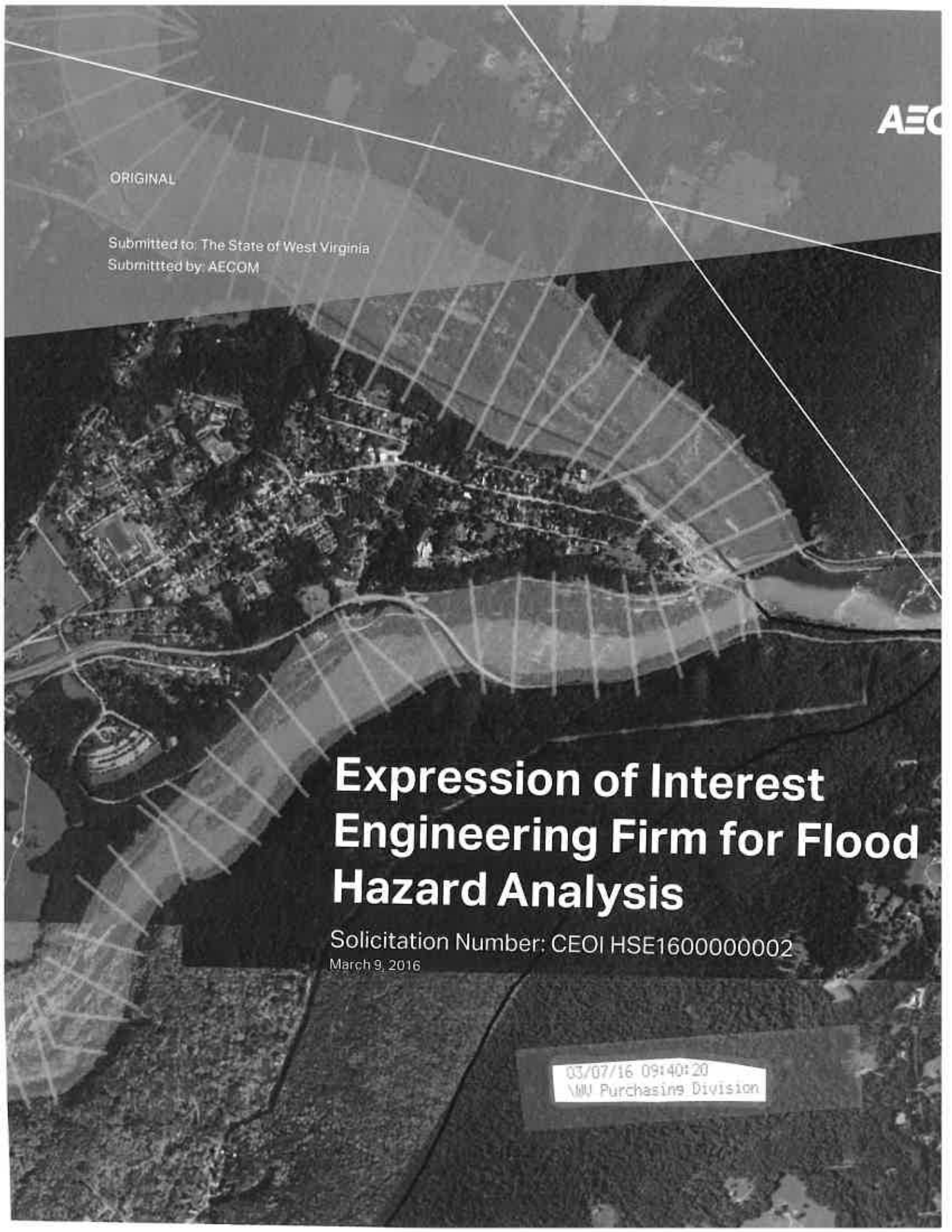


ORIGINAL

Submitted to: The State of West Virginia
Submittted by: AECOM

Expression of Interest Engineering Firm for Flood Hazard Analysis

Solicitation Number: CEOI HSE1600000002
March 9, 2016

AECOM
12420 Milestone Center Drive
Suite 150
Germantown, Maryland 20876
www.aecom.com

301.820.3000 tel
301.820.3009 fax

March 4, 2016

Ms. Tara Lyle
State of West Virginia
Department of Administration, Purchasing Division
2019 Washington Street East
Charleston, West Virginia 25305

Subject: **Expression of Interest**
Engineering Firm for Flood Hazard and Analysis
Solicitation Number: **CEOI 0606 HSE1600000002**

Dear Ms. Lyle:

The State of West Virginia is looking for a vendor to support the State in developing accurate approximate 1-percent-annual-chance floodplains to better identify flood risk and build safer communities that are resilient to storm events. To assist the State, AECOM has built a team that offers unparalleled experience, expertise, innovation, and foresight to serve the State in this initiative. Our project team comprises engineering, mapping, and hazard mitigation professionals who know and understand hydrology and hydraulics, floodplain mapping, and local community mitigation germane to West Virginia. In short, we are offering the State:

Licensed Qualified Staff – A project team with extensive relevant experience, local presence, and knowledge, having worked throughout West Virginia since 1953.

Mapping Program Leadership – An industry leader in floodplain mapping and flood hazard analysis. We have produced approximately 40 percent of FEMA's mapping inventory nationwide. Additionally we have worked with 25 state Cooperating Technical Partners (CTPs) to update their flood mapping and provide expertise in risk analysis and mitigation.

Knowledge of the Region – Familiarity with the flood risks and mitigation challenges associated with the Appalachian Mountain and Plateau regions.

Thank you for the opportunity to showcase our staff qualifications and past performance on similar scope projects and to offer our approach to flood hazard analysis and mapping. The attached Expression of Interest provides details to affirm our claim to be the industry leader for flood hazard analysis and mapping. We are confident that this submittal demonstrates our experience and successful past performance on similar scope projects.

If you require additional information or would like to meet the AECOM team, please contact our proposed Program Manager, Christine Estes, PE, CFM at 301.820.3282 or christine.estes@aecom.com.

Sincerely,
AECOM Technical Services, Inc.

John D. Bowers, PE
Vice President

Christine Estes, PE, CFM
Program Manager

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Centralized Expression of Interest
02 — Architect/Engr

Proc Folder: 184203

Doc Description: Engineering firm for flood hazard analysis

Proc Type: Central Contract - Fixed Amt

Date Issued	Solicitation Closes	Solicitation No	Version
2016-01-25	2016-02-16 13:30:00	CEOI 0606 HSE1600000002	1

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Name, Address and Telephone Number:

AECOM Technical Services, Inc.
12420 Milestone Center Drive, Suite 150
Germantown, Maryland 20876

FOR INFORMATION CONTACT THE BUYER

Tara Lyle
(304) 558-2544
tara.l.lyle@wv.gov

Signature X FEIN # 95-2661922 DATE March 4, 2016

offers subject to all terms and conditions contained in this solicitation

The West Virginia Purchasing Division for the Agency, WV Division of Homeland Security and Emergency Management, is soliciting CEOI responses from qualified firms to provide a contract to provide necessary engineering and other related professional services to provide riverine flood hazard analysis and mapping services for the State of West Virginia on an as needed basis, per the attached documentation.

ACCOUNTING TECHNICIAN 304-558-5380 HOMELAND SECURITY & EMERGENCY MANAGEMENT BLDG 1 RM EB80 1900 KANAWHA BLVD E CHARLESTON WV25305-0360 US	ACCOUNTING TECHNICIAN 304-558-5380 HOMELAND SECURITY & EMERGENCY MANAGEMENT BLDG 1 RM EB80 1900 KANAWHA BLVD E CHARLESTON WV 25305-0360 US

Line	Comm Ln Desc	Qty	Unit Issue
1	Professional engineering services		

Comm Code	Manufacturer	Specification	Model #
81100000			

Extended Description :

Professional engineering services

Line	Event	Event Date
1	Technical questions due by 4:00 pm	2016-02-04

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CEOI HSE1600000002

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	Addendum No. 1	[ ]	Addendum No. 6
[X]	Addendum No. 2	[ ]	Addendum No. 7
[X]	Addendum No. 3	[ ]	Addendum No. 8
[ ]	Addendum No. 4	[ ]	Addendum No. 9
[ ]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

AECOM Technical Services, Inc.
Company

John D. Bewers, PE, Vice President
Authorized Signature

March 4, 2016
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.

RFQ No. HSE1600000002

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

MANDATE: 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 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: _____ Date: March 4, 2016

State of Maryland

County of Montgomery to-wit:

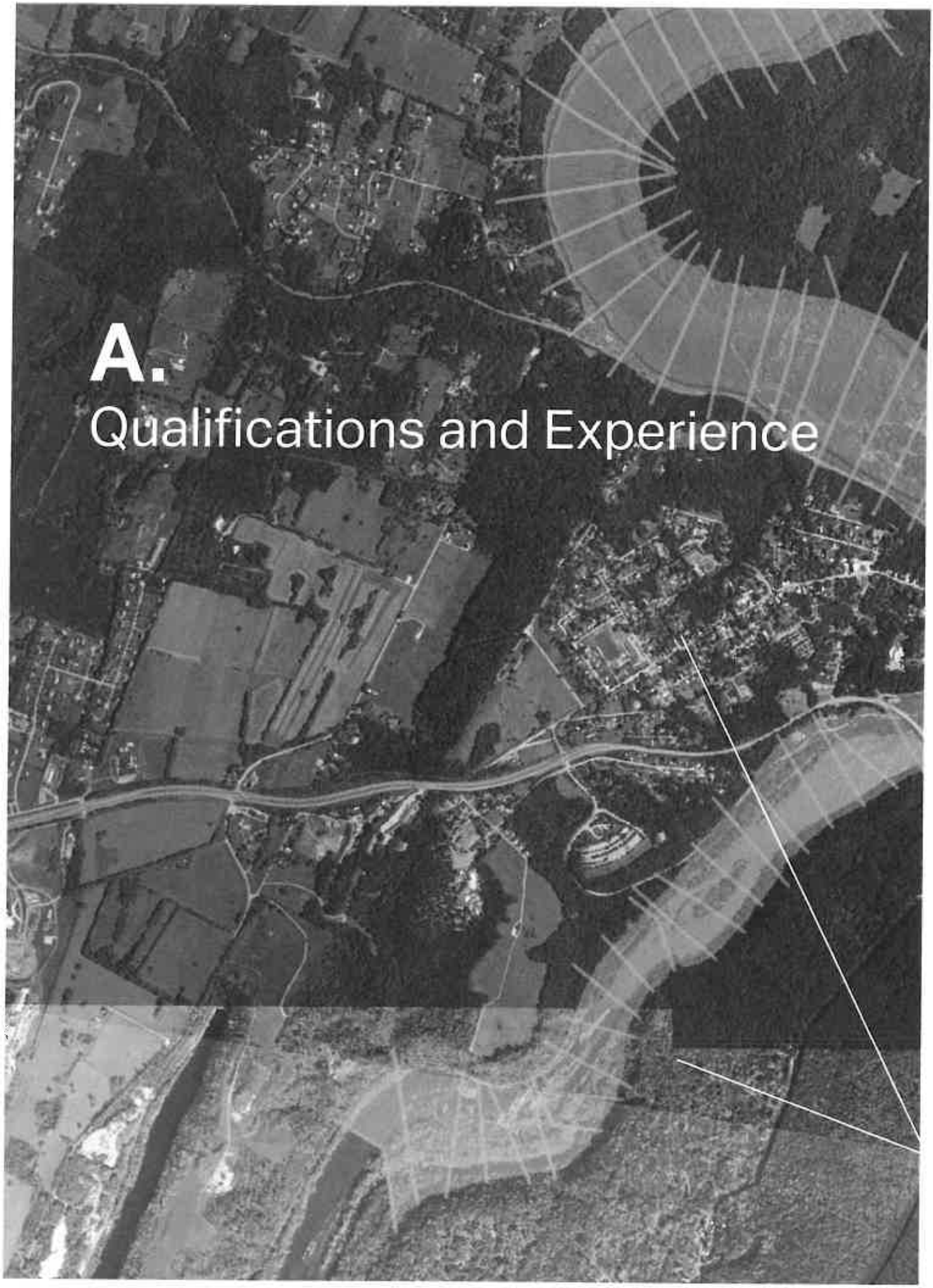
Taken, subscribed, and sworn to before me this 4th day of March, 2016

My Commission expires November 19, 2017.

AFFIX SEAL HERE

SHARON A. SMITH NOTARY PUBLIC MONTGOMERY COUNTY MD

NOTARY PUBLIC Sharon A. Smith



A.
Qualifications and Experience

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A. Qualifications and Experience

AECOM's vision is to be a dependable, trusted, and innovative partner to the State of West Virginia.

Introduction

AECOM, through its legacy companies, including URS Corporation, has been providing engineering services to the State of West Virginia since the 1950s. Since 2009, AECOM has also worked closely with the Federal Emergency Management Agency (FEMA) Region III under the Risk MAP production and technical services contract. We have performed hundreds of flood studies for the Region, including in West Virginia.

AECOM is a premier, fully integrated professional and technical services firm positioned to design, build, finance, and operate infrastructure assets around the world for public and private-sector clients. With over 85,000 employees—including architects, engineers, designers, planners, scientists, and management and construction services professionals—we serve clients in over 150 countries around the world. AECOM is ranked as the #1 engineering design firm by revenue in *Engineering News-Record* magazine's annual industry rankings and has been recognized by *Fortune* magazine as a World's Most Admired Company. AECOM provides a blend of global reach, local knowledge, innovation, and technical excellence in delivering customized and creative solutions that meet the needs of clients' projects.

AECOM has prepared this submittal to present our team, interest in, and qualifications for performing riverine flood hazard analysis and mapping services for the Division of Homeland Security and Emergency Management (DHSEM) in response to your Request for Expression of Interest. AECOM offers DHSEM a unique combination of capabilities and experience:

- Successful completion of hydrologic and hydraulic (H&H) modeling and mapping covering 200,000+ square miles of land area and 135,000+ miles of stream.
- A Program Manager that has direct, relevant experience with FEMA's Risk Mapping, Assessment and Planning (Risk MAP) program nationwide and direct applications to FEMA Region III.
- Experience and knowledge working in West Virginia for more than 60 years.
- Recent experience providing the exact services requested. AECOM performed a flood study for Jefferson County, WV, which included the development of advisory flood heights for over 100 miles of stream and creating deliverables for the WV Flood Tool.
- A long history of assessing and modeling flood risk, responding to flooding events, and conducting proactive mitigation planning working with all levels of government, from federal to state to local communities.
- A dedicated staff of over 500 engineers, and geographic information system (GIS) professionals who work full time on watershed and Special Flood Hazard Area projects.
- Experience conducting or reviewing flood studies in over 1,000 counties nationwide and in every FEMA region, and producing over 43,000 Flood Insurance Rate Map (FIRM) panels.
- State-of-the-art local, regional, and national technical capabilities and subject matter expertise, enabling us to provide additional services that the State might need, such as sophisticated two-dimensional (2D) hydraulic and levee modeling, dam breach analysis,

Hazus and risk assessments, and efficient floodplain characterization.

- Intricate knowledge of FEMA's programs and Risk MAP. AECOM has been serving as a contractor for FEMA and numerous states and partners for over 40 years. In this capacity, our team members work routinely with FEMA Headquarters and Region III on technical studies, giving us a comprehensive understanding of the overall direction and evolution of the Risk MAP program.

More than 60 Years of Experience in the State

AECOM's work in the State of West Virginia began in 1953 with a small project to investigate the water and sewer system for the Town of Union in Monroe County and, over the years, expanded to full program work throughout the State. Other legacy projects in West Virginia include the architectural and engineering design of our nation's first automated People Mover Transit System in Morgantown and the Charleston Coliseum design. We also converted a military base in Martinsburg to accommodate one of the largest aircraft in the world, designed a 1,200-inmate federal prison on a mountaintop removal coal mine site, promoted green infrastructure on a variety of projects, and provided engineering services for highways and bridges throughout the State. Our West Virginia offices have performed work in every county in West Virginia.

AECOM's West Virginia presence is reflected through our two offices in Morgantown and Kenova. Our Morgantown office has four Professional Engineers (PE) and one GIS professional that can support this contract. We continue to grow in our expertise and are adding team members who enhance the services we are able to provide to our clients. Our Kenova office has one GIS professional available to assist in this effort.

Our staff in the Morgantown office has a long history with flood mapping and GIS in the State and particularly north-central West Virginia. We have been involved with local planning and GIS development in Monongalia County for over 10 years and are familiar with the mapping resources available to GIS professionals in the State. In addition to our GIS staff, the Morgantown office is also home to a strong and respected transportation group working with the West Virginia Department of Transportation and other State agencies daily. Our staff routinely addresses bridge hydraulic and floodplain studies associated with roadway crossings of streams in counties around the State. In West Virginia, AECOM is also a recognized leader in planning, design, visualization, alternatives analysis, cost estimation, prioritization, and public involvement.

For FEMA Region III, we have performed analysis of hydrology, hydraulics, and mapping, on over 3,000 miles of new Zone A; including over 100 miles for Jefferson County, WV. We have performed Discovery and developed Flood Risk Products for six HUC-8 watersheds in the Region, including the Conococheague-Opoquon Watershed, which covers four states, including West Virginia.

Under contract with the Canaan Valley Institute (CVI), AECOM developed the first Digital Orthophoto Quarter Quadrangle (DOQQ)-based FIRM for Hampshire County in 2000. We performed the hydraulic analysis to evaluate the 1-percent-annual-chance flood for the Zone AE streams in the county, totaling approximately 58 miles of new study. We also conducted flood studies and FIRM production for Gilmer and Preston Counties for CVI.

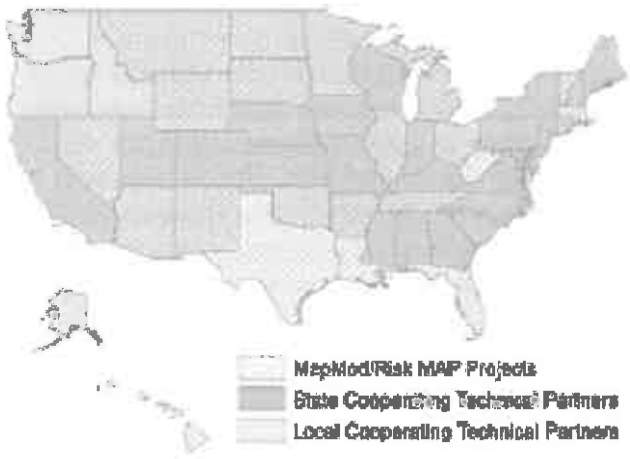
Additionally, AECOM has worked for the U.S. Army Corps of Engineers (USACE) Huntington District for the past 16 years. Our USACE work in the State includes the update of master plans for flood control projects spread over West Virginia and design, installation, and operations and maintenance of the Automatic Data Acquisition Systems (ADAS) at Bluestone Dam.

Local Presence – National Knowledge

The team assembled for the State of West Virginia combines our local experience with our national knowledge of floodplain mapping. AECOM has been performing floodplain mapping for FEMA, states, and local agencies throughout the United States for over 40 years. As a FEMA contractor, we have continuously improved our production processes and tools so that we can produce countywide and watershed floodplain studies and FIRM updates better, faster, and more cost-effectively.

AECOM's vision is to be a dependable, trusted, and innovative partner to the State of West Virginia. Together, we want to help build a stronger West Virginia with safer, smarter, and more sustainable communities.

AECOM's vision for meeting the State's needs is rooted in decades of experience serving Cooperating Technical Partner (CTP) states throughout the country. AECOM has partnered with 42 of FEMA's CTPs, including 25 states, under 75 different Mapping Activity Statements (MASs). AECOM is currently a CTP contractor for statewide floodplain mapping projects for several Regions throughout the country. Some states where AECOM currently holds state CTP contracts include Colorado, Delaware, Georgia, Iowa, Kansas, Mississippi, New Jersey, New York, North Carolina, South Carolina, and Utah. Our project team has seen it all from a CTP perspective and we are ready to help solve any challenge DHSEM might face. This experience enables AECOM to anticipate change and develop tools, guidance, and training materials to help clients successfully implement Risk MAP across communities, states, and regions.



AECOM has nationwide project experience working for state and Local CTPs and FEMA

We will continue to build upon our recent accomplishments by increasing flood risk awareness and engaging communities to fully understand new flood maps. This will help them take action to reduce potential loss of life and property from flood hazards. We will support the State in identifying flood hazard mitigation actions and we will effectively communicate and explain those actions to its citizens through creative and effective community engagement and outreach activities.

1. Licensed Professional Engineer

AECOM is licensed to practice engineering in the State of West Virginia. Our proposed Program Manager, Christine Estes, is a both a Registered PE and a Certified Floodplain Manager (CFM) and possesses more than 16 years of engineering and mapping experience. Our project team also includes licensed PEs in West Virginia, including our Hydrology and Hydraulics Technical Advisor, David Weaver, PE. Ms. Estes is applying for a WV PE license through reciprocity and expects to receive her licensure before contract award.

2. Staff Qualifications and Experience

Our proposed team for this project was carefully selected to provide the State with a strong local presence while leveraging our state-of-the-art regional and national expertise, which only a large specialized firm such as AECOM can provide. AECOM brings professional quality, plus a staff that is strongly committed and passionate about supporting West Virginia in delivering its mapping program.

AECOM's proposed project team's knowledge and understanding of the National Flood Insurance Program (NFIP) has been developed through our long-term relationship with FEMA and our involvement with local and state agencies. Our staff working at the Regional Support Center in Philadelphia are considered an extension of the Regional staff. We have a close relationship with FEMA Region III that will benefit the State of West Virginia when coordinating flood studies.

Key Personnel

Program Manager – Christine Estes, PE, CFM. Ms. Estes has over 16 years of experience in civil and environmental engineering, as well as more than a decade of project management experience managing multi-discipline teams for large water resources engineering and mapping contracts. Ms. Estes is the department head for AECOM's

Floodplain Analysis and Coastal Engineering group located in Germantown, MD. This group comprises more than 56 staff specializing in water resources, mapping, FIRM processing, hydrology and hydraulics, and technical support to the FEMA Production and Technical Services (PTS) contracts. For over 6 years, she has served as the AECOM Program Manager for all Risk MAP work performed for FEMA Region III. She has extensive floodplain management experience and has worked on FEMA studies since the start of her career. She has prepared complex H&H models for rivers, reservoirs, and watersheds. Her modeling and software expertise includes HEC-RAS, HEC-1, HEC-2, HEC-HMS, XP-SWMM, ICPR, and ArcGIS. Ms. Estes has worked on the FIRM production of over 75 countywide studies for which she provided management, engineering, mapping, and/or quality control expertise.

Principal in Charge – John Bowers, PE. Mr. Bowers has more than 33 years of experience in engineering, program management, and company operations. As a Vice President within the Water Business Unit, Mr. Bowers is authorized to negotiate with the State, as well as allocate whatever resources are necessary to meet all requirements under the proposed contract. His work includes management of FEMA technical assistance contracts and he has extensive experience (more than 10 years) managing a large nationwide indefinite delivery/indefinite quantity contracts, overseeing as many as 100 concurrent task orders (TOs), and deploying specialty resources from all over the United States.

Quality Assurance Officer – Joseph Chapman, PE, CFM. Mr. Chapman has more than 28 years of experience in the civil engineering field and will provide quality assurance throughout the duration of the contract. He has extensive experience in floodplain mapping, flood risk assessment, and flood mitigation projects in support of federal, state, and local agencies and has provided post-disaster support ranging from field damage assessments to the development of flood recovery mapping to support rebuilding efforts for the past 25 years. Mr. Chapman has managed and supported over a dozen CTP clients nationwide. Mr. Chapman currently serves as AECOM's North American Technical Practice Leader for Flood and Natural Hazard Risk Management. He has extensive experience delivering quality products for CTPs across the nation.

Hydrologic and Hydraulic Modeling Lead – Michael Seering, PE, CFM. Mr. Seering has more than 12 years of experience in civil and environmental engineering with a focus on water resources and project management. He now serves as the Hydrology and Hydraulics Team Lead for the Germantown, MD office, overseeing nine engineers ranging from junior to senior levels. He has prepared floodplain mapping studies and has performed H&H evaluations for states, FEMA, and USACE throughout the country.

