



The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.

Header

List View

General Information Contact Default Values Discount Document Information

Procurement Folder: 184203
Procurement Type: Central Contract - Fixed Amt
Vendor ID: 000000160983
Legal Name: GANNETT FLEMING INC
Alias/DBA:
Total Bid: \$0.00
Response Date: 03/08/2016
Response Time: 18:42

SO Doc Code: CEOI
SO Dept: 0606
SO Doc ID: HSE1600000002
Published Date: 2/26/16
Close Date: 3/9/16
Close Time: 13:30
Status: Closed
Solicitation Description: Addendum No. 3-Responses attached and extend the bid opening

Total of Header Attachments: 0
Total of All Attachments: 0



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

**State of West Virginia
 Solicitation Response**

Proc Folder : 184203

Solicitation Description : Addendum No. 3-Responses attached and extend the bid opening

Proc Type : Central Contract - Fixed Amt

Date issued	Solicitation Closes	Solicitation No	Version
	2016-03-09 13:30:00	SR 0606 ESR03081600000004166	1

VENDOR
000000160983 GANNETT FLEMING INC

FOR INFORMATION CONTACT THE BUYER
 Tara Lyle
 (304) 558-2544
 tara.l.lyle@wv.gov

Signature X **FEIN #** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Professional engineering services				\$0.00

Comm Code	Manufacturer	Specification	Model #
81100000			

Extended Description :	Professional engineering services
-------------------------------	-----------------------------------

SUBMITTED TO:

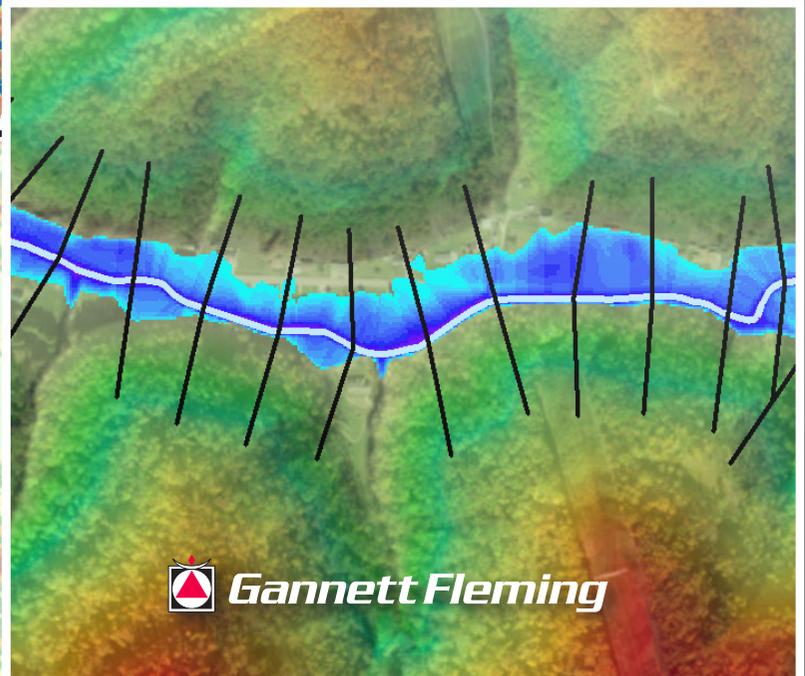
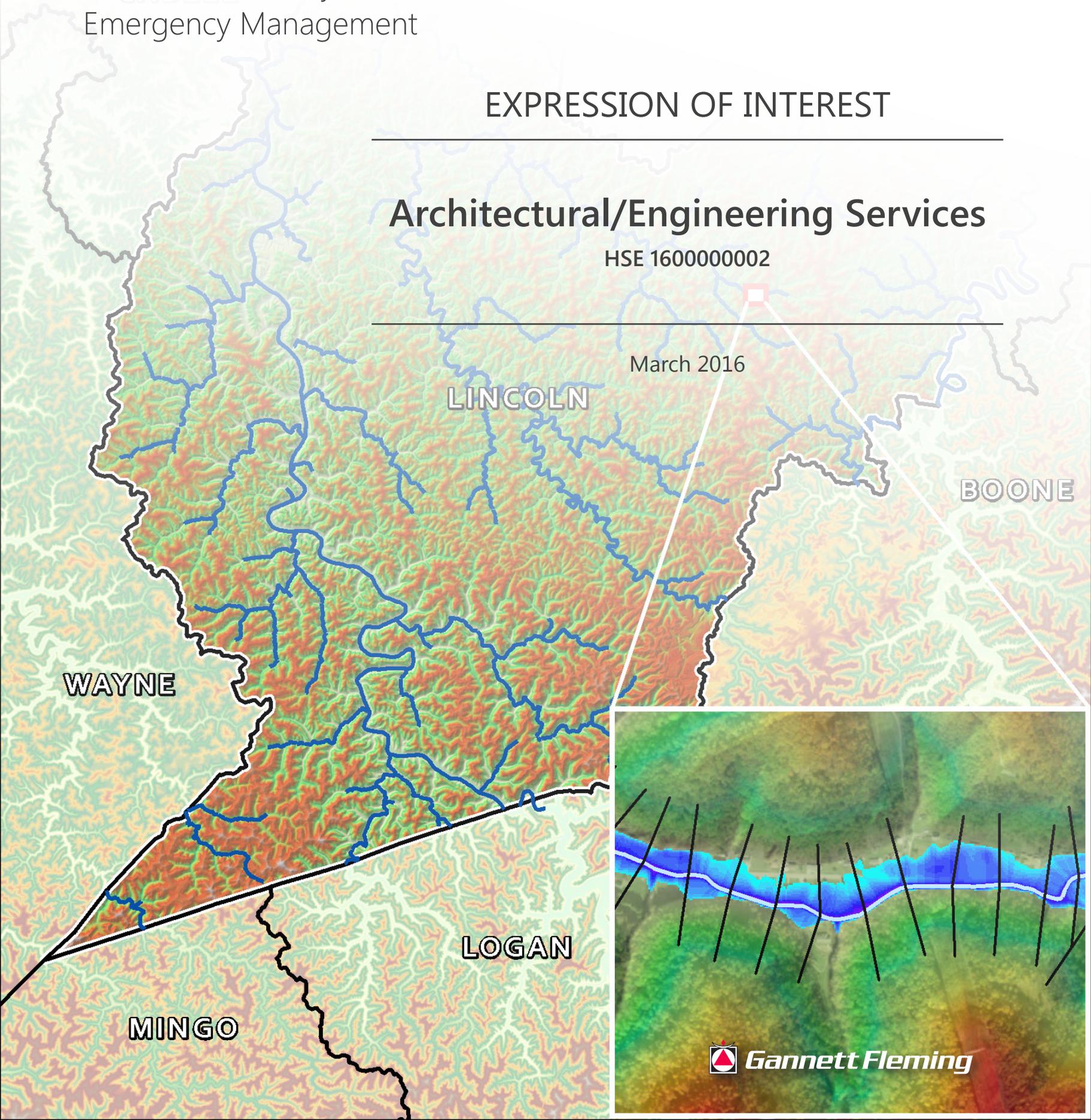
West Virginia Division of
Homeland Security and
Emergency Management

EXPRESSION OF INTEREST

Architectural/Engineering Services

HSE 1600000002

March 2016





*Excellence Delivered **As Promised***

March 8, 2016

Department of Administration
Purchasing Division
2019 Washington Street East
Charleston, WV 25305-0130

RE: Expression of Interest (EOI) – Architectural/Engineering Services, Solicitation Number HSE1600000002

Ladies and Gentlemen:

In response to the West Virginia Homeland Security and Emergency Management's (Agency's) request for EOIs, Gannett Fleming, Inc. has assembled this document to demonstrate our interest and qualifications in providing riverine flood hazard analysis and mapping services for the State of West Virginia on an as-needed basis. Gannett Fleming is a multi-disciplinary engineering firm focused on flood control engineering services since our founding 100 years ago. We have completed flood mapping and hydrologic and hydraulic (H&H) modeling for tens of thousands of river miles across the nation.

Gannett Fleming has served Federal Emergency Management Agency (FEMA) and its predecessor organization (Housing and Urban Development) on floodplain mapping/insurance assignments since the early 1970s. As a contractor to FEMA Region III providing services related to the Map Modernization (Map Mod) Program, we completed floodplain modeling and mapping for more than 8,000 stream miles in more than 650 communities in Pennsylvania and West Virginia and distributed more than 2,000 Digital Flood Insurance Rate Maps (DFIRMs). In addition, Gannett Fleming is currently serving FEMA as a Production and Technical Services (PTS) contractor under their Risk MAP Program. We are also currently assisting the U.S. Army Corps of Engineers Modeling, Mapping, and Consequences (MMC) Center by providing GIS-based tools and H&H analyses, consequence assessments, and inundation mapping across the United States. Our digital mapping products produced by our custom DFIRM mapping tools include DFIRM databases and panels, and we use real-time GIS presentations to foster community input and track community concerns. We will leverage this recent and relevant experience to provide similar services to the State of West Virginia efficiently and accurately, from a single integrated GIS/H&H team.

Our familiarity with the hydraulic environment in West Virginia extends beyond FEMA flood mapping. Gannett Fleming has provided mapping and H&H modeling for approximately 1,500 river miles in West Virginia. We also completed water resource studies in Randolph and McDowell Counties. Our team members have the experience necessary to accurately and efficiently complete the enhanced Zone A analyses and assist the Agency with your flood risk map program.

Christopher D. Krebs, PE, CFM, GISP will be the Project Manager and primary point of contact. Chris specializes in GIS applications for flood hazards and has integrated geospatial technologies and developed custom GIS solutions for more than 50 flood control and water resources projects. Chris also has led multiple training seminars on behalf of FEMA on integrating GIS with HEC-RAS hydraulic modeling and using GIS for floodplain mapping. He has managed all of the firm's flood mapping projects and will use this experience to help him lead our integrated engineering and GIS team, all located in one office, to successfully complete all project tasks on time and within budget to meet the Agency's objectives.

The noted strengths of our Team and project approach include:

Firm Stability

- History of 100 years of continuous service to our clients
- A track record of bringing high quality, innovative, cost-effective solutions to our clients

March 8, 2016

Re: EOI – Architectural/Engineering Services, Solicitation Number HSE160000002o1

Page 2 of 2

Extensive FEMA NFIP Experience

- 45 years of floodplain mapping and flood insurance study experience
- 10 years of Map Modernization experience with FEMA Region III and Cooperative Technical Partners and national PTS Risk MAP experience
- Significant experience and expertise in H&H modeling of flood control structures
- Intimate knowledge of FEMA policy, procedures, and standards, including their limitations
- Extensive experience and understanding of the limitations of using LiDAR data to support floodplain modeling and delineation activities
- Expertise in all areas of floodplain management, data collection, modeling, mapping, DFIRM production, Risk MAP products, risk assessment, mitigation, preliminary distribution, post-preliminary processing, and community outreach

Veteran Project Team with Extensive Flood Study Experience

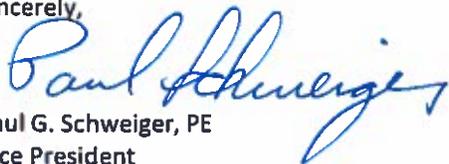
- A strong Project Manager with a career dedicated to floodplain management, FEMA's NFIP program, and the development of innovative cost-saving approaches using GIS technology
- A management team with an average of more than 20 years of experience
- A project team of nearly 20 proposed individuals, collectively having several hundred years of recent and relevant experience
- An entire team with intimate knowledge of FEMA Map Mod and Risk MAP procedures

Innovation Resulting In Cost Savings

- Experience and history in providing clients with integrated GIS solutions and digital dissemination of work products
- Development of unique solutions, such as the DFIRM Development Kit (DDK) to improve the quality of deliverables and flood data production efficiency
- A unique project approach that leverages our extensive FEMA flood study and GIS experience and a management approach of collective team collaboration to achieve project goals
- Cost and schedule controls that have reduced the cost of some flood study and mitigation planning activities by as much as 50 percent.

