENGINEERING
Subsurface Explorations; Geological and Geophysical Surveys; Landslide Studies and Remediation; Dam and Impoundment Design; Foundation Design Recommendations; Soil Characterization and Stabilization; Sinkhole Remediation; Infiltration Studies

CIVIL ENGINEERING
Site Grading and Development Plans, Commercial/Industrial Site Developments, Landscape Design, Storm Water Best Management Practices, Hydrologic Studies, Green Sustainable Design, Retaining Wall Design, Utility Design, Land Use and Planning Consultation, Construction Specifications and Contract Documents, Construction Contract Administration

DRILLING AND SAMPLING
Geotechnical and Environmental Drilling and Sampling; Monitoring Well and Piezometer Installation; Rock Coring; Bridge Pier Borings; Air Track Probes

CONSTRUCTION MATERIALS ENGINEERING AND TESTING
Soils and Fills; Concrete; Asphalt and Aggregate; Footings; Pile Foundations; Floor Flatness; Structural Steel; Seismic Monitoring; Welds; Paint and Fireproofing; Roof; Compressive Strength; EFAS; NDT; Mortar and Grout; Laboratory Analysis of Soil and Rock; Special Inspections

ENVIRONMENTAL
Hydrogeological Studies; Fracture Trace Analysis; Groundwater and Soil Assessment; Site Remediation Design; Phase I/II ESAs; Brownfield Site Assessment; Asbestos, Mold and Lead-Based Paint Inspection; Wetland and Forest Management Services; Regulatory Compliance Assistance & Permitting

SURVEYING AND MAPPING
Topographic & Planimetric Mapping; Construction Layout; Subdivision Platting; ALTA / NSPS Surveys; Property Boundary Surveys; Aerial Photogrammetry; Drone Surveying

LOCATIONS

MARYLAND
Hagerstown
301-797-6400

VIRGINIA
Winchester
540-667-9300

Sterling
703-729-3456

WEST VIRGINIA
Scott Depot
304-755-0721

Morgantown
304-296-2562

PENNSYLVANIA
Mechanicsburg
717-590-7429

New Stanton
412-257-1325

OHIO
Portsmouth
740-249-4304

www.triadeng.com

LAKE FOREST ESTATES DAM REHABILITATION
Jefferson County, WV

CLIENT CONTACT INFORMATION:
Mr. James M. Corey
115 Neenah Court
Harpers Ferry, WV 25425
304.724.1430
Jcorey48@gmail.com

The Lake Forest Estates dams include primary and secondary earth fill dams located in adjacent valleys. The dams are connected by an open channel originally thought to be the principal spillway for the primary dam. In 2005, the Owner was notified by the WVDEP Dam Control Division that the dams were under the State's jurisdiction, and they were ordered to complete an engineering study and safety assessment. Problems which were initially identified included excessively steep slopes, uncontrolled embankment seepage, large trees on the embankments, blocked spillway channels, and a non-functional riser in the secondary dam.

Initial stability evaluations indicated that the dams did not meet present safety standards. Furthermore, hydrologic and hydraulic analyses proved that the dams would not comply with State standards for the design storms. Rehabilitation design included flattening of the upstream and downstream slopes, a blanket drain and filter system to control seepage and enhance stability of the primary dam, a new overflow weir and discharge channel for the primary dam, a new principal spillway riser and outlet for the secondary dam, and a new emergency spillway channel for the secondary dam. Design plans, specifications, reports and an Emergency Action Plan were submitted and approved by WVDEP. Construction was accomplished during the construction season with full-time monitoring and testing by Triad. Final inspection and approval by WVDEP were achieved.

FERNDALE LAKE DAM REHABILITATION
Hampshire County, WV

CLIENT CONTACT INFORMATION:
Mr. Josh Haza
PO Box 42
Springfield, WV 26763
304.492.4050
jhkaza@frontiernet.net

Triad conducted a site visit to review current conditions associated with concerns of recent seepage, failure of the principal spillway concrete discharge apron, and seepage along the principal spillway pipe. Identified during initial inspection included erosion at the discharge end of the principal spillway pipe in addition to piping failure above the pipe alignment and midway between the dam crest and discharge point.

Triad was charged with designing principal spillway repairs and drainage measures to containerize seepage along each groin and route them to the principal spillway discharge channel.

Engineering services provided by Triad consisted of inspection, design of replacement filter diaphragm, preparation of construction plans, preparation of technical specifications for construction repairs, preparation, and approval, of a design report for review by the WVDEP – Dam Safety, and preparation of WVDEP – Dam Safety forms DS-1 and DS1A. The project included control services during construction of repairs.

TRIAD ENGINEERING, INC.

DAVID L. GRAHAM, PS

SURVEY SERVICES MANAGER

EDUCATION
Woodson School of Surveying

PROFESSIONAL EXPERIENCE
43 Years

CERTIFICATIONS
OSHA Certificate
CADD Certificate

REGISTRATIONS & LICENSES
Professional Surveyor
West Virginia [redacted]

SKILLS
FEMA Flood Surveys
ALTA / NSPS Land Title Surveys
Boundary
Subdivision
Construction Stake Out
As-Build
Bridge & Highways
Industrial

PROFESSIONAL AFFILIATIONS
WV Association of Professional Surveyors

HIGHLIGHTS OF EXPERIENCE

Mr. Graham brings over 43 years of diverse surveying and construction management experience to the Triad team. He is responsible for all survey services provided in our northwest region. Mr. Graham has provided survey services to municipalities, residential, commercial and industrial developments and construction groups. His background includes experience as a Professional Surveyor, Field Engineer, Consultant, Construction Supervision, and Project Management.

RELEVANT PROJECT EXPERIENCE

Pumped Storage, Bath County, VA
Mr. Graham was a surveyor on the Bath County Pumped Storage Project which consisted of two earthen filled dams, an upper reservoir and lower lake. The project had several miles of power conduits (concrete / steel lined tunnels) and 3 – 1,000 ' vertical shafts. The power plant was a 6 unit hydro-electric pumped storage plant.

Lake Amistad Hydro=Electric Power Plant, Del Rio, TX
Mr. Graham was the surveyor in charge for the Lake Amistad Hydro-Electric Power plant which is a two unit power plant constructed at the base of the existing Amistad Dam and in the Rio Grande River. The overall project was supervised by the Army Corps of Engineers.

Lake Lynn Generation Plan, Monongalia County, WV
As Survey Manager, Mr. Graham provided oversite for a property line survey to stake and mark the property line of the Lake Lynn Generation Plant along the Northeast and Southeast border of Cheat Lake.

Camp Dawson 3498G-12H30 Building, Kingwood, WV
As Manager, Mr. Graham was responsible for overseeing the construction stakeout of the 160 feet by 50 feet metal building system with a finished floor elevation of 1,000.85 feet. Services provided included stakeout for site grading, stak building column lines, layout of layout anchor bolts as required.