Hydrologic and Hydraulic Technical Advisor – David Weaver, PE. Mr. Weaver is an experienced project manager who oversees and develops planning studies, engineering design, design-build, and construction management for a variety of project types and disciplines. Mr. Weaver will assist with the Hydrology and Hydraulics tasks. As branch manager of the Morgantown, WV office, he supervises the operations in that office and coordinates with other AECOM offices around the country.

Mapping, FIRM, and Data Management Lead – David Rubenstein, CFM. Mr. Rubenstein has dedicated his 15-year career to the study, development, and outreach of flood hazard areas for the NFIP. Mr. Rubenstein has over 7 years of experience as a Study and Project Manager for AECOM's Water Resources Group. Mr. Rubenstein also has over 12 years of experience in GIS. Mr. Rubenstein has worked on numerous projects in FEMA Region III. Mr. Rubenstein is a resident of Hedgesville, WV and is a member of the West Virginia Floodplain Management Association.

Topographic Data Development Lead – Amelia Vincent, PE, CFM. Ms. Vincent brings 14 years of experience in the development of topographic data sources. She serves as a subject matter expert on terrain analysis and development on multiple FEMA contracts in Region III, as well as multiple state contracts. She has extensive experience with ArcGIS, WISE, and HEC-RAS software and Light Detection and Ranging (LiDAR) data processing.

Hazard Mitigation Planning Lead – Jae Park, PhD, CFM. Dr. Park has more than 21 years of experience in the areas of hazard mitigation and disaster recovery. He has managed over $400 million in federal and state funding for 11

presidentially declared disaster recoveries and worked with FEMA in establishing hazard mitigation and recovery policies. He provides programmatic management support ranging from National Technical Review of FEMA's Hazard Mitigation Assistance grant applications and Benefit-Cost Analysis (BCA) training to program guidance and policy development for the agency.

Community Outreach Lead – Ann Terranova, CFM. Ms. Terranova has created, managed, and implemented strategic community engagement and outreach programs to assist clients in solving highly controversial and complex technical and environmental problems. Through demonstrated experience, she knows how to successfully plan for and complete community engagement and risk communications projects. Ms. Terranova served as the Risk Communications and Outreach Lead for former URS participation as a joint venture member company for Risk MAP. Ms. Terranova also served as the Task Leader and Senior Community Planner for FEMA's Long-Term Community Recovery program conducting needs assessments for coastal communities in Mississippi and Texas impacted by Hurricane Katrina.

Quality Control Lead – Jeffrey Sengebusch. Mr. Sengebusch is a FIRM Processing Team Leader with 14 years of experience working with the NFIP, including quality assurance / quality control (QA/QC) reviews of FIRMs and Flood Insurance Study (FIS) Reports, FIRM and FIS production, and all aspects of Post-Preliminary Processing. He possesses extensive knowledge of FEMA Guidelines and Specifications, and has conducted QA/QC reviews on over 350 FISs, including more than 30 in Region III and more than 10 in West Virginia. Mr. Sengebusch is also the Project Manager for several NFIP FISs in Region VI for which he manages all financial and production aspects.

Table 1 below demonstrates the experience of the key personnel with projects that are directly relevant to the scope proposed by the State.

Table 1: AECOM Staff Experience on Relevant Projects

Name	FEMA Production Technical Services A&E	FEMA Risk MAP	North Carolina Floodplain Mapping	South Carolina Flood Mapping	Delaware Flood Mapping Study	Kentucky Statewide Map Modernization	Kansas Flood Mapping	FEMA Hazard Mitigation
Christine Estes, PE, CFM	■	■	■	■	■	■	■	■
Joseph Chapman, PE, CFM	■	■	■	■				
Michael Seering, PE, CFM	■	■	■	■			■	■
David Rubenstein, CFM	■	■	■	■			■	
Amelia Vincent, PE, CFM	■	■	■	■	■			
Jae Park, PhD, CFM	■	■						■
Ann Terranova, CFM	■	■						■
Jeffrey Sengebusch	■	■	■	■	■		■	■
Rajendra Rachmalla, PE, CFM	■	■		■				
Erik Gruenes, EIT	■	■						
William Leonetti, EIT	■	■						
Kjersti Lupo, CFM	■	■		■			■	
Heather Blair, CFM	■	■		■			■	
Michael Onufrychuk	■	■		■			■	
Shane Parson, PhD, PE, CFM	■	■						

Experience with Similar Projects

Over the past 15 years, AECOM has performed over 500 countywide FEMA studies covering over 80,000 miles of stream and produced more than 27,000 FIRM panels nationally. AECOM staff's knowledge and understanding of the NFIP has been developed through our long-term relationship with FEMA and our involvement with local and state agencies.

Table 2 on the following page provides a brief overview of our experience with similar projects. This experience is further documented by the references provided in Section 3 and our Past Projects in Section 5.

2-1. Hydrologic and Hydraulic Modeling

AECOM has provided engineering support to FEMA since the 1970s and state and local clients since 2000. Our support has been suitable for FIRM production for Map Modernization and Risk MAP projects and watershed basin studies, and has resulted in quality products delivered on time and within budget.

AECOM has performed hundreds of flood frequency assessments using a variety of methods, including statistical analysis of gage data and U.S. Geological Survey (USGS) regional regression equations. We frequently use the method described in USGS Technical Bulletin No. 17B, *Guidelines for Determining Flood Flow Frequency*, to determine frequency peak flow discharges based on recorded gage flow data.

AECOM's success in hydrologic modeling is due to our continued use of the optimal available technologies, which allows us to provide our clients very cost-effective, high quality models. The team is experienced in using ArcGIS, ArcHydro, HEC-GeoHMS, and Watershed Modeling System (WMS) to automate watershed hydrologic analysis. Our engineers are skilled at controlling inputs to and quickly assessing outputs from automated procedures to get quality models. These tools use triangulated irregular networks developed from digital terrain models (DTMs) to automatically delineate watershed and sub-basin boundaries, determine flow paths, and provide runoff factors based on available soil coverage and land use information. In addition, we have used GIS to provide automated extraction of Manning's n-values from digital land use coverage.

In conjunction with our hydrologic modeling capabilities, AECOM staff members are also highly experienced in conducting hydraulic stream analyses. AECOM has performed hydraulic analyses in support of FISs for FEMA for more than 33 years. On a typical workday, more than 50 AECOM engineers and mapping specialists in the Germantown, MD Office use automated methods to conduct modeling and mapping tasks for flood hazard mapping projects.

We have used the USACE's HEC-RAS software to perform hydraulic modeling for over 135,000 miles of streams. We have used HEC-RAS for studies in almost every FEMA Region in the country, for many state CTPs, and also for local municipal clients.

Mr. Seering, AECOM's Hydrologic and Hydraulic Modeling Lead, has over 12 years of experience in riverine flood engineering, with 5 years focused on performing hydrology and hydraulics modeling and 6 years focused on managing flood study teams for watershed and countywide projects. He has performed and managed numerous flood studies for thousands of miles of Zone A study streams, using a variety of toolsets and methodologies. While functioning as a manager on FEMA flood studies, he has also served as a subject matter expert, working with FEMA to update their standards and guidance for hydrology and hydraulics, including Zone A engineering.

Table 2: Specific Project Experience At-a-Glance

Client and Program	Similar Experience
FEMA Risk MAP Program – PTS, Regions II, III, IV, VI, VIII, and IX (under two joint venture contracts)	Manage TOs spanning seven AECOM offices. Maintained a Schedule Performance Index (SPI) over 0.99 for a contract worth approximately $600M. Updated riverine and coastal studies for over 6,800 miles of detailed study, over 46,000 miles of approximate study, and over 5,500 miles of redelineation, and updated 16,100 FIRM panels for over 6,000 communities. Technical methods have ranged from the traditional one-dimensional (1D) steady state HEC-RAS modeling, to two-dimensional (2D) unsteady state modeling for more complicated flow situations, and alluvial fan analysis in western study areas. AECOM has produced Risk MAP products for 25 watersheds covering over 900 communities, working closely with the Regions to find innovative approaches to using Risk MAP products.
North Carolina Floodplain Mapping Program	Managed 118 TOs totaling over $100M. Managed 60 sub agreements totaling $30M. Performed 15,000+ miles of H&H modeling and produced 10,000+ FIRM panels to date. Acquisition and processing of over 40,000 square miles of LiDAR-derived terrain data. All quality, schedule, and budget requirements have been either met or exceeded.
South Carolina Flood Mapping Initiative	AECOM completed over 12,000 miles of H&H analysis. Mapped over 7,000 square miles of Special Flood Hazard Area. Developed over 4,500 individual FIRM panels. Completed 36 countywide FISs. Issued new preliminary FIRMs in 42 out of 46 counties and one watershed. Currently developing preliminary map products for four counties and six watersheds. Completed storm surge modeling using ADCIRC and SWAN for entire coast of South Carolina. Conducted over 105 community meetings throughout the State. Completed six and developing 14 other Risk Map product projects. Processed over 25,000 square miles of LiDAR-derived elevation models with hydrologic breaklines.
Delaware Flood Mapping Study Services	AECOM completed three flood mapping task orders: 60 miles of limited detailed study in Sussex County, 32 miles of limited detailed study in the Appoquinmink watershed, and 30 miles of limited detailed study in the Murderkill watershed. AECOM is currently completing 170 miles of limited detailed study, 57-miles of base-level study, and 33 miles of redelineation in Kent and Sussex Counties, DE. The current TO includes a limited survey of 230 road crossings and the development and processing of 39 revised FIRM panels.
Kentucky Statewide Map Modernization, QA/QC and Risk MAP	The AECOM Team is responsible for 12,030 square miles of terrain processing; 13,115 square miles of hydrology; 4,120 miles of hydraulic analyses; 7,360 square miles of FEMA map panels; and 50 counties reviewed for compliance with Kentucky preferences and FEMA Guidelines and Specifications for the Kentucky Risk MAP Program. Our consolidated FEMA Cost Performance Index (CPI) and SPI are 1.0 and 0.99, indicating remarkable CTP performance to FEMA.
Kansas River Modeling and Floodplain Analysis	AECOM has been working with the State of Kansas, on its CTP contract, since 2008. AECOM has performed H&H on over 1,200 miles of stream and approximately 100 miles of redelineation. AECOM has also been tasked with performing QC reviews for hundreds of miles of detailed and approximate modeling for the State of Kansas.
FEMA Hazard Mitigation Technical Assistance Program	AECOM, through its legacy firms, including URS, has continuously served FEMA's mitigation program since 1995. We have provided pre-disaster, during disaster, and post-disaster mitigation and environmental services for every disaster type and in every state.

2-2. Floodplain Identification and Mapping

AECOM has been creating floodplain mapping deliverables, for FEMA and CTPs, for almost two decades now. The AECOM team is very familiar with FEMA's standards and has mapped approximately 40 percent of FEMA's mapping inventory nationwide. Since 2000, AECOM has mapped over 80,000 miles of streamline. Whether it is a detailed study, limited detail, redelineation, or approximate study, AECOM has created the required floodplain mapping deliverables.

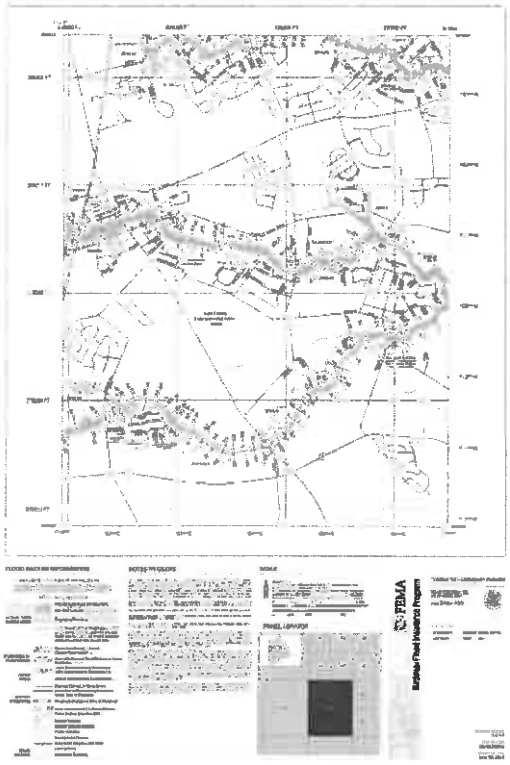
Example of post RAS and floodplain mapping

2-3. Digital FIRM Development

AECOM has a long history of successfully developing digital FIRMs to FEMA standards, including preparing FIRM databases for over 1,000 counties and producing over 43,000 FIRM panels.

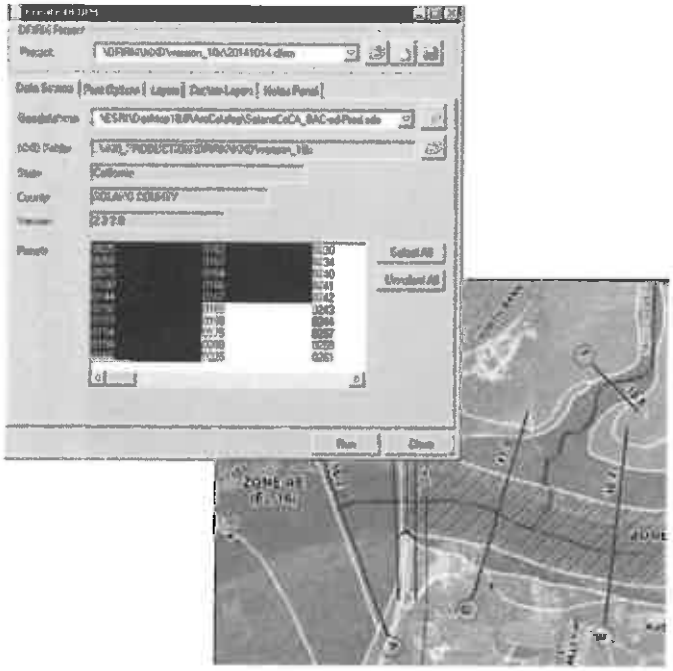
The FIRM production platform developed by AECOM provides several enhancements that reduce our overall FIRM production costs while improving the accuracy of the end product. AECOM has developed tools that format our production databases to FEMA's standards and has created export functions to produce GIS deliverable output for Mapping Information Platform (MIP) uploads and FEMA Map Service Center submittals. The use of these tools affords AECOM undisputed cost efficiency when producing FEMA FIRMs for the State of West Virginia.

AECOM has an unmatched record in producing digital products for FEMA's flood hazard mapping program. In the past 2 years, AECOM produced more than 1,850 FIRM panels, which included more than 3,000 miles of Zone A to FEMA specifications.



AECOM has the technical capabilities to produce the cartographic products that will be vetted and approved by the DHSEM project team, as demonstrated by the work we are performing in West Virginia under our Risk Assessment, Mapping, and Planning Partners (RAMPP) TO contracts with Region III. Our cartographic products are optimized for display in web and mobile applications, and play an integral role in the next generation of public outreach campaigns and notification methods.

Mr. Rubenstein, AECOM's Floodplain Mapping, FIRM Development, and Data Management Task Lead, worked on and managed over 30 studies, from start to finish, throughout the country. In the last couple years, Mr. Rubenstein played a significant role in the Alleghany and Bradford, PA floodplain mapping tasks, which are similar in geography to parts of West Virginia.



2-4. Data Management

AECOM is very experienced managing data for flood studies, including base map data, large aerial photography and terrain datasets, and all flood study output data (model results, floodplain boundaries, FIRM databases, etc.). We have more than adequate server capacity to archive large datasets for flood studies long after the projects are complete.

AECOM's vast CTP involvement provides us with second-to-none experience managing CTP projects and tasks in the FEMA MIP. All AECOM flood study managers are responsible for monthly updates in the MIP and uploading all data deliverables to the MIP according to FEMA's strict specifications. Our project team has several MIP experts ready to assist our already experienced project and task managers in navigating the FEMA flood study process in the MIP. If there is an issue with or in the MIP, our MIP experts have likely seen it before. If we haven't, our team has the experience and the connections to make sure we contact the correct person to get the issue resolved quickly.

We are intimately familiar with FEMA's requirements to update its Coordinated Needs Management Strategy (CNMS) database to record valid streams once studies are complete and identify mapping needs that are found during the flood study process. We have lead several CNMS tasks for FEMA, including performing the validation of 62,000 miles of streams nationwide.

Under our FEMA PTS contract, we also have a TO to update the National Flood Hazard Layer (NFHL) once new studies become effective. We understand how important it is for FEMA to maintain the NFHL database to provide a consistent and accurate flood layer for the country that can be used by communities and the public to understand their flood risk.

Under contract with FEMA Region III, we are currently working on developing advisory 1-percent-annual-chance storm event (Zone A) floodplains and depth grids for Jefferson County, WV and we are preparing the data for use on West Virginia's Flood Tool. We have worked with Eric Hopkins at WV GIS Technical Center to ensure our deliverables meet the requirements for compatibility with the site.

We are very familiar with West Virginia's online WV Flood Tool and refer to it frequently to view data for the State. We also frequently use many other state websites that have been developed for flood risk communication, including USACE's toolset in Iowa, Louisiana's LA Floodmaps developed by Louisiana State University, and Maryland's Flood Risk Application.

2-5. Topographic Data Development

AECOM's experience serving FEMA and State governments with DTM and topographic data development dates to the inception of the Flood Map Modernization program. AECOM has supported FEMA and assisted in developing its Data Capture Standards (*Guidelines and Standards for Flood Risk Analysis and Mapping* and *Guidelines and Specifications for Flood Hazard Mapping*) and stakeholder LiDAR business plans and acquisition specifications (North Carolina and Tennessee), managed LiDAR acquisition and QC programs, and developed value-added topographic data products supporting flood studies. In addition to our service to FEMA, AECOM has other national/international experience in topographic and bathymetric data

development activities in more than 40 states and six countries totaling over 150,000 square miles.

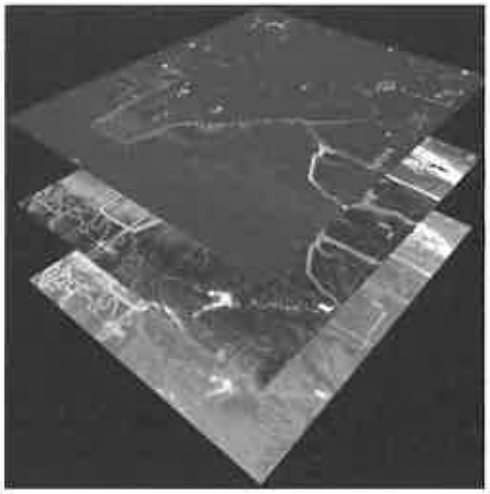
AECOM is experienced in using different types of topographic and bathymetric data sources, such as LiDAR, mass points, breaklines, rasters, and contours as source feature classes, and combining them to create a seamless DTM.

We use ArcGIS and LiDAR editing tools to pre-process data into the correct feature class format and convert the source data into the required study area projections and units. Our engineers and GIS staff members are proficient working with topographic and bathymetric data sets in different formats (such as LiDAR, 2D and 3D shapefiles, File GeoDatabase feature classes, USGS Digital Elevation Models, rasters, AutoCAD, and MicroStation files), datums, units, and projections. We are skilled in using ArcGIS to develop DTMs for hydraulic analyses and to develop hydrologically correct DTMs for hydrological analyses. Our staff also developed and use automation methods, such Python scripts, model builder tools, and macros to efficiently perform batch routine tasks.

AECOM is able to effectively manage large amounts of LiDAR data. With increasingly smaller point spacing and increased accuracy of the LiDAR, there is an increase in the density of the data points and file sizes. Countywide LiDAR data sets may range from 50 to 150 GB. AECOM is experienced with working with large data sets within File GeoDatabases and Spatial Database Engines as a platform for DTMs.

Our Topographic Team Lead, Ms. Vincent has developed DTMs utilizing topographic data sources including LiDAR, USGS National Elevation Dataset rasters, mass points, breaklines, and contours for use with H&H modeling as well as floodplain mapping for counties and watersheds in Delaware, Maryland, and Virginia. Ms. Vincent has also developed seamless DTMs consisting of bathymetric and topographic data for the overland wave analysis and coastal flood studies in Virginia. As a subject matter expert in terrain, Ms. Vincent has performed numerous detail checks and independent technical reviews of DTMs and seamless topographic and bathymetric terrains for studies in:

- West Virginia
- Delaware
- Maryland
- Pennsylvania



2-6. Hazard Mitigation Planning

AECOM planners nationwide have assisted more than 400 local government entities to prepare hazard mitigation plans (HMPs) in compliance with Title 44 of the Code of Federal Regulations Section 201.6, including a recently completed multijurisdictional HMP for Huntingdon County, PA. Our successful completion of these plans and subsequent approvals by FEMA demonstrates our in-depth understanding of the local hazard mitigation planning process, federal requirements, and how to work with a wide variety of communities. For FEMA Region III, we supported two multijurisdictional plan reviews in 2010 and conducted a pilot program for plan integration in Maryland, Delaware, and Pennsylvania and prepared a guide called *Plan Integration: Linking Local Planning Efforts* dated December 2014.

As one of FEMA's prime contractors, AECOM has unparalleled experience in hazard mitigation planning. Through several contracts with FEMA, including the Hazard Mitigation Technical Assistance Program (HMTAP) contract and the Risk MAP contract, AECOM has been involved in numerous mitigation planning projects at the state, regional, and local levels. We will bring this expertise to bear in efficiently developing your HMP for rapid FEMA approval.

AECOM brings detailed knowledge and understanding of FEMA mitigation planning requirements and mitigation planning processes from the following FEMA experience:

- Technical assistance for the 2011 update of the *Local Mitigation Plan Review Guide*
- Development and delivery of Mitigation Strategy training module for communities updating their plans
- Development of the new "Plan Review Workshop" on reviewing a mitigation plan in 2012
- Authoring the FEMA 386 series of nine How-To Guides for mitigation planning
- Preparation of planning training sessions for FEMA and more than 20 plan development workshops nationwide

2-7. Community Outreach

AECOM has extensive experience with outreach related to both the FEMA Map Modernization Program and its Risk MAP Program. Numerous AECOM professionals have attended Discovery, Flood Risk Review, Consultation Coordination Officer (CCO), Open House, and Resiliency Meetings. Working to deliver FEMA's and the states' message of reducing flood damage by building more resilient and sustainable communities has been at the core of AECOM's work with the NFIP for over 30 years.

AECOM assisted FEMA in Mississippi, after Hurricane Katrina, as well as in New York and New Jersey, after Hurricane Sandy, during the controversial roll-out of Advisory and Preliminary FIRMs. In both Mississippi and Texas, the AECOM team worked closely with neighborhood advocacy groups to conduct an outreach campaign that focused on hard-to-reach disaster survivors.

For the State of North Carolina, AECOM assisted in over 100 community meetings by preparing presentations and maps and addressing mapping and engineering questions from citizens and public officials.

Ms. Terranova, AECOM's Community Outreach Task Lead, has served as the Community Engagement and Risk Communication Lead for PTS Provider RAMPP and Compass on Risk MAP. This involved a high degree of coordination with communities affected by FEMA's initiative to communicate about the risks of living and working in high flood hazard areas. In Region III, Ms. Terranova helped to plan and execute flood risk review meetings and coordinated the development and delivery of training with coastal CTPs on non-regulatory flood risk products. In addition, Ms. Terranova provided community engagement and risk communication support in the Advisory Base Flood Elevation and Preliminary Work Map rollout in New York and New Jersey in the aftermath of Hurricane Sandy. She worked closely with FEMA Regional and Headquarters staff in developing communications materials for New York City and New Jersey Governor-hosted meetings with community officials, Congressional staff, and the media.

2-8. Other Services

AECOM understands that West Virginia is only requesting services for enhanced approximate level flood hazard analysis and mapping at this time; however, we have listed a few other services that we are experts in and that could benefit the State.

Program Management

AECOM is experienced in assisting CTPs in the development of MASs. AECOM has assisted the South Carolina Department of Natural Resources (SCDNR) in the development of 24 MASs since the inception of the current SCDNR CTP contracts. This has directly resulted in over $28M of CTP funding to the State. AECOM has also contributed to and assisted in the development and updating of CTP Business Plans for SCDNR and other CTPs.