By selecting Gannett Fleming, the Agency will work with an experienced team of integrated GIS and H&H professionals who will use custom GIS and modeling tools to efficiently and accurately develop flood risk maps and assist the Agency with developing a comprehensive flood risk map program. Thank you for the opportunity to submit our EOI. If you have any questions or would like additional information, please contact me at pschweiger@gfnet.com or 717-763-7211, ext. 2504.

Sincerely,



Paul G. Schweiger, PE
Vice President

Table of Contents



1. Centralized Expression of Interest 1-1

2. Key Staff 2-1

 2.1. Staff Qualifications, Experience, and References..... 2-1

 2.2. Staff Certifications Applicable to this Project 2-5

 2.3. Staffing Plan 2-10

 Resumes..... 2-12

3. Experience 3-1

 3.1. Past Projects 3-2

4. Approach and Methodology for Meeting Goals and Objectives..... 4-1

 4.1. Goal #1 4-1

 4.2. Goal #2 4-5

 4.3. Goal #3 4-14

 4.4. Goal #4 4-15

5. Forms 5-1

 Purchasing Affidavit 5-1

 Addendum Acknowledgement..... 5-2



1. Centralized Expression of Interest



Purchasing Division
 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:

Gannett Fleming, Inc.
 207 Senate Avenue, Camp Hill, PA 17011
 (717) 763-7211

FOR INFORMATION CONTACT THE BUYER

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

Signature X

FEIN # 25-1613591

DATE 2/12/2016

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

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.

INVOICE TO	SHIP TO
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

SCHEDULE OF EVENTS

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

HSE160000002	Document Phase Final	Document Description Engineering firm for flood hazard analysis	Page 3 of 3
---------------------	--------------------------------	---	------------------------------

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions



Purchasing Division
 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: Addendum No. 1 - Extend the bid opening

Proc Type: Central Contract - Fixed Amt

Date Issued	Solicitation Closes	Solicitation No	Version
2016-02-12	2016-02-23 13:30:00	CEOI 0606 HSE1600000002	2

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:

Gannett Fleming, Inc.
 207 Senate Avenue, Camp Hill, PA 17011
 (717) 763-7211

FOR INFORMATION CONTACT THE BUYER

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

Signature X

FEIN # 25-1613591

DATE 3/8/2016

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

Addendum No. 1 - To extend the bid opening from 02/16/2016 to 02/23/2016. Responses to vendor questions will be issued under separate addendum.

INVOICE TO	SHIP TO
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

SCHEDULE OF EVENTS

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

HSE160000002	Document Phase Final	Document Description Addendum No. 1 - Extend the bi d opening	Page 3 of 3
---------------------	--------------------------------	---	------------------------------

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions



Purchasing Division
 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: Addendum No. 2 - Extend the bid opening

Proc Type: Central Contract - Fixed Amt

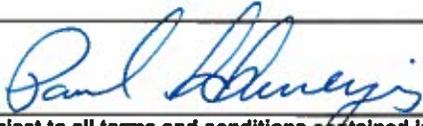
Date Issued	Solicitation Closes	Solicitation No	Version
2016-02-19	2016-03-01 13:30:00	CEOI 0606 HSE1600000002	3

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:

 Gannett Fleming, Inc.
 207 Senate Avenue, Camp Hill, PA 17011
 (717) 763-7211

FOR INFORMATION CONTACT THE BUYER
 Tara Lyle
 (304) 558-2544
 tara.l.yle@wv.gov

Signature X  FEIN # 25-1613591 DATE 3/8/2016

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

Addendum No. 2 - To extend the bid opening from 02/23/2016 to 03/01/2016. Responses to vendor questions will be issued under separate addendum.

INVOICE TO	SHIP TO
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

SCHEDULE OF EVENTS

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

HSE160000002	Document Phase Final	Document Description Addendum No. 2 - Extend the bi d opening	Page 3 of 3
---------------------	--------------------------------	---	------------------------------

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions



Purchasing Division
 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: Addendum No. 3-Responses attached and extend the bid opening

Proc Type: Central Contract - Fixed Amt

Date Issued	Solicitation Closes	Solicitation No	Version
2016-02-26	2016-03-09 13:30:00	CEOI 0606 HSE1600000002	4

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:

Gannett Fleming, Inc.
 207 Senate Avenue, Camp Hill, PA 17011
 (717) 763-7211

FOR INFORMATION CONTACT THE BUYER

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

Signature X



FEIN # 25-1613591

DATE 3/8/2016

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION:

Addendum No. 3 - Responses to vendor questions attached. See attached pages. The bid opening has been moved from 03/01/2016 to 03/09/2016.

INVOICE TO	SHIP TO
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

SCHEDULE OF EVENTS

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

HSE160000002	Document Phase Final	Document Description Addendum No. 3-Responses attached and extend the bid opening	Page 3 of 3
---------------------	--------------------------------	---	------------------------------

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions

2. Key Staff



Gannett Fleming, Inc. is registered in West Virginia as a professional engineering firm. In addition, our team members have the qualifications and experience needed to perform accurate, compliant flood hazard analysis and mapping services for the State of West Virginia. Each team member's **certifications and/or registrations relevant to their work on this project** are provided in this section. **References for key personnel** are provided in Table 2-1. Additionally, **our firm's staffing plan is illustrated on our organizational chart, Figure 2-1.**

2.1. Staff Qualifications, Experience, and References

Our personnel have **extensive experience with FEMA flood hazard identification, including automated H&H modeling, terrain development, and flood hazard mapping**, in addition to **experience developing advanced GIS products to effectively convey the risks at both the community and individual property level.** They will provide the West Virginia Division of Homeland Security and Emergency Management (Agency) with **high quality services and innovative solutions that will ultimately save time and reduce costs for the State.**

Our cohesive team is located in one office, enabling efficient collaboration and communication while working on assignments. Our key personnel have been working together for the past 10 years supporting FEMA's Map Modernization and Risk Mapping Assessment and Planning (MAP) Programs. In addition, **10 of our team members are Certified Floodplain Managers, including all of our key personnel**, introduced below. Their expertise in GIS and flood hazard mapping will ensure that **the Agency will receive FEMA-compliant, technically sound services for their projects.**



Our proposed **Project Manager, Christopher Krebs, PE, CFM, GISP** has dedicated his 23 years of professional experience to floodplain management and the application of GIS technology to provide engineering solutions. Chris is a **Certified Floodplain Manager since 2001, Professional Engineer, GIS Professional, and Certified**

Esri ArcGIS Desktop Professional. He has more than

10 years of experience as a technical evaluation contractor for FEMA on the NFIP where **he reviewed and performed hundreds of flood insurance studies and map revisions.** Since 1996, he has been applying automated hydrologic and hydraulic (H&H) applications on flood studies and dam assessments, and shortly thereafter started **developing his own custom GIS applications to support flood hazard identification.**

Chris understands the **intertwined relationship between engineering and GIS.** His GIS application development and flood modeling expertise provides a solid foundation for him to **successfully lead the development of cost-effective solutions for the State.**

Chris is a hands-on manager with extensive technical expertise who currently manages our existing Risk MAP Production and Technical Services (PTS) TS contract. Between 2006 and 2013, he **successfully managed more than \$10 million in task orders on our Map Modernization contracts in FEMA Region III without a single change order request.**

Chris has led instruction on flood modeling and mapping topics, including courses on *HEC-HMS and HEC-RAS Modeling, Using GIS to Identify Flood Hazards, Understanding the FEMA Map Revision Process, and Integrating GIS with Hydraulic Modeling.* Along with Amanda Hess, he presented an "Introduction to Hydrologic Modeling Using Geospatial Information" as part of an Association of State Dam Safety Officials (ASDSO) Online Training Series. **Chris also led the design, development, testing, and overall production of a collection of GIS tools** to advance 1D and 2D HEC-RAS modeling efforts at the U.S. Army Corps of Engineers' (USACE's) Mapping, Modeling, and Consequence (MMC) Center.



Project Principal, Paul Schweiger, PE (WV), CFM will provide project oversight, assistance and leadership with the aim of improving project outcomes. As a Vice President of the firm, **he will commit the firm, regularly monitor the performance of the contract, and ensure that optimum resources are available to the Agency at all times.**



2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002



Paul began his career performing hydraulic analyses for FEMA Flood Insurance Studies for communities in Florida, Georgia, and South Carolina. Over the past 20 years, **Paul has been almost continuously involved as a Senior Engineer, Project Manager, or Project Principal in completing H&H and water resources engineering projects for the West Virginia Natural Resources Conservation Service (NRCS).** During the past four years, Paul was responsible for leading two significant research projects for FEMA including: (1) Updating "FEMA Guidelines for Selecting and Accommodating Inflow Design Flows for Dams" (FEMA 94), and, (2) developing an interactive internet teaching portal, *Lessons Learned from Dam Incidents and Failures*.

Paul regularly conducts public meetings and workshops. He is a frequent speaker and instructor at FEMA-sponsored training venues, regularly teaches national seminars and webinars, and **provides custom training for federal and state agencies.** He is currently serving as an **expert H&H engineer on Independent External Peer Review panels for several USACE flood control projects** and has experience providing **litigation support** in the area of **riverine flooding**.



Ashley Mengle, CFM, GISP will lead our GIS efforts that include topographic data development, floodplain mapping, DFIRM production services and flood risk assessment. Ashley has been essential to our FEMA Map Mod and Risk MAP contracts and has been involved in every step of the DFIRM deliverable, including **base**

map acquisition, development of the DFIRM databases and map panels to the final deliverables submitted to the Map Service Center (MSC).

Ashley has helped develop numerous GIS applications to support LiDAR terrain processing, H&H analyses, floodplain mapping, and DFIRM production including the **development of our DFIRM Development Kit, which streamlines the map production process while maintaining consistency and quality.** Ashley has **led the production of DFIRM panels, Flood Insurance Studies and/or Flood Risk Products in Lincoln County, West Virginia; Pennsylvania, Tennessee, Florida, and Georgia.**

In addition to distributing more than 2,000 DFIRM panels within FEMA Regions III and IV, Ashley has led the development of consequence assessment reports (CARs) to support the Critical Infrastructure Protection and Resilience and Dam Safety programs for the USACE. She developed and analyzed 11 dam break and HEC-FIA models and summarized hydraulic and economic results in the comprehensive CAR. Ashley also developed inundation map atlases for the dams.