Wolf Run Mining Company, Philippi, WV
Mr. Graham supervised his team in providing baseline control points above and mid-slope for the purpose of detecting any movement of a potential slide area. At the completion of establishing control, slip monitoring procedures were created which included monitoring the site at specified intervals, providing photographic and video documentation, maintaining a chronological history of the area, and providing updated reports.

Longwall Mining Subsidence Monitoring, Marshall County, WV
As Manager, Mr. Graham directed installation of strain gauges, field surveys, and daily monitoring services to assist in the monitoring of a transmission pipeline. Upon completion of initial baseline and consequent daily follow-up surveys, a report of data subsidence / consistency was completed and submitted.

Mt. Storm Power Station, Mt. Storm, WV
Mr. Graham provided oversite for survey stakeout services to assist in the renovations at this power station. Services included initial and certified as-built surveys as well as for stakeout of office calculations and site control.

TRIAD ENGINEERING, INC.

JOHN HAYNES, PE
DRILLING SERVICES MANAGER

EDUCATION
West Virginia Institute of Technology
BS, Mechanical Engineering
BS, Civil Engineering

PROFESSIONAL EXPERIENCE
26 Years

CERTIFICATIONS
- Certified Monitoring Well Installer [redacted]

REGISTRATIONS & LICENSES
- Professional Engineer, West Virginia [redacted]
- Professional Engineer, Maryland [redacted]

SKILLS
- Managing Multiple Drill Crews
- Organizing drills, crews, and supplies for drilling projects
- Design of Subsurface Explorations
- Approval of Design Drawings
- Proposals
- Drilling Inspection
- Geotechnical Analysis & Reporting
- Geotechnical Engineering and Drilling Cost Estimating and Bid Preparation

HIGHLIGHTS OF EXPERIENCE

Mr. Haynes serves as the Senior Drilling Manager for Triad's drilling operations when he manages all drilling and sampling activities conducted by the firm's regional offices. Mr. Haynes previously served as a Project Geotechnical Engineer. Mr. Haynes' duties include design and implementation of the subsurface investigations, assignment of laboratory testing, approval of design drawings, development of technical specifications, and preparation of drilling and geotechnical engineering cost proposals and reports.

RELEVANT PROJECT EXPERIENCE

Statewide Geotechnical Drilling IDIQ, Various Locations, WV
This project consists of an as-needed, on-call 1 to 2 year contract for providing geotechnical drilling to the West Virginia Division of Highways. Triad has maintained this contract since 1998 and Mr. Haynes has managed the contract since 2012. Recent projects have included water borings (off shore drilling) for the I-64 Nitro, St. Albans, Bridge and borings for several bridge replacements in various locations in Berkeley and Hampshire Counties, WV.

Morris Impoundment, Dodridge County, WV
The project consists of the construction of an impoundment for the construction of a secondary containment system for a centralized water storage tank in Dodridge County, WV to be used in development of natural gas wells. Mr. Haynes provided drilling supervision and oversight during the subsurface investigation portion of the project. The subsurface investigation consisted of drilling 7 test borings to depths ranging from 16.5 to 45 ft. beneath the existing ground surface. Standard Penetration Testing was performed at each location and rock coring was performed at select borings.

Cenalli Impoundment, Barbour County, WV
The project consists of the construction of an impoundment with an approximate total volume of 10.2 million gallons, located in Barbour County, WV. We understand that the impoundment will be used as a centralized pit for the storage of water used in development of natural gas wells. Mr. Haynes provided drilling supervision and oversight during the subsurface investigation portion of the project. The subsurface investigation consisted of drilling 4 test borings to depths ranging from 30 to 40 ft. beneath the existing ground surface. Standard Penetration Testing and rock coring was performed at each location.

Pleasants County PSD Water Storage Tanks, Pleasants County, WV
Mr. Haynes escorted Triad drillers to this project site and worked with the drill crew during the subsurface investigation. Following the subsurface investigation, Mr. Haynes developed computerized boring logs, assigned laboratory testing, and prepared a geotechnical report including foundation recommendations, allowable bearing capacities, and estimated settlements.

Corridor H Drilling-Kerens to Parsons, Section 1B, Randolph, Tucker County, WV
The project consists of the geotechnical drilling for a 5.62 mile section of a 4 lane Expressway which extends from Interstate 79 near Weston, WV east to the Virginia state line near Wardensville, WV. Mr. Haynes was the project manager for this project which consisted of 272 Borings for a total drilling footage of 15,757 feet. This project was extremely difficult due to the extremely steep terrain and strict environmental requirements.

WEST VIRGINIA BOARD OF PROFESSIONAL SURVEYORS

Certificate of Authorization

Triad Engineering, Inc.

Scott Depot, West Virginia

CERTIFICATE OF AUTHORIZATION # 20-5438

This certificate is issued by the West Virginia Board of Professional Surveyors in accordance with *W.Va. Code §30-13A-20*
The person or organization identified on this certificate is licensed to conduct professional surveying and mapping services in the State of West Virginia for the period

January 1, 2020 through December 31, 2020

This certificate is not transferrable and must be displayed at the office location for which issued.

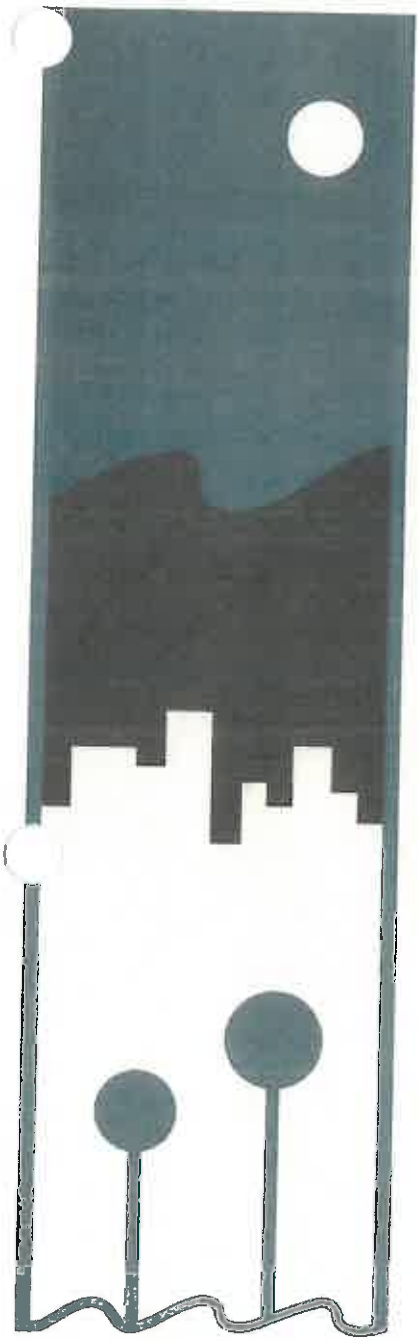
In witness whereof, I have put my hand, this 31st day of December 2019