Preliminary and Post-Preliminary Processing

In addition to having requisite engineering and GIS mapping capabilities and qualifications, we have in-place systems to support the preliminary and post-preliminary processes necessary to incorporate new flood studies into effective FEMA products. This includes providing for legal due processes required by NFIP regulations, including preparation of public notices and Flood Hazard Determination Notices, supporting local communities in updating and adopting NFIP-compliant floodplain management ordinances, conducting public and community meetings, reviewing and resolving any appeals or protests submitted during the statutory appeal period, completing all necessary FEMA paperwork, archiving the data in approved FEMA format, and preparing the final deliverables submission package directly to FEMA. Through the Risk MAP contracts, AECOM has successfully conducted the regulatory preliminary and post-preliminary process for hundreds of studies and has processed them all the way to the effective date.

Non-Regulatory Risk Map Flood Risk Products

From past FEMA and state contracts, AECOM has

extensive experience in creating non-regulatory Flood Risk Products, including the Flood Risk Database, Flood Risk Report, and Flood Risk Map for approximately 50 counties or watersheds. The non-regulatory risk information helps FEMA meet its Risk MAP vision of delivering quality data that increases public awareness and leads to action that reduces risk to life and property. Our innovative approach to producing Risk MAP products follows our approach to producing any product. We focus on automated tools and processes that link engineering components to GIS outputs. AECOM has developed automated GIS tools, such as "Chance Analyst," that streamline the data production of the required products. All non-regulatory products developed go through the required independent QA/QC steps stipulated by FEMA guidelines before the products are distributed to the public, including internal QA/QC and independent review by FEMA Region III staff. AECOM is committed to providing assistance and resources to DHSEM and we can train officials in the use of non-regulatory products that are developed for all Risk MAP projects.

Example of flood depth grids

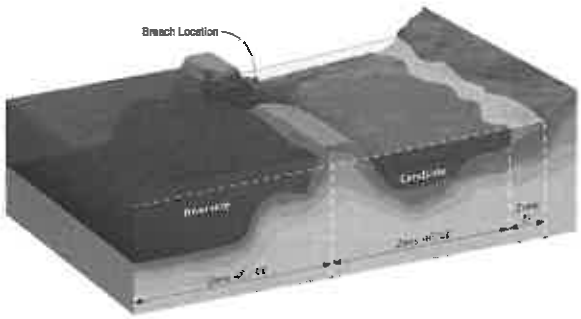
Dam and Levee Engineering

AECOM provides all phases of engineering related to dams and impoundments—from planning through environmental and regulatory permitting, design, construction, and operation and maintenance of facilities. We have provided multidisciplinary planning and design services to the Natural Resources Conservation Service, USACE, U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, as well as state and local governments throughout the country. We can support DHSEM with a range of services regarding West Virginia's 606 dams and 76 levees recognized by the USACE.

Our designs have won awards from many state and national organizations, such as the Association of State Dam Safety Officials, the American Consulting Engineers Council, and the American Society of Civil Engineers. Our dam instrumentation and ADAS was the first to be recognized by the USACE.

AECOM provides expertise with specialized H&H analyses and mapping required for levee analysis using the protocols under FEMA's Levee Analysis and Mapping Procedures (LAMP). AECOM's LAMP experts, including Mr. Seering, were key players in developing the LAMP protocols through our PTS contract with FEMA and have been involved with more than 10 LAMP pilot projects across the country. AECOM also has LAMP projects beyond the pilots in Louisiana, Texas, and New Jersey. AECOM recently helped Indiana County, PA understand their options regarding certification for the Cherry Tree Levee system. We modeled scenarios according to LAMP procedures and developed maps that showed those scenarios. We participated in community meetings where the LAMP modeling and mapping was presented, which helped the County have a better understanding of certification potential, remaining rehabilitation needs, and grant information available to them.

In addition to the standard 1D steady state modeling used for the majority of FEMA studies, AECOM has extensive experience in more complex unsteady state and 2D modeling techniques necessary to analyze levee breaching situations in accordance with LAMP protocols. For example, our ongoing Emergency Action Plan updates for the Mississippi Department of Wildlife, Fisheries, and Parks require the use of unsteady HEC-RAS analyses to develop dam failure inundation maps. We routinely model complex embankment failure scenarios using 2D models, such as FLO2D and HEC 5.0. As evidenced by our LAMP pilot projects in St. Charles and Jefferson Parishes near New Orleans, we understand the complex interactions between interior drainage systems and levee breach analyses.



Example of structural based inundation procedure

3. References

1) **Michael Powell, CFM**
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4. Staffing Plan

Introduction

Our project team comprises professionals who understand hydrology and hydraulics, floodplain mapping, and local community mitigation challenges in West Virginia. Building on our years of experience providing innovative solutions throughout the country, AECOM has assembled a dynamic team to provide engineering and mapping support services with solutions that are as unique as the State of West Virginia. Our Germantown, MD office will be responsible for managing and performing the services described in this submittal, and other offices, including in Morgantown, WV and Kenova, WV, will provide additional support. Our Program Manager, Principal in Charge, Quality Officer, and Technical Task Leads all work out of the Germantown, MD office. We will use staff in our West Virginia offices to provide technical production and outreach support.

AECOM brings both national expertise and local knowledge to this initiative. AECOM offers a local presence with in-depth knowledge of unique flooding characteristics in West Virginia, as well as extensive outreach capabilities. AECOM is rounded out with national experts who can help solve the State's complex engineering, data collection, and GIS needs. The Germantown office has over 30 onsite engineers and GIS staff, but also has the nationwide reach to bring in many experts and staff to assist as needed.

AECOM has a unique combination of highly qualified and experienced team members who have dedicated a significant amount of their careers to performing floodplain mapping in FEMA Region III, especially Ms. Estes, our Program Manager. Collectively, our team provides a comprehensive range and depth of experience unique from other teams, especially regarding floodplain mapping in Region III and for the nation regarding the FEMA Risk MAP initiative. By combining the cumulative resources of AECOM, our ability to deliver on your expectations is unrivaled.

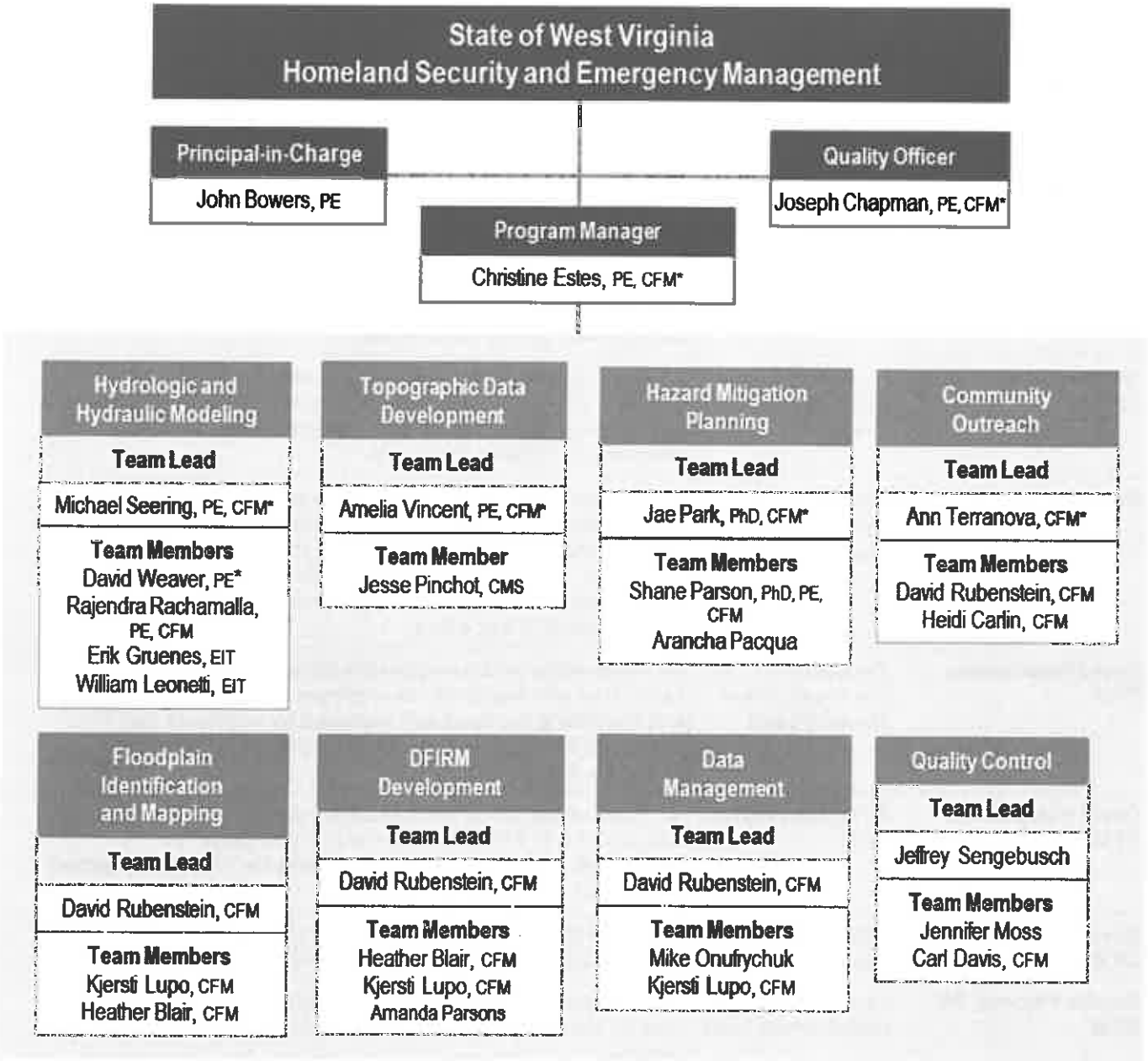
The organization chart on the following page depicts the management and technical staff combined under the leadership of our Program Manager, Ms. Christine, Estes, PE, CFM.

In addition to the staff shown on the next page, AECOM has more than 1,000 staff throughout Region III in related disciplines who can supplement the proposed staff. We have the capacity to quickly complete flood studies, as evidenced by our completion of over 100 miles of advisory flood height analysis for Jefferson County, WV within 2 months.

Staff by Discipline in Region III and Germantown, MD

Discipline	Region III	Germantown
Civil Engineers	315	41
Coastal Engineers	13	11
Computer Programmers	32	29
Dam Engineers	6	6
Emergency Management Specialists	75	75
Foundation/Geotechnical Engineers	30	7
Geologists	119	28
GIS Specialist	67	29
Hydrology and Hydraulics	30	11
Mapping and FIRM Processing	15	15
Planners: Mitigation	111	11
Project Managers	285	50
Public Outreach Specialists	13	13
Water Resources Engineers	104	32

AECOM's Proposed Organization



* Key Personnel (resumes are included at the end of this section)

The roles and responsibilities of these staff are as follows:

Table 3: Key Personnel Roles and Responsibilities

Name	Role	Responsibilities
Christine Estes, PE, CFM	Program Manager	Ms. Estes is responsible for leading the effort of the development of enhanced approximate 1-percent-annual-chance floodplains for the State of West Virginia. Ms. Estes will be responsible for client communication, and management and overall health of all projects.
Joseph Chapman	Quality Assurance Officer	Mr. Chapman will provide quality assurance throughout the duration of the contract. He will apply has extensive experience in floodplain analysis and mapping and working with CTPs across the Country to ensure that the project team is providing DHSEM with quality deliverables.
Michael Seering, PE, CFM	Hydrologic and Hydraulic Modeling Lead	Mr. Seering will be responsible for leading the H&H modeling for the State of West Virginia. Mr. Seering will be responsible for H&H staffing and ensuring staff are performing the work according to FEMA's Standards.
David Weaver, PE	Hydrologic and Hydraulic Modeling Advisor	Mr. Weaver is a project manager who will use his over 25 years of experience and local knowledge of West Virginia to assist in the H&H modeling tasks, and use his knowledge of local conditions to advise on appropriate H&H methodology. Mr. Weaver will work out of the Morgantown office as he supervises the operations in that office.
David Rubenstein, CFM	Floodplain Identification and Mapping Lead	Mr. Rubenstein will be responsible for performing the tasks associated with floodplain development. This includes cleaning and smoothing the floodplain delivered by engineers and following FEMA's Standards and completing the Floodway Boundary Standards forms.
David Rubenstein, CFM	FIRM Development Lead	Mr. Rubenstein will be responsible for performing the tasks associated with FIRM development for this study. Mr. Rubenstein will follow FEMA's Standards for FIRM development for this task.
David Rubenstein, CFM	Data Management Lead	Mr. Rubenstein will be responsible for maintaining and following FEMA's Data Capture Standards Technical Reference manual.
Amelia Vincent, PE, CFM	Topographic Data Development Lead	Ms. Vincent will be responsible for processing topographical data for the modeling efforts required for the State of West Virginia.
Jae Park, PhD, CFM	Hazard Mitigation Planning Lead	Dr. Park will use his many years in hazard mitigation planning to further assist the State of West Virginia with any hazard mitigation planning needs.
Ann Terranova, CFM	Community Outreach Lead	Ms. Terranova will use her many years of experience as a community outreach specialist to assist the State of West Virginia in communicating flood risk to community officials and the public.
Jeffrey Sengebusch	Quality Control Lead	Mr. Sengebusch will use his years of QC experience to ensure all deliverables meet the requirements and expectations of the State of West Virginia and FEMA. Jeff will make sure that all reviews are compliant with FEMA's Technical Reference Manuals. Jeff will review all draft and final deliverables.

5. Past Projects

The projects that begin on the next page provide details that attest to the quality of work AECOM delivers. The table below provides a quick summary of the relevancy between these projects and the required scope of work.

Table 4: AECOM Projects Encompass All Scope Requirements

Project Name	Hydrologic and Hydraulic Modeling	Floodplain Identification and Mapping	FIRM Development	Data Management	Topographic Data Development	Hazard Mitigation Planning	Community Outreach
FEMA Risk MAP Contracts	■	■	■	■	■	■	■
North Carolina Floodplain Mapping Program	■	■	■	■	■	■	■
South Carolina Flood Mapping Initiative	■	■	■	■	■	■	■
Delaware Flood Mapping Study Services	■	■	■	■	■		
Kentucky Statewide Map Modernization, QA/QC and Risk MAP	■	■	■	■	■		■
Kansas River Modeling and Floodplain Analysis	■	■	■	■			
FEMA Hazard Mitigation				■		■	■

FEMA Production and Technical Services A&E (PTS) Nationwide

Client Name
Federal Emergency Management Agency

Project Manager
Stuart Rooney
1800 S Bell St., Crystal City, VA 22202
Phone: 202.646.1643
Email: stuart.rooney@fema.dhs.gov

Overall value
$150 million (est.)

End Date
2019

Type of Project
Mapping and Hazard Analysis

Services

Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; FIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

AECOM is a key member of a team with one of FEMA's two IDIQ Risk MAP Program contracts for PTS.

AECOM is the managing partner of the Compass PTS Joint Venture Team. Compass is committed to serving FEMA's Risk MAP, HMTAP and Building Sciences programs by delivering credible and efficient products and services while being responsible, transparent and visionary in our execution.

Under the standard operations task order, Compass provides HQ and Regional Support and Production services in Regions I, III, IV, VI and VIII. Support includes:

- **Policy/GSSC** - Support policy development and analysis, update and support the transformation of the Guidelines and Standards
- **MIP and NFHL** - Provide MIP SME technical support in Regions I, III, IV, VI and VIII
- **Communication and Outreach** - Provide tier II support to FEMA's Mapping Information eXchange, CTP curriculum development and training
- **HQ Support** - Provide technical support to the Technical Mapping Advisory Council, onsite support at HQ, innovation and trend analysis

AECOM provides services on a range of Regional and National efforts for FEMA including:

- **Levee Technical Support** - Provide levee policy, guidance and other technical support
- **Coastal Technical Support** - Provide technical support to mitigate high priority coastal risks to the Risk MAP program
- **CNMS and FOA** - Provide policy and guidance development related to CNMS, update FOA guidance, perform national CNMS quarterly consolidation
- **Flood Risk Products (Non-Regulatory Products)** - Support development and deployment strategies
- **MT-2 Processing** - Review and process
  - MT-2 requests in accordance with 44 CFR 65 and 72

Regional Task Orders

Compass was awarded the opportunity through a competitive selection process to perform FOA, H&H analysis, floodplain mapping, and develop regulatory and flood risk products (i.e. non-regulatory products) in Regions I, IV, V, VI and VIII

Disaster and Hazard Mitigation

- **FEMA Region VI May 2015 Texas Floods Rapid Response** - In response to historic flooding in the Central Texas area on Memorial Day 2015, FEMA Region VI

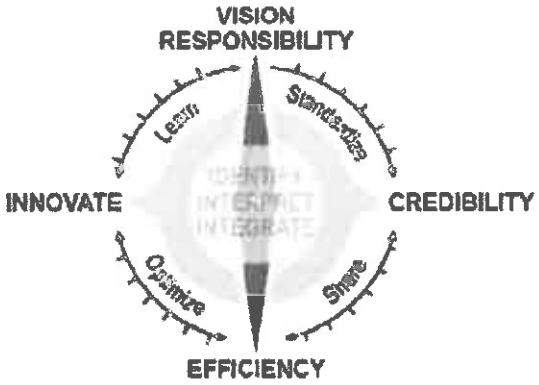
requested support in providing rapid delivery of updated flood hazard and risk data along several impacted rivers and creeks. The updated flood risk products included Advisory Base Flood Elevation maps, depth grids, expanded flood risk maps, and velocity grids for approximately 100 stream miles of updated study reaches. Compass also collected HWM data and prepared a loss avoidance study as part of this effort.

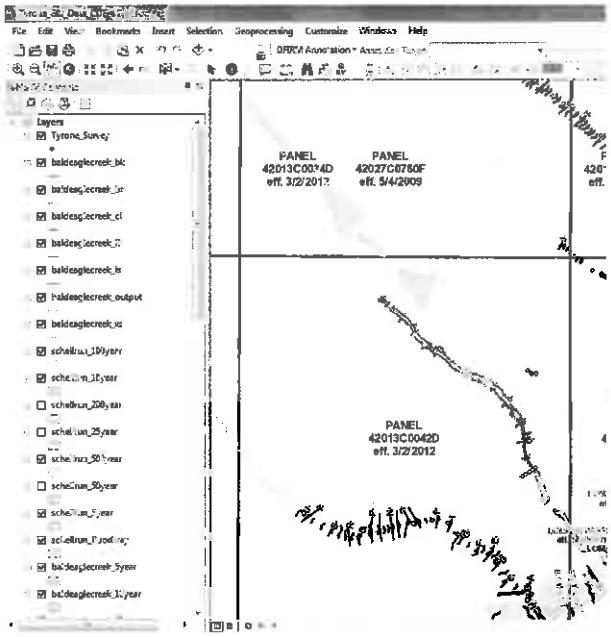
- **Louisiana Hazard Mitigation Grant Program** - Following Hurricane Katrina (DR-1603), FEMA received hundreds of project applications for HMGP funds that require technical reviews to confirm acceptability of the engineering design and benefit-cost analysis. Compass provides technical and management support to continue technical HMGP project reviews primarily for drainage improvement and wind retrofit projects submitted under DR-1603 in LA.

Project Goals and Objectives

Compass is committed to serving FEMA's Risk MAP, HMTAP and Building Sciences programs by delivering credible regulatory and non-regulatory products and services while being a responsible and innovative partner with FEMA.

cOmpass
Identify. Interpret. Integrate





Incorporation of new USACE flood study for Tyrone, PA into Blair County, PA FIRM database.

Risk MAP Production and Technical Services Contract Nationwide

Client Name
Federal Emergency Management Agency

Project Manager
Mike McGinn
Phone: 202-646-3576
E-mail: Michael.mcginn@fema.dhs.gov

Overall Value
$600 million

End Date
2015

Type of Project
Mapping and Hazard Analysis

Services

Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; DFIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

Please note: This project was under contract to URS which became a part of the AECOM family of companies in October 2014.

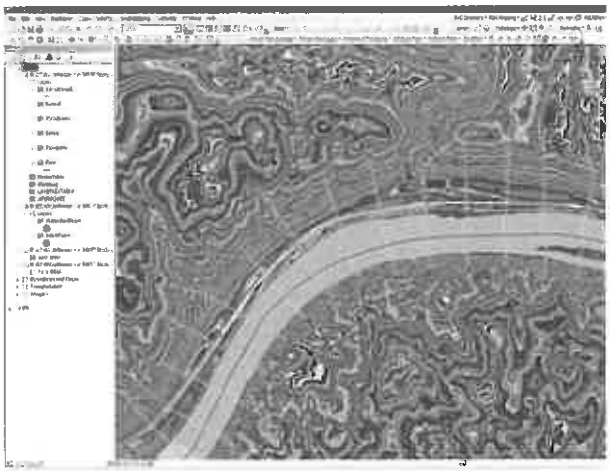
AECOM has delivered successful results for FEMA's Risk MAP Program since its inception.

As a joint venture partner for RAMPP, URS (now AECOM) provided FIRM production and technical services to assist FEMA with identifying flood hazards throughout Regions II, III, IV and VI. URS provided production and technical services for Flood Insurance Studies and Flood Insurance Rate Maps, including extensive hydrologic and hydraulic engineering and mapping. We also provided hazard risk assessment, mitigation planning and outreach, and other related services under this contract. Production tasks included watershed studies, countywide studies, Physical Map Revisions for levee areas; and revisions to coastal flood hazard studies. All studies were completed in accordance with FEMA's Guidelines & Standards and earned value data for tracking contract performance is conducted through a custom-built dashboard and entries into the MIP.

Additional tasks under the Regional production task orders include:

- Collecting LiDAR data
- Conducting independent QA/QC of LiDAR data
- Conducting independent QA/QC of engineering analyses performed by other mapping partners
- Producing FIRMs using engineering analyses performed by other mapping partners
- Conducting independent QA/QC of FIRM and FIS production by other mapping partners
- Providing post-preliminary processing services for studies prepared by other mapping partners
- Conducting CNMS analyses

For FEMA Region III, we have performed over 3,000 miles of new Zone A hydrology, hydraulics and mapping, including for Jefferson County, WV. We have performed Discovery and developed Flood RIsk Products for six HUC-8 watersheds in the Region, inlcuding the Conococheague-Opoquon Watershed that covers four states, cinlcuding West Virginia.



Other task orders under the PTS contract have included the following services:

- Performing Hazus runs to help develop an Annualized Loss Estimate for the nation
- Providing review of Community Mitigation Plans
- Developing guidelines for dam failure inundation analysis and mapping
- Performing Phase 3 CNMS analysis for FEMA Regions II, III, and VI

Technical Support to FEMA, CTPs, and Other Stakeholders

RAMPP operated Regional Support Centers in Regions II, III, and VI, tailoring local support to the unique requirements and challenges of each Region. These services included helping with action planning, tracking program metrics, providing programmatic and technical support to CTPs, tracking levee accreditation efforts, updating CNMS, geospatial data coordination, responding to internal and external data requests, assisting with community map adoption, and supporting Regional community engagement.

RAMPP supported CTPs with LOMR delegation training and performs quality reviews of all CTP deliverables. We also supported CTPs on MIP-associated tasks to ensure their success in the program.

As FEMA refocused its flood mapping program on achieving risk reduction actions, RAMPP understood the importance of Whole Community solutions and increased its community engagement services to include a wide variety of strategies for improved risk communication. For example, RAMPP:

- Prepared the Coastal Outreach Strategies and developed outreach websites for Regions II, III, and VI
- Developed the Action Potential Index to help prioritize engagement efforts
- Helped establish, administer, and participate in Region II and III Coastal Outreach Advisory Teams (COATs)

Project Goals and Objectives

URS helps FEMA achieve its goal of promoting mitigation action at the local level to increase resilience and reduce risk by executing an efficient program for delivery of high-quality Risk MAP products; providing FEMA with industry leadership in engineering and digital mapping; constantly innovating to enhance product effectiveness and flexibility while reducing costs; and providing leaders and managers who are dedicated to resilience, risk reduction, and the success of Risk MAP and the NFIP.

"

Christine, that sounds like a great idea. As always, I really appreciate the tremendous amount of support we are getting on these mapping projects.

Mike Powell, State NFIP Coordinator, DNREC, regarding RAMPP support under our Risk MAP contract with FEMA Region III. "

North Carolina Floodplain Mapping Program Statewide

Client Name
North Carolina Department of Public Safety, Floodplain Mapping Program

Project Manager
John Dorman
4105 Reedy Creek Road
Raleigh, NC 27607
Phone: 919.715.5711 Extension 102
Email: John.Dorman@ncdps.gov

Overall value
$100 million

End Date
Ongoing

Type of Project
Mapping and Hazard Analysis

Services

Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; DFIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

Please note: This project was under contract to URS which became a part of the AECOM family of companies in October 2014.