Amanda Hess, PE, CFM will lead our H&H modeling team. Amanda has **more than 15 years of experience in riverine H&H modeling.** She **regularly instructs** technical seminars and webinars on **hydrologic modeling using HEC-HMS and hydraulic modeling using HEC-RAS.**

Amanda leads a group of engineers entirely devoted to H&H modeling. Their experience ranges from detailed steady-state hydraulic modeling of short reaches to support bridge replacement projects to large scale unsteady flow hydraulic modeling extending hundreds of miles to **very detailed examination of two- and three-dimensional hydraulics in floodplains** and at hydraulic structures. Together, they have **modeled and mapped thousands of river miles across the United States, including more than 1,500 river miles in West Virginia.** Amanda and her staff, under the direction of Project Manager, Chris Krebs, have also prepared hydraulic models for FEMA map modernization projects and for FEMA Letters of Map Revision. **The seamless integration of GIS and hydraulics necessary for the success of these projects is fostered by Amanda and Chris' collaboration and cross-training of both GIS- and hydraulics-focused staff.**

Amanda's technical specialties include floodplain studies, one- and two-dimensional hydraulic modeling, inundation modeling and mapping, hazard assessment, hydrologic modeling and analysis and dam engineering. Amanda is **currently serving as an expert H&H engineer** on Independent External Peer Review panels for a large USACE project and has **experience providing litigation support in that area of riverine flooding.**

Q16-5291





2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE1600000002

Table 2-1: Key Personnel Qualifications and References. Gannett Fleming's key personnel are all Certified Floodplain Managers and average 20 years of experience.

Staff Name	Yrs. Exp.	Degree	Registration(s)/ Certification(s)	Client References
Key Personnel				
Christopher D. Krebs	23	BS, Civil Engineering	PE, CFM, GISP	Nikki Roberts, PE (FEMA, Region III) 215-931-5575 Nikki.Roberts@dhs.gov Timothy Ridley, PE (NRCS WV) 304-284-7573 Timothy.Ridley@wv.usda.gov Craig Thomas (USACE, Baltimore) 410-962-6095 Craig.M.Thomas@usace.army.mil
Paul G. Schweiger	32	BS, Civil Engineering – Water Resources Engineering; MS, Civil Engineering – Hydrology/Hydraulics	PE, CFM	Andy Deichert, PE (NRCS WV) 304-284-7563 Andy.Deichert@wv.usda.gov Timothy Ridley, PE (NRCS WV) 304-284-7573 Timothy.Ridley@wv.usda.gov Brad Iarossi, PE (U.S. Fish and Wildlife Service) 703-358-2211 Brad_iarossi@fws.gov
Ashley R. Mengle	9	BS, Geo-Environmental Studies	CFM, GISP	Mark Vieira (FEMA Region IV) 770-220-5450 Mark.Vieira@fema.dhs.gov Craig Thomas (USACE Baltimore) 410-962-6095 Craig.M.Thomas@usace.army.mil Phil Dye, PE (USACE, Vicksburg) 601-631-7467
Amanda J. Hess	17	BS, Civil Engineering; MS, Civil Engineering	PE, CFM	Delbert Shriver (WV DEP) 304-368-2000, ext. 3712 delbert.g.shriver@wv.gov Arthur C. Miller, PhD, PE, CFM 814-571-0486 James W. Gallagher, Jr. PE (NH DES) 603-271-1961 James.Gallagher@des.nh.gov



2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002



Table 2-2: Integrated Team of H&H and GIS Professionals Qualifications. Gannett Fleming's proposed team of qualified integrated professionals have degrees, and professional registrations and certifications relevant to their proposed roles.

Staff Name	Yrs. Exp.	Degree	Registration(s)/ Certification(s)
Robert M. Wiley	9	BS, Geography - Geographic Information Systems (GIS) Concentration	CFM
Jillian N. Arnold	12	BS, Geo-Environmental Studies	CFM
Kayla J. Kiphart Briggs	8	BS, Geo-Environmental Studies	
Gregory L. Richards	9	BS, Civil Engineering; MS, Civil and Environmental Engineering	PE, CFM
Benjamin P. Israel-Devadason	11	BS, Civil Engineering; MS, Civil Engineering	PE, CFM
William J. Kingston, III	6	BS, Civil Engineering; MS, Civil Engineering	CFM
Adrienne K.W. Shaner	7	BS, Environmental Engineering	PE
Jesse M. Pope	6	BS, Civil Engineering; MS, Civil Engineering	
Nathan C. Clymer	8	BS, Civil Engineering Technology	PE, CPESC
Kate E. Aulenbach	3	BS, Environmental Engineering	CFM
Wesley C. Hollenbach	3	BS, Environmental Engineering	EIT
Yan (Vicky) Wang	6	BS, Civil Engineering; MS, Civil Engineering; PhD, Civil and Environmental Engineering	
Adam J. Moyer	10	AAS, Surveying Technology; BS, Civil Engineering Technology	PLS
Brian S. Miller	9	BS, Civil Engineering Technology	PE





2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002

2.2. Staff Certifications Applicable to this Project

DEPARTMENT OF PROFESSIONAL AND OCCUPATIONAL REGULATION
COMMONWEALTH OF VIRGINIA

EXPIRES ON: 10-31-2016

9960 Mayland Dr., Suite 400, Richmond, VA 23268
Telephone: (804) 987-8900

NUMBER: [REDACTED]

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

CHRISTOPHER DANIEL KREBS
[REDACTED]

ALLEGATION OF THIS DOCUMENT, USE AFTER EXPIRATION, OR USE BY PERSONS OR FIRM OTHER THAN THOSE NAMED HEREIN, IS UNLAWFUL PROSECUTION UNDER THE STATUTES OF VIRGINIA.

(SEE REVERSE SIDE FOR NAME AND/OR ADDRESS CHANGE)

PROJECT CITY: COMMONWEALTH OF VIRGINIA (STATE HEREIN)

BOARD FOR APELSCIDA
PROFESSIONAL ENGINEER LICENSE
NUMBER: 0402032852 EXPIRES: 10-31-2016

CHRISTOPHER DANIEL KREBS
6200 LOOKOUT DRIVE
MECHANICSBURG, PA 17055

DEPARTMENT OF PROFESSIONAL AND OCCUPATIONAL REGULATION
9960 Mayland Dr., Suite 400, Richmond, VA 23268

ALLEGATION OF THIS DOCUMENT, USE AFTER EXPIRATION, OR USE BY PERSONS OR FIRM OTHER THAN THOSE NAMED HEREIN, IS UNLAWFUL PROSECUTION UNDER THE STATUTES OF VIRGINIA.

GIS Certification Institute
This certifies that

Christopher Krebs

has met the standards for ethical conduct and professional practice as established by the GIS Certification Institute for recognition as a
Certified Geographic Information Systems (GIS) Professional (GISP)
and is therefore entitled to all the rights and privileges thereunder.

This grant of certification shall expire or be deemed inactive on 2/25/2019 unless, by that date, the individual shall have successfully completed recertification.
Certification Number 6218 Date of Initial Certification 2/25/2009

Martin Roche
Martin Roche, GISP
GISP President

Bill Hodge
Bill Hodge, GISP
GISP Executive Director

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

Christopher D. Krebs, 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. [REDACTED] ISSUED 11/8/2001. THIS CERTIFICATE SHALL EXPIRE 1/31/2018, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

Mark Reagan
Mark Reagan, PE, CFM
PRESIDENT

Chris M. Berginnis
Chris M. Berginnis, CFM
EXECUTIVE DIRECTOR

ASFPM
CFM
CERTIFIED

Esri Certified

ArcGIS Desktop Professional 10

Christopher Krebs
January 17, 2011

Jack Dungenood
Jack Dungenood, President

Esri Certified
Certificate Code: 042711
Verification #: 000000287025

www.esri.com/Certification/Verification

esri

West Virginia State Board of Registration
for Professional Engineers

PAUL G. SCHWEIGER
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

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

Paul G. Schweiger, 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. [REDACTED] ISSUED 8/4/2012. THIS CERTIFICATE SHALL EXPIRE 7/31/2016, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

Thomas V. Morey
Thomas V. Morey, CFM
PRESIDENT

Chris M. Berginnis
Chris M. Berginnis, CFM
EXECUTIVE DIRECTOR

ASFPM
CFM
CERTIFIED



2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002



Q16-5291





2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002

A SECURE ONLINE SERVICE FROM UTAH.GOV

Subscribers | FAQs | Support | Print Doc. A.A.A.

UTAH DIVISION OF OCCUPATIONAL AND PROFESSIONAL LICENSING
LICENSEE LOOKUP & VERIFICATION SYSTEM

RELATED LINKS & RESOURCES

Details for GREGORY LYNN RICHARDS

License Information

Name: GREGORY LYNN RICHARDS
 City, State, Zip, Country: MECHANICSBURG, PA 17050, UNITED STATES
 Profession: ENGINEERING AND SURVEYOR
 License Type: PROFESSIONAL ENGINEER
 License Number: [REDACTED]
 Obtained By: APPLICATION
 License Status: ACTIVE
 Original Issue Date: 02/22/2013
 Expiration Date: 02/28/2017
 Agency and Disciplinary Action*: NONE
 Docket Number: N/A

Going Mobile?
Get License Info on Your Mobile
Visit this site with your mobile device

Department of Commerce
 Utah Division of Occupational & Professional Licensing
 Utah Department of Commerce
 Contact Us
 Public Meeting

Data Forwarded
 Request Address List of Licensees
 Request other info

For technical assistance, please call: 801-963-0275
 For informational assistance, please call DOPLS at: (801) 530-0528

Feedback

Would you like to hear from you?
 Please contact us at: 801-963-0275

Education:

School Name	Major	Graduation Date	Cegree
UTAH STATE UNIVERSITY	CIVIL ENGINEERING	2009-12-12	BACHELOR OF SCIENCE
UTAH STATE UNIVERSITY	CIVIL & ENVIRONMENTAL ENGINEERING	2009-12-12	MASTER OF SCIENCE

Back | Do Another Search | Obtain a License Verification

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

Gregory L. Richards, 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. [REDACTED] ISSUED 10/31/2011. THIS CERTIFICATE SHALL EXPIRE 1/31/2018, UNLESS RENEWED ACCORDING TO THE RULES OF THIS BOARD.

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

Chad M. Berginns, CFM
ASSOCIATION OF STATE FLOODPLAIN MANAGERS
EXECUTIVE DIRECTOR, CHAD M. BERGINNS, CFM

ASFPM
CFM
CERTIFIED

TEXAS BOARD OF PROFESSIONAL ENGINEERS

BE IT KNOWN THAT

Benjamin Praisz Israel Devadason

HAVING GIVEN SATISFACTORY EVIDENCE OF QUALIFICATIONS REQUIRED UNDER THE TEXAS ENGINEERING PRACTICE ACT, TEXAS CIVIL STATUTES, ARTICLE 3271a, IS GRANTED THIS

LICENSE TO PRACTICE AS A

PROFESSIONAL ENGINEER

IN THE STATE OF TEXAS

PROVIDED THIS LICENSE IS NOT REVOKED AND IS RENEWED ACCORDING TO LAW

TEXAS BOARD OF PROFESSIONAL ENGINEERS
IN WITNESS WHEREOF,
WE HAVE HEREUNTO SET OUR HANDS AND AFFIXED THE SEAL OF THE BOARD AT THE CITY OF AUSTIN, THIS 29TH DAY OF DECEMBER 2010.