2020

Sefton R. Stewart, P.S., Chairman
Lantz G. Rankin, P.S., Member

James T. Rayburn, P.S., Secretary
Gary D. Facemyer, P.E, P.S., Member

Douglas C. McElwee, *Esq.*, Public Member



WEST VIRGINIA CONTRACTOR LICENSING BOARD

CONTRACTOR LICENSE

Authorized by the

West Virginia Contractor Licensing Board

Number: WV006875

Classification:

GENERAL ENGINEERING

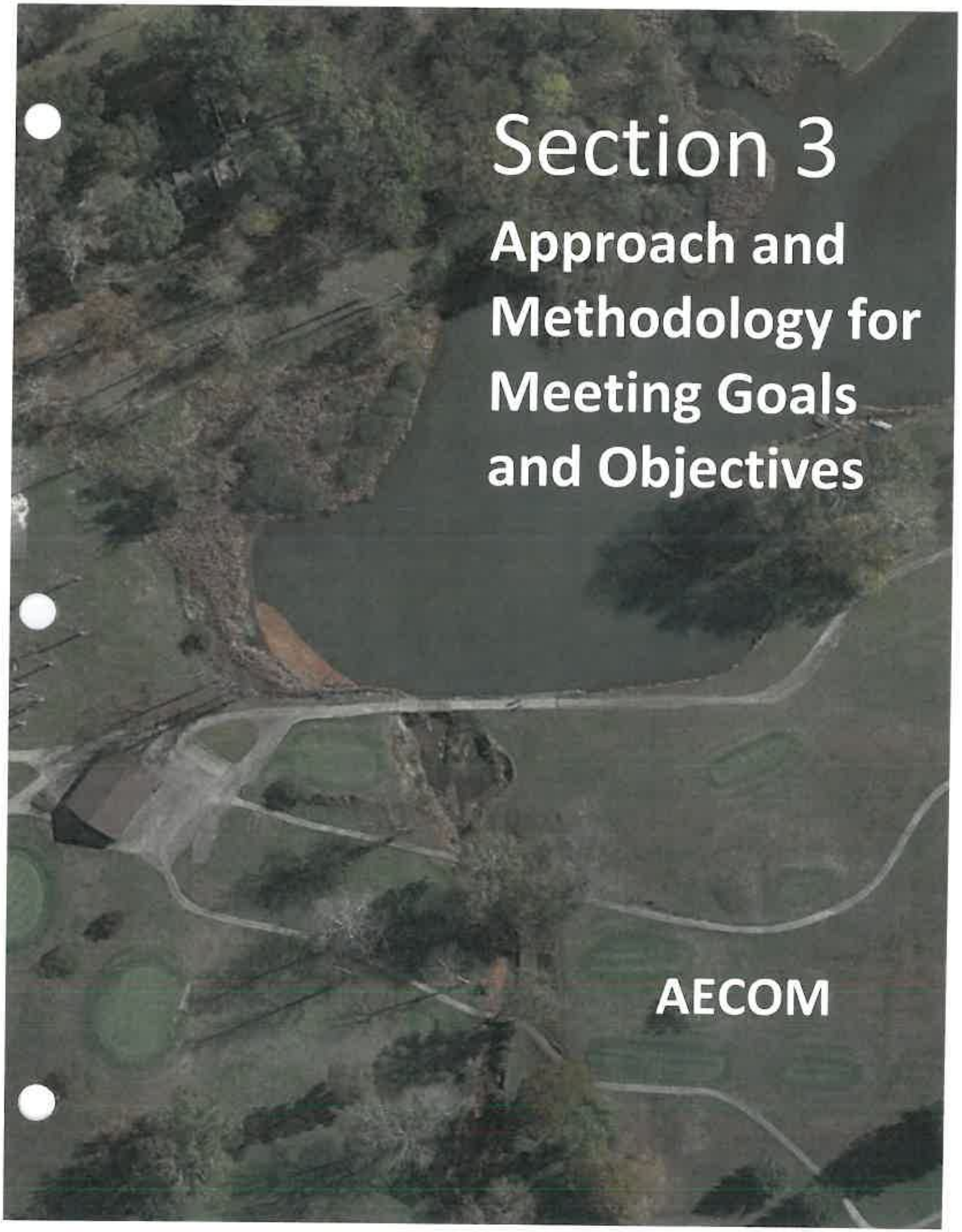
TRIAD ENGINEERING INC
DBA TRIAD ENGINEERING INC
10541 TEAYS VALLEY RD
SCOTT DEPOT, WV 25560

Date Issued	Expiration Date
SEPTEMBER 27, 2019	SEPTEMBER 27, 2020

Authorized Company Signature

Chair, West Virginia Contractor Licensing Board

This license, or a copy thereof, must be posted in a conspicuous place at every construction site where work is being performed. This license number must appear in all advertisements, on all bid submissions and on all fully executed and binding contracts. This license cannot be assigned or transferred by licensee. Issued under provisions of West Virginia Code, Chapter 21, Article 11.