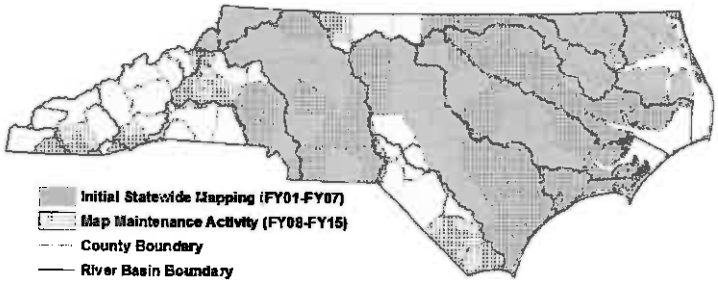
AECOM has provided floodplain mapping, risk assessments and risk mitigation services for the State of North Carolina since 2001 as a prime contractor. AECOM is NCFMP's primary contractor for flood hazard analysis and mapping on 11 of the State's 17 river basins, and is performing map maintenance for 15 counties.

AECOM has provided floodplain mapping, risk assessments and risk mitigation services for North Carolina since 2001. AECOM has been assigned 118 task orders with NCFMP totaling over $100M in fees, and has consistently delivered quality products on time and within budget. The NCFMP is FEMA's State Cooperating Technical Partner (CTP) responsible for updating flood hazard data and producing and disseminating updated floodplain maps for all communities in North Carolina. The project involves topographic data development, field survey, Hydrology & Hydraulic analysis, DFIRM production, community outreach, IT development, natural hazard risk assessment and mitigation, geodatabase design, website design, and emergency response tool development.

AECOM's work has included topographic data development, field survey, H&H analysis, DFIRM production, community outreach, IT development, geodatabase design, website design, and emergency response tool development. AECOM has been responsible for over 4,800 stream miles of detailed study, 11,000 miles of limited detail study, and 6,000 miles of redelineation, including 50,000 new BFEs, which appear on the State's maps. AECOM also was responsible for production of more than 8,500 DFIRM panels, and compiled building footprint data for 73 counties.

AECOM has developed many innovative tools for the state, most of which have direct application for FEMA:

- AECOM assisted in the data collection and development of the iRisk application which provides statewide parcel level risk assessments for a variety of natural hazard and drives mitigation action through various planning tools
- Digital Display Environment (D2E): AECOM led development of the geodatabase

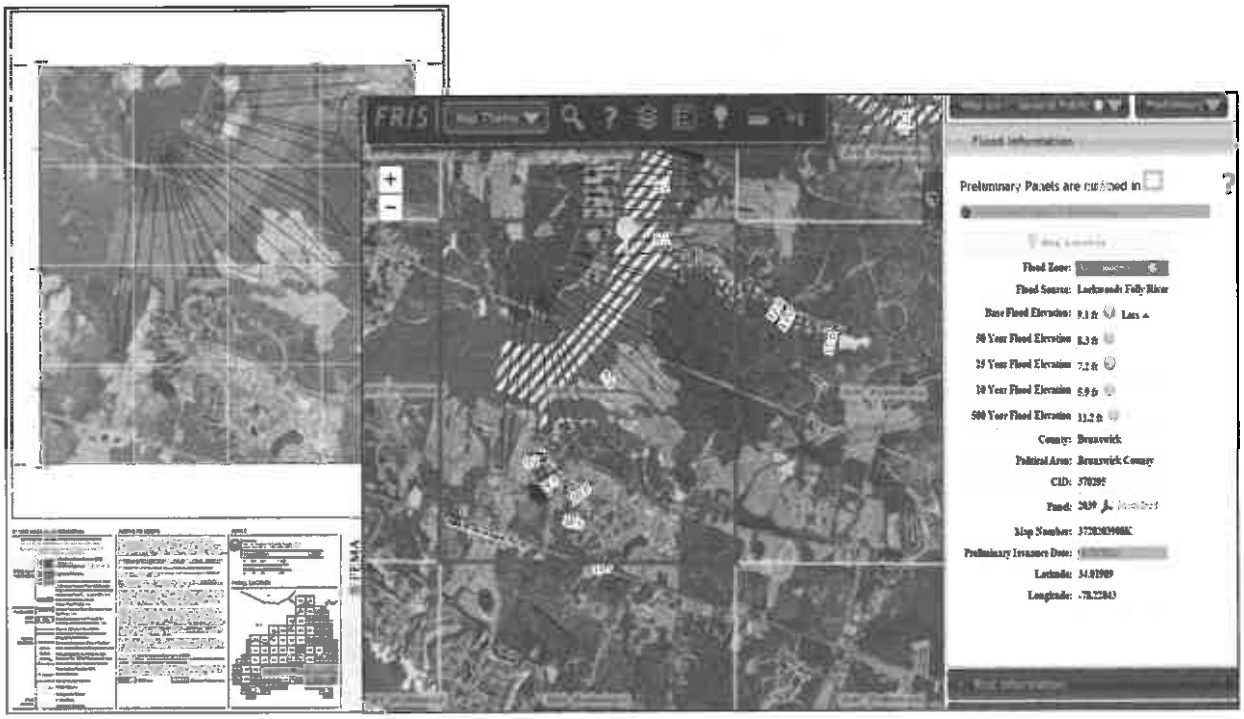


schema supporting NC's all-digital NFIP product concept to support

- FIRM/FIS display and print on demand capability, eliminating legacy cartographic products and providing a 50% cost savings for preliminary data production
- AECOM developed the LDS methodology, which provided an efficient method (1/8 the cost of traditional detail study) of modeling and providing base flood elevations for existing un-numbered A Zones. – AECOM developed flood inundation mapping data that is being used for flood warning applications, providing citizens with early warning applications in various flooding scenarios

GIS & DFIRM Production - AECOM has been responsible for the production of close to 10,000 FIRM panels for the NCFMP. AECOM has also compiled building footprint data for 74 NC counties.

In addition to FIRMs, AECOM has supported the NCFMP in many data mapping and map-making initiatives. In 2003, AECOM developed the flip-flop map to be used during community outreach meetings, which were the pre-cursor to the modern day CSLF datasets. In 2007, AECOM performed coastal inundation mapping for the entirety of the coastline of NC up to the 20 foot contour interval and created a diverse range of coastal SLOSH maps for analysis purposes. In 2011, 2012 and again in 2015, AECOM developed floodplain inundation maps for US Forest Service campground sites for the NCFMP. In 2015, AECOM produced extents, comparison and difference maps depicting SLOSH maximum of maximums versus the 1% annual chance water surface elevation extents for the entire coastline of North Carolina.



NCFMP Data Management - In 2014, in support of NCFMP's all digital floodplain mapping platform, AECOM was tasked with quality control and upload of all incoming contractor data submittals. These data submittals are loaded into the NCFMP's Enterprise FLOOD Geodatabase supporting the FRIS website. AECOM developed a suite of tools for QC and Upload to insure automation and data integrity of incoming Geodatabase and associated hard files data.

CNMS/NVUE - In 2010, 2014 and 2015 AECOM performed statewide analyses to provide updated New, Valid, or Updated Engineering (NVUE) and Coordinated Needs Management Strategy (CNMS) updates for the NCFMP.

Increasing Resilience, Producing Risk MAP Products – The data AECOM developed is the backbone for Statewide, parcel level risk assessments in the Regional Flood Risk Information System (RFRIS).

Technical Support for Risk Analysis and Floodplain Management Issues - AECOM has provided SME support to NCFMP through the development of multi- hazard risk calculations, consequence determination methodologies, mitigation alternative development and scoring, and communication of risk for RFRIS system for 10 natural hazards.

Risk Reduction and Hazard Mitigation Assistance Support - AECOM has been contributing to the iRisk project for the NCFMP since 2009. iRisk was initially a FEMA pilot program to develop data and tools for mitigation planning but has been fully implemented into the NCFMP workflows and the resulting data is available on both the FRIS and iRisk websites. During the initial pilot AECOM assisted with hazard identification/derivation for 14 different natural hazards, risk assessment and communication techniques, and the development of a tool to assist communities to efficiently update and implement mitigation plans. In addition to the iRisk Geodatabase design, AECOM led the development of the consequence analysis and risk assessment phases of the program. By integrating existing methodologies with newly developed techniques we were able to build simple but effective loss estimation and risk assessment methods to calculate risk at the individual structure and at the community level.

Regional Support - AECOM has partnered with NCFMP in the development of many high level initiatives including development of the watershed based study approach, the statewide paneling scheme, a revised DFIRM prototype, the intelligence behind RFRIS, and the database framework for the all-digital display of Flood Insurance Study data.

Data Development and Program Delivery - AECOM pioneered the LDS methodology, which provided an efficient method (1/8 the cost of detail study) of modeling and providing base flood elevations for existing un-numbered A Zones. AECOM developed flood inundation mapping data that is being used for flood warning applications.

Innovation and Efficiency - AECOM developed the Hazard Analyst tool, which provides pre-disaster demographic and population support planning, and worked side by side with NCFMP staff at the Emergency Operation Center during Hurricane Hannah to assist in pre-event planning efforts. AECOM developed a County Disaster Recovery Plan tool to promote consistency in County disaster recovery plans.

AECOM's experience with NCFMP as a leader in innovation, efficiency and providing data, tools and support to communities to drive mitigation action are directly transferrable to nationwide Risk MAP support. The all-digital environment and workflow has been developed and could be applied nationwide.

Future Conditions Mapping - AECOM studied future conditions for Wake, Durham, Guilford, and New Hanover Counties. The studies included detailed hydrologic and hydraulic modeling for over 140 miles of stream, which involved detailed calibration to rain and stream flow gages. The future conditions modeling was

based on future conditions land use GIS layers provided by the counties and municipalities. All modeling was performed using WISE, which provides automated tools for development of H&H models. The automated tools consist of rapid development of SCS curve numbers, time of concentrations and reach and reservoir routings. NEA Optimization and Mapping

Community Outreach & Coordination - AECOM has assisted in over 100 community meetings by preparing presentations and maps and addressing mapping and engineering questions from citizens and public officials. There are two outreach meetings scheduled for each County; one for community officials and one for the general public. The goals for the community official's meeting are to review the changes made to map products and the study methods applied, provide an overview of the post-preliminary process and projected schedule that the study will follow through the statutory appeal period, map finalization, map adoption and delivery. Open house meetings for the general public are made available to make citizens aware of the preliminary map products, inform them of changes to flood hazard information as it relates to individual properties, and explain the formal process to follow should they have a formal comment or appeal to submit on the preliminary flood hazard information.

Project Goals and Objectives

The State of North Carolina, through FEMA's Cooperating Technical Partnership Initiative, was the first CTP. As a CTP, the State assumed primary ownership and responsibility of the National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRMs) for all North Carolina communities. The first phase of this project included six major river basins in Eastern North Carolina. This project is by far the largest most comprehensive floodplain project of its kind in the United States. AECOM, as a subcontractor, performed work for five of the six major river basins included as Phase 1 of the project including 33 counties. AECOM is currently working on Phase II, in 2 major river basins.

"

AECOM has been a valued partner in the North Carolina Floodplain Mapping Program and has, and continues to be critical to this program's success.

John Dorman, Director, NCFMP

"

South Carolina Flood Mapping Initiative Statewide

Client Name
South Carolina Department of Natural Resources

Project Manager
Maria Cox Lamm
2762 Wildlife Lane; West Columbia, SC 29172
Phone: 803.734.9493
Email: CoxM@dnr.sc.gov

Overall Value
$30 million

End Date
Ongoing

Type of Project
Mapping and Hazard Analysis

Services

Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; DFIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

Please note: This project was under contract to URS which became a part of the AECOM family of companies in October 2014.

In the past 20 years, floods and hurricanes have caused more than $7 billion in damage in South Carolina. Through a CTP initiative with FEMA, the South Carolina Department of Natural Resources (SCDNR) initiated a program to update flood hazard information for all communities in the state.

AECOM has been under contract with SCDNR to support their CTP initiative with FEMA since the inception of the program in 2004. Over this time, AECOM has:

- Completed over 12,000 miles of H&H analysis
- Mapped over 7,000 square miles of Special Flood Hazard Area
- Developed over 4,500 individual FIRM panels
- Completed 36 countywide Flood Insurance Studies
- Issued new preliminary FIRM's in 42 out of 46 counties and one watershed
- Developing preliminary map products for four counties and six watersheds
- Completed storm surge modeling using ADCIRC and SWAN for entire coast of South Carolina
- Conducted over 105 community meetings throughout the State with local, state and federal agency representatives, Congressional office staffers, business leaders and property owners
- Completed 6 and developing 14 other Risk Map Product projects
- Processed over 25,000 square miles of LIDAR-derived elevation models with hydrologic breaklines

For these studies, AECOM (formerly URS who joined the AECOM family of companies in October 2015) is responsible for the scoping meeting, LIDAR QA/QC, hydrologic analysis, detailed hydraulic analysis, limited detailed hydraulic analysis, redelineation of existing detailed studies, digital conversion of existing studies, DFIRMs, DFIRM database, and post-preliminary processing for these three countywide projects. The hydrologic and hydraulic analysis for each county is being conducted using the automated GIS-based WISE automated computer models.

AECOM assisted SCDNR in developing the Region's first Statewide Coastal Mapping Activity Statement to model the storm surge along the entire South Carolina coastline. This project updated the coastal hazard analyses in order to produce updated DFIRMs and FIS reports for all six of South Carolina's coastal counties (Horry, Georgetown, Charleston, Colleton, Beaufort, and Jasper). AECOM led the effort to run the ADCIRC model, STWAVE 2-D wave setup model, and conduct the JPM-OS statistical analysis. AECOM also prepared detailed wave analyses, coastal hazard mapping, and DFIRMs for three of the counties.

Currently, AECOM is providing various engineering services related to flood hazard protection. It includes performing periodic updates to the state's Flood Map Modernization Management Support business plans, developing updated flood hazard data for multiple counties and watersheds within South Carolina, post preliminary processing of DFIRM production, programming and GIS support for the development of tools, engineering and GIS assistance during post disaster situations, provide communities with FEMA's Risk MAP products, and guiding the State floodplain coordinator through FEMAs transition from the Map Mod program to the Risk MAP program.

Quality Assurance Plan - A large component of this assistance is providing quality control and review of topographic information, H&H modeling, and DFIRM mapping developed by others.

AECOM developed, in partnership with all mapping partners involved, a project specific Quality Assurance Plan. In summary, this SCDNR QA Plan describes the following major QA/QC activities:

- Approval of base map selection and existing information to be included in the study
- Approval of overall project scope/schedule milestones
- Early SCDNR staff review/concurrence of study support contractors (SSC) technical basis and assumptions
- Review of SSC activities to assure they are following their own QA/QC Plans
- Review of SSC draft and final study products to assure technical adequacy & consistency across the State
- Final review of all materials to assure usability and conformance with FEMA Standards (formally known as Guidelines and Specifications)
- Integration of the above steps into the study process with minimal or no impacts to the overall study schedule.

Flood Ordinance Tool – AECOM created an interactive Floodplain Ordinance Tool which are used by local communities to easily update their Floodplain Ordinance. This tool will guide community officials through a series of questions that will help them quickly develop an NFIP-compliant flood prevention ordinance for their community. There are four ordinance types that can be generated by this user-friendly tool. Each template is specific to both the source of flooding (coastal or riverine) and type of jurisdiction (county or municipal). The tool guides the user through a series of questions required to complete the desired ordinance. In

addition, the user will be able to save entered data so that the information required can be generated in multiple work sessions. Finally, the tool will provide information on the Community Rating System (CRS) score their community could possible receive if they include standards above the minimum NFIP criteria. The user will be able to generate the ordinance and store this new document on their local disk storage as a *.pdf file.

Scoping - Study methods are based on community needs identified during the scoping/discovery process, and available digital terrain data. AECOM coordinated with the individual counties, South Carolina Council of Governments and SCGS for base map data and orthophotography data. H&H Analysis: Detailed study, limited detail study, automated approximate study methods, and redelineation are used to update flood hazard information. We have used WISE for H&H analysis for over 7,000 miles of streams. Storm surge analysis is being conducted for the coastal counties of Beaufort, Colleton, and Horry Counties.

Flood Hazard Mapping - FIRMs (vector based) will be produced for each county based on updated flood hazard analysis in accordance with current FEMA digital standards. To date, 22 are completed, 2 are preliminary, and 6 studies are in production. AECOM coordinated with the USACE on levee certification issues in South Carolina.

State Business Plan - AECOM assisted the SCDNR with its Map Modernization Plan which was prepared to assist FEMA in the development of regional and national plans for implementing the FEMA Map Modernization Program.

Outreach - We coordinate/conduct outreach activities to keep communities informed and engaged in the process. We canvas communities to ascertain existing data or other products, services, or funds that can be leveraged in the flood study. Activities include scoping meetings and PDCC. A total of 21 scoping meetings for 29 counties and one watershed; 24 PDCC meetings; and 3 Public Open House meetings have been held.

Post-Preliminary Processing - AECOM is conducting post-preliminary processing activities for our assigned counties.

The [AECOM] staff is always willing to go the extra mile... This project has had many changes throughout its life cycle. The team has adjusted to those changes in stride.

Maria Cox Lamm, CFM State NFIP Coordinator, SCDNR

Project Goals and Objectives

SCDNR is a Cooperating Technical Partner with FEMA and the principal agency responsible for the National Flood Insurance Program in South Carolina. As such, SCDNR is responsible for implementation of the Statewide Flood Map Modernization Initiative. Under this project, AECOM has assisted the State in preparing a statewide plan for updating the maps throughout the state, identifying funding needs, reviewing the standards that will be used to collect LiDAR information, prioritizing county-wide studies, conducting hydrologic and hydraulic analysis, and creation of a DFIRM.

Delaware Flood Mapping Study Services Statewide

Client Name
Delaware Department of Natural Resources and Environmental Control

Project Manager
Michael Powell
89 Kings Highway Dover, DE 19901
Phone: 302.739.9921
Email:
Mike.Powell@state.de.us

Overall value
$817,000
(combined contracts)

End Date
Ongoing

Type of Project
Mapping and Hazard Analysis

Services
Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; DFIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

Please note: This project was under contract to URS which became a part of the AECOM family of companies in October 2014.

AECOM (as the former URS) has been providing floodplain mapping services to DNREC since they became a CTP over a decade ago.

Both AECOM and the former URS are providing Flood Mapping Services under Master Service Agreements (MSA) with DNREC. In addition, the former URS provided services under the first flood mapping contract for DNREC. The flood studies are in support of their CTP agreement with FEMA to provide updated Flood Insurance Studies (FISs).

Under the first flood mapping contract, URS completed the following three flood mapping task orders: 60 miles of limited detailed study in Sussex County, 32 miles of limited detailed study in the Appoquinmink watershed, and 30 miles of limited detailed study in the Murderkill watershed.

URS provided the following services under the second contract: development of a hazard mitigation portfolio; development of a Website to display statewide flood hazard information, including flood depths; dam breach analyses; and development of a sea level rise flood mapping scenario to help DNREC carry out Executive Order 41, which requires DNREC to prepare Delaware for emerging climate impacts.

AECOM is completing 170 miles of limited detail study (LDS), 57-miles of base-level study, and 33 miles of redelineation in Kent and Sussex Counties, DE. This task order includes a limited survey of 230 road crossings and the development and processing of 39 revised FIRM panels.

QA/QC of LIDAR Data - The USGS is provided to DNREC state-wide LIDAR data for use in flood studies. For the Sussex County Task order, AECOM provided an independent QA/QC review of this data and our team developed hydro-corrected breaklines for the use in the hydrologic and hydraulic modeling.

Field Measurements - AECOM field teams provided field measurements at road crossings for input to the hydraulic model.

Hydrologic Analyses - Utilizing automated GIS methodology, AECOM is developing estimated peak discharges using regional regression equations and USGS gage data.

Hydraulic Analyses – AECOM is conducting hydraulic analyses utilizing the Watershed Information System (WISE™) program to the level of a Limited Detailed Study (LDS). The WISE program is an automated GIS methodology which enables effective creation of HEC-RAS models for all of the streams. The hydraulic analyses will support placement of Base Flood Elevations (BFEs) on the maps to promote accurate floodplain management.

Floodplain Mapping - AECOM is using automated methods to plot the 100-year and 500-year predicted floodplains.

DFIRM Preparation - AECOM is creating Digital Flood Insurance Rate Maps (DFIRM) for the map panels that are affected by the re-study. All three Delaware counties have county-wide DFIRMs; therefore, these studies will result in revised map panels for areas that are being restudied.

Project Management Support – AECOM is providing management support for the contract through development of Mapping Activity Statements, preparation of Progress Reports for submittal to FEMA, support for updates to FEMA's Mapping Information Platform (MIP), and other tasks that are part of FEMA processes.

Under our new contract with the State, we have just started our first task order to develop an inventory of all coastal structures and impoundments in the state, which will include field work to verify characteristics and conditions of the structures.

"

URS' high quality of work, expertise in a range or areas, timeliness in meeting deadlines, willingness to go above and beyond when needed, and responsiveness have all been outstanding, and made the projects move forward smoothly. Many others in the Department, and in FEMA, have been similarly impressed with your work.

Michael S. Powell
DNREC Flood Mitigation Program

"

Project Goals and Objectives

AECOM is providing floodplain mapping services to DNREC and developing flood studies in support of their CTP agreement with FEMA to provide updated Flood Insurance Studies (FISs).

Kentucky Statewide Map Modernization, QA/QC and Risk MAP
Statewide

Client Name
Kentucky Division of Water

Project Manager
Carey Johnson
200 Fair Oaks Lane, 4th Floor
Frankfort, KY 40601
Phone: 502.564.3410
Email: carey.johnson@ky.gov

Overall Value
$19 million

End Date
Ongoing

Type of Project
Mapping and Hazard Analysis

Services
Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; DFIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

AECOM has served for nearly a decade in supporting KDOW as a Cooperating Technical Partner (CTP) contractor.

Along with QA/QC services, KDOW selected AECOM to provide approximately 75% of their Risk MAP program production services. As a result, AECOM assists KDOW in many aspects of the Risk MAP Program including watershed based project planning, mitigation action and strategic initiatives, communications with FEMA, public outreach, engineering, map production and adoption, quality assurance, and delivery of regulatory and non-regulatory Risk MAP products.

Since 2009, production has been completed and/or scoped for more than 50 counties. As part of the FY2009 assignment, AECOM completed FEMA Map Updates for 13 counties and is charged with providing QA/QC for 2 counties. FY2010 assignment included reg. and non-regulatory products for the Upper Cumberland River HUC-8 watershed, the Union County Levee Analysis, and QA/QC of the Statewide Coordinated Needs Management Strategy (CNMS). FY2011 contract includes the Lower Levisa and Tug Fork HUC-8 watersheds as well as the Fulton County Levee Analysis.

The FY2012 assignment includes the Lower Kentucky watershed. FY2013 and FY2014 include the lower Cumberland watershed. The map included summarizes where we have provided Risk MAP services throughout Kentucky. We also performed the Union County, Kentucky Levee Analysis and Mapping Procedures (LAMP) Pilot study, 1 of 25 pilot studies in the Nation, providing feedback to FEMA regarding the LAMP process. We consider ourselves fortunate and honored to have provided successful efforts toward these major activities:

- Scoping, outreach, and public meetings
- Over 12,000 square miles of terrain processing
- Over 13,000 square miles of hydrologic analysis
- Over 4,000 linear miles of hydraulic analysis
- Over 7,000 square miles worth of FIRM Panels
- 50 counties reviewed for KY & FEMA compliance

Map Summarizing AECOM FEMA Floodplain Mapping Work in Kentucky

"

[AECOM] has always maintained an outstanding relationship with the Kentucky Division of Water (a FEMA CTP). Their engineering and mapping products have always been of excellent quality with particular emphasis placed on the client's need and input. The client service provided by [AECOM] is certainly topnotch; always geared to the overall improvement and efficiency of the program and needs within.

Carey Johnson, KDOW
Kentucky Risk MAP

"

Project Goals and Objectives

KDOW management and AECOM performance have resulted in our efforts maintaining positive, solid FEMA performance metric indexes.