[Signature]
BOARD CHAIR

[Signature]
BOARD SECRETARY

SERIAL NUMBER [REDACTED]

Association of State Floodplain Managers

ASFPM

ASFPM Certification Information

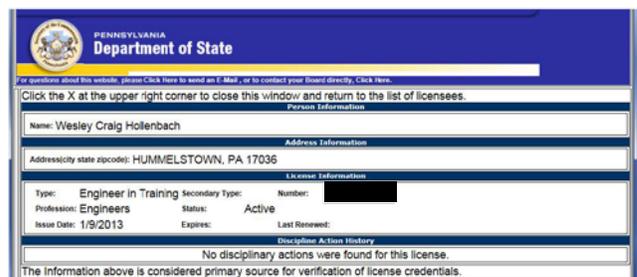
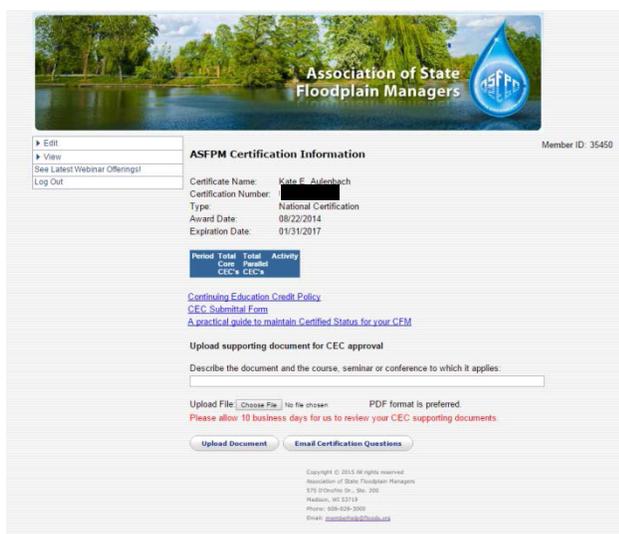
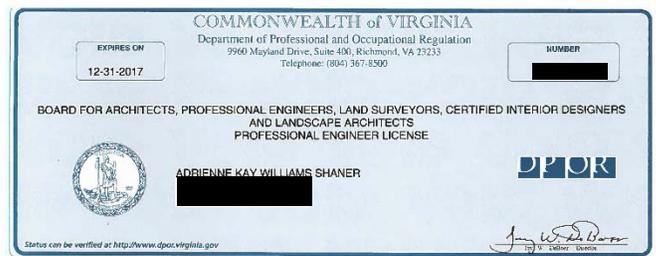
Person Name: Benjamin Israel-Devadason
 Certificate Name: Benjamin P. Israel-Devadason
 Certificate Number: [REDACTED]
 Type: National Certification
 Award Date: 10/24/2008
 Expiration Date: 01/31/2017

Period	Total CEC's	Activity
02-01-2015 to 01-31-2017	12.00	CEC Activity History
02-01-2013 to 01-31-2015	16.00	CEC Activity History
02-01-2011 to 01-31-2013	16.00	CEC Activity History
02-01-2009 to 01-31-2011	16.00	CEC Activity History



2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002



Q16-5291



2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002

Commonwealth of Pennsylvania
 Department of State
 Bureau of Professional and Occupational Affairs
 PO Box 2649 Harrisburg PA 17105-2649

15 0103191

License Type
 Professional Land Surveyor

License Status
 Active

Initial License Date
 06/07/2012

Expiration Date
 09/30/2017

ADAM JAMES MOYER
 License Number [REDACTED]

[Signature]
 Commissioner of Professional and Occupational Affairs

Commonwealth of Pennsylvania
 Department of State
 Bureau of Professional and Occupational Affairs
 PO Box 2649 Harrisburg PA 17105-2649

13 0008004

License Type
 Professional Engineer

License Status
 Active

Initial License Date
 01/02/2014

Expiration Date
 09/30/2015

BRIAN SCOTT MILLER
 License Number [REDACTED]

[Signature]
 Acting Commissioner of Professional and Occupational Affairs



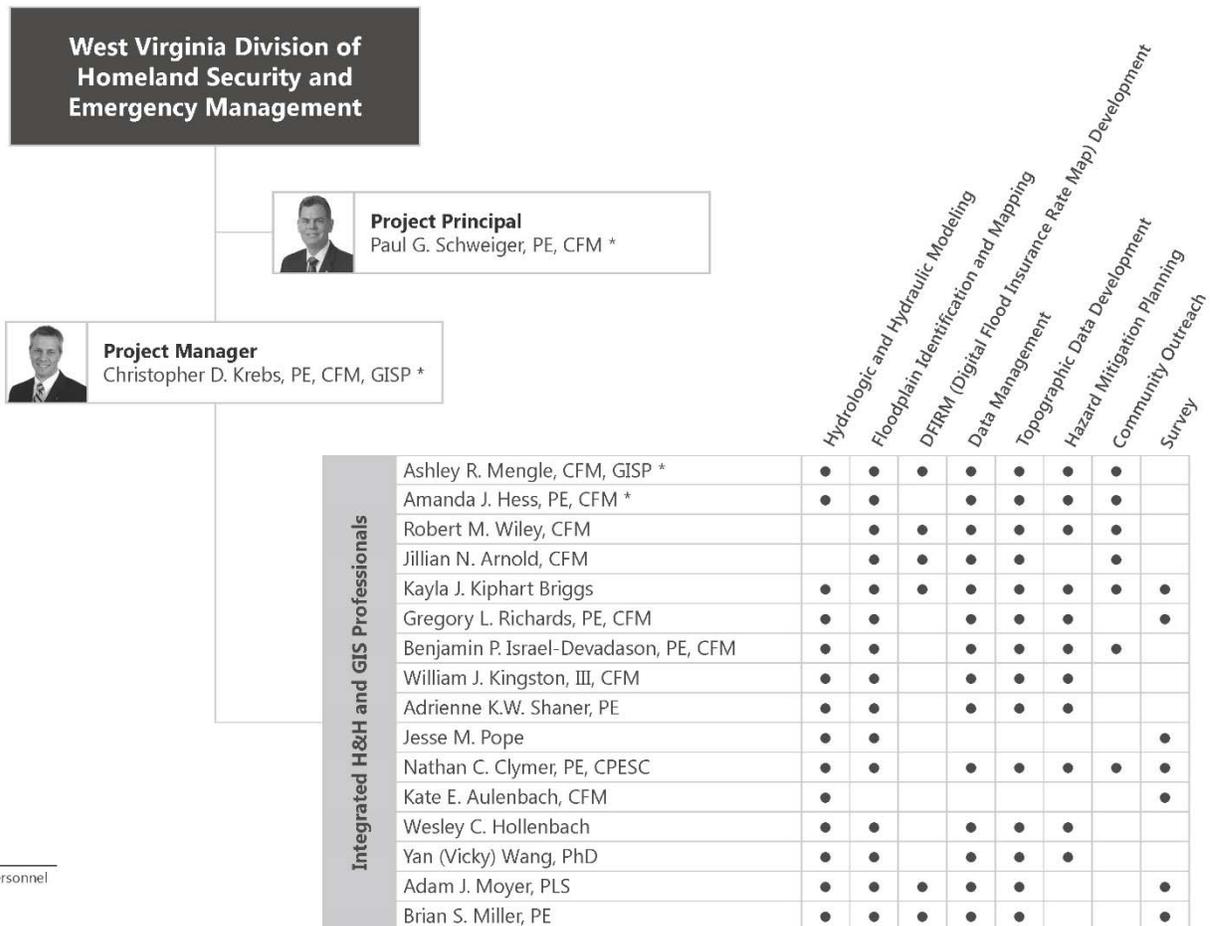
2. Key Staff

Architectural/Engineering Services, Solicitation Number HSE160000002



2.3. Staffing Plan

Figure 2-1: Organizational Chart of Proposed Team. Gannett Fleming includes cross-trained GIS- and hydraulics-focused personnel led by professionals adept at seamlessly integrating the services necessary for the success of this project.



CERTIFICATE OF *Authorization*

STATE BOARD OF REGISTRATION FOR PROFESSIONAL ENGINEERS

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

*has complied with section §30-13-17 of the West Virginia Code governing
the issuance of a Certificate of Authorization. The Board hereby notifies you of its
certification with issuance of this Certification of Authorization for the period of:*

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

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



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

A stylized, handwritten signature in black ink, consisting of a long horizontal line with a small loop at the end.

BOARD PRESIDENT



Resume – Christopher D. Krebs, PE, CFM, GISP

Architectural/Engineering Services, Solicitation Number HSE1600000002

Project Role:

Project Manager

Years Experience with Current Firm: 13

Years Experience with Other Firms: 10

Education:

BS, Civil Engineering, The Pennsylvania State University, 1992

Professional Registrations:

PE: Virginia - No. [REDACTED] 1999)

Certified Floodplain Manager - No. [REDACTED] 2001)

Certified Geographic Information Systems Professional (GISP): Cert. No. [REDACTED] (2009)

Esri Certified ArcGIS Desktop Professional 10: Cert. No. [REDACTED] (2011)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

Pennsylvania Association of Floodplain Managers (PAFMA)

Summary of Role and Experience

Vice President of Gannett Fleming and Manager – GIS Services, Environmental Resources Division in charge of the integration of spatial technologies with the everyday engineering and planning practices of the firm's Environmental Resources Division. Possesses extensive geographic information system (GIS) and Global Positioning System (GPS) expertise and knowledge regarding the development of applications related to engineering, specifically utility infrastructure inventory and data conversion, hydrologic and hydraulic (H&H) engineering model integration, digital terrain modeling, and master planning for a broad range of public and private sector clients.

Professional Engineer and Certified Floodplain Manager proficient in surface water H&H and the National Flood Insurance Program administered by the U.S. Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA), along with several aspects of stormwater and floodplain management. Engineering experience includes H&H and FEMA expert testimony, the preparation of hundreds of FEMA map revisions, flood hazard studies, hydraulic structures design, and flood mitigation and watershed master planning. Received extensive experience and training on several industry-standard H&H computer models; led classroom instruction on using GIS to identify flood hazards and on

HEC-HMS and HEC-RAS modeling; and facilitated workshops on FEMA map revisions.

Related Projects

FEMA Region III Indefinite Delivery/Indefinite Quantity (ID/IQ) Contract, Flood Map Modernization, DHS, FEMA, Region III. Senior Project Manager in charge of the scoping, technical approach, and execution of two 5-year ID/IQ contracts in support of FEMA's Flood Map Modernization program. The project has included the development of more than 20 new modernized Flood Insurance Studies (FISs) and 2,000 Digital Flood Insurance Rate Map (DFIRM) panels for more than 600 local communities in FEMA Region III while providing the following services:

- Conducting new H&H analyses and floodplain mapping using GIS for more than 100 stream miles
- Redelineating the 1 and 0.2 percent annual-chance floodplain and regulatory floodway boundaries for thousands of miles of effective detailed studied streams using updated digital terrain data
- Revising approximate Special Flood Hazard Areas based on new H&H analyses along more than 5,000 stream miles using a customized GIS tool similar to the U.S. Geological Survey's StreamStats program
- Developing a countywide DFIRM database from the newly developed digital flood hazard information and GIS data provided by local communities
- Performing field surveys using conventional and GPS techniques for bridge and culvert crossings and natural stream valley cross sections according to FEMA standards
- Developing digital terrain models to support automated H&H modeling and floodplain mapping
- Reviewing available topographic data sources and GIS base mapping provided by local and state GIS departments
- Producing thousands of hard-copy preliminary DFIRMs
- Producing more than 20 countywide FIS reports in digital and hard-copy formats.