Section 3

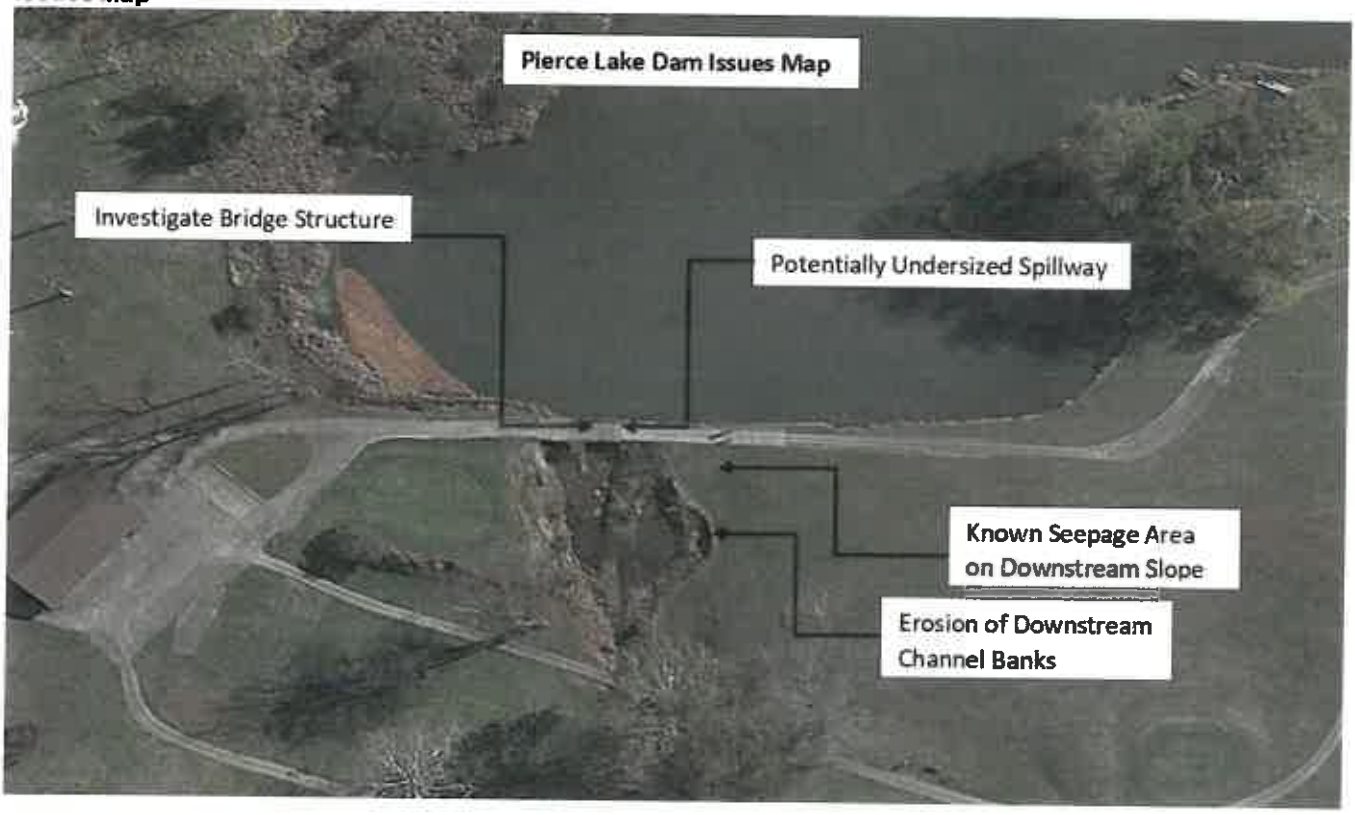
Approach and Methodology for Meeting Goals and Objectives

AECOM

Project Understanding

Our team has reviewed the Expression of Interest (EOI) supplied on wvOASIS system. We understand that that the impounded Pierce Lake is a key component of the Camp Dawson infrastructure that provides storm water management and is used for WVARNG training. The dam is exhibiting signs of seepage on the downstream face and the services of a qualified Dam Engineering firm are needed. AECOM will investigate and analyze the dam, develop a remedial design, construction bid documents, and provide bid phase services. A map of known and potential issues is provided below.

Issues Map



Key Issues:

- **Determination of WV State Regulations Applicable to Pierce Lake Dam Hazard –** determining the dam hazard classification of the dam will be key to designing a rehabilitation that meets both WV State requirements as well as the WVARNG needs.
- **Known Seepage on the Downstream Slope** – As noted in the EOI seepage has been observed on the downstream face of the dam. This should be investigated.
- **Potentially Undersized Spillway (New Control Structure may be required)** – H&H modelling should be performed to determine if the dam's current spillway capacity. If spillway capacity is determined to be insufficient then the design of a new control structure will be required.
- **Erosion of Downstream Channel Banks** – Observed erosion should be investigated and may require the design of a stilling basin and/or channel erosion protection.
- **Investigate Bridge Structure** – The bridge structure over the existing spillway should be inspected to ensure that supports/abutments are still providing adequate support for the structure.

Technical Approach

Review of Available Information and Data
AECOM Dam Engineers will perform a detailed inventory and review of all pertinent engineering documentation that is available for the dam. In addition to review of physical documentation, AECOM will interview staff and gather information regarding the history of the dam and its operation. Establishing a baseline of information on the condition and performance of the dam will enable AECOM to appropriately scope field investigations that will support the development of the remediation of the dam.

Dam Safety Inspection
AECOM Dam Engineers led by our proposed Senior Geotechnical Dam Engineer will perform visual inspection of the above ground portions of the dam and spillway. The inspection will be performed in general conformance with state or the practice technics using the West Virginia USDA-NRCS Formal Dam Inspection Checklist.

Bridge Structure Inspection
Field inspection and related services to assess the continued use of the existing bridge to accommodate pedestrian and minor vehicular traffic is anticipated and will include due-diligence inspection as the structure may require some repair and rehabilitation for safety purposes and/or to obtain the required level of service. To this end, we also understand the need to search for available structural drawings of the bridge and other background information.

Following our preliminary review, we will develop an inspection access plan that will ensure a thorough inspection of the entire structure using safe and efficient access methods, allowing hands-on access of all elements of the bridge. AECOM has extensive experience in the inspection and evaluation of bridges of all size. We anticipate that the inspection will be performed from ground level, with the use of ladders as needed. In addition to conventional visual inspection methods, we often use rope access techniques, drones, and non-destructive evaluation during bridge inspections as necessary.

If deficiencies or deterioration are noted during the field inspection, recommendations for repairs or other modification will be developed as part of the project services. Plans, Specifications, and Estimates will be developed for recommended modifications of the bridge, using conventional materials and techniques commonly used for similar bridge structures.

Utility Location
The objective of the proposed investigation is to document the horizontal locations of subsurface utility lines within the identified project area. The investigation will be conducted in general accordance with a utility quality level B survey as described in the applicable guideline from the American Society of Civil Engineers entitled "Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data." The investigation will involve the following tasks:

- Records Research: AECOM will review hard copy and/or electronic utility records that may be obtained by the client or other entity. If applicable, AECOM will also submit utility locate requests to West Virginia 811 at least 2 weeks prior to the start of work to assist in identifying potential additional utility owners that may have utility systems within the designated project area. We will then evaluate the collected materials for validity and for indications of potential additional available records. The full set of gathered records will be used to develop a CADD or GIS drawing file that documents the inventory of subsurface utilities. The drawing file will include information on the probable number, type, size and material composition of the subsurface utilities. The results of the records research will not be used as a substitute for the surveyed locations of lines identified with geophysical and optical methods unless the subject utility cannot be verified using industry standard techniques for this level of investigation. AECOM will utilize generally accepted engineering practices in an effort to verify the information obtained from the records research. However, AECOM cannot guarantee the completeness or accuracy of this third party provided information.

- Site Survey: AECOM will conduct a visual site reconnaissance survey to identify surface features associated with subsurface features of concern. These surface features including but not limited to manholes, inlets, cleanouts,

pedestals, transformers, hydrants, meters, and valves. Identified surface features not already documented on existing site plans will be surveyed using differential global positioning system (DGPS) to record their horizontal coordinates. No elevation data will be collected. The information from the site survey will be correlated to the obtained utility records to identify and resolve discrepancies.