Statewide Kansas River Modeling and Floodplain Analysis

Client Name
State of Kansas

Project Manager
Tom Morey
900 SW Jackson
Room 456, Topeka, KS
66612
Phone: 785.296.5440
Email:
tom.morey@kda.ks.gov

Overall value
$500,000 plus to date

End Date
Ongoing

Type of Project
Mapping and Hazard Analysis

Services

Hydrologic and Hydraulic Modeling; Floodplain Identification and Mapping; FIRM Development; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

Please note: This project was under contract to URS which became a part of the AECOM family of companies in October 2014.

AECOM is one of two contractors selected to work with the State of Kansas to meet their Floodplain mapping needs. Since 2008 AECOM has mapped over 1,200 miles of detailed and approximate modeling and almost 100 miles of redelineation. AECOM also plays a vital role in the quality review process, by review other contractors modeling data provided to the State of Kansas.

Based on the quality of our work, AECOM (formerly URS which became part of the AECOM family of companies in October 2014) has been selected as a prime contractor by the Kansas Department of Agriculture (KDA), Division of Water Resources for statewide flood analysis and mapping two consecutive times since 2004.

Montgomery County, Kansas River Modeling and Floodplain Analysis

The Montgomery County, Kansas River Modeling and Floodplain Analysis Task Order is one of the projects conducted under the current contract. This task order is part of the State's Cooperating Technical Partnership with Federal Emergency Management Agency (FEMA) for flood map modernization. The goal of the Task Order is to prepare an updated flood study for the entire county in compliance with FEMA requirements and the National Flood Insurance Program.

The Task Order involved AECOM conducting hydrologic and hydraulic analysis for approximately 850 miles of stream within the county.

For efficient hydrologic and hydraulic analysis on hundreds of miles of stream, experienced URS engineers applied automated GIS and engineering tools for optimal productivity. Automated processes were used for initial flowpaths and cross-section placement, creating elevated cross-sections for HEC-RAS from the topographic data, developing and importing n-values, and mapping the flood inundation. Our experienced engineers modified and validated automated outputs, as needed, to correctly model the floodplain. The automated GIS tools

interact with HEC-RAS to compute the water surface elevations. AECOM engineers perform iterative adjustments to cross-section alignments and modeling parameters with the resulting water surface elevations to ensure the modeling inputs are adequate for calculating the floodplains accurately.

Based on the hydrologic and hydraulic models, AECOM's automated tools conducted the floodplain delineation of water surface profiles. Our automated mapping tools were then used to efficiently convert the digital inundations maps into FEMA's approved format for floodplain boundaries. In addition, AECOM redelineated the floodplain boundary of approximately 25 miles of stream based on improved topographic data. All floodplain boundaries met FEMA's requirements, including FEMA Procedural Memorandum 38, for Floodway Boundary Standards. Based on the new information, AECOM is preparing 38 Digital Flood Insurance Rate Map panels and the Flood Insurance Study. All submittals and deliverables are prepared according to FEMA's Guidelines and Specifications.

AECOM is also created the Flood Insurance Study (FIS) in compliance with the National Flood Insurance Program. The FIS and preliminary maps were issued on October 17, 2014.

Miami County, Kansas Flood Insurance Study

The Miami County, Kansas Flood Insurance Study is part of a larger IDIQ contract with the Kansas Department of Agriculture, Division of Water Resources. Highlights of the engineering and mapping include

- Retrieved and Incorporated newly revised topographic and base map data
- Perform detailed engineering studies on 4.1 miles of the Marais Des Cygnes River and 5.3 miles of Pottawatomie Creek.
- Performed approximate engineering on 320 miles of stream
- Performed redelineation on 91.8 miles of previous detailed streams
- Created 47 FIRMs
- Created FIS
- Completed all submittals and deliverables according to FEMAs Guidelines and Specifications including
  - Floodway Boundary Standards Report in accordance with FEMA PM 38 (2008)
  - Compliant with FEMA's Quality Reviews (QR 1-7)

"

David Rubenstein could not be more attentive to our needs. All technical reviews have been completed on time and are generally completed ahead of schedule. The engineers conducting reviews have been thorough and have taken their role in our Quality Control seriously. Quality Control is very important to us and Dave and his team have proven it is important to them as well, we appreciate that.

AECOM has provided perfect service on all of our ITR projects, including the Coffeyville project. No need for improvement.

Keep up the good work.

Dane Bailey
Kansas Department of Agriculture

"

Project Goals and Objectives

AECOM is providing all aspects of FEMA flood studies to KDA, including performing hydrologic and hydraulic analysis, floodplain mapping, FIRM and FIS development, FIRM database development, preliminary and post preliminary production. We are helping KDA be a successful CTP and meet Region VII goals and metrics.

Hazard Mitigation and Technical Assistance Program
Nationwide

Client Name
Federal Emergency Management Agency

Project Manager
J. Francisco Oporto
500 C Street, SW
Washington, DC 20472
Phone: 202.646.2594
Email:
Frank.Oporto@fema.dhs.gov

Overall value
$150 million

End Date
Ongoing

Type of Project
Hazard Analysis

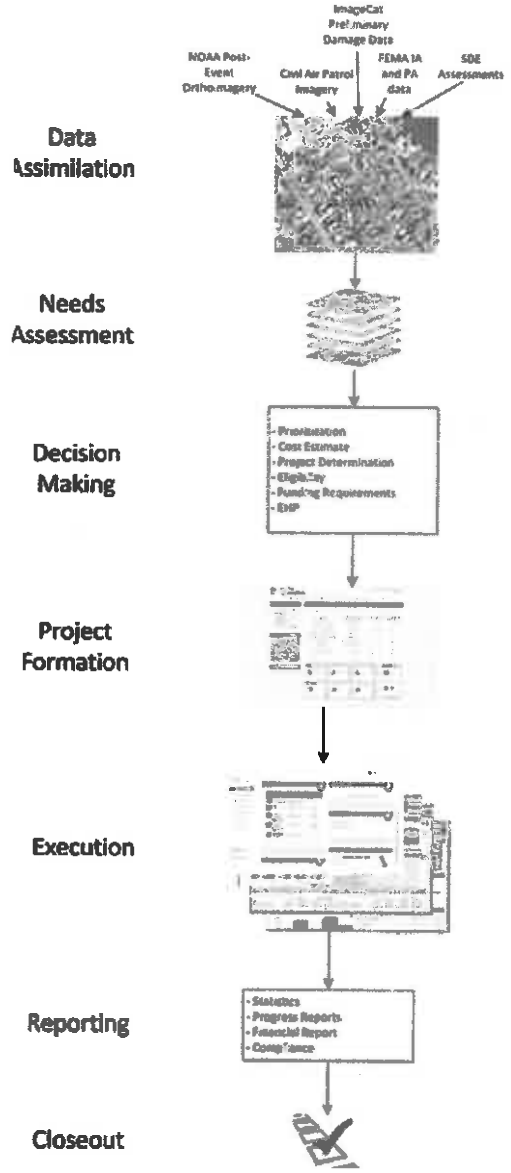
Services

Floodplain Identification and Mapping; Data Management; Topographic Data Development; Hazard Mitigation Planning; Community Outreach

Please note: This project was under contract to URS which became a part of the AECOM family of companies in October 2014.

AECOM reviewed approximately 400 hundred state, tribal, and local hazard mitigation plans between 2008 and 2015 to establish compliance with the requirements of the Disaster Mitigation Act of 2000 relative to the planning process as well as to the content of the plan under the Hazard Mitigation Technical Assistance Program (HMTAP) and the Risk Mapping, Assessment, and Planning (Risk MAP) contracts.

URS, now AECOM, as prime contractor, has been supporting FEMA's Mitigation Directorate, with a broad range of pre and post disaster technical support and planning services for implementation of mitigation programs since 1995. URS was issued more than 500 Task Orders under the contract and has provided support on nearly 100 disaster declarations. The services provided have included evaluation of structural and nonstructural flood mitigation measures, identification of coastal and riverine flood hazards, flood loss damage surveys and aggregation for mitigation planning, flood loss estimation and depth damage function development, GIS and GPS applications, benefit/cost analyses, training, environmental planning, and geotechnical engineering.



Riverine Flood Hazard Analyses

We have completed more than 50 riverine flood hazard analyses throughout the country. These analyses have required a variety of hydrologic and hydraulic analytical methods. Hydrologic analyses in support of these flood hazard analyses and assessment of specific flood event recurrence intervals have been performed. The watersheds analyzed have ranged in size from less to 1 square mile to major river systems. Because of the variation in stream size a variety of hydrologic analyses techniques have been employed including HEC-1, HEC-HMS, Bulletin 17B, TR-20, SWMM, and USGS Regression Equations. Hydraulic analyses to evaluate current flood hazards, update the delineation of those flood hazards on currently effective FISs, and to evaluate the effectiveness and impacts of proposed flood mitigation projects have been performed on a variety of watercourses including high velocity, narrow flood plain streams as well as low gradient, wide flood plain major river systems. The majority of the hydraulic analyses have been performed using HEC-2 or HECRAS. Some proposed dam projects and unique heavily urbanized watersheds have required the use of the UNET, and the DAMBRK models. We have also used WSP2 and a simplified hydraulic model, QUICK2. Modeling has been performed to FEMA Study Contractor Specifications including the production of digital maps using ARC-INFO. We have used ARCINFO GIS applications to both hydraulic analyses and development of flood plain maps using digital elevation models and both HEC-2 and HEC-RAS.

Flood Hazard Mitigation

URS has assisted FEMA in providing support to communities in developing flood hazard mitigation alternatives and evaluating impacts and merits of various mitigation alternatives. Specific mitigation projects that have been addressed under this contract have included floodwalls, geodesign barriers, berms, floodgates, channel improvements, flood control reservoirs, levees, series of flood control reservoirs throughout a watershed, flood proofing, and acquisition and relocation of flood prone structures. Evaluations have included development of conceptual designs, construction cost estimates, benefit/cost analyses, and assessment of environmental impacts.

Benefit Cost Analysis

Benefit/cost analyses for these projects requires collection of both demographic and flood hazard data and using those data to establish depth damage relationships. It has often been necessary to aggregate these relationships for several types of direct and indirect damages to fully assess the estimated flood loss so that the benefits from suggested mitigation projects can be quantified. We have developed guidance for FEMA to supply to state and local governments in performing these same analyses. We have developed guidance for using default data sets as well as how to perform the analyses when the user has better defined data. We have also recently updated all of FEMA's benefit/cost modules including the methodology and default data for depth damage analyses. Our mitigation evaluation assignments have also included building performance evaluations. We have performed these evaluations in both riverine and coastal flood environments.

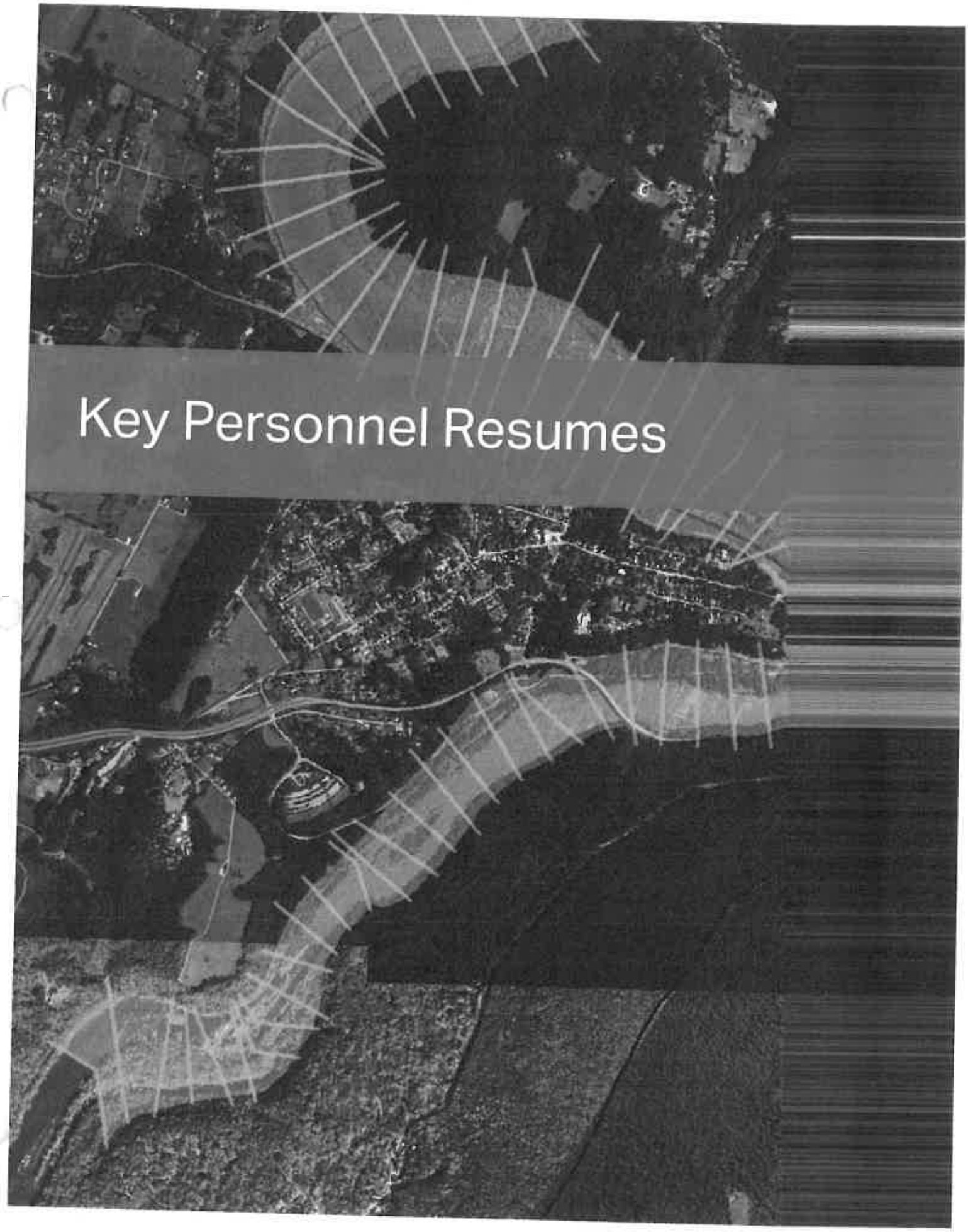
GIS Applications and Flood Damage Surveys

GIS and ARC-INFO in particular have been used to support hydraulic analyses and the development of digital flood plain maps according to FEMA Study Contractor Specifications. Additionally, we have used GIS and ARC-INFO to assist FEMA in delineating the extent of flooding from field damage assessments using GPS technology linked to GIS as well as remote sensing digital information. These applications have been particularly useful in evaluating the primary areas for targeting flood hazard mitigation projects. This application was particularly helpful in assisting FEMA evaluate damage extent in Virginia, West Virginia, California, Minnesota and Ohio. In these applications, we surveyed damage to thousands of structures,

geocoded the information, and used GIS technology to present the data for use in mitigation planning. Additionally, the data collected in these projects were organized to facilitate depthdamage functions for flood loss estimations and eventual mitigation project benefit/cost analyses.

Project Goals and Objectives

The planning support mission areas focus primarily on the following four national priorities: implement the National Incident Management System (NIMS) and National Response Framework (NRF); expanded regional collaboration; strengthen interoperable communications capabilities; strengthen chemical, biological, radiological, nuclear and explosive detection, response and decontamination capabilities. NPD has partnered with the NIMS Integration Center (NIC), the Department of Energy (DOE) and others to enhance response and recovery related support to state and local jurisdictions.



Key Personnel Resumes

AECOM

Christine Estes, PE, CFM

Program Manager

Areas of Expertise

Floodplain Management

Watershed Management Plans

Stormwater Management

Watershed, Lake, and Stream Restoration

Hydrology and Hydraulics

NPDES Compliance

Low Impact Development (LID)

Education

MS, Civil and Environmental Engineering, Virginia Tech University

BS, Civil Engineering, University of Virginia

Licenses/Registrations

Registered Professional Engineer: VA, MD, GA, IA

Certified Floodplain Manager, 2006

AECOM Certified Project Manager, 2008

Years of Experience

17 years

Professional Associations

Association of State Floodplain Managers (ASFPM)

Virginia Floodplain Managers Association (VFMA)

Virginia Lakes and Watersheds Association (VLWA)

Maryland Associations of Floodplain and Stormwater Managers (MAFSM)

Pennsylvania Association of Floodplain Managers (PAFPM), member of Stormwater Sub-committee

Summary

Ms. Estes has over 17 years of experience in civil and environmental engineering. As a water resources engineer, she has performed studies for floodplain management, total maximum daily loads (TMDLs), national pollutant discharge elimination system (NPDES) compliance, stormwater management, watershed planning, Low Impact Development (LID) implementation, and water quality monitoring. She has prepared complex hydrologic, hydraulic, and water quality models for rivers, reservoirs, and watersheds. Her modeling and software experience includes the use of HEC-RAS, HEC-1, HEC-2, HEC-HMS, HSPF, BASINS, CE-QUAL-W2, XP-SWMM, ICPR and ArcGIS. Ms. Estes has over a decade of project management experience. Ms. Estes has worked on the Flood Insurance Rate Map (FIRM) production of over 75 county-wide studies where she provided management, engineering, mapping, and/or quality control expertise.

Experience

FEMA Region III, RAMPP Risk Map. Deputy Regional Manager. Ms. Estes serves as the Deputy Regional Manager for FEMA Region III under RAMPP's (Joint Venture of URS and Dewberry) Risk Map contract. Ms. Estes is responsible for overseeing all of Region III related activities performed by URS under the Risk Map contract, including FIRM production, coastal analysis, hazard risk assessment, outreach assistance, and technical support.

FEMA Region III, Conococheague-Opoquon Watershed Discovery and Risk MAP Project, Pennsylvania, West Virginia, Virginia, Maryland. Project Manager. Ms. Estes led Risk MAP Discovery tasks for the Conococheague-Opoquon Watershed. She developed the Discovery report and assisted with map development and participated in Discovery meetings with communities. She is now managing the creation on Flood Risk Products for the watershed including depth grids, Hazus analysis and a Flood Risk Database, Report, and Map.

FEMA Region III, Jefferson County, WV Zone A Study. Project Manager. Ms. Estes is leading an effort to create advisory 1% annual chance storm event floodplains for all effective Zone A floodplains in the County. She has overseen the new hydrologic analysis using regression equations, hydraulic analysis using HEC-RAS, and mapping and depth grid development using Geo-RAS and ArcGIS tools.

Iowa Department of Natural Resources, Physical Map Revision (PMR), Buchanan County, IA. Project Manager. Ms. Estes is the Project Manager for this task order contract with IA DNR. This project involves updating the Flood Insurance Study, conducting hydrologic analysis, conducting base and enhanced hydraulic analysis of the Wapsipinicon River within the City of Independence and Buchanan County, IA, and producing Digital Flood Insurance Rate Maps (DFIRMs) and a Flood Insurance Study (FIS) to incorporate the updated analysis.

SCDNR, DFIRM Production, Georgetown County. SC. Project Manager. Ms. Estes is the Project Manager for this task order contract with SCNDR. This project involves updating the Flood Insurance Study, performing coastal analysis, conducting hydrologic and hydraulic analysis of Approximate, Limited Detailed, and Detailed Study Streams, and producing Digital Flood Insurance Rate Maps (DFIRMs) and a Flood Insurance Study (FIS) for Georgetown County, SC.

Kansas Department of Agriculture, Kansas MapMod, Senior Engineer. Ms. Estes provided management of quality control/quality assurance activities for approximate flood studies in Kansas. She has reviewed hydrology, hydraulics, floodplain mapping, DFIRMs, and FIS texts for 8 counties.

FEMA Region III, Lower Susquehanna-Swatara Watershed Study, Pennsylvania. Project Manager. Ms. Estes is the Project Manager for this watershed study, which involves Discovery and new base level hydrology and hydraulics analysis for all Zone A streams within the watershed. The study will result in new floodplain mapping and workmaps for the watershed.

FEMA Region III, Scottsville Levee Remapping, Albemarle County, VA. Project Manager. Ms. Estes is the Project Manager for this remapping task for FEMA Region III. This project involves updating the Flood Insurance Study and producing Flood Insurance Rate Maps (FIRMs) for Albemarle County, VA to reflect the accreditation of the Scottsville levee.

FEMA Region III, FIRM Production, Bradford County, PA. Project Manager. Ms. Estes was the Project Manager for this county-wide flood study for FEMA Region III. This project involved updating the Flood Insurance Study, conducting hydrologic and hydraulic analysis of Approximate and Detailed Study Streams and producing Flood Insurance Rate Maps (FIRMs) for Bradford County, PA.

Alabama DECA, DFIRM Production, Senior Engineer and Task Manager, Covington and Butler Counties, AL. Senior Engineer and Task Manager. Ms. Estes provided management, technical guidance, and quality assurance and quality control of the countywide restudy and DFIRM production for Butler and Covington counties.

Georgia Dept. of Natural Resources (DNR), Georgia Flood Map Modernization Program Cooperating Technical Partner (CTP), Atlanta, GA. Senior Engineer and Task Manager. This project for the

Georgia DNR involved the production of Georgia's statewide flood map modernization program, in compliance with the Federal Emergency Management Agency (FEMA). Ms. Estes's responsibilities included the oversight and management of all engineering phases of floodplain mapping for two counties, including: hydrology, hydraulics, floodplain mapping, and QA/QC.

FEMA, Hazard Mitigation Technical Assistance Program (HMTAP) Watershed Planning and Management Studies, Nationwide. Senior Engineer. Ms. Estes was involved with the HMTAP contract, providing management of task orders, technical expertise for hydrologic and hydraulic modeling, and quality control of deliverables. Her HMTAP experience includes providing management services for the Flood Data Analysis Task Order that helped Iowa develop flood recovery maps for 16 counties (8,937 miles of stream) within 60 days as part of their recovery and mitigation efforts.

FEMA, FEMA MT-2 Reviews, Nationwide. Water Resources Engineer. Ms. Estes reviewed and processed CLOMR and LOMR (MT-2) requests to FEMA for floodplain and/or floodway revisions as a subcontractor. Her responsibilities involved examining submitted hydrologic and hydraulic models (HEC-1 and 2, HEC-RAS, etc), including complex hydraulic conditions, and preparing map revisions.

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation

9960 Mayland Drive, Suite 400, Richmond, VA 23233

Telephone: (804) 367-8500

EXPIRES ON

06-30-2016

NUMBER

[redacted]

BOARD FOR ARCHITECTS, PROFESSIONAL ENGINEERS, LAND SURVEYORS, CERTIFIED INTERIOR DESIGNERS AND LANDSCAPE ARCHITECTS
PROFESSIONAL ENGINEER LICENSE

CHRISTINE DICKSON ESTES
5112 MACARTHUR BLVD NW
 # 311
WASHINGTON, DC 20016

Status can be verified at http://www.dpor.virginia.gov

(SEE REVERSE SIDE FOR PRIVILEGES AND INSTRUCTIONS)

DPOR-LIC (05/2015)

COMMONWEALTH of VIRGINIA

Department of Professional and Occupational Regulation

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PROFESSIONAL ENGINEER LICENSE
NUMBER: [redacted] EXPIRES: 03-30-2016

CHRISTINE DICKSON ESTES
5112 MACARTHUR BLVD NW
 # 311
WASHINGTON, DC 20016

Status can be verified at http://www.dpor.virginia.gov

DPOR-PC (05/2015)

ASSOCIATION OF STATE

FLOODPLAIN MANAGERS, INC.

CERTIFICATION BOARD OF REGENTS

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

Christine E. Worley, CFM

IS DULY REGISTERED AS AN

ASFPM CERTIFIED FLOODPLAIN MANAGER

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. US-06-01810, ISSUED 5/20/2008. THIS CERTIFICATE SHALL EXPIRE 7/31/2016, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS
PRESIDENT, THOMAS V. MOREY, CFM

ASSOCIATION OF STATE FLOODPLAIN MANAGE..
EXECUTIVE DIRECTOR, CHAD M. BERGINNIS, CFM

ASFPM CFM® CERTIFIED

AECOM

Joseph Chapman, PE, CFM

Quality Assurance

Areas of Expertise

Technical Review
Quality Assurance
Floodplain Mapping
Risk Assessments
Mitigation

Education

BS, Civil Engineering, Clemson University

Licenses/Registrations

Professional Engineer: North Carolina
Professional Engineer (Civil): Texas

Years of Experience

27 years

Professional Associations

American Society of Civil Engineers
South Carolina Association for Hazard Mitigation
North Carolina Association of Floodplain Managers
Indiana Association for Floodplain and Stormwater Management

Training and Certifications

Certified Floodplain Manager

Summary

Joe Chapman has extensive experience in floodplain mapping, flood risk assessment and flood mitigation projects in support of Federal, State and Local agencies and has provided post-disaster support ranging from field damage assessments to the development of flood recovery mapping to support rebuilding efforts. Mr. Chapman has managed and supported over a dozen CTP clients nationwide.