In addition, led the development of several custom GIS applications designed for automated floodplain modeling and mapping, integrated field survey data with Light Detection And Radar (LiDAR), managed and processed large LiDAR terrain data sets, developed a DFIRM database, produced DFIRM panels, and performed



Resume – Christopher D. Krebs, PE, CFM, GISP



Architectural/Engineering Services, Solicitation Number HSE1600000002

QA/QC of GIS data. Provided independent QA/QC of LiDAR elevation data, H&H modeling, floodplain mapping, DFIRM database, and hard-copy map products produced by partners and subconsultants.

FEMA Flood Map Modernization, Post-Flood Risk Assessment, Northeastern PA, DHS, FEMA, Region III. Task Order Manager assessing and reporting the flood risks in six northeastern Pennsylvania counties. The project included compiling flood data and coordinating with more than 200 local communities; evaluating FEMA's effective flood hazard information; assessing flood damage using FEMA's HAZUS model; identifying and prioritizing map update needs; compiling a GIS database for interactive public meetings; preparing flood risk questionnaires for local communities; organizing and conducting several public meetings to gather additional data and document community concerns, experiences, and observations regarding the flood; and preparing a report that summarized the findings.

FEMA Risk Mapping, Assessment, and Planning (Risk MAP) Production and Technical Services (PTS), DHS, FEMA. Senior Project Manager managing multiple task orders under this contract. Serves as primary liaison to the LLC partnership and coordinator of our firm's operations. Worked closely with FEMA staff and actively participated in meetings and workshops to help formulate the Risk MAP vision, approach, and products. Work Orders totaling more than \$2.6 million through 2014 included validating flood hazard engineering and mapping in support of FEMA's Coordinated Needs Management Strategy; developing guidelines for the evaluation of risk-based hydrologic safety of dams; lessons learned from dam failures; managing the acquisition of LiDAR data and providing QA/QC; independent technical H&H reviews; and performing new Risk MAP flood studies for multiple watersheds in FEMA, Region IV; the development of risk-assessment products to help communities better understand their flood risk while identifying mitigation alternatives.

Modeling, Mapping, and Consequence (MMC) Analysis for USACE-owned Dams, U.S. Army Corps of Engineers (USACE), Vicksburg District, MMC Production Center. Senior Project Manager conducting eight dam failure and consequence studies for large flood control facilities across the United States. Dam-break studies include GIS-based unsteady-flow HEC-RAS models, followed by inundation mapping in a GIS environment using HEC-GeoRAS and custom mapping tools, and a consequence

analysis conducted using HEC-FIA to determine economic and human impacts. The project includes large-scale HEC-RAS models with split-flow reaches, levee overtopping, dams with rule-based gate operations, and offline storage areas and backwater areas. Consequence assessments considered economic damages, loss-of-life, and lost benefits due to dam failure. The hydraulic and consequence models support a risk-based assessment, prioritization, and management framework.

Prior to Gannett Fleming:

Flood Mapping Coordination Contractor, FEMA. Senior Project Engineer assisted with the design of an in-house enterprise GIS database to support all phases of FEMA's flood hazard identification and mapping program. The geodatabase design was part of the development of a larger system to help produce next-generation DFIRM products. Led the design and development of several custom GIS applications to support FEMA "limited-detailed" flood analyses. The applications provided tools to manage countywide GIS databases and large terrain data sets, automate hydrologic analyses using U.S. Geological Survey regression equations, and perform an "approximate" HEC-RAS analysis with limited field survey. These GIS-based H&H applications were utilized by engineering staff on numerous countywide flood studies.

FISs and Map Revisions, Nationwide. As Project Engineer, prepared and reviewed Flood Insurance Studies and FIRM Revisions for the NFIP. Also, provided technical assistance in reviewing the hydrologic and hydraulic analyses performed for areas subject to riverine flooding in the western half of the United States and assessed the effects of flood control projects and floodplain development on flood risks. Responsibilities included the evaluation of flood mitigation works, both existing and proposed, such as levees, dams, channelization projects, stormwater management facilities, erosion and sediment control structures, and storm drain systems with regard to regulatory compliance and floodplain impacts. Coordinated with federal, state, and local floodplain management officials, engineers, developers, and private citizens to resolve technical deficiencies and appeals and to verify compliance with regulations and laws governing floodplain development.

Q16-5291





Project Role:

Project Principal

Years Experience with Current Firm: 29

Years Experience with Other Firms: 3

Education:

BS, Civil Engineering – Water Resources Engineering, University of New Brunswick, 1983

MS, Civil Engineering – Hydrology/Hydraulics, University of New Brunswick, 1986

Professional Registrations:

PE: West Virginia - No. [REDACTED] (2009); Pennsylvania - No. [REDACTED] (1990); New Jersey - No. [REDACTED] (1991); New York - No. [REDACTED] (2009); North Dakota - No. PE-[REDACTED] (2010); Illinois - No. [REDACTED] (2010); Virginia - No. [REDACTED] (2011); Arizona - No. [REDACTED] (2012); New Hampshire - No. [REDACTED] (2014); Montana - No. [REDACTED] (2015)

Association of State Floodplain Managers, Inc. (ASFPM)
Certified Floodplain Manager - No. [REDACTED] (2012)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

United States Society on Dams (USSD)

Association of State Dam Safety Officials (ASDSO)

Technical Advisor for Natural Resources Conservation Service (NRCS) Study Work Group

Federal Emergency Management Agency (FEMA) Dam Safety Review Board Private Sector Representative (2009-2011)

Summary of Role and Experience

Vice President and Manager Dams and Hydraulics Section responsible for many areas of water resources engineering, including dam design and inspection, dam assessments, and design reviews, as well as providing construction contract administration services for dam and flood control projects. Special areas of expertise include hydrologic and hydraulic (H&H) studies for dams and bridges, dam rehabilitation, and facilitating potential failure modes analyses. Has provided engineering services on more than 500 dams of various types and sizes. Other technical specialties include designing fish passage facilities, conducting hydraulic analyses of natural and man-made waterways using steady and unsteady flow modeling techniques, performing water supply and safe-yield investigations for complex water supply systems, preparing bridge scour and spillway

erodibility investigations, and developing computer software for water resources engineering applications. Possesses proficiency with DAMS2/SITES, WSP2, HEC-1, HEC-HMS, HEC-2, HEC-RAS, HEC-4, NWS DAMBRK, MAPS, HY 8, KYPIPE, FLOWMaster and HMR52. Leads 2-D hydraulic modeling investigations using XP 2D, Flo-2D, SMS 2D, and TUFLOW. Has provided expert testimony and litigation support as a Hydraulic Engineer in the area of riverine flooding, water supply system operation, and public safety at low-head dams. Expert H&H Engineer on U.S. Army Corps of Engineers (USACE) Independent Peer Review Panels for Dam Safety Action Classification (DSAC) I Dams and new dam designs. Approved Federal Energy Regulatory Commission (FERC) facilitator for performing failure-modes analysis exercises for dams and an ASDSO instructor for conducting engineering and dam-owner workshops.

Related Projects

Development of Guidelines for the Evaluation of Risk-Based Hydrologic Safety of Dams, RiskMAP, Washington, DC, U.S. Department of Homeland Security (DHS), FEMA. Project Principal and co-author for a guidance document for the evaluation of the hydrologic safety of dams, including guidelines for determining the spillway design flood for new and existing dams. The compilation and publication of FEMA's *Selecting and Accommodating Inflow Design Floods for Dams* document will provide a tool to assist state dam safety programs in evaluating the adequacy of their current hydrologic guidelines and provide dam designers with a consistent methodology across state lines. The guidelines are intended to assist states and dam owners with difficult decisions and limited resources related to protecting the public safety and public resources. Tasks included performing a comprehensive literature review, administering a questionnaire regarding current hydrologic guidelines to each state and federal agency that regulates dams, preparing a report summarizing the state of the practice, and preparing a guidance document for the hydrologic safety of dams.

Dam Assessments, Breach Modeling, and Inundation Mapping for 112 Dams Located in WV, WI, NH, ND, and NM, U.S. Department of Agriculture (USDA), NRCS. Project Principal developing dam failure models; preparing inundation mapping using HEC-GeoRAS, HEC-RAS, ArcGIS, and Google Earth software; and performing dam assessments for 112 NRCS dams located in West





Virginia, Wisconsin, New Hampshire, North Dakota, and New Mexico. The dam breach unsteady-state hydraulic models range in reach lengths from 2 miles to 66 miles and include junctions and downstream tributaries. The H&H modeling tasks involved reviewing existing H&H data, including as-built drawings and emergency action plan (EAP) maps; collecting and processing topographic data using state-of-the-art geographic information system (GIS) tools; building and preparing dam breach models using HEC-GeoRAS and HEC-RAS software; preparing inundation mapping using ArcGIS and Google Earth tools; comparing dam breach inundation maps with existing EAP maps, relevant Federal Emergency Management Agency (FEMA) studies, and FEMA 100- and 500-year floodplain maps; and preparing user-friendly deliverables including four-dimensional inundation mapping videos using advanced ArcGIS and Google Earth tools. The dam assessment tasks also included performing dam inspections; conducting reconnaissance of downstream impact areas; preparing hydrologic and auxiliary spillway models using the NRCS SITES program to evaluate the sufficiency of the existing dams to conform to current design and analysis criteria; identifying deficiencies; preparing failure indexes; and developing and evaluating rehabilitation alternatives.

Indefinite Delivery/Indefinite Quantity Dam Architectural/Engineering Services, Dam Assessments, WV, NH, NM, WI, and ND, USDA, NRCS. Project Principal preparing dam assessment reports for 103 NRCS dams located in West Virginia, New Hampshire, New Mexico, Wisconsin, and North Dakota. Work includes performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam-failure modeling using HEC-RAS; preparing inundation mapping using ArcGIS; conducting hydrologic and hydraulic analyses; performing auxiliary spillway analyses using SITES; identifying deficiencies; and developing rehabilitation alternatives and planning-level cost estimations. Work also includes estimating persons at risk and completing NRCS risk evaluations.

Indefinite Delivery/Indefinite Quantity Dam Architectural/Engineering Services, Dam Assessments, WV, WI, ND, NM, and NH, USDA, NRCS. Senior Project Manager preparing dam assessment reports for 79 dams. Work includes performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam-failure modeling using HEC-RAS; preparing inundation mapping using ArcGIS; conducting hydrologic

and hydraulic analyses; performing auxiliary spillway analyses using SITES; preparing failure-risk indexes; identifying deficiencies; and developing rehabilitation alternatives.

Salem Fork Site 11 and Site 11A Hydrologic Analysis, Auxiliary Spillway Integrity Analysis, Dam Break Analysis, and Inundation Mapping, Harrison County, WV, USDA, NRCS. Project Principal conducting detailed hydrologic study, auxiliary spillway integrity analyses, and dam break hydraulic analyses of Salem Fork Site 11 and Site 11A dams and their floodplain in Harrison County, West Virginia. Tasks included reviewing existing H&H data; collecting topographic data; developing several NRCS SITES H&H models; performing a site visit; completing an approximate survey of channel obstructions; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software. The dam breach model was run to simulate failure of the dam during both sunny-day and hydrologic loading conditions in order to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios. A complete dam assessment, including developing dam rehabilitation alternatives was also prepared for this project.