- Geophysical Survey: The geophysical survey will be conducted using a combination of optical, pipe and cable locator and ground-penetrating radar (GPR) methods. The combination of these methods provides added confidence in locating both metallic and non-metallic utilities. AECOM will conduct sweep searches using the pipe and cable locators and GPR across the accessible extents of the survey area. If suitable utility access points (e.g. exposed open pipe, valve stem) exist within the vicinity of the proposed survey area, the pipe and cable locator instruments may be used to apply signals directly to utilities that cannot otherwise be located from the surface. Where possible, acoustic and/or optical methods will be used to verify connections between surface accessible points including sewer line connections between manholes or outlets. The lateral extents of suspected subsurface utilities will be marked in the field using semi-permanent marking paint and/or pin flags. The positions of the identified subsurface utilities will be recorded using the DGPS system.

- Subsurface Utility Depiction: Subsurface utility lines and associated features identified based on the records research and surveyed during site and geophysical surveys will be depicted on a composite subsurface utility plan. AECOM will correlate the designated depictions with the utility records and/or surveyed appurtenant surface features to identify potential additional utilities that may not have been designated. If the results of the correlation indicates differences that cannot be resolved through further geophysical surveying using the designated survey methods and/or further discussions with the respective utility owner, AECOM will document the differences accordingly on the subsurface utility site plan and will provide recommendations for additional measures such as intrusive investigations to resolve the issues.

Geotechnical Field Investigations

AECOM proposes to perform geotechnical soil borings in the crest and toe of the dam embankment. The information obtained from the borings will be utilized in the subsequent seepage and slope stability analysis. In order to perform an acceptable seepage and stability analysis, we need to determine the in-situ properties of the embankment soils. Samples obtained from the borings will be subject to laboratory testing in order to define strength parameters for the analysis. AECOM will subcontract Triad of Morgantown, West Virginia to provide all labor and equipment to perform the subsurface geotechnical investigation. Borings will be grouted to within three feet of the ground surface with either cement grout or bentonite/cement grout. Excess drill spoils will be disposed of on-site (either scattered on site or stockpiled at a location designated by WVRANG. Laboratory testing of the field samples collected will be performed in accordance with applicable ASTM standards. A geotechnical data report will be provided that includes boring logs, a boring location plan, and associated laboratory testing data.

Topographic Survey

AECOM will utilize out subcontractor Triad's Professional Land Surveyors and survey crews to perform a detail topographic survey of the site to supplement LiDAR data and any previous surveys completed at the site. This survey will be completed to be utilized in the dam slope stability and seepage analysis and to confirm key elevations to ensure the accuracy of the final design drawings.

Hydrology & Hydraulic Analysis

AECOM will perform a hydrologic and hydraulic (H&H) analysis that will include the following:

- Development of Hydrologic Parameters for the Dam's Watershed Including: Watershed delineation assuming that a single watershed will be used to model the entire watershed contributing to Lake Pierce Dam, runoff curve number estimates for the watershed, and time of concentration estimates for the watershed.

- Development of Hydraulic Parameters for the Dam and Reservoir Including: Stage-storage rating curve (developed using as-built drawings and GIS data supplemented with any available bathymetric survey data), and Stage-discharge rating curve (developed using any available as-built drawings supplemented with topographic survey data).

- Development of a Hydrologic Model: The Spillway Design Flood (SDF) will be routed through the dam and spillway using HEC-HMS and HEC-RAS software. This model will be used to determine if the current spillway meets dam safety criteria and inform the decision making process whether or not a new control structure or any modifications to the existing spillway will be required.

Dam Seepage and Stability Analysis

AECOM will perform seepage and slope stability modeling on the maximum cross-section of the dam. This will require defined engineering parameters for the embankment as constructed and in its current condition, obtained in the geotechnical field investigation.

Computer modeling analyses will be performed to determine the slope stability under existing conditions. The computer modeling analysis will be performed in general accordance with United States Army Corps of Engineers EM 1110-2-1902 Slope Stability (2003) and NRCS TR-60 Earth Dams and Reservoirs (2019).

Seepage and slope stability analyses will be performed using GEOSLOPE Geostudio 2016 (Version 8.16.2.14053) SEEP/W and SLOPE/W software. Spencer's method, which satisfies all static equilibrium conditions, will be used in these analyses.

The seepage analyses will be performed with GeoStudio 2016 SEEP/W computer modelling software using USACE EM 1110-2-1901 Engineering and Design "Seepage Analysis and Control for Dams" (1993) methodology. SEEP/W is a finite element software for modelling groundwater flow and is capable of simulating steady-state and transient conditions using 2D analysis. Calibration of the seepage models will be performed considering existing conditions with known phreatic surface elevations from any available piezometer and/or borehole log data and correlated with hydraulic conductivity laboratory testing. These elevations will used to estimate the phreatic surfaces through the embankments. Existing boundary conditions for seepage analysis will be based on observed and designed conditions.

Analysis conditions that will be performed to determine if slopes meet minimum recommended factor of safety include:

- Rapid Drawdown: Rapid drawdown slope stability analysis is performed using the Slope Stability for Rapid Drawdown Method developed by Duncan, Wright, and Wong (1990) and detailed in USACE EM 1110-2-1902 (2003). This method uses two phreatic surfaces. The initial phreatic surface is developed for steady-state conditions at the maximum storage or surcharge pool elevation. The pool level is then assumed to rapidly drawdown to the lowest gated or ungated outlet. Drawdown of the reservoir is modeled as instantaneous. The phreatic surface within the embankment is modeled as being unchanged. For this analysis, both total stress and effective stress parameters are utilized. This is a conservative approach as actual drawdown would not likely occur instantaneously.

- Steady-State without Seismic Forces: Steady-State conditions are evaluated for maximum storage pool (usually spillway crest elevation) and maximum surcharge pool elevations. Analyses are performed on the downstream slope of the embankment. For long-term stability all soils are assumed fully drained and are expressed in terms of effective strength parameters.

- Steady-State with Seismic Forces: For Steady-State with seismic forces, a horizontal acceleration constant is added to the slope stability model to simulate seismic conditions. The downstream slope is analyzed based on seismic loading guidelines detailed in USACE ER 1110-1-1806 (2016).

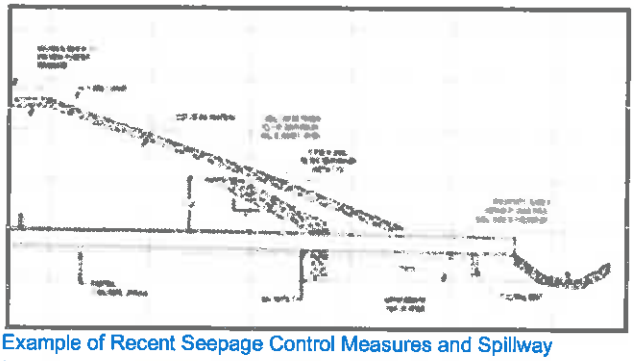
Remediation Alternatives

AECOM Dam Engineers will develop alternatives to deal with the issues identified during the field investigation by using the engineering analysis described in previous sections above. Once an alternative has been selected in coordination with the project team AECOM will develop Construction Documents suitable for bidding including drawings, specifications and construction cost estimates at the 35%, 65%, 95% and 100% design stages.