Mr. Chapman currently serves as the North American Technical Practice Leader for Flood and Natural Hazard Risk Management for AECOM. He has more than 25 years' experience in managing and performing small- and large-scale water resource projects as both an engineer and project manager. From 2011 – 2014 he served as a Technical Director in AECOM's Australian business leading the Queensland Water Resources team. Prior to his time in Australia he led the Watershed Concepts division of AECOM's US Water Business line; in this role he was responsible for the operations of 12 offices with more than 160 employees in North America performing floodplain mapping, flood risk assessment, flood hazard mitigation, and geospatial projects in support of FEMA.

Mr. Chapman will provide quality assurance and serve as a technical advisor to the team.

Experience

South Carolina Flood Map Modernization, SCDNR, Statewide, SC. Principal-In-Charge (PIC) for AECOM's contract with the State, who is a CTP supporting FEMA's flood map modernization efforts. Provides guidance and direction related to contract negotiations, program specifications and priorities and provides senior technical guidance on study production. Also participates in outreach activities associated with scoping and PDCC meetings. To date, studies have included over 1,000 stream miles of completed detail, limited detail and approximate H&H engineering studies and over 350 completed vector-based DFIRM panels.

North Carolina Floodplain Mapping Program (NCFMP), State of North Carolina. Senior Technical Advisor. Oversees engineering and DFIRM mapping production. To date, this project has resulted in field survey of over 3,000 bridges and culverts; over 13,000 miles of hydrologic and hydraulic analysis; and production of over 8,500 FIRM panels. The project included future conditions analysis on detail study

and limited detail study streams in Wake, New Hanover, Orange, and Durham Counties.

Mississippi Flood Map Modernization, MDEQ, Statewide, MS. Senior Technical Advisor as part of MGI, LLC joint venture. Worked with State and FEMA officials in establishing the MS mapping program and developing program specifications and priorities. Assisted State officials in conducting scoping meetings and contributes to resolution of technical and programmatic issues and ongoing outreach associated with post-Katrina flood map updates.

FEMA Risk MAP Production & Technical Services, FEMA, Nationwide. Senior Project Manager responsible for the oversight of over $10 Million a year in riverine hydrologic and hydraulic modeling and mapping task orders. Also served as the LiDAR/Topographic Mapping Subject Matter Expert for the BakerAECOM team.

Mecklenburg County, Watershed Study Updates and Digital Flood Insurance Rate Map Mapping, Mecklenburg County, North Carolina. Principal in charge responsible for contract management and implementation of the quality assurance program. Work includes updated watershed-based studies for nine different watersheds covering over 180 miles of stream within the county. Studies included development of updated existing and future land hydrologic and hydraulic models for the 2-, 10-, 15-, 50-, 100-, and 500-year existing conditions storms and 100-year future conditions storm. Responsible for facilitating watershed-based stakeholder groups to obtain concurrence on land use updates that are developed.

City of Florence, Flood Mitigation Project, Florence, South Carolina. Project manager for development of a hazard mitigation plan and elevation certificate survey. GIS was used to identify and rank the floodplain problems and mitigation solutions were recommended to reduce the likelihood of flooding. Responsibilities included all public relations related to project impact, the development of an action plan, evaluation and ranking of known flood problems, and field survey and elevation certificates for more than 100 structures.

State-wide LiDAR Acquisition, FEMA Region VI IDIQ – LA. Technical Advisor. Coordinated with subcontractors regarding schedule and deliverables; coordinated with other partners including FEMA, USACE and LSU regarding deliverables and storage/ distribution of final terrain deliverables; and development of QC protocols to ensure compliance with FEMA requirements. Included subcontractor acquisition of over 43,000 square miles of LIDAR data, field survey of checkpoints in accordance with FEMA QA/QC standards, RMSE calculations and qualitative visual review of all LIDAR tiles, and development of final TIN and DEM deliverables.

North Carolina Board of Examiners for Engineers and Surveyors

This is to certify that

Joseph B. Chapman

is duly licensed and entitled to practice

Engineering

until December 31, 2016 when this certificate expires.

Registration Number: [redacted] Status: CURRENT

Nils W. Joyner Jr., Chair

Richard M. Benton, Secretary

NORTH CAROLINA ASSOCIATION OF FLOODPLAIN MANAGERS

NCAFPM

CERTIFIED FLOODPLAIN MANAGER (CFM®) PROGRAM

Accredited by the Association of State Floodplain Managers

IN RECOGNITION OF HAVING MET THE NATIONAL CERTIFICATION REQUIREMENTS, THE BOARD OF DIRECTORS OF THE NORTH CAROLINA ASSOCIATION OF FLOODPLAIN MANAGERS HAS AWARDED THE TITLE OF **CERTIFIED FLOODPLAIN MANAGER** TO

Joseph B. Chapman, CFM

IN RECOGNITION THEREOF, THIS CERTIFICATE IS ISSUED THIS DAY 9/11/2002.
This Certificate Shall Expire on 1/1/2017.
Certification number NC-02-0048

William R. Tingle

William R. Tingle, CFM
NCAFPM Executive Director

ASFPM CFM CERTIFIED

John W. Fullerton

John W. Fullerton, CFM
NCAFPM Chair

AECOM

Michael Seering, PE, CFM

Hydrologic and Hydraulic Modeling Lead

Areas of Expertise

Project Management
Hydrology, Hydraulics
FEMA Flood Studies
FEMA Levee Analysis and Mapping

Education

ME, Civil Engineering, Colorado State University
BS, Biological Systems Engineering, Virginia Polytechnic Institute

Licenses/Registrations

Professional Engineer: MD

Years of Experience

11 years

Professional Associations

American Society of Civil Engineers
Association of State Flood Plain Managers

Training and Certifications

Certified Floodplain Manager, #US-06-02079
Computer Skills: ADCIRC, ArcGIS, AutoCAD, GeoRAS, HEC-RAS, Microstation, WISE

Summary

Mr. Seering is a Professional Engineer and Certified Floodplain Manager with skills in civil and environmental engineering and a focus on water resources and project management. His technical experience includes flood studies and stormwater management; his project management experience encompasses client communication, schedule and financial management, and technical team leadership. He has led business efficiency initiatives in first pass analysis and determinations of flood management ordinance requirements. He has managed and performed engineering analyses for numerous flood study projects for a variety of clients.

Experience

FEMA HQ Project Manager, IDIQ Stream Level Assessment of NVUE Miles in FEMA Regions II, III, and VI. Project Manager. Managed the budget and fulfillment of the technical scope of work of this project. This project involves stream level assessment for updated NVUE status of over 20,000 miles of expiring stream reaches for FEMA.

FEMA, Engineering and Mapping Tool Maintenance and Updates. Project Manager. Managed the budget and schedule for technical solutions to engineering and mapping tools to improve internal processes on FEMA flood studies.

FEMA Region III, Allegheny County, PA. Managed the budget, client relationship, and fulfillment of the technical scope of work of this project. This project involves conducting hydrologic and hydraulic analyses, including for leveed streams, producing FIRM panels, updating the FIS, developing Risk MAP products, and performing public outreach, including leading public meetings on FEMA regulations and flood risk.

FEMA Region III, Indiana County, PA. Project Manager. Managed the budget, client relationship, and fulfillment of the technical scope of work of this project. This project involves riverine levee analysis and outreach for the Cherry Tree Levee Systems under FEMA's Levee Analysis and Mapping Procedure.

FEMA Region VI, Conway and Pope Counties, AR. LAMP Subject Matter Expert. Provided technical guidance on technical execution and outreach for non-accredited riverine levees in Conway and Pope Counties, Arkansas under FEMA's Levee Analysis and Mapping Procedure.

FEMA Region III, IDIQ Carroll County, MD. Project Manager. Managed the budget, client relationship, and fulfillment of the technical scope of work of this project. This project involves reviewing and resolving community appeals, issuing a revised preliminary FIRM and FIS, and processing the post-preliminary FIRM and FIS.

FEMA Region III, IDIQ Brandywine Watershed, Delaware/Maryland/

Pennsylvania. Project Manager. Managed the budget, client relationship, and fulfillment of the technical scope of work of this project. This project involves conducting hydrologic and hydraulic analyses, producing FIRM panels, updating the FIS, development of non-regulatory risk products, and performing public outreach, including leading public meetings on FEMA regulations and flood risk.

FEMA HQ, Risk MAP Levee Support (Compass Joint Venture). Water Resources Engineer. Provided technical assistance in development and reporting for FEMA's levee policy development and implementation and levee data management, including coordination with USACE for joint systems.

FEMA HQ, Risk MAP Levee Support. Water Resources Engineer. Provided technical assistance in development and reporting for FEMA's Mid-term Levee Inventory (MLI) database, summary reporting for the Provisionally Accredited Levee (PAL) tracking spreadsheet, monthly technical report, and fulfillment of short-term information requests from the client. Represented the Joint Venture, RAMPP, on the integration of FEMA's MLI into USACE's National Levee Database (NLD). Represented RAMPP on the non-breach levee scenario work-group, which includes other contractors and the client. Researched international levee issues and performed pilot studies to provide recommendations to FEMA on its revision to levee analysis and mapping policy. Performed quality control reviews for the technical review and guidance for the breached levee scenarios and dispositioned public review comments for the new policy development for FEMA. Developed specifications for new Risk MAP products to be customized specifically for levees.

FEMA HQ, National Discovery. Project Manager. Managed the budget, client relationship, and fulfillment of the technical scope of work of this project. This project involves developing new National and regional guidance on obtaining and using datasets for FEMA Discovery Projects.

USACE, National Levee Database Outreach. Water Resources Engineer. Provided technical assistance at International Conference on Large Dams (ICOLD) to provide delegates with information and answer questions on USACE's National Levee Database (NLD).

FEMA HQ, FEMA Guidelines and Specifications. Water Resources Engineer. Provided technical assistance in development and reporting for FEMA's evaluation and revision to its standards and guidance outlined in the Guidelines and Specifications for development of the new Knowledge Sharing System, under the RAMPP Joint Venture PTS contract.

Georgia DNR, Flood Map Modernization Program CTP Contract. Water Resources Engineer. Developed hydraulic models for the delineation of floodplain boundaries for FEMA flood maps.

SCDNR, South Carolina Storm Surge Analysis, SC. Water Resources Engineer. Performed quality control reviews of topographic and bathymetric grids developed for coastal storm surge modeling in ADCIRC.

SCDNR, South Carolina Flood Study, SC. Water Resources Engineer. Developed hydraulic models for the delineation of floodplain boundaries for FEMA flood maps. Created flood profiles from hydraulic analyses output. Performed quality control checks on FEMA Flood Insurance Rate Map panels.

ASSOCIATION OF STATE

FLOODPLAIN MANAGERS, INC.

CERTIFICATION BOARD OF REGENTS

HEREBY CERTIFIES THAT PURSUANT TO THE PROVISIONS OF THE CHARTER FOR THE CERTIFIED FLOODPLAIN MANAGER PROGRAM

Michael J. Seering, CFM

IS DULY REGISTERED AS AN

ASFPM CERTIFIED FLOODPLAIN MANAGER

IN TESTIMONY WHEREOF THIS CERTIFICATE HAS BEEN ISSUED BY THE AUTHORITY OF THE CERTIFICATION BOARD OF REGENTS, CERTIFICATE NO. US-06-0207P, ISSUED 8/30/2006. THIS CERTIFICATE SHALL EXPIRE 1/31/2017, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

CERTIFICATION BOARD OF REGENTS
PRESIDENT, MARK RIEBAU, P.E., CFM

ASSOCIATION OF STATE FLOODPLAIN MANAGERS
EXECUTIVE DIRECTOR, CHAD M. BERGINNIS, CFM

ASFPM CFM CERTIFIED

AECOM

David L. Weaver, PE

Hydrology and Hydraulics Technical Advisor

Areas of Expertise

Infrastructure Design and Construction
Drainage
Stormwater Management
Erosion and Sedimentation Control

Education

MS, Civil Engineering, University of Washington
BS, Civil Engineering, Clemson University

Licenses/Registrations

Professional Engineer: West Virginia

Years of Experience

28 years

Training and Certifications

AECOM Americas Project Manager Accreditation – Level 3, Senior Project Manager

Professional Associations

National Society of Professional Engineers
American Council of Engineering Companies, West Virginia
American Society of Civil Engineers
American Society of Highway Engineers
Morgantown Area Chamber of Commerce

Summary

Mr. Weaver is an experienced project manager who oversees and develops planning studies, engineering design, design-build and construction management for a variety of project types and disciplines. As branch manager of the Morgantown 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.

Experience

West Virginia Department of Transportation - Division of Highways, I-79 TIF District Interchange Design-Build, Monongalia County, West Virginia. 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.

West Virginia Department of Transportation - Division of Highways, Wells Bridge (WV 18), Tyler County, West Virginia. Project Director responsible for Design Study, Contract Plans, and associated NEPA (environmental) documents for the replacement of an existing 171 ft. bridge carrying WV Route 18 over Middle Island Creek. Project includes approach roadway, utility coordination, and right-of-way acquisition plans.

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 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.

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.

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 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.

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.

City of Morgantown, Walnut Street Infrastructure Improvement Project, Historic Central Business District, Morgantown, West Virginia. Project Manager responsible for site investigations, programing, conceptual design, and the development of plans, specifications, and cost estimates for the streetscape project from Spruce Street to High Street. Services also include stakeholder engagement, bidding/negotiation support, and construction administration.

West Virginia Department of Transportation - Division of Highways, US Route 35 Design-Build Tender Phase, from WV 869 to Mason CR 40, Putnam and Mason Counties. Project Manager during the tender phase design competition which involved the design 14.6 miles of new expressway, local roads, and three mainline bridges and multiple box culvert structures.

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.

West Virginia Department of Transportation - Public Port Authority, Inland Intermodal Port Economic and Market Analysis, West Virginia. Project Manager responsible for a study of the feasibility, planning, development, construction and operation of a proposed intermodal facility at Prichard. The study included a port market analysis, site feasibility analysis, construction and finance analysis, operations and sustainability analysis, and economic impact analysis.

West Virginia State Board of Registration for Professional Engineers

DAVID L. WEAVER

WV PE [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, 2016

AECOM

David Rubenstein, CFM

Flood Identification and Mapping; DFIRM Development; and Data Management Lead

Areas of Expertise

Program Management
Floodplain Mapping
DFIRM Production
Preliminary Processing
Post Preliminary Processing
ArcGIS
WISE

Education

AA, Communications, Montgomery College

Years of Experience

15 years

Professional Associations

Association of State Flood Plain Managers (ASFPM)
West Virginia Floodplain Management Association (WVFMA)
Virginia Lakes and Watershed Association (VLWA)
Kansas Association of Floodplain Managers (KAFM)

Training and Certifications

2006, Certified Floodplain Manager

Summary

Mr. Rubenstein is currently working for the Stormwater and Flood Mitigation Group, where he has over seven years of experience as a Study and Project Manager for the Water Resources Group. He manages the financial, production and client relation aspect of many FEMA National Flood Insurance and Certified Technical Partner projects. Mr. Rubenstein also has over twelve years of experience in Geographical Information Systems (GIS). As a GIS Specialist, he has detailed knowledge of many of the ARC GIS components.

Experience

Map Modernization Initiative, South Carolina Department of Natural Resources. Program Manager. Manages watershed and coastal studies involving over 1,000 stream miles of H&H modeling, coastal flood analyses, floodplain mapping, FIRM production and post-preliminary processing through map adoption. Manages Risk MAP conversion projects for watershed and coastal studies including production of Flood Risk Database, Flood Risk Reports and Flood Risk Maps. Responsible for the financial management and earned value reporting for all on-going projects

Kansas Department of Agriculture. Project Manager. Mr. Rubenstein is currently the Project Manager for the Kansas Department of Agriculture's CTP contract. The Team has a contract with the State of Kansas to reanalyze flood hazards throughout the various portions of the state. Kansas is partnered with FEMA, through FEMA's CTP initiative, and assumes primary ownership and responsibility for the NFIP FIRMs. The project includes collection of digital elevation data using LIDAR technology and development of flood elevation data using automated hydrologic and hydraulic technology. URS is using GIS based modeling systems that incorporates gage analysis and regional regression equations for the hydrologic simulation and HEC-RAS hydraulic software for development of floodplain and floodway boundaries. URS combines the modeling and Redelineation to produce Digital Flood Insurance Rate Maps (DFIRMs) for riverine areas.

DFIRM Coordinator. As DFIRM Coordinator Mr. Rubenstein was responsible for making sure the team of GIS/Mapping Specialists are creating DFIRMs according to FEMA's Guidelines and Specifications Manual. Mr. Rubenstein managed a team of 16 GIS specialists to meet the needs and deadlines of multiple projects and project managers. He

maintained constant contact with the various mapping partners to make sure that all maps are being created according to FEMA's specifications.

UMAP Leader. Mr. Rubenstein was the mapping lead on the internal software creation of UMAP, which uses an ArcInfo based program to create DFIRMs and the database more proficiently and accurately according to FEMA's Map Modernization specifications. Currently, he is the technical lead for mapping updates for GeoRampp (Mapping software for Risk MAP). Recently, David's expertise was used in FEMA's new Guidelines and Specification changes for Appendix K and L and PM 66.

DFIRM Task Manager, FEMA Region IV Map Modernization. DFIRM Task Manager for 8 counties under this contract. All of the counties mapped on were delivered on time and on budget to the client. For the Nassau County project, he was both the DFRIM Task Manager, and the Assistant Project manager. Under this assignment he managed staff, budget and addressed any mapping needs that were required.

DFIRM Task Manager, South Carolina Map Modernization. Mr. Rubenstein was the DFIRM Task Manager for 11 counties in South Carolina. David made sure that all panels were completed to FEMAs Specifications. Mr. Rubenstein still takes part in many of the state's Preliminary Community Coordination meetings.

FEMA, Risk MAP. Study Manager. Mr. Rubenstein is currently the study manager for over 10 projects under FEMA's Risk MAP program. David is responsible for all aspects of the multi-year, multi-million dollar projects. Mr. Rubenstein manages riverine analyses, coastal analysis, floodplain mapping, DFIRM production, post–preliminary processing, and non-regulatory Risk MAP products; for several countrywide studies in FEMA Regions II, III and VI. The projects involved studying over 1,000 miles of stream, creating over 500 FIRM panels, multiple DFIRM database and preliminary and post-preliminary processing. Mr. Rubenstein has created numerous non-regulatory products and has attended many community outreach meetings. All deliverables are compliant with FEMA's Guidelines and Specifications. David's studies have over 1,000 panels with combined budgets over two million dollars. These studies include Detailed, Limited Detailed, Approximate, Coastal and Redelineated Studies.

Current studies:

Montgomery County, Kansas
Brown County, Texas
Seneca Watershed, South Carolina
Wateree Waterdshed, South CArolina
Burlington County, New Jersey
Middlesex County, New Jersey
Monmouth County, New Jersey
Ocean County, New Jersey

Past Studies:

East Baton Rouge, Louisiana
Onondaga County, New York
Erie County, New York
Lafayette, Louisiana

FEMA, Hurricane Sandy Advisory Base flood Elevation Maps (aBFE), Project Manager. Mr. Rubenstein worked with FEMA, under the Risk MAP program, to Acquire ongoing Risk MAP study data and relevant Hurricane Sandy technical data. Perform coastal analysis and floodplain mapping for the impacted geographies in New York and New Jersey. Provide documentation of methodologies, assumptions, and data sources. Participate in coordination meetings with FEMA staff. Develop advisory maps and data layers. Provide innovative data dissemination methods via web-based or GIS-based solutions and support advisory product usability with outreach and communication staff.

Task Manager, Delaware Department of Natural Resources and Environmental Control (DNREC). Task manager for two counties in Delaware. These two counties are only having specific county areas mapped. DNREC also has specific requests that data be provided in a work map form. This request was initiated so the community can determine how they will be affected by the flooding before the maps become effective.

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Amelia Vincent, PE, CFM

Topographic Data Development Lead

Areas of Expertise

Riverine and Coastal Modeling

Risk MAP Discovery for Coastal Communities

Terrain Analysis

Geographic Information Systems

Floodplain Structure Inventory

Hurricane Evacuation and Coastal Planning

Education

MS, Biological Systems Engineering, Virginia Polytechnic Institute and State University

BS, Biological Engineering, Louisiana State University

Years of Experience

14 years

Licenses/Registrations

Professional Engineer: Virginia

Professional Associations

Association of State Flood Plain Managers (ASFPM)

Virginia Lakes and Watershed Association (VLWA)

West Virginia Floodplain Management Association (WVFMA)

Kansas Association of Floodplain Managers (KAFM)

Training and Certifications

2007, Certified Floodplain Manager

Summary

Ms. Vincent is a project water resources engineer with experience in terrain analysis, riverine and coastal modeling, and Risk MAP Discovery. She has extensive experience with ArcGIS, WISE, and HEC-RAS software and Light Detection and Ranging (LiDAR) data processing. Ms. Vincent has performed a variety of tasks for U.S. Army Corps of Engineers (USACE) projects such as structure inventories, post-flood damage surveys, documenting coastal planning meetings, economic analyses, GIS, and database management. Her Federal Emergency Management Agency (FEMA) expertise involves development of digital terrain models for hydraulic and hydrologic analyses, ADCIRC grid development, riverine and coastal modeling, hurricane planning and development of training materials for hurricane related software.

Experience

FEMA Risk MAP. Technical Specialist. Subject Matter Expert for Terrain Development. Ms. Vincent is one of the joint venture Subject Matter Experts for terrain analysis and development. She helped develop terrain workflow and review procedures for terrain tasks and answers technical questions relating to elevation data, vertical and horizontal datums, and terrain processing software.

Terrain Developer; HUC-8 Watershed Studies; Lower Sabine Watershed, LA and TX; Grand Lake O' The Cherokees, OK; Seneca Watershed, SC; and Wateree Watershed, SC. Project Engineer. Ms. Vincent developed digital terrain models (DTMs) for these HUC-8 watersheds. Topographic data sources used for terrain development include LiDAR, USGS National Elevation Dataset rasters, mass points, breaklines, and contours. The DTMs were developed using ArcGIS and consists of ESRI terrains used for hydraulic analysis and floodplain mapping in support of Digital Flood Insurance Rate Map (DFIRM) development. Ms. Vincent also prepared the Technical Support Data Notebooks (TSDNs) for these studies.

FEMA Regions II, III, IV, and VI. Technical Reviewer. Ms. Vincent has performed detail checks and independent technical reviews of DTMs, seamless topographic and bathymetric terrains, base maps, survey data, field reconnaissance, DFIRM databases and TSDNs for counties / parishes in these states.

Terrain Developer. Ms. Vincent developed digital terrain models (DTMs) for counties/parishes nationwide, including West Virginia.

Topographic data sources used for terrain development include LiDAR, USGS National Elevation Dataset rasters, mass points, breaklines, and contours. The DTMs were developed using WISE or ArcGIS and consists of TINs or ESRI terrains used for hydraulic analysis and floodplain mapping in support of DFIRM development. Hydro-correct DTMs were developed for some counties and were used during the hydrologic analysis to delineate basins and calculate time of concentration. Technical Support Data Notebooks (TSDNs) were also prepared for these studies. In addition, Ms. Vincent developed DTMs in support of the Kansas High Water Marks Project, HMTAP Task Order 42 in West Virginia, HMTAP Task Order 65 in New York, South River in Virginia, and the Iowa Loss Avoidance Study.

Durham and Orange Counties, NC. Project Engineer. Ms. Vincent assisted in the transfer of the WISE terrain project to the URS Germantown network to make sure terrain was usable and accessible to the project team performing the detailed hydraulics modeling. She helped troubleshoot terrain issues to help the project team move forward with the modeling.