Upper Deckers Site 1 Hydrologic Analysis, Auxiliary Spillway Integrity Analysis, Dam Break Analysis, and Inundation Mapping, Preston County, WV, USDA, NRCS. Project Principal conducting a detailed hydrologic study, auxiliary spillway integrity analyses, and dam break hydraulic analyses of Upper Deckers Site 1 dam and its floodplain in Preston County, West Virginia. Tasks included reviewing existing H&H data; collecting topographic data; developing several NRCS SITES H&H models; performing a site visit; completing an approximate survey of channel obstructions; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software. The dam breach model was run to simulate failure of the dam during both sunny-day and hydrologic loading conditions in order to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios. A complete dam assessment, including developing dam rehabilitation alternatives, was also prepared for this project.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 8

Years Experience with Other Firms: 1

Education:

BS, Geo-Environmental Studies, Shippensburg University, 2007

Professional Registrations:

Association of State Floodplain Managers, Inc. (ASFPM)
Certified Floodplain Manager (CFM) - No. [REDACTED]
(2009)

Certified Geographic Information Systems Professional
(GISP): Cert. No. 4 [REDACTED] (2013)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)
Pennsylvania Association of Floodplain Managers (PAFPM)

Summary of Role and Experience

Senior GIS Analyst responsible for providing geographic information system (GIS) solutions and support for government and private sector projects including but not limited to dams and hydraulics, geotechnical, water and wastewater, transportation, and environmental planning disciplines. Duties include employee supervision, task management, data development, conversion, processing, database development, spatial analysis, cartography, and quality assurance/quality control (QA/QC). Also has extensive experience in hydrologic and hydraulic (H&H) modeling and the development and testing of custom-built GIS models to aid in automation and QC. Proficient using the following software: Esri ArcGIS software suite (ArcInfo, ArcMap, ArcCatalog, ArcToolbox, Spatial Analyst); ArcGIS Online; ArcView 3.x; the U.S. Army Corps of Engineers HEC-RAS, HEC-HMS, and HEC-FIA; Global Positioning System (GPS) units (Trimble XT, XH and R1); and Microsoft Office Suite.

Related Projects

Risk Mapping, Assessment, and Planning (Risk MAP), Flood Studies U.S. Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA), Region IV. Lead Senior GIS Analyst completing and overseeing Risk MAP watershed studies in FEMA Region IV. Tasks have included a scoping meeting with the communities to determine areas in need for a new or revised study, and H&H analyses and technical reviews

along several hundreds of stream miles. Oversaw the review and completion of several other studies in the watershed through coordination with the U.S. Army Corps of Engineers (USACE) and another consulting firm. Additional tasks include flood hazard identification and mapping, development of DFIRM and Flood Risk products including consequence assessments using the results of the hydraulic models in Hazus to communicate risk and engage the communities in mitigation practices.

Map Modernization Program, PA, MD, VA, DE, and WV, DHS, FEMA, Region III. GIS Analyst developing H&H models to compute 100-year-flood elevations, and delineate new floodplain boundaries. Duties included developing hydrologically correct Digital Terrain Models and stream networks to support automated H&H modeling and floodplain mapping. Redelineated the 1 and 0.2 percent annual chance floodplain and regulatory floodway boundaries for miles of effective, detailed studied streams using updated terrain data. Revised Zone A Special Flood Hazard Areas based on new approximate H&H analyses along streams using customized GIS tools and HEC-RAS modeling. Developed and distributed regulatory DFIRM products, and also developed an ArcGIS Online Web Map to disseminate modeling results for PA.

Risk MAP Conversions, Hendry, Martin, and Okeechobee Counties, FL, DHS, FEMA, Region IV. Lead Senior GIS Analyst producing Risk MAP products for three counties in Florida. Products are used by FEMA to increase public awareness and lead to action that reduces risk to life and property. Based off of hydraulic models for more than two dozen flooding sources, floodplains were delineated and supplemental products were developed to identify flood risk. Based on FEMA guidelines and specifications, GIS databases and a Flood Risk Report and Flood Risk Map were developed using custom GIS tools for each of the counties. The Risk MAP products were presented to the communities to identify mitigation actions.

Modeling, Mapping, and Consequence (MMC) Analyses for Dams, Bathymetric Channel Surface GIS Tool Development, Nationwide, USACE, Vicksburg District. Lead Senior GIS Analyst designing the workflow and GIS tools to aid in three-dimensional (3-D) visualization and bathymetric channel surface development. Through testing with out-of-the-box Esri tools and various terrain sources such as LiDAR and NED, several workflows and a suite of custom GIS tools were designed to automate the



Resume – Ashley R. Mengle, CFM, GISP

Architectural/Engineering Services, Solicitation Number HSE1600000002



development of a bathymetry stream channel surface and the visualization of 3-D GIS data in Esri's desktop environment. Worked closely with a developer to communicate tool requirements and overseeing the development of the python scripts. Throughout the development process, performed extensive QC of the ArcGIS Add-in and ArcGIS toolbox to minimize user error as much as possible, as well as data input issues. Also developed help documentation and training resources, which included tutorial videos to provide step-by-step instructions on how to use the tools.

MMC Analyses for Dams, Nationwide, USACE, Vicksburg District. Senior GIS Analyst performing dam break analyses and leading inundation mapping and consequence assessments for multiple dams across the nation. Tasks have included data development and terrain processing, modeling five failure scenarios and five operational scenarios using HEC-RAS, performing inundation mapping using custom GIS tools, developing map products, and conducting a consequence assessment using HEC-FIA. HEC-RAS dam break models were developed along more than 1,200 river miles. Tasks under this project also include leading the development of consequence assessments using HEC-FIA. Results from the dam break analyses, Hazus, and the National Structure Inventory were used to determine structure damage values, populations at risk, and life-loss estimates. Larger event failure scenarios were modeled for multiple warning times varying before and after breach initiation. Evacuation rates, warning times, and depths of flooding were assessed to determine the areas where the most people would be impacted by flooding. Results are used for future risk-based assessments and prioritization.

Consequence Assessment Reports (CAR), Nationwide, USACE, Vicksburg District. Senior GIS Analyst leading the development of CARs to support the Critical Infrastructure Protection and Resilience and Dam Safety programs under the MMC Production Center for USACE. Eleven dam break and HEC-FIA models were developed and analyzed, and hydraulic and economic results were summarized in the comprehensive CAR. Data was gathered to understand the history of the dam site and the consequences from a potential dam failure. Inundation mapping was developed for the fail and non-fail scenarios at each of the dams across the United States. GIS data was analyzed to summarize the impacts of the inundation areas on critical infrastructure. An

overview of the extents of consequences within communities was included in the CAR, which describes the populated reaches downstream of the dam and the critical facilities that are impacted. The reach extents summary also includes failure wave arrival time and depth information that would be beneficial for community officials to use for evacuation purposes. These CARs will be used to develop a standardized Emergency Action Plan (EAP) map product.

Dam Break Modeling and Consequence Analysis for R.D. Bailey Dam; Wyoming and Mingo Counties, WV, USACE, Vicksburg District. GIS Analyst performing a dam break analysis and leading a consequence analysis for R.D. Bailey Dam. Tasks have included topographic data development, modeling five failure scenarios and five operational scenarios using HEC-RAS, and performing inundation mapping using custom GIS tools. Tasks also include leading the development of a consequence assessment using USACE HEC-FIA. Results from the dam break analysis were used as inputs for population at risk and life-loss estimates. Evacuation rates, warning times, and depths of flooding have been assessed to determine the areas where the most people would be impacted by flooding.

Dam Assessments, WV, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). GIS Analyst preparing dam assessment reports for 66 NRCS dams located in West Virginia. Work included collection and compilation of GIS data used for modeling including a digital terrain model, stream network, and base mapping data. Tasks also involved performing dam-failure modeling using HEC-RAS and preparing inundation mapping.

Q16-5291





Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 16

Years Experience with Other Firms: 1

Education:

BS, Civil Engineering, The Pennsylvania State University, 1997

MS, Civil Engineering, The Pennsylvania State University, 1999

Professional Registrations:

PE: Pennsylvania - No. [REDACTED] (2004); New Hampshire - No. [REDACTED] (2014)

Certified Floodplain Manager - (2009)

Professional Affiliations:

American Society of Civil Engineers (ASCE)

Association of State Dam Safety Officials (ASDSO)

United States Society on Dams (USSD)

Summary of Role and Experience

Hydrology and Hydraulics Group Manager and Senior Project Engineer in the Dams and Hydraulics Section

responsible for leading a team of engineers to perform hydrologic and hydraulic (H&H) analyses for water resources projects and design hydraulic structures related to flood control reservoirs, dams, bridges, and channel improvement construction, rehabilitation, and reconstruction projects, including the design of spillways, outlet works, and stilling basins. In addition to completing H&H analyses, responsibilities include verifying the work of others and interpreting and communicating results to the project team and to the client. Also responsible for teaching technical training seminars on hydrology and hydraulics. Technical specialties include conducting two-dimensional (2-D) hydraulic modeling, developing dam break inundation mapping based on unsteady hydraulic models, performing hydrologic analyses to route inflow hydrographs through complex reservoir systems, assessing bridge scour, assessing hazard classification of hydraulic structures based on failure consequences, and determining the reservoir safe yield. Proficient in using the U.S. Army Corps of Engineers (USACE) HEC-1, HEC-2, HEC-RAS, and HEC-HMS software; the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Water Resource Sites Analysis (SITES) computer model; PondPack; and the Watershed Modeling System, as well as developing in-house computer programs for

water resource engineering applications. Has provided litigation support as a Hydraulic Engineer in the area of riverine flooding and water supply system operation.

Related Projects

Dam Assessments, WV, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). Senior Project Engineer reviewing H&H analyses associated with dam assessment reports for 66 NRCS dams located in West Virginia. Work included performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam-failure modeling using HEC-RAS; preparing inundation mapping, H&H analyses, and auxiliary spillway analyses using the NRCS SITES computer model; identifying deficiencies; and developing rehabilitation alternatives and planning-level cost estimations.

Lost River Watershed, Hardy County, WV, USDA, NRCS. Project Engineer completing H&H planning-level studies and investigations to support an environmental impact statement and designing a new 90-foot-high zoned earthfill dam. Completed hydrologic analyses using the NRCS SITES computer model, which was also used to evaluate the proposed spillway's susceptibility to erosion damage and breaching. Performed dam break analyses using HEC-RAS and HEC-GeoRAS in conjunction with ARC-GIS. Tasks also included preparing dam break inundation mapping.

Indefinite Delivery/Indefinite Quantity Architectural/Engineering Services, Upper Deckers Creek Site 1 Safe-Yield Study, Preston County, WV, USDA, NRCS. Senior Project Engineer assessing safe yield for Upper Deckers Creek Site 1. Work included developing a computer model and a hydrologic database to simulate the daily operation of the reservoir for the period of transposed streamflow record from approximately 1910 to 2011. Safe yield for a range of possible storage conditions was investigated based on computer model simulation and on requirements in compliance with the West Virginia Division of Health Guidelines. Prepared drawdown statistics, a safe-yield-probability relationship, and a summary report.

Development of Guidelines for the Risk-Based Hydrologic Safety of Dams, Washington, DC, U.S. Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA). Author of two





documents related to the evaluation of the hydrologic safety of dams under FEMA's Risk Mapping, Assessment and Planning Strategy. The first document, *FEMA P-919: Summary of Existing Guidelines for the Hydrologic Safety of Dams*, includes a comprehensive literature review and a survey of the hydrologic guidelines currently used by each state and federal agency that regulates dams. The second document, an update to *Selecting and Accommodating Inflow Design Floods for Dams*, is intended to provide a tool to assist state dam safety programs in evaluating the adequacy of their current hydrologic guidelines and provide dam designers with a consistent methodology across state lines.