Our experience in dam engineering is unmatched: our engineers are currently supporting a variety of active embankment and foundation remediation projects. We will bring our local knowledge together with global expertise to deliver a safe, efficient dam project for the WVRANG.

We will consider viable alternatives for the Pierce Lake Dam that could include:

- Blanket drain and/or toe drain
- Seepage cutoff through the embankment
- Construction of a new control structure
- Spillway bridge improvements



Example of Recent Seepage Control Measures and Spillway Improvements designed by AECOM.

Permitting

AECOM will prepare the necessary applications for permits including but not limited to Section 401 and 404 permits. In order to accomplish this, a wetland and waters delineation will be conducted in accordance with criteria established in the 1987 U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual. Upon completion of the field investigation, AECOM will prepare a Wetlands and Waters Delineation Report describing the wetlands and other waters in the study area. The Wetlands and Waters Delineation Report will contain a clear and concise summary of the delineation process and results, including USACE field data forms and site photographs. The team will prepare maps that clearly identify the wetland and upland areas within the study area.

AECOM will prepare draft permit applications for required permits related to the rehabilitation of Pierce Lake Dam. Permits may include the following:

- USACE 401/404
- Erosion & Sediment (E&S) Control
- National Pollutant Discharge Elimination System (NPDES)
- Dam Alteration
- US Fish and Wildlife Services (USFWS)
- State Historic Preservation Office (SHPO)

Operations & Maintenance (O&M) Plan

AECOM will develop an O&M Plan which will provide a summary of available data (as-built drawings, design reports, construction records, inspection reports, etc.), inspection requirements, roles and responsibilities for maintenance and emergency response personnel, and other pertinent information to ensure the dam will operate adequately in the future. The plan will include numerous operations, maintenance, and repair features of all component parts and identify the approximate annual cost estimate to execute the O&M plan.