Great Lakes Early Demonstration for Discovery Project for Oak Orchard-Twelvemile Watershed, New York Counties of Monroe, Orleans, and Niagara. Project Engineer. The purpose of the Early Demonstration Project was to help FEMA better understand the costs for developing and delivering the Discovery products to State, local, and tribal stakeholders and to create a refined process for developing and delivering the products that account for new activities, eliminate unnecessary steps, demonstrate efficiencies, and standardize best practices across all FEMA Regions. Ms. Vincent assisted with State, Federal, and local stakeholder coordination; preparation of meeting agendas, presentations, and evaluation forms; data gathering and collection; and Discovery report and map development.

WISE Terrain and Approximate Hydraulic Modeling Trainer. Ms. Vincent has provided training on the WISE terrain and hydraulics modules for other offices. She presented an overview on the modeling process and provided hands-on training. Ms. Vincent also provides technical support to other AECOM offices using this software.

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Amelia A. Vincent, CFM

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Jae G. Park, PhD, CFM

Hazard Mitigation Planning Lead

Areas of Expertise

Hazard Mitigation Program and Planning

Sustainable Disaster Recovery

Risk Analysis and Management

Disaster Management Policy Analysis

Grant Programs

Education

Ph.D., Urban and Regional Science, Texas A&M University, 1998

MS, Community and Regional Planning, Iowa State University, Ames, 1992

Years of Experience

22 years

Professional Associations

American Planning Association

Association of State Floodplain Managers

National Emergency Management Association (NEMA)

Advisory Board Member of DHS Center of Excellence – Natural Disasters, Coastal Infrastructure and Emergency Management, University of North Carolina, Chapel Hill

Training and Certifications

Certified Floodplain Manager (CFM)

Summary

Dr. Park has more than 22 years of experience and expertise in the areas of risk management, hazard mitigation, and sustainable disaster recovery from Hurricane Fran, Floyd, Isabel, Katrina, Sandy and other declared disasters. He has been involved in hazard mitigation/recovery policy/program development, risk assessment and benefit cost analysis, mitigation planning, needs assessments, housing recovery program development and implementation, risk perception, and communication research at the Federal, regional, state, and municipal level as well as with private clients. Prior to joining AECOM, Dr. Park was the Assistant Director for the Division of Emergency Management, State of North Carolina.

Experience

FEMA, Unified Hazard Mitigation Assistance Program Guidance Development and Update, Nationwide. Task Lead. Task is to develop Unified Hazard Mitigation Assistance Program guidance for five hazard mitigation funding programs: PDM, FMA, RFC, SRL, and the Hazard Mitigation Grant Program (HMGP). The intent of this alignment is to enhance the quality and speed of grant awards on an allocation and competitive basis to State, local, and Tribal entities for worthwhile, cost-beneficial activities designed to reduce the risks of future damage in hazard-prone areas. At the same time, unification yields new opportunities to expand national outreach for all types of mitigation.

FEMA, Pre-Disaster Mitigation Joint Explanatory Statement Grant Program (PDM-JES) Technical Support, Nationwide. Benefit Cost Analysis Lead. Provided technical support to FEMA Headquarters, regions, and states in identifying eligible mitigation projects, cost-effectiveness and feasibility review of sub applications, and data collection. The technical assistance also involved a remote sub application review, on-site training, and one-on-one meetings with local government officials to provide comments for lacking information and revise the project application scope that is more aligned with the PDM-JES guidance.

South Carolina Emergency Preparedness Division, South Carolina Hazard Mitigation Plan, West Columbia, SC. Task Manager. Development of a hazard mitigation plan for the State, including conducting a planning process, assessing risks, and developing a mitigation strategy. A draft was approved by FEMA. Updated elements will include an evaluation of recent hazard events, identification of

changes in hazard vulnerability, and a review and update of the proposed mitigation actions. Mr. Park was responsible for conducting hazard analysis and vulnerability assessments of all natural hazards identified in the state.

New York State Governor's Office of Storm Recovery, State of New York Rising Community Reconstruction. Project Manager. Provided recovery planning assistances to the communities severely damaged by Hurricanes Sandy and Irene and Tropical Storm Lee for facilitating resilient and sustainable community reconstruction. As a Project Manager, led a team of public outreach specialist; subject matter experts in housing, economic development, structural engineering, stormwater management, risk analysis, GIS, and planning to perform risk assessment, public engagement and consensus building, benefit cost analysis, recovery projects identification and development and plan writing.

New England Regional Catastrophic Planning Initiative, MA, RI, NH. Technical Lead. Assessed regional capabilities and identify gaps in existing disaster housing planning efforts based on housing stock analysis using a catastrophic event scenario. Based on the gap analysis, AECOM developed a Regional Disaster Housing Annex, including concept of operation, pre-and post- actions, and lists of housing solutions. An Executive Playbook was also created to provide guidance and decision support tools to promote orchestrated recovery efforts among the impacted communities. In addition Commonwealth of Massachusetts Disaster Housing Recovery Plan and local planning toolkits were developed based on the NERCPI planning template.

FEMA, Task Order to Develop Methodology for Determining the Losses Avoided as a Result of Adopting Hazard-Resistant Building Codes, Nationwide. Technical Lead. Developed a first generation method of calculating building code adoption losses avoided estimates derived from existing data and analyses and propose implementation strategy of the methodology nationwide. The major components to the methodology include the selection of the pilot sites, data collection and screening, calculation of losses avoided using an analysis tool such as Hazus, review and validation of results.

New Castle County Flood Mitigation Education and Outreach Project, New Castle County, DE. Project Manager. Evaluating mitigation techniques for 33 repetitive flooded properties and developing education materials for local repetitive loss reduction strategies. With assistance from state officials, conducted a workshop for the benefit of local officials with the goal of identifying roadblocks to implementing flood mitigation projects at the local level, and identifying local project priorities.

FEMA Hazard Mitigation Technical Assistance Program. Analyst. Providing post-disaster technical support and programmatic assistance to the agency's mitigation program in response to floods, hurricanes, earthquakes, and terrorist attacks throughout the U.S. Support services included engineering, mitigation planning, benefit-cost analysis and training, and a Multihazards-US (HAZUS-MH) analysis.

AECOM

Ann Terranova, CFM

Community Outreach Lead

Areas of Expertise

FEMA Project and Program Management

Community Engagement and Outreach

Risk and Crisis Communications

Facilitation

Education

BS, Man/Environment Relations, Urban Planning Emphasis, Pennsylvania State University

Years of Experience

30 years

Training and Certifications

AECOM Certified Project Manager

Certified Floodplain Manager, Association of State Floodplain Managers

Summary

For more than 30 years, Ann Terranova, Senior Program Manager and Senior Communications Specialist, has created, managed, and implemented strategic training, facilitation, and communications programs to assist clients solve highly controversial and complex technical and environmental problems. Ms. Terranova served as the Risk Communications and Outreach Lead for former URS participation as a joint venture member company in the Federal Emergency Management Agency's Risk Mapping, Assessment, and Planning Program (Risk MAP). Ms. Terranova also served as the Task Leader and Senior Community Planner for FEMA's Long Term Community Recovery program conducting needs assessments for coastal communities in Mississippi and Texas impacted by Hurricane Katrina. She identified long term community recovery planning needs through a highly interactive process with key stakeholders, including local elected officials, community leaders, state planning agencies and the Mississippi Governor's Commission on Recovery, Rebuilding and Renewal and the City of Galveston, Texas Long Term Recovery Committee.

Relevant Experience

FEMA Risk MAP PTS, FEMA Regions II, III, IV, V, VI, Community Engagement and Risk Communications Lead, Strategic, Communications Services/Key Account Program Management. Ms. Terranova served as the Community Engagement and Risk Communication Lead for PTS Provider RAMPP on the Federal Emergency Management Agency's Risk Mapping, Assessment, and Planning Program (Risk MAP). This involved a high degree of coordination with communities affected by FEMA's initiative to communicate about the risks of living and working in high flood hazard areas. Ms. Terranova provided community engagement and risk communication support in the Advisory Base Flood Elevation and Preliminary Work Map rollout in New York and New Jersey in the aftermath of Hurricane Sandy. She worked closely with FEMA Regional and Headquarters staff in developing communications materials for New York City and New Jersey Governor-hosted meetings with community officials, Congressional staff, and the media.

HMTAP Floodplain Management Technical Assistance Task Order Manager, Communications Services/Key Account Program Management. Ms. Terranova leads a team of strategic communications and NFIP experts in the execution of FEMA's Floodplain Management Branch Technical Assistance Contract under the URS HMTAP Contract. She has been responsible for all aspects of Task Order administration as well as directing qualified staff in providing support to the Community Rating System efforts, the development of a FPM Accomplishments document showcasing important program achievements, preparation of four higher standards one-pagers, and the development of Web content recommendations for enhancing FPM presence on FEMA.gov.

FEMA National Levee Outreach Task Order Manager, Communications Services/Key Account Program Management. Ms. Terranova provided to support to FEMA in the development of a National levee outreach program to increase awareness and understanding of risks associated with living with levees. The Task Order was a complex, multi-task project which required close coordination with FEMA's FloodSmart program to ensure consistency of levee-related materials promoted on both the FEMA and FloodSmart websites.

TARC National Dam Safety Program Task Order Manager, Communications Services/Key Account Program Management. Ms. Terranova led a team of strategic communications specialists in the development of a multi-dimensional strategy to enhance the visibility of FEMA's National Dam Safety Program. Through the development of the strategy, Ms. Terranova helped to create the overarching theme regarding shared responsibility for dam safety awareness and actions to reduce associated risks when living and working in areas affected by dams. Discrete elements of the program included development and implementation of the 2013 National Dam Safety Awareness Day, the development of the NDSP 2012 Annual Year in Review, establishing the NDSP presence on FEMA.gov and the preparation of multiple updates to important NDSP publications.

U.S. Army Corps of Engineers National Levee Database Outreach Task Order Manager, Communications Services/Key Account Program Management. AECOM is providing support to the U.S. Army Corps of Engineers (USACE) in developing and implementing a comprehensive communications and outreach strategy to raise awareness about the USACE National Levee Database (NLD) and increase usership by important internal and external audiences. Ms. Terranova is leading a team of strategic communications and public relations specialists in the development and implementation of a multi-faceted, multi-media communications strategy to meet USACE NLD

communications goals and objectives. A cornerstone of the strategy is conducting stakeholder interviews to gather information about the current level of NLD use and how the USACE can enhance communications to raise awareness and increase its use. An important component of the work provided by AECOM is the development and delivery of NLD training and the development of information materials about the NLD database. To garner support, URS is providing meeting facilitation services with key internal and external stakeholders to obtain important feedback on the efficacy of the NLD.

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Jeffrey Sengebusch

Quality Control Lead

Areas of Expertise

Floodplain Management
National Flood Insurance Program
DFIRM and FIS QA/QC
FIS Production
Post Preliminary Processing

Education

BS, Geography and Environmental Planning, Towson University

Years of Experience

14 years

Training and Certifications

AECOM Project Manager Certification, 2009

Summary

Mr. Sengebusch has 14 years' experience working with the National Flood Insurance Program (NFIP), including all aspects of Post-Preliminary Processing, QA/QC reviews of Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study Reports, and DFIRM and FIS production. He possesses Extensive knowledge of FEMA G&S, and has completed FEMA training for MIP Workflow and FHDs on the Web Publication. Mr. Sengebusch is the Project Manager for several NFIP Flood Insurance Studies for which he manages the financial and production aspects.

Experience

FEMA, Risk Map Contract, FIRM Processing. Project Manager. Mr. Sengebusch is the Project Manager for several Flood Insurance Studies in FEMA Regions III and VI, where he is responsible for all aspects of the studies including production, QC, financial, and coordination. Mr. Sengebusch is also the RAMPP QR3 and QR7 Coordinator for this contract, as well as the Post Preliminary Team Leader for the AECOM Germantown office. He conducts reviews and manages the workflow for QR3 and QR7 Reviews in Regions II and III on behalf of FEMA. He manages post preliminary schedules, and production for all AECOM Germantown projects. Mr. Sengebusch coordinates all applicable internal and external quality reviews.

FEMA, Risk Map Contract, FEMA Region III QA/Post Preliminary Processing Lead. Mr. Sengebusch is the QA/Post Preliminary Lead for FEMA Region III. He coordinates all quality reviews on behalf of FEMA Region III for the Compass Joint Venture. He is responsible for the coordination of docket approvals, reporting of Joint Venture metrics, and serves as a liaison between regional mapping partners and the Regional Service Center. Other responsibilities include approving tasks in the Mapping Information Platform, coordinating Federal Register publications and performing quality reviews on behalf of FEMA Region III.

FEMA, South Carolina Flood Mapping CTP Contract. Project Manager for QA/QC Task Orders. He is also the Post-Preliminary Processing Lead. He manages the independent QA/QC work of engineering analysis and mapping that is required under this contract. He conducts the post-

preliminary processing for all AECOM (URS) flood studies under this contract, conducting PDCC meetings with communities, initiation of appeal periods, addressing appeals and protests, preparing the LFD, and submitting final GPO packages. He has coordinated with FEMA Region IV, RMC IV, SCDNR, and the NSP for these tasks. Mr. Sengebusch also leads the QA/QC reviews of DFIRMs and Flood Insurance Studies for all AECOM counties under this contract.

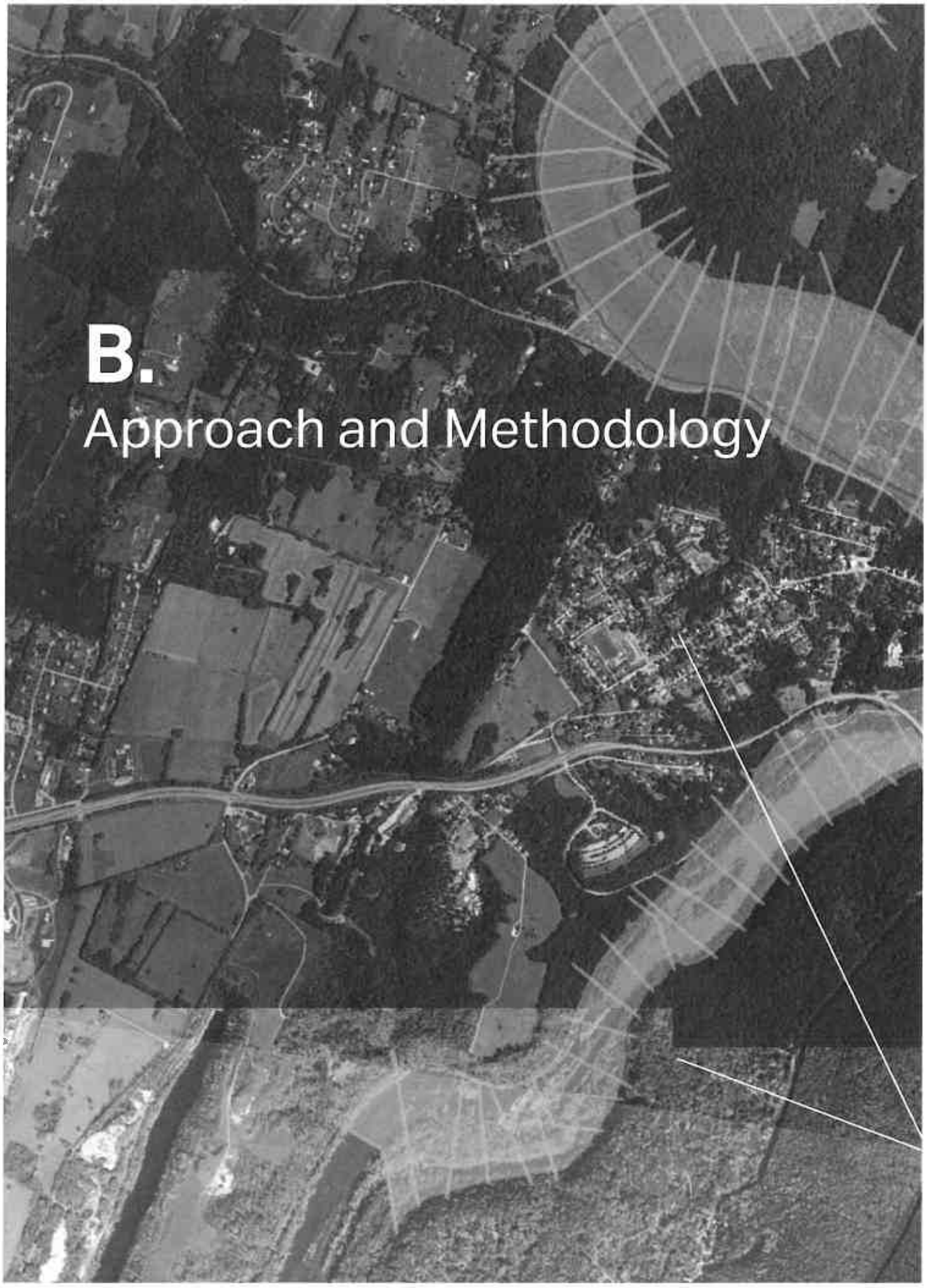
FEMA Region IV, ID/IQ Contract, FIRM Processing. Assistant Project Manager for QA/QC Task Orders. He was also the Post-Preliminary Processing Lead. He conducted the post-preliminary processing for all flood studies under this contract, conducting PDCC meetings with communities, initiation of appeal periods, addressing appeals and protests, preparing the LFD, and submitting final GPO packages. Mr. Sengebusch also led the QA/QC reviews of DFIRMs and Flood Insurance Studies, and production of large countywide Flood Insurance Studies under this contract. He has overseen the post-preliminary processing of 8 countywide studies, and the external QA/QC efforts for 43 countywide studies.

FEMA Region IX, ID/IQ Contract FIRM Processing. Assistant Project Manager for QA/QC Task Orders. He was also the Post-Preliminary Processing Lead. He conducted the post-preliminary processing for all flood studies under this contract, preparing the LFD, and submitting final GPO packages. Mr. Sengebusch also led the QA/QC reviews of DFIRMs and Flood Insurance Studies, and production of large countywide Flood Insurance Studies under this contract. He oversaw the post-preliminary processing of two countywide studies, and the external QA/QC efforts for 23 countywide studies.

FEMA, Alabama Flood Mapping CTP Contract, FIRM Processing. Peer Reviewer. Primary roles include QA/QC reviews of DFIRM panels, and Flood Insurance Studies. He also provides training and technical support for team members.

FEMA Region VI, ID/IQ Contract, FIRM Processing. Peer Reviewer. Primary roles include QA/QC reviews of DFIRM panels, and Flood Insurance Studies.

FEMA, Flood Map Production Coordination Contract, Fairfax, VA. Peer Reviewer. Mr. Sengebusch provided technical assistance, mapping support, and quality control reviews in support of the NFIP. Activities included production of DFIRMs, processing of Flood Insurance Study Reports, and QA/QC reviews to ensure a high quality product to the client.



B.
Approach and Methodology

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B. Approach and Methodology

AECOM has completed over 135,000 miles of hydrologic and hydraulic analysis and floodplain mapping for FEMA studies nationwide.

Introduction

AECOM's holistic technical capabilities, combined with up-to-date Risk MAP program knowledge and vast national expertise, provide the West Virginia DHSEM with a team that can serve as a true partner in accomplishing your CTP program objectives, maximizing funding available to the State for these activities, and creating long-term flood hazard resilience in West Virginia communities. We are prepared to provide the State with flood hazard analysis and mapping services that are as simple and cost-effective as possible, such as only producing advisory floodplains that will not be incorporated into FEMA's FIRMs. We are also ready to provide more robust flood risk assessment products to the State if requested.

We understand West Virginia's geography, land use, and growth patterns as they pertain to flood map challenges. We would be honored to assist you in assessing, communicating, and mitigating your flood risk hazards and updating West Virginia's floodplain maps to provide accurate flood risk information in an accessible, digital format that will benefit both State and local entities and enhance your State's resilience against natural hazards.

Good communication and adherence to high quality will be guiding principles in our work for the State. We will work with DHSEM at the start of the program to outline a communication plan that suits your needs. We will also develop a program-specific quality work plan that we will apply to all flood study projects for DHSEM.

The following sections discuss how we will apply our proven technical approaches and methodologies for floodplain hazard analysis and mapping for studies selected by DHSEM. Our project approach to flood studies and technical methodologies to complete them have been tested and refined over our decades' worth of experience.

1. Technical Approach

AECOM has unparalleled expertise in conducting FEMA floodplain studies using automated GIS-based H&H analyses, and delivering projects in both countywide and HUC 8 watershed formats. AECOM is a leader in integrating GIS into the floodplain mapping and management process through customized tools, and has continuously implemented innovative procedures.

AECOM has a dedicated full-time Research and Development Team that focuses solely on enhancing and improving efficiency to FEMA's programs and deliverables. For example, AECOM has used our WISE software for H&H analysis, coastal analysis, and FIRM production for more than 15 years and has seen a reduction in costs over time.

The focus in the Risk MAP program and most CTP programs is to produce credible studies and to reduce flood risks by developing the ability of stakeholders to take appropriate actions. AECOM is committed to continuous improvement in all aspects of our projects, and has a widespread reputation of producing credible products. We will bring our commitment to continuous improvement to all studies produced for DHSEM.

AECOM will produce model-backed 1-percent-annual-chance-event floodplains for West Virginia

that will improve the accuracy of current Zone A floodplains and deliver quality data to areas currently unmapped. Our experience and innovation in model-backed Zone A delineation is reflected in our development of specific GIS tools, such as WISE, SwiftMap, and GeoRAMPP, to make the Zone A floodplain development a more efficient process. We have used these tools to automate some of the GIS-related Zone A processes and we have used them to produce more than 64,000 miles of model-backed, regulatory-quality Zone A streams on published FIRMs. In Region III, specifically, we have modeled over 3,000 Zone A miles. Outputs from our studies are always non-proprietary and the data can be shared with and easily used by states, communities, and others for floodplain management and other purposes.

AECOM will use our efficient GIS tools to create HEC-RAS models and map the flooding source. Along with terrain data, our tools allow our engineers to:

- Set flow change locations
- Delineate watershed boundaries
- Delineate stream centerlines and determine flow paths
- Calculate hydrology for all required flood events (from simple regression equations through detailed rainfall-runoff modeling with HEC-HMS)
- Lay out cross sections
- Set Manning's n values in overbanks and channels
- Create all required model inputs for HEC-RAS
- Make model edits
- Map floodplain boundaries
- Create water surface triangulated irregular network TINs that provide water surface elevations (Base Flood Elevations [BFEs]) at any point in the floodplain
- Create flood depth grids

1.1. Hydrologic and Hydraulic Modeling

1.1.1 Hydrologic Watershed Modeling

Expertise conducting hydrologic modeling using methods appropriate for the physiographic and meteorological characteristics of West Virginia is a critical component to correctly assess flood risk. Our project team brings experience relevant to both West Virginia's mountain ranges in the eastern panhandle and central regions (through our studies in West Virginia, Maryland, Pennsylvania, and Virginia) and rolling hills and plateaus to the west (through our studies in West Virginia, western Pennsylvania, and Kentucky). Our team includes a blend of staff that specializes in hydrologic numerical modeling, rainfall-runoff model development and calibration, and hydrologic post-disaster flood hazard verification.

Examples: Subbasin delineation using GIS for peak flow calculations

AECOM's success in hydrologic modeling is a result of our continued use of the newest available technologies, which allows us to provide our clients very cost-effective, high-quality models. The team will use ArcGIS tools and ArcHydro to automate the watershed hydrologic analysis using the best available terrain data. These tools use TINs developed from DTMs to automatically delineate watershed and sub-basin boundaries, determine flow paths, and provide runoff factors based on available soil coverage and land use information.

AECOM has performed hundreds of flood frequency assessments using a variety of methods, including statistical analysis of gage data and USGS regional regression equations. Once watersheds and flow paths are delineated using automated methods, we will use automated tools within ArcHydro to generate drainage area inputs for the latest regional regression equations for West Virginia, USGS' *Estimation of Flood-Frequency Discharges for Rural, Unregulated Streams in West Virginia* dated 2010, and calculate results to determine new peak flow values for selected study areas. Having only one input parameter in the State's regression equations, the drainage area, makes the calculation of peak flow values very simple and cost-efficient. When USGS gages are present, we will use the method

described in USGS Technical Bulletin No. 17B, *Guidelines for Determining Flood Flow Frequency*, to determine frequency peak flow discharges based on recorded gage flow data. If drainage areas are smaller than the regression equation limitations (0.1–0.21 square miles depending on region), we will apply the rational method to determine peak flow values. We recently applied these methods to develop new peak 1-percent-annual-chance flow values for Jefferson County, WV.