HEC-HMS and HEC-RAS Technical Seminar, Various Locations, ASDSO. Co-Instructor for two technical seminars sponsored by the Association of State Dam Safety Officials (ASDSO): HEC-HMS and HEC-RAS. The HEC-HMS course focused on hydrologic computations for dam safety using the USACE's Hydrologic Modeling System. The HEC-RAS course provided instruction in one-dimensional, steady, and unsteady numerical hydraulic modeling with a focus on applications for dam safety. The co-instructor for both courses was Dr. Arthur C. Miller. ASDSO plans to continue to offer these courses annually on an alternating basis.

Floodplain Map Modernization Program, Region III Flood Studies, Clinton, Centre, and Luzerne Counties, PA, U.S. DHS, FEMA, Region III. Project Engineer reviewing Zone A flood inundation mapping for Clinton and Centre counties and completing and reviewing detailed H&H studies in Luzerne County. Also responsible for verifying the computer application that was developed to automate hydrologic computations. As a member of a joint venture, our firm was issued task orders to develop Digital Flood Insurance Rate Maps (DFIRMs) and Flood Insurance Studies (FIS) in accordance with FEMA DFIRM geographic information system (GIS) database specifications. Combined the effective FIS and flood hazard mapping information for 65 communities within Clinton County and Centre County into a single countywide FIS and DFIRM using automated procedures within a GIS environment.

Dam Break Analysis for Clifton Forge Dam, Clifton Forge, Alleghany County, VA, Town of Clifton Forge. Project Manager conducting a detailed dam break analysis of Clifton Forge Dam and its downstream floodplains in Alleghany County, Virginia. Tasks included reviewing existing H&H data; analyzing soil, land use, and

topographic data; developing H&H models of the study site using HEC-GeoHMS, HEC-HMS, HEC-GeoRAS, HEC-RAS, and geographic information system (GIS) software; applying HMR 51 and 52 methodology to obtain probable maximum precipitation/storm estimates; modeling the dam breach and running the unsteady flow hydraulic computations in HEC-RAS; and determining the flood inundation areas using GIS. Evaluated sunny-day and hydrologic loading conditions to predict the flood extents and water surface elevations of outflow from the reservoir for each scenario.

Ryerson Station State Park Dam Emergency Action Plan (EAP), Greene County, PA, Pennsylvania Department of Conservation and Natural Resources (DCNR). Hydrologic and Hydraulic Task Manager overseeing completion of dam break analysis and inundation mapping for the EAP for Ryerson Station State Park Dam. Analyses included evaluation of hazard areas; hydrologic analyses using geographic information system (GIS)-based watershed models and application of HMR 51 and 52, as well as HEC-HMS; auxiliary spillway analyses using the NRCS SITES computer model; incremental damage analysis; dam breach analyses and hydraulic computations using the unsteady flow component of HEC-RAS; and the development of flood inundation hazard area mapping using GIS.

Ryerson Station State Park Dam, Greene County, PA, Pennsylvania DCNR. Project Engineer performing H&H analyses for the conceptual design of dam rehabilitation alternatives for the existing concrete gravity dam. Estimated the probable maximum flood and other events using a HEC-1 hydrologic model of the watershed and reservoir. Prepared spillway discharge rating curves for the existing spillway based on the U.S. Department of the Interior, Bureau of Reclamation's methodology presented in *Design of Small Dams*. Performed standard-step backwater analyses of the reach downstream of the dam using the HEC-RAS computer model to assess tailwater conditions during extreme flood events.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 1

Years Experience with Other Firms: 8

Education:

BS, Geography, The Pennsylvania State University, 2007

Professional Registrations:

ASFPM Certified Floodplain Manager (CFM): Association of State Floodplain Managers, Inc. - No. [REDACTED] (2011)

Summary of Role and Experience

GIS Analyst with over 10 years of GIS and mapping experience. As a member of the GIS team within the Environmental Resources Division at the Camp Hill, PA office, Robert provides support for the following disciplines: dams and hydraulics, geotechnical, transportation, and environmental planning. Relevant skills include cartography, spatial analysis, database management, GIS quality control, FEMA DFIRM production, FEMA Risk MAP products, terrain processing, remote sensing, and 3D analysis. Proficient in the following software: Esri ArcGIS software suite, ArcSDE, Model Builder, ArcGIS Online, HAZUS, Global Positioning System (GPS), and Microsoft Office, including Word, Excel, PowerPoint, and Access. Additionally, Robert has over three years of project management experience and has been involved with approximately 50 FEMA Flood Insurance Studies where he provided support in management, GIS/mapping, community outreach, and quality control.

Related Projects

Risk Mapping, Assessment, and Planning (MAP) Conversion, Conococheague-Opequon Watershed, Region III, parts of MD, PA, VA, and WV, U.S.

Department of Homeland Security, Federal Emergency Management Agency (FEMA), Region III. Deputy Project Manager and GIS Specialist responsible for daily project management tasks, client communications, and creation of Risk MAP products for the Conococheague-Opequon Watershed in parts of four states. The products are used by FEMA to increase public awareness and lead to action that reduces risk to life and property. Based on FEMA guidelines and specifications, flood risk datasets including flood depth grids and HAZUS risk assessment data, were incorporated into a Flood Risk Database, Flood Risk Report and Flood Risk Map for the Watershed.

The Risk MAP products were to be presented to the communities at subsequent Resilience Meetings to help identify mitigation actions.

Risk MAP Conversions, Virginia Coastal Risk MAP Product Development, U.S. Department of Homeland Security, FEMA, Region III and U.S. Army Corps of Engineers (USACE). Deputy Project Manager and GIS Specialist tasked with the compilation of Risk MAP Products for the coastal regions of eight separate Virginia counties within FEMA Region III. Played a major role in the development of specifications for delivering the FEMA Region III Total Exposure in Floodplain (TEIF) risk assessment data within the aforementioned Risk MAP Products. Additionally, assisted with daily project management tasks and client communications, and also assisted with QA/QC on the developed products.

FEMA Risk MAP, Coastal Flood Studies – Region III, parts of DE, MD, and VA, U.S. Department of Homeland Security, FEMA, Region III. GIS Specialist responsible for development of seamless floodplain mapping, DFIRM databases, FIRM panels, and Flood Insurance Study Reports for coastal areas in three Delaware counties, five Maryland counties, and seven Virginia counties. The developed DFIRM map products were delivered to the FEMA Mapping Information Platform and distributed to all communities within the coastal study areas. Subsequently attended Consultation Coordination Officer (CCO) Meetings where the Flood Insurance Study materials were presented to community officials; also attended Open House Meetings to relay floodplain information to community members through the use of an interactive web-based flood information portal. At the conclusion of the comments and appeals period for each county, the final map products were developed and delivered to the FEMA Map Service Center for publication.

Risk MAP Program Support, York County, PA, U.S. *Department of Homeland Security, FEMA.* GIS Specialist responsible for the incorporation of approximately 850 miles of newly modeled streams and associated floodplains into a countywide DFIRM Database and creation of FIRM Panels. The developed DFIRM map products were delivered to the FEMA Mapping Information Platform and distributed to all communities within York County, PA. Additional tasks included floodplain mapping and a risk assessment in HAZUS, utilizing user-defined depth grids based on hydraulic models, to communicate risk and engage the



Resume – Robert M. Wiley, CFM

Architectural/Engineering Services, Solicitation Number HSE160000002



communities in mitigation practices. The risk assessment data was incorporated into a county Flood Risk Database, Flood Risk Report and Flood Risk Map.

FEMA Risk Mapping, Assessment, and Planning (MAP), Flood Studies – Allegheny, Bradford, and Sullivan Counties, PA, U.S. Department of Homeland Security, FEMA, Region III. GIS Specialist responsible for development of seamless floodplain mapping, countywide DFIRM databases, FIRM panels, and Flood Insurance Study Reports for three Pennsylvania counties. The developed DFIRM map products were delivered to the FEMA Mapping Information Platform and distributed preliminary to all communities within the study areas. Subsequently attended Consultation Coordination Officer (CCO) Meetings where the Flood Insurance Study materials were presented to community officials. Also responsible for incorporating comments and appeals for each county into the DFIRM Databases and DFIRMs. After all appeals were incorporated, the final map products were developed and delivered to the FEMA Map Service Center for publication.

Risk MAP Conversions, Allegheny, Bradford, and Sullivan Counties, PA, U.S. Department of Homeland Security, FEMA, Region III. GIS Specialist responsible for producing Risk MAP products for three counties in Pennsylvania. Products are used by FEMA to increase public awareness and lead to action that reduces risk to life and property. Based off of hydraulic models, floodplains were delineated and supplemental products were developed to identify flood risk. Based on FEMA guidelines and specifications, a Flood Risk Database, Flood Risk Report and Flood Risk Map were developed for each of the counties. The Risk MAP products were presented to the communities at subsequent Resilience Meetings to help identify mitigation actions, receiving positive feedback from attendees and FEMA.

FEMA Risk MAP, Flood Study – Wateree Watershed, Region IV, SC, U.S. Department of Homeland Security, FEMA. Project Manager responsible for overseeing the budget and production of the Flood Insurance Study materials and community outreach of the Wateree Watershed study in South Carolina. DFIRM databases were developed alongside Flood Insurance Rate Maps (FIRMs) for four separate counties. Those products were then distributed to all participating communities within the study extents and Preliminary DFIRM Community Coordination (PDCC) Meetings were held following the release of Flood Insurance Study materials.

Risk MAP Conversions, Clarendon, Orangeburg, and Williamsburg Counties, SC, U.S. Department of Homeland Security, FEMA, Region IV. Project Manager and GIS Specialist responsible for producing Risk MAP products for three counties in South Carolina. Products are used by FEMA to increase public awareness and lead to action that reduces risk to life and property. Based off of hydraulic models for more than 40 flooding sources, floodplains were delineated and supplemental products were developed to identify flood risk. Based on FEMA guidelines and specifications, a Flood Risk Database, Flood Risk Report and Flood Risk Map were developed for each of the counties. The Risk MAP products were presented to the communities at subsequent Resilience Meetings to help identify mitigation actions.

North Carolina Statewide Digital Orthoimagery Quality Control, North Carolina Center for Geographic Information and Analysis (CGIA). GIS Specialist responsible for conducting and overseeing the review of orthoimagery raster data collected and processed for the state of North Carolina in an effort to improve the accuracy for the North Carolina 911 Board. The review included the following components: visual quality, metadata, and horizontal accuracy. Several rounds of visual reviews were coordinated through the use of Esri's ArcGIS software, and any necessary corrections were made to the raster files before sending to the client for publication. The data was then published to the North Carolina One Map Geospatial Portal, where the orthoimagery is available for public use.

Map Modernization Program, PA, MD, VA, DE, and WV, U.S. Department of Homeland Security, FEMA, Region III. GIS Associate responsible for aiding in the updating and creation of Digital Flood Insurance Rate Maps for FEMA so the organization can move floodplain data and maps to a digital format. Mapping applications were performed through the FEMA DFIRM Toolset, which utilized Job Tracking for ArcGIS (JTX), to track progress on each ongoing Map Modernization Program study throughout the country.