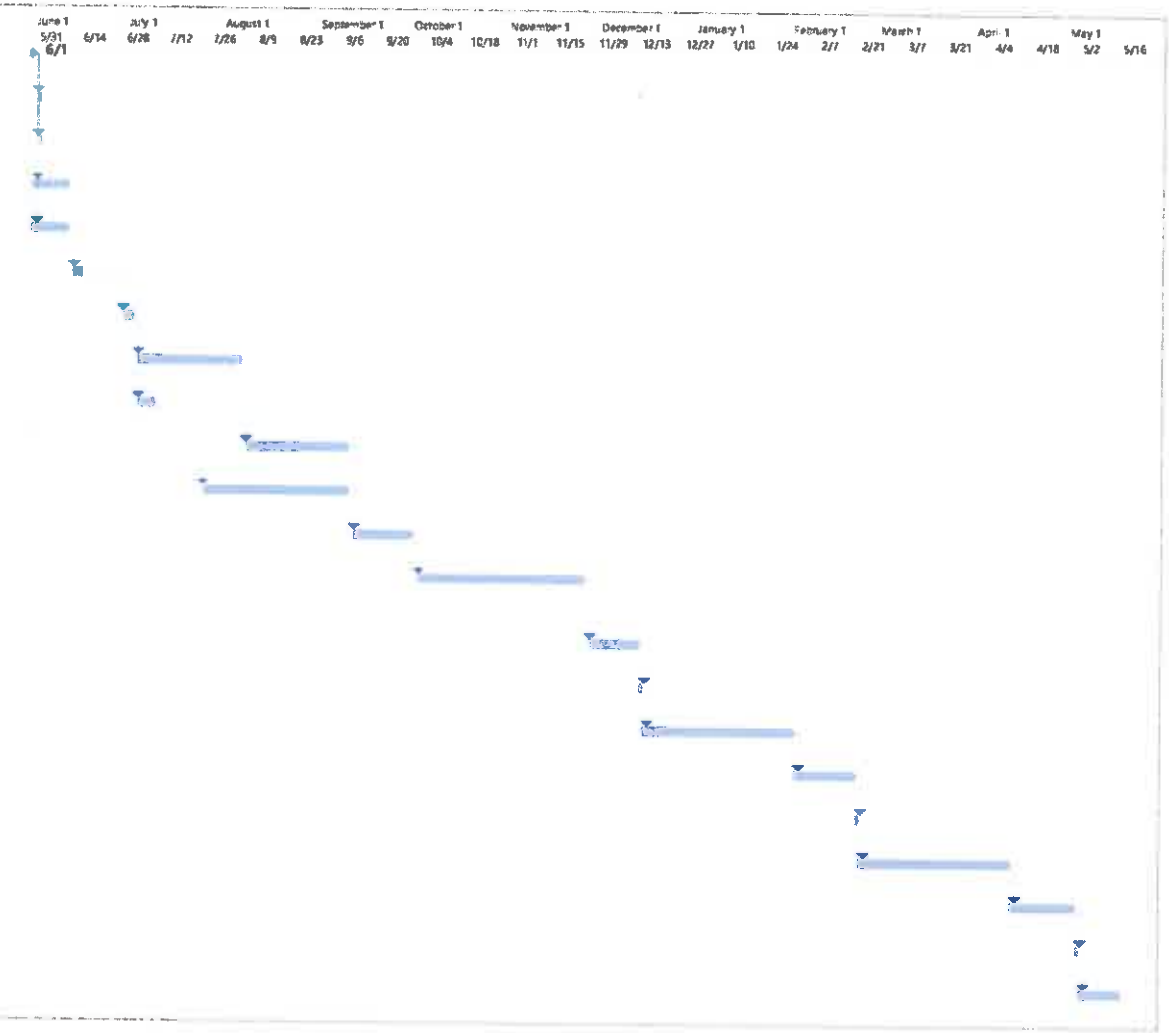
Bid Phase Services

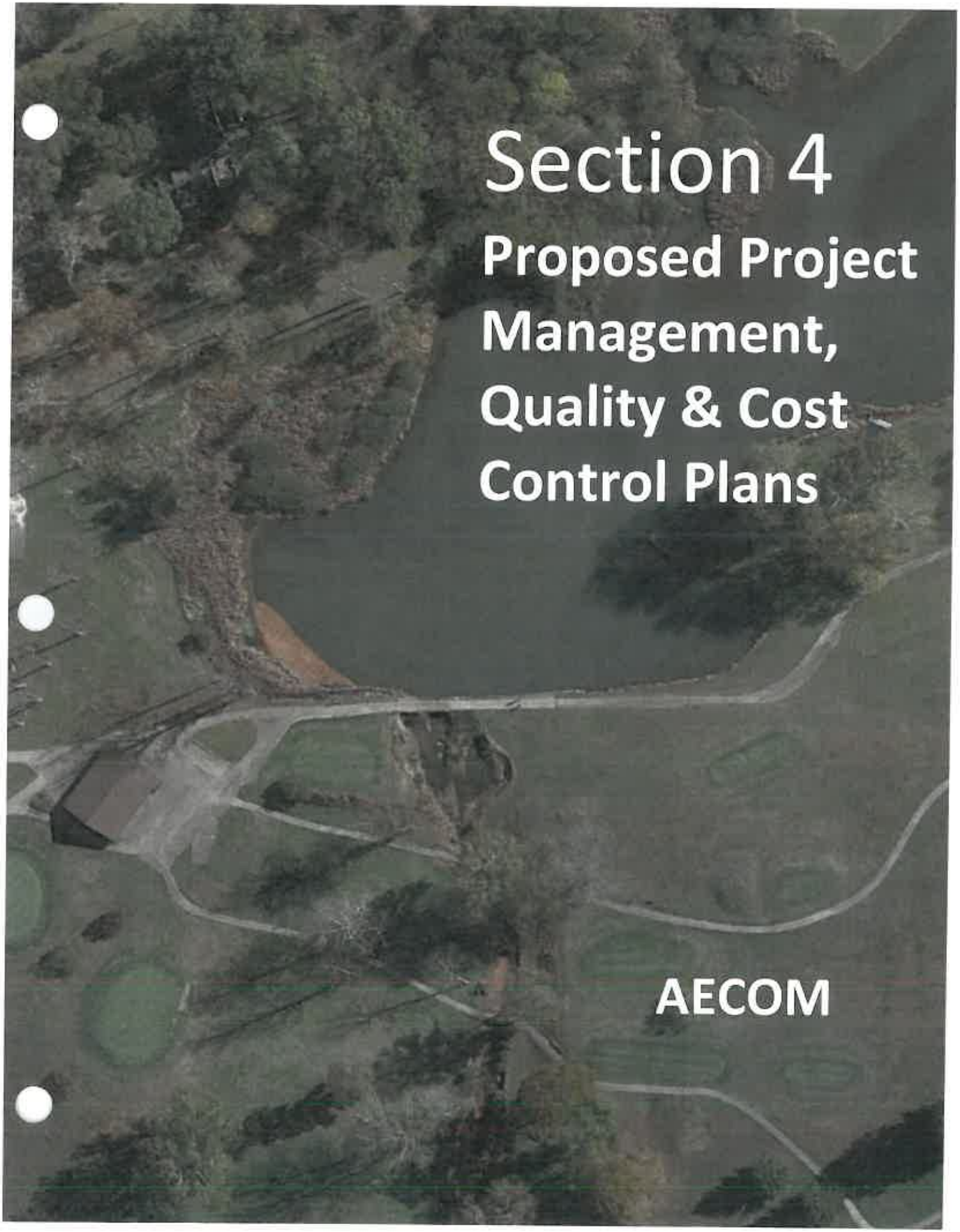
AECOM will provide bidding phase services, including participation in the pre-bid meeting, aid in the preparation of addenda during bidding, evaluation of contractor bids, and preparation of conformed plans and specifications. During the pre-bid meeting, AECOM will describe the overall design to the bidders and will answer contractor questions. AECOM will provide written responses to bidders' inquiries. These responses will be documented in addenda to the bid documents. AECOM will evaluate bids and provide comments regarding the completeness and adequacy of the bids. Conformed plans and specifications will be prepared to incorporate the additional information contained in the bidding addenda into the construction set of plans and specifications.

Figure 1. Proposed Project Execution Schedule

Based on the provided service start date of June 1, 2020 and the provided service end date of May 31, 2020 we have prepared the proposed project schedule provided below.

ID	Task Name	Duration	Start	Finish
1	Contract/Task Order Award	0 days	Mon 6/1/20	Mon 6/1/20
2	Project Kickoff Meeting	1 day	Wed 6/3/20	Wed 6/3/20
3	Dam Safety Inspection	1 day	Wed 6/3/20	Wed 6/3/20
4	Document Review	10 days	Mon 6/1/20	Fri 6/12/20
5	Develop Project Safety Plan	10 days	Mon 6/1/20	Fri 6/12/20
6	Geophysical Utility Investigation	2 days	Mon 6/15/20	Tue 6/16/20
7	Subsurface Exploration Program	3 days	Wed 7/1/20	Fri 7/3/20
8	Laboratory Testing	25 days	Mon 7/6/20	Fri 8/7/20
9	Topographic Survery	5 days	Mon 7/6/20	Fri 7/10/20
10	Perform Slope Stability and Seepage Analyses	25 days	Mon 8/10/20	Fri 9/11/20
11	Updated H&H Analyses	35 days	Mon 7/27/20	Fri 9/11/20
12	Geotechnical Data Report and H&H Report	15 days	Mon 9/14/20	Fri 10/2/20
13	35% Drawings, Specifications & Cost Estimate including Existing and Proposed Utility Plans	40 days	Mon 10/5/20	Fri 11/27/20
14	Review of 35% Design Submittal	12 days	Mon 11/30/20	Tue 12/15/20
15	35% Design Submittal Review Meeting	1 day	Wed 12/16/20	Wed 12/16/20
16	65% Drawings, Specifications & Cost Estimate	35 days	Thu 12/17/20	Wed 2/3/21
17	Review of 65% Design Submittal	14 days	Thu 2/4/21	Tue 2/23/21
18	65% Design Submittal Review Meeting	1 day	Wed 2/24/21	Wed 2/24/21
19	95% Drawings, Specifications & Cost Estimate	35 days	Thu 2/25/21	Wed 4/14/21
20	Review of 95% Design Submittal	15 days	Thu 4/15/21	Wed 5/5/21
21	95% Design Submittal Review Meeting	1 day	Thu 5/6/21	Thu 5/6/21
22	100% Construction Documents and Cost Estimate	10 days	Fri 5/7/21	Thu 5/20/21





Section 4

Proposed Project Management, Quality & Cost Control Plans

AECOM

Proposed Project Management

AECOM is proposing to assign Mr. Michael McIntyre, PE as the Project Manager to lead the project. Mr. McIntyre is the AECOM Dams Practice Lead and has over 16 years of experience managing a wide variety of dams engineering projects. He will be the overall project lead and guide the project according to the agreed upon SOW and service agreement, supported by the various project disciplines. Mr. McIntyre is a West Virginia-licensed Professional Engineer experienced in dam engineering and project management of dam and hydraulics projects with complementary expertise in geotechnical engineering. This project management structure will enable each discipline to focus on their respective scopes of work with the Project Manager integrating the team together throughout the project. AECOM will also employ an expert subcontractor to support this project. Triad Engineering has experience working in West Virginia with AECOM and brings knowledge of dam and hydraulics projects. This specialty subcontractor will report to the Project Manager and will complement the work performed by AECOM. Our proposed organizational chart is provided in the section below on page 62.