1.1.2 Hydraulic Stream Analyses and Floodplain Generation

Because of the hilly nature of the terrain, most West Virginia streams can be accurately studied by a 1D model. AECOM will use the USACE's model HEC-RAS to perform 1D steady state hydraulic analysis of all study steams and calculate water surface elevations for desired flood frequencies, such as the 1-percent-annual-chance storm event.

AECOM uses automated modeling techniques where appropriate to improve efficiency. The automated platforms we use include ArcGIS, ArcGIS Server, HEC-GeoRAS, WMS, and automated tools developed in-house, such as WISE, SwiftMAP, and GeoRAMPP. AECOM will use HEC-GeoRAS to create cross sections and import data into hydraulic models for West Virginia study streams, resulting in significant time savings over traditional analytical methods. HEC-GeoRAS can cut an unlimited number of cross sections to best represent the study of rivers and streams and automatically generate the geometric data for input into HEC-RAS, minimizing data entry. We will also use GIS tools to provide automated extraction of Manning's n-values from digital land use coverage.

West Virginia-specific hydraulics expertise is provided by David Weaver in our Morgantown office, which is home to a strong and respected transportation group working with the West Virginia Department of Transportation and other State agencies daily. Our staff routinely addresses bridge hydraulic and floodplain studies associated with roadway crossings of streams in counties around the State.

1.2. Floodplain Identification and Mapping

After the hydraulic model is completed, HEC-GeoRAS will be used to read the water surface elevation results from HEC-RAS and automatically delineate draft floodplains for WV study streams. Because this mapping is done in the GIS environment, electronic deliverables in the FIRM database structure can easily be created. We understand that DHSEM is only requesting advisory floodplains at this time, but the floodplains we produce will be accurate enough to meet FEMA standards. The boundaries will meet FEMA's Procedure Memorandum (PM) 38, *Implementation of Floodplain Boundary Standard (FBS)*. AECOM has been creating FBS reports for various FEMA regions since PM 38's implementation on October 17, 2007, when AECOM attended one of the first training sessions. AECOM will create FBS reports that document the accuracy of the floodplains we develop for the State of West Virginia, so that the boundaries can be incorporated in future FEMA map products if desired.

AECOM is very familiar with FEMA's *Guidelines and Standards for Flood Risk Analysis and Mapping* (*Guidelines and Standards*), as AECOM leadership helped FEMA define what was a Program Standard, Working Standard, Guidance, or Best Practices. This familiarity provides AECOM with an intimate understanding of what FEMA requires in the Risk MAP program for floodplain mapping deliverables.

AECOM will also use our in-house GIS automation tools to efficiently create water surface elevation and depth grids based on the floodplain boundary. The water surface grids can be used to determine the water surface elevation for the 1-percent-annual-chance storm event (BFE) at any point (grid cell) within the floodplain. This information is very useful for submitting Letter of Map Change requests in Zone A floodplains where BFEs are not printed and labeled on the FIRMs. The depth grids can be used to determine the depth of flooding from the 1-percent-annual-chance storm event at any point (grid cell) within the floodplain.

1.3. DFIRM Development

AECOM has developed a series of customized tools that allow us to efficiently produce FIRM panels from production Esri Spatial Database Engine (SDE) Geodatabases. One of these tools is DFIRM.net, which automatically batch generates the panel collar and title block, and subsequently loads and symbolizes each feature class to create the FIRM panels for an entire county in one single step. This reduces the potential for errors introduced in the

production process by manually creating the individual FIRM panels. DFIRM.net can be customized to include special CTP border layout specifications if desired.

Our FIRMs are produced using ArcGIS10.x and a spatially enabled relational database management system (RDBMS) engine (ArcSDE 10). The benefits of this tool are that we work in a true relational database environment that provides a scalable and robust solution, ensuring data consistency in a central database accessible to all AECOM offices.

A critical input component to the FIRM is the delineation of the flood hazard boundary. Having conducted hundreds of flood studies covering thousands of stream miles nationwide, AECOM has extensive experience in GIS and we will automate the delineation of West Virginia floodplains in accordance with FEMA standards.

We realize that maximizing available budgets through the optimization of the production process is of vital importance. AECOM's in-house automation tools, such as GeoRAMPP and UMAP, have effectively increased our capacity to conduct flood studies and produce flood maps. Our team members will use GeoRAMPP to create FIRM products that result in a robust geodatabase deliverable to DHSEM. For mapping and database development, UMAP will be used within the GeoRAMPP framework. UMAP uses an ArcGIS-based framework to automate certain steps of the FIRM and database development process and formats the deliverables to FEMA's *Guidelines and Standards* (per FEMA's Technical Reference: *Flood Insurance Rate Map (FIRM) Panel* [November 2015]).

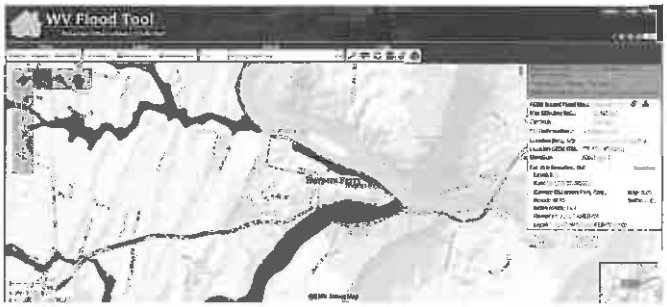
1.4. Data Management

AECOM will actively manage and organize data for DHSEM flood hazard analysis and mapping services, including base map data, large terrain datasets, and all flood study output data (model results, floodplain boundaries, FIRM databases, etc.). We will deliver all data according to FEMA and West Virginia requirements and standards.

If requested, we will upload required data development deliverables to FEMA's MIP according to FEMA's strict specifications. We will prepare metadata for all deliverables and submit data that is formatted according to the latest Data Capture Standards; outlined in FEMA's Technical Reference: *Data Capture* (November 2015). Also, if requested, we will update FEMA's CNMS database to record valid streams at key steps of the study process, and record identified mapping needs that are found during the flood study process; according to FEMA's Technical Reference: *CNMS Database User's Guide* (May 2015).

We will prepare all data for use on West Virginia's Flood Tool. From our experience developing advisory 1-percent-annual-chance storm event (Zone A) floodplains and depth grids for Jefferson County, WV, we understand what deliverables are needed to make the data compatible with existing data and aspects of the West Virginia Flood Tool.

AECOM will consult the State on requested deliverables, but we can use the following guidance provided by Eric Hopkins at West Virginia GIS Technical Center for our data deliverables:



1) DELIVERABLE 1: **Advisory Flood Height Raster Grid**
   a) Raster Type: Esri grid
   b) Coordinate System and Projection
      i) Universal Transverse Mercator (UTM) Zone 17 North, Horizontal Datum of 1983, Linear Unit: meter
      ii) State Plane West Virginia South FIPS 4702 (or the coordinate system in use by the county GIS system if other than UTM 17 N), Horizontal Datum of 1983, Linear Unit: foot (US)
   c) Resolution
      i) Advisory data production should take advantage of the best available elevation data source
      ii) Current data has a 3-meter (10-foot, approx.) cell size. New data must be 3-meter or finer.
   d) Bit / Pixel Type, Depth
      i) Pixel Type = floating point
      ii) Pixel Depth = 32 bit
   e) Negative values / edge anomalies occur near boundaries and should be investigated

and eliminated in order to avoid confusion for users.

2) DELIVERABLE 2: A **Floodplain Polygon** matching the water surface and depth grids must also be submitted.
3) DELIVERABLE 3: **Study Area (County) Boundary** must match existing official county boundary data produced by the West Virginia Department of Environmental Protection in 2002 (http://wvgis.wvu.edu/data/dataset.php?ID=136). If other boundary data are used, then a feature class built in the same coordinates/projection(s) as the GRID data must also be submitted.
4) DELIVERABLE 4: A downloadable **Engineering Data Package** must be submitted with, or as soon as is practicable following submission of the grid and Floodplain data. This data package is highly useful for future modeling and must include the following:
   a) Stream lines with digital FIRM stream name: It is crucial for linking download packages that the stream lines upon which models are based are correctly named and included in the streams feature class provided with other engineering data. Stream names must match attribute field wtr_nm in digital FIRM feature class s_wtr_ln.
   b) Cross Section / cut lines
   c) Digital Elevation Model (DEM) – Countywide, as extracted from statewide, USGS quadrangle based data or similar. Extracted DEM data may be processed further than the source. Inclusion of the specific countywide data set used ensures reproducibility by subsequent users.
   d) DEM Buffer – Subset of DEM used for stream-/reach-based model, again subject to specific processing and essential for future reference and use.
   e) HEC-RAS model .PRJ and associated files, stream-/reach-based.
   f) Metadata, validated to Federal Geographic Data Committee Content Standard for Digital Geospatial Metadata or International Organization for Standardization (ISO) standard, submitted as separate XML files (and optional text files) for each of the following. Avoid unnecessary generic content and focus on a detailed process steps and an explanation of how each data set is produced.
      i) Floodplain
      ii) Hydraulics
      iii) Hydrology
      iv) Cross Sections
      v) DEM
      vi) Streams

1.5. Topographic Data Development

We have advanced terrain processing methods that capitalize on advances in cloud computing technology, partnerships with Amazon Web Services and Esri, and many years of experience in incorporating legacy data into current mapping applications. The AECOM team continually monitors and utilizes the latest advancements in photogrammetric and mapping technology. We can offer solutions that take advantage of such technologies as LiDAR, or the team can use conventional techniques to create DEM and DTM data sets. Our goal is to apply the appropriate technology to ensure appropriate solutions for our clients.

DTMs are the foundation on which hydraulic and hydrologic analyses and subsequent floodplain mapping are based. Therefore, it will be critical for West Virginia riverine flood studies to not only use the best available topographic data, but to also ensure the source data are processed correctly during DTM development. AECOM will ensure that they are. Technology and automation during development of DTMs allows AECOM to work efficiently to deliver accurate topographic mapping for flood studies; these efficiencies will result in controlled costs, high-quality deliverables, and schedules met for DHSEM.

DTM development in West Virginia will require experience and knowledge in working with riverine areas. Topographic data sources may need to be combined to create a seamless DTM for use in modeling and mapping across political boundaries. AECOM's engineers and GIS staff possess these skill sets and have developed DTMs for numerous riverine stream studies. AECOM has produced seamless DTMs for all projects in FEMA Regions II, III, IV, and VI, VIII, *and IX, and for our CTP work in many states.*

Cost Control

Based on project experience, we have designed our DTM workflow to identify issues before proceeding to the next step in the process, eliminating the need for costly rework.

Quality of Work

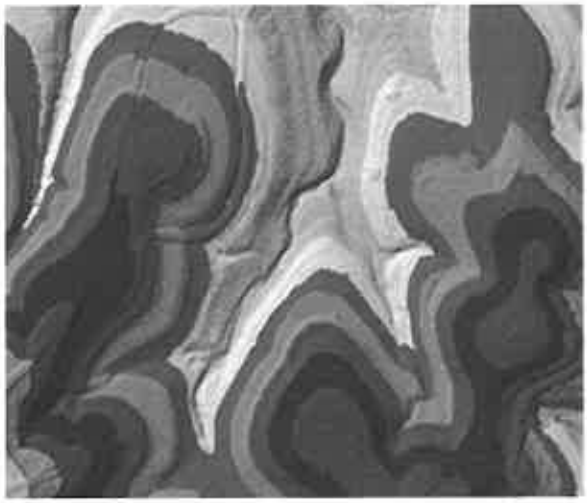
Our high-quality DTMs help streamline the production process and result in high-quality hydraulic products and maps that meet FEMA requirements.

Compliance with Performance Schedules

DTMs are the critical path for all production tasks. AECOM routinely processes multiple concurrent DTMs to meet schedule pressures and eliminate delays.

Processing

AECOM is experienced in using different types of topographic data sources, such as LiDAR, mass points, breaklines, rasters, and contours as source feature classes, and combining them to create a seamless DTM.



AECOM is experienced in using the best available topographic data sources to develop seamless DTMs for studies

We will use ArcGIS and LiDAR editing tools to pre-process data into the correct feature class format and convert the source data into the required study area projections and units. Our engineers and GIS staff are proficient working with topographic data sets in different formats (such as LiDAR las, 2D and 3D shapefiles, File GeoDatabase feature classes, USGS DEMs, rasters, AutoCAD, and MicroStation files), datums, units, and projections. We will use ArcGIS tools to develop DTMs for hydraulic analyses and to develop hydrologically correct DTMs for hydrological analyses. Our staff will develop and use automation methods such Python scripts, model builder tools, and macros to efficiently perform batch routine tasks.

AECOM can effectively manage large amounts of LiDAR data. With increasingly smaller point spacing and increased accuracy of the LiDAR, there is an increase in the density of the data points and file sizes. Countywide LiDAR data sets may range from 50 to 150 GB. AECOM is experienced with working with large data sets within File GeoDatabases and SDEs as a platform for DTMs.

The DTM development workflow includes a QA/QC review process to establish that the data were processed correctly and to identify and address any unnaturally high or low elevations or incorrectly classified LiDAR points to ensure the DTM accurately reflects the bare earth surface.

1.6. Hazard Mitigation Planning

According to Federal regulations, each hazard mitigation plan must identify locations at risk of being affected by natural hazards. Some hazards, such as heavy snowfall, typically affect an entire planning area; other hazards, such as flooding, affect only specific locations within a planning area.

AECOM uses GIS to develop maps that identify locations at risk of experiencing damage. By comparing hazard-prone locations with locations where structures and infrastructure are located, we assist local communities to understand what assets are most at risk of being damaged by a natural hazard.

AECOM uses Hazus, the FEMA GIS-based software, to estimate economic losses due to earthquakes, floods, and hurricane winds. Hazus estimates the number of buildings in hazard-prone locations, estimates the value of the buildings, and calculates the potential cost of repairing damages. We use Hazus so that local officials can compare the potential for damages due to hazards of varying magnitudes such as a 3-foot-deep flood and a 6-foot-deep flood.

Maps are included in our hazard mitigation plans and form the basis for making mitigation strategy decisions. AECOM conducted Hazus analyses for Greene County, NY and Huntingdon County, PA plans within the past year. AECOM also conducted work involving mapping to identify California locations where major wildfires destroyed vegetation

and that were subsequently at risk of experiencing erosion or debris-flow and increased flooding.

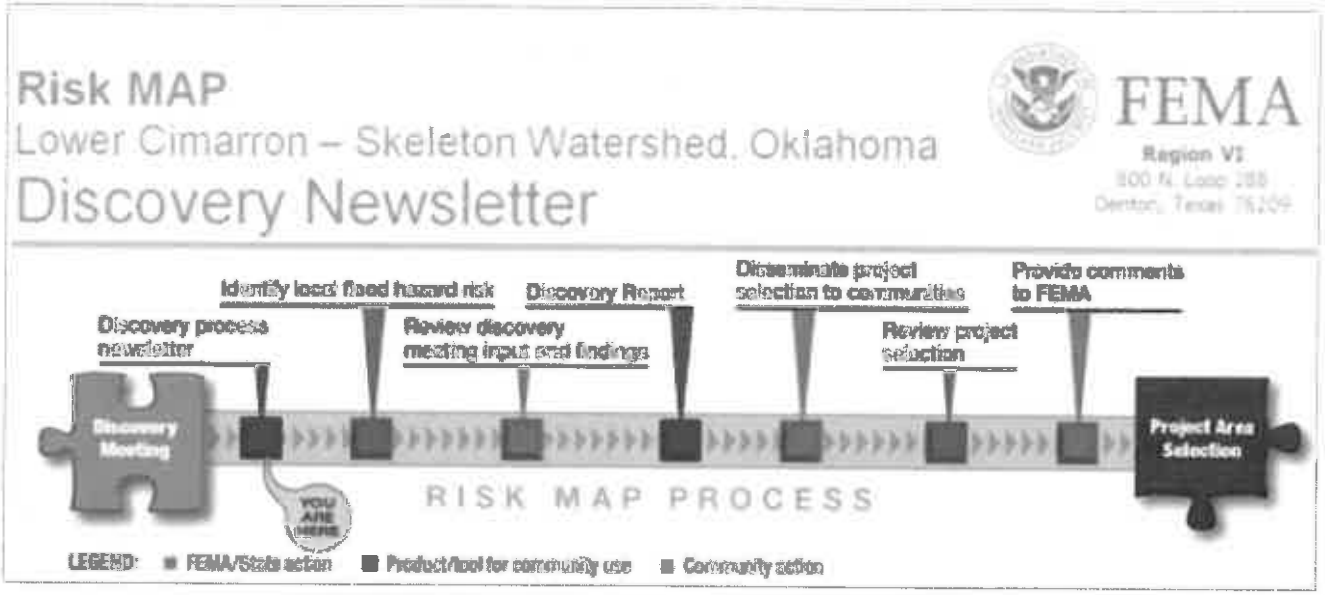
Maps are a useful tool for emergency managers and decision-makers to help them link documented risks with realistic mitigation strategies that use resources effectively and enable them to better manage post-disaster recovery operations. Maps included in AECOM plans also help the general public to better understand how their community may be affected by hazards.

1.7. Community Outreach

AECOM has assembled a team of nationally recognized public relations, flood risk mapping, and insurance experts to work in partnership with DHSEM on its CTP program. AECOM has extensive experience with outreach related to both the FEMA Map Modernization Program and its Risk MAP Program. We assisted FEMA in Louisiana and Mississippi, after Hurricane Katrina, as well as in New York and New Jersey, after Hurricane Sandy, during the controversial roll-out of Advisory and Preliminary FIRMs.

Currently, a typical Risk MAP project includes conducting up to five community engagement meetings throughout the mapping study process. Three of these meetings, including Discovery, Resilience, and Preliminary DFIRM Community Coordination (PDCC)/CCO Meetings, are required under the Risk MAP Program. A Flood Risk Review meeting (designed to allow stakeholders to review new floodplain boundaries) and Open Houses (open to the public and often held in conjunction with the CCO meeting) are desirable to achieve a successful project outcome.

AECOM will support DHSEM during the outreach meetings in presenting the new floodplains and preliminary FIRMs, and answering questions about the analyses. AECOM has provided technical support at outreach meetings throughout the country and has coordinated meeting logistics, including developing meeting agendas and public notices; securing meeting space; coordinating invitations to meeting participants; preparing meeting materials, including presentations, fact sheets, maps, and other handouts; facilitating discussions; and documenting meeting outcomes. We have also worked extensively with FEMA's Community Engagement Risk Communications provider in Region III and will help the State leverage its support. AECOM has developed an interactive facilitation process for Local Levee Partnership Team meetings that maximizes community input into how levees should be mapped.



Risk MAP Newsletters were developed by AECOM, as part of RAMPP, to communicate project details to communities and stakeholders

Flood Risk Review Meetings Key to Understanding Community Flood Risk

- The Flood Risk Review meeting is technically focused and gives community officials the opportunity to review draft Risk MAP products.
- This meeting is essential in communities where significant changes in the identified flood hazard occur. It allows the project team to highlight the flood risk associated with the changes, and gives communities the opportunity to review the results and begin communicating that risk to affected residents and businesses before formal adoption of hazards.

AECOM has developed a wide array of products and guidance documents to help FEMA, states, and local municipalities communicate the results and implications of the flood studies we perform. For example, AECOM was instrumental in developing FEMA's user guidance for non-regulatory products as well as communications guidance that community officials can use in talking to their constituents about the non-regulatory products. These documents are FEMA Operating Guidance No. 3-11, *Communicating Flood Risk with Risk Map Datasets and Products*. AECOM will leverage the important insights gained through our involvement in developing these guidance documents to further enhance our outreach activities.

Well planned outreach activities with targeted audiences can reduce political stress, confrontation in the media, and public controversy that can arise from lack of information, misunderstanding, and/or misinformation. As part of our work conducted for FEMA, local municipalities, and state and county governments, AECOM project team members have attended hundreds of community meetings prior to and subsequent to preliminary map issuance, including several meetings in Region III. Community meetings serve as an outlet to make communities aware of the significant changes in the flood maps for each community, and allow a forum for discussion and feedback.

Our approach for any public meeting is to capitalize on the experience of AECOM's public involvement specialists for the design of the meeting and engage AECOM map specialists and technical experts to field questions and assist individuals in determining changes in flood zone for individual properties. As an effective means to communicate information to property owners, we have conducted "over the shoulder," or Open House meetings, where multiple workstations are set up so that community residents can see their property on a computer and understand the flood hazards in the area. Under our Risk MAP PTS contract, several AECOM team members have had recent experiences with a variety of community meetings throughout Region III.

2. Communication with the State

AECOM will prepare a communication plan for each TO awarded by DHSEM. The plan will outline how communication will occur with the State for that task, such as starting with a kickoff meeting then having regular bi-weekly status calls, monthly status reports, and in-person meetings at key phases of the project. The kickoff meeting with DHSEM will clarify scope items, project approach, deliverables, and schedule. Regular calls and meetings are expected to cover current TO status by discussing outreach needs, deliverables, technical issues, scheduling, invoicing, and budget status. DHSEM will always be kept up to date on all work performed by AECOM.

Our Program Manager will be able to meet with DHSEM as often as needed. Our Germantown, MD office is less than 40 miles from the West Virginia border, and within a 4-hour driving distance of DHSEM's office in Charleston, WV. Our Program Manager will have immediate access to staff with expertise covering almost every conceivable topic related to hazard identification and mitigation (not just flood related). Webinars can be used to allow DHSEM to consult with other offices and experts on a moment's notice. AECOM's management philosophy revolves around proactive planning and accurate, timely, and clear communication between our Program Manager and our client, and key Technical Task Leads.

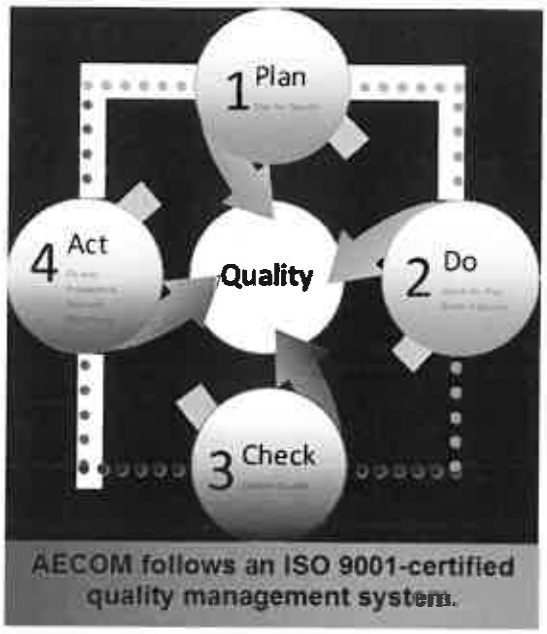
3. Quality Management

Prior to initiating work on any project, AECOM develops a project-specific work plan. This is a basic requirement mandated by the AECOM Quality Management System. Our project QA/QC work plan establishes the road map for all team members and details the protocols and procedures that will be

used to implement the project, including staffing, schedules, project management and technical tools, all key deliverables, QA/QC procedures, and health and safety protocols. AECOM will leverage the QA/QC work plan toward achieving project completion on time, on budget, and to the requirements of the DHSEM.

Quality has been ingrained into the corporate identity of AECOM through the execution and maintenance of a formal policy and procedure.

AECOM has extensive experience in performing QA/QC on both regulatory and non-regulatory products directly for FEMA and state CTPs. We review thousands of draft and final NFIP products annually and have developed a variety of checklists and automated tools to produce high-quality engineering and mapping deliverables. Our checklists and automated tools ensure each component, such as modeling data, FIS report data, and mapping data layers, are in agreement. Our checklists will be tailored for West Virginia to ensure we are meeting all requirements set forth by DHSEM. Many AECOM offices are available for independent QA/QC, if needed, to meet schedule or regulatory requirements of the State and FEMA. Our QA/QC processes have been approved for use in FEMA Region III. Our team has worked extensively with FEMA and Region III PTS reviewers and has successfully limited review times through proactive coordination, discussion, and dispositioning QA/QC calls.



AECOM follows an ISO 9001-certified quality management system.