Client Coordination

To achieve successful project outcomes, we place a premium on clear, consistent communication with our clients. We structure the execution of our projects to so that our clients informed of aspects of work, external communications, and any project challenges.

As leader of the project, the Project Manager will be directly available to the stakeholders for consultation and will be the primary point of contact as well as the designated Engineer-in-Charge. Appropriate staff from our team will be available to address client concerns, attend meetings and teleconferences, and respond to questions and other requests for information under direction of the Project Manager. This means that Purchasing and WVRANG gets the right answers from the experts.

Risk Management

Project risks present challenges to both project owners and consultants, contractors and other stakeholders involved. AECOM recognizes that these risks impact both the owner and the consultant, and as such we seek to identify project risks early in the project and identify mitigation measures to minimize the impacts these risks have on project execution and outcomes.

Risk-based thinking is part of each step in AECOM's project delivery process. As part of our scoping process, AECOM requires that the project team identify conditions or aspects of the project that may impact successful completion of the project. Sometimes these are obvious risks such as hazardous health and safety conditions. To address the risk of adverse health and safety conditions AECOM will prepare a Health and Safety Plan to document potentially adverse conditions and tasks and provide measures to address them so work can be executed in a safe manner.

Scope, Schedule and Cost Control

AECOM recognizes that managing multiple disciplines and a SOW in the context of meeting our clients' needs while maintaining the agreed-upon schedule and staying within budget, is a challenge all its own.

- Knowledge: How we manage projects can determine whether they meet your expectations. If work is technically sound or even excellent, but delivered late or over budget, we haven't met your expectations. We can't – and don't – leave project management to chance. At a minimum, AECOM requires its project managers to achieve internal project management certification by completing "MAP" training – Managing AECOM Projects offered in association with the University of California Los Angeles. The MAP curriculum, which includes in-person instruction and online courses, closely aligns with the Project Management Institute's Project Management Body of Knowledge, the basis of PMI's Project Management Professional (PMP) certification recognized worldwide. AECOM'S MAP approach facilitates consistency, especially critical when multiple disciplines and complex SOWs are involved.

- Tools: Like many of our large-organization peers, AECOM employs state-of-the-art

management and technical software and systems. Recently, however, AECOM has taken this one step further by having its high-performing project managers collaborate with programmers to build a proprietary project management platform. This platform centralizes project data and synthesizes multiple management systems, delivering efficiencies and time to project managers and their teams. Our clients benefit in turn as:

- ✓ Project documents, deliverables, and quality control activities are centralized and tracked on a single project management and production platform.
- ✓ Project planning and planning for technical quality – always a priority – are strengthened. Starting in the proposal stage and continuing throughout each project, technical leads plan how and by whom the work will be done to best address client requirements.
- ✓ Dashboards and reports help project managers and their teams to quickly understand progress and trends, identify potential issues, and communicate status to stakeholders.
- ✓ Globally consistent templates facilitate collaboration, clarity and visibility among the team's disciplines.

Quality Assurance/Quality Control

AECOM provides our clients with a proven Quality Management System (QMS) that is certified to the internationally renowned ISO 9001:2015 standard yet is sufficiently flexible to address the specific requirements of this project. Quality management is central to our project management approach, and our project team includes individuals assigned to specific quality roles under our system. As a key component of the project management process, AECOM's QMS is fully integrated into our project management platform so that quality control engrained in the way AECOM manages our projects. The general components of AECOM's approach to project quality management, and the parties responsible for them, are depicted below.

Initiating Quality

Quality begins with AECOM's understanding of your project goals and objectives, emphasizing communication with the stakeholders and a review of project inputs. Assigning technically qualified and experienced personnel to produce and review the work is an important next step. Our initial planning and scheduling activities, including defining the various project work tasks and associated quality activities, are foundational to a successful project.

Producing Quality

AECOM requires a project plan on all projects to define key parameters, deliverables, and goals and guide the work of the team. The plan is discussed at the project team kickoff meeting and updated as needed to inform the team of new developments. As work proceeds, several critical technical activities are undertaken, including:

- Proper application of codes, standards and design criteria.
- Ongoing oversight and supervision for accuracy and completeness as work proceeds.
- Distribution of in-progress documents at defined intervals for quality review.
- Coordination among disciplines.
- Verification of compatibility and consistency among document types, such as drawings and specifications.
- Resolution and closure of in-progress review comments.

QUALITY PROCESS

Phase	Planning and Approach	Design and Development	Checking	Review	Verification
Responsible parties	Project Manager Project Director Lead Verifiers Project Quality Rep	Discipline Leads Discipline Staff	Discipline Reviewers	Lead Verifier Project Manager Project Director Peer Teams	Project Quality Rep Project Manager

Confirming Quality
While it is important to build quality into the work as it is performed, formal checking and review are critical QMS activities. Quality checking activities, which are documented with two-level approvals, include:

- Checking calculations for correctness and completeness of mathematics, methodology, selection of software, application of standards and codes, and general approach.
- Checking drawings, presentations, and public communications within each discipline to confirm design layout, dimensions and details. Potential interferences, conflicts and interface issues are resolved through interdisciplinary reviews.
- Checking specifications for content and application, as well as compliance with the prescribed format, and for consistency throughout the specifications.
- Checking studies and reports for content, logic, clarity and soundness of recommendations, as well as grammar, punctuation and format.

Delivering Quality
Deliverables undergo a final verification check before they are submitted. A lead verifier evaluates the deliverable for completeness and consistency, adherence to quality requirements, and resolution of comments. The Lead Verifier then signs a Technical Quality Review Record and transmits it to the Project Manager, who is then responsible for the final overlook, approval and submittal. This final independent evaluation assesses the submittal's state of readiness, without diminishing the Project Manager's accountability for the quality of the work being released. As a check-and-balance activity, this review pairing helps AECOM consistently deliver quality and value to our clients.

Improving Quality
A key component of AECOM's quality program and ISO 9001 is continuous improvement. We learn from our experiences and apply those lessons to future work through a formal, iterative process. The true focus of this process is to generate client satisfaction, one of AECOM's core values.

"The Mosul Dam Task Force (MDTF) Project Delivery Team (PDT) is recognized outstanding delivery of the project's strategic objectives; plan &execute an emergency grouting program to mitigate the extremely high risk of dam failure for what USACE calls 'the most dangerous dam in the world'... the Mosul Dam Project Delivery Team is a credit to the Mosul Dam Task Force, TransAtlantic Division, and the entire Corps of Engineers." – Stacey K. Hirata, PE, SES and Edward E. Belk, Jr., PE, SES, Co-Leaders, Program and Project Management Community of Practice

Figure 2. Proposed Project Organizational Chart