Q16-5291





Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 12

Years Experience with Other Firms: 0

Education:

BS, Geo-Environmental Studies, Shippensburg University, 2004

MS, Biology, Shippensburg University, 2009

Professional Registrations:

Certified Floodplain Manager (CFM) - Cert. No. [REDACTED] (2010)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

Society of Wetland Scientists

Summary of Role and Experience

Environmental Scientist II responsible for performing terrestrial and aquatic ecosystem studies in association with National Environmental Policy Act (NEPA) and Pennsylvania Department of Environmental Protection (PADEP) Chapter 105/U.S. Army Corps of Engineers (USACE) Section 404 permitting. Responsibilities include task management of terrestrial and aquatic ecosystem investigations, report writing, agency coordination in association with PADEP Chapter 105 and USACE Section 404 permit applications and Ohio Environmental Protection Agency (OEPA) Individual 401 Water Quality Certification, and coordination with project engineers and technicians to minimize and avoid impacts to natural resources.

GIS Analyst II responsible for providing geographic information system (GIS) support for government and private sector projects including but not limited to dams and hydraulics, geotechnical, water and wastewater, transportation, environmental analysis, wetland delineation, and U.S. Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) flood insurance studies (FIS). Duties include data development, conversion, processing, database development, spatial analysis, cartography, and quality assurance/quality control (QA/QC).

Related Projects

FEMA Flood Map Modernization Program, Lincoln County, WV, DHS, FEMA, Region III. GIS Analyst leading

basemap acquisition and development and Digital Flood Insurance Rate Map (DFIRM) development and preliminary mapping for this updated countywide study. Duties included coordinating with municipalities and Lincoln County to obtain the most up-to-date GIS data available; manipulating and creating a DFIRM database in accordance with Appendix L of the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners*; performing QA/QC of a countywide FIS report in accordance with Appendix J of the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners*; utilizing the DFIRM Development Kit to streamline preliminary map creation and annotation that will be distributed to the communities and county. Involved with outreach including community meetings to discuss final FEMA products.

FIS Report Production, Various Locations, PA, DHS, FEMA, Region III. GIS Analyst developing FIS reports for 14 counties in accordance with Appendix J of the FEMA *Guidelines and Specifications for Flood Hazard Mapping Partners*. Duties included merging multiple effective FIS studies, georeferencing effective DFIRM, producing flood profiles, producing floodway data tables, and conducting QA/QC of project deliverables. The final product included combining effective FISs for each community within a county into a single, countywide FIS.

Indefinite Delivery/Indefinite Quantity (ID/IQ) Contract – Lost River Site 16 Dam, Lost City, Hardy County, WV, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), West Virginia State Office. Environmental Scientist supervising the field effort to identify and delineate waterways and wetlands according to the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)*. Delineation efforts encompassed the 235-acre Lost River Site 16 study area and the 14-acre Edwards Run off-site mitigation area located in Hampshire County. Accompanied the USACE during the field review of the delineation boundaries, which resulted in the USACE approving the boundaries and issuing a preliminary jurisdictional determination, which was later used in calculating wetland and stream impacts. Served as the USDA's authorized agent and primary author of the USACE Application for Department of the Army (404) Permit and State of West Virginia Department of Environmental Protection Application for 401 Water Quality Certification.





Floodplain Map Modernization Program, PA, MD, VA, DE, and WV, DHS, FEMA, Region III. GIS Analyst providing basemap compilation, data conversion, and digitization of flood data. Responsible for the development of DFIRM database layers and quality control of FIS reports, such as flood profiles and floodway data tables. Georeferenced effective maps to accurate basemaps and digitized flood hazard data. Performed GIS QC using customized tools and topology classes. Conducted consistency checks between the DFIRM database and countywide FISs. Used GIS tools provided on FEMA's Mapping Information Platform to produce hard-copy DFIRM panels.

FEMA Floodplain Mapping, Bedford, Franklin, Fulton, and Huntingdon Counties, PA, DHS, FEMA, Region III. GIS Analyst laying out cross sections, computing 100-year-flood elevations, and delineating new floodplain boundaries. Duties included developing hydrologically correct digital terrain models and stream networks to support automated hydraulics and hydrology (H&H) modeling and floodplain mapping. Redelineated the 1 and 0.2 percent annual chance floodplain and regulatory floodway boundaries for miles of effective, detailed, studied streams using updated terrain data. Revised Zone A Special Flood Hazard Areas based on new approximate H&H analyses along streams using customized GIS tools and HEC-RAS modeling. Managed the completion of preliminary DFIRM production and distributions to the communities within these counties. Involved with outreach to these counties in community meetings to discuss final product presentation.

FEMA Floodplain Mapping, Blair, Cambria, Cameron, Clarion, Clearfield, Luzerne, and Forest Counties, PA, DHS, FEMA, Region III. GIS Analyst laying out cross sections, computing 100-year-flood elevations, and delineating new floodplain boundaries. Duties included developing hydrologically correct digital terrain models and stream networks to support automated H&H modeling and floodplain mapping. Developed triangular irregular networks from light detection and ranging used in modeling and mapping. Redelineated the 1 and 0.2 percent annual chance floodplain and regulatory floodway boundaries for miles of effective, detailed, studied streams using updated terrain data. Revised Zone A Special Flood Hazard Areas based on new approximate H&H analyses along streams using customized GIS tools and HEC-RAS modeling.

Floodplain Map Modernization Program, York County, PA, DHS, FEMA, Region III. GIS Analyst preparing draft digital data for DFIRM production. Duties included collecting and manipulating basemaps, processing GIS data sets into a single Esri personal geodatabase in accordance with Appendix L of the *FEMA Guidelines and Specifications for Flood Hazard Mapping Partners*, performing QA/QC of a countywide FIS report in accordance with Appendix J of the *FEMA Guidelines and Specifications for Flood Hazard Mapping Partners*, producing metadata, georeferencing scanned flood hazard boundary map and FIRMs, and digitizing floodplain boundaries.

Floodplain Map Modernization Program, Adams County, PA, DHS, FEMA, Region III. GIS Analyst preparing draft digital data and the development of DFIRMs. Duties included collecting and manipulating basemaps, processing GIS data sets into a single Esri personal geodatabase in accordance with Appendix L of *FEMA Guidelines and Specifications*, georeferencing scanned flood hazard boundary maps and FIRMs, digitizing floodplain boundaries, performing QA/QC of a countywide FIS report in accordance with Appendix J of the *FEMA Guidelines and Specifications for Flood Hazard Mapping Partners*, using FEMA-developed DFIRM tools to produce DFIRMs in accordance with Appendix K of the *FEMA Guidelines and Specifications for Flood Hazard Mapping Partners*, and conducting manual and automated QA/QC of deliverables. The final product included combining flood hazard mapping information for each community within a county into a single, countywide DFIRM and making draft and preliminary submissions in the required GIS submittal format using the K (Production) drive on the Mapping Information Platform.

Development of the DFIRM Development Kit (DDK), Camp Hill, PA. Led the design and development of the DDK, a customized GIS approach to the creation of DFIRM products that meet FEMA guidelines and specifications. Utilized file geodatabases and new functionality found in ArcGIS 10.x such as Data-Driven Pages, Dynamic Text, and the Map Production Extension aids in streamlining the process of creating final and preliminary FEMA DFIRM products.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 7

Years Experience with Other Firms: 1

Education:

BS, Geo-Environmental Studies, Shippensburg University, 2009

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

Summary of Role and Experience

GIS Analyst responsible for providing geographic information system (GIS) support, such as collecting and managing GIS data, creating cartographic maps for internal clients among the different practices in our firm and for external clients such as the Federal Emergency Management Agency (FEMA), and maintaining quality assurance/quality control (QA/QC) on the data. Adept at using various software programs such as the ArcGIS 9 and 10.x package, ArcView 3.x, Global Positioning System (GPS) units (Trimble XH and XT), ArcPad 10 and mobile GIS, and Microsoft Office, including Word, Excel, and PowerPoint.

Related Projects

Risk Map, Coordinated Needs Management Strategy, Southeastern U.S., U.S. Department of Homeland Security (DHS), FEMA, Region IV. GIS Analyst for database organization; collection of engineering study information by means of the Flood Insurance Study report, FEMA library, and FEMA Map Service Center; and validation of the engineering study along all detailed and approximate reaches in 71 counties.

FEMA Flood Map Modernization Program, Bedford, Fulton, Franklin, and Huntingdon Counties, PA, DHS, FEMA, Region III. GIS Analyst assisting in the redelineation and mapping of floodplains using new light detection and ranging data to more accurately model 100-year and 500-year floodplain boundaries. Duties included creating countywide stream centerline layers, attributing stream centerline layers, conducting new approximate hydraulic and hydrologic analyses along streams using customized GIS tools and HEC-RAS modeling, revising county floodplain polygon and line layers, and building Digital Flood Insurance Rate Map databases.

DFIRM Development Kit (DDK), Camp Hill, PA, DHS, FEMA, Region III. GIS Analyst tasked with testing and providing constructive input on how to improve the DDK, resulting in a more efficient and better process when creating Digital Flood Insurance Rate Maps (DFIRMs). Assisted in creating and writing the *DDK Instruction Manual*, a detailed document of how to use the DDK to create DFIRMs. The DDK is a customized GIS approach to the creation of DFIRM products that meet FEMA guidelines and specifications.

Map Modernization Program, Bedford, Blair, Cambria, Clearfield, Cameron, Clarion, Forest, Franklin, Fulton, and Huntingdon Counties, PA, DHS, FEMA, Region III. GIS Analyst assisting in the creation of final deliverable DFIRM products for FEMA's Map Service Center store. Tasks include incorporating valid comments from municipalities on preliminary DFIRMs, creating georeferenced .png files of the maps, and finalizing geodatabase data for deliverables.

Modeling, Mapping, and Consequence (MMC) Analyses for Dams, Dam Break Studies, Nationwide, U.S. Army Corps of Engineers (USACE), Vicksburg District. GIS Analyst tasked with pre- and post-HEC-RAS processing for dam break studies across the United States. LiDAR data from various sources covering hundreds of square miles was gathered and processed. A bathymetric channel surface was developed using custom GIS tools to estimate underwater geometry for cutting cross sections. A number of additional custom GIS tools were developed and used for data development and import in to HEC-RAS. Results were extracted from HEC-RAS, and inundation areas were delineated in GIS. Custom smoothing algorithms are applied to the inundation boundaries to minimize clean and maintain consistency.

MMC Analyses for Dams, Consequence Assessments, Nationwide, USACE, Vicksburg District. GIS Analyst tasked with performing consequence assessments by using USACE's HEC-FIA program. The HEC-FIA models were developed to analyze flood impacts to better plan for flood emergencies and to assess post flood disasters. Numerous custom GIS tools were developed to compile data for import into HEC-FIA. Damages are assessed at each structure that is input into the model. The structure inventory was imported from a combined statewide Hazus database. Structures were reviewed to make sure they were not within the stream channel in order to avoid damages being calculated on low-flow simulations. A terrain grid was used to determine structure





elevations. A depth grid for each of the 10 scenarios modeled was imported. Simulations were modeled for each of the fail and non-fail scenarios modeled in HEC-RAS. For each scenario, a detailed summary report was produced containing the cost of damages broken down by impact area. The population at risk and life loss estimates, based on evacuation, warning times, and depth of flooding, were analyzed to determine the areas where most people would be impacted by the flooding. These results were reviewed and compiled for all scenarios of the dam break analyses and will be used for future risk-based assessments and prioritization.

MMC Analyses for Dams, Bathymetric Channel Surface GIS Tool Development, Nationwide, USACE, Vicksburg District. GIS Analyst assisting in the creation of the workflow and GIS tools developed for three-dimensional (3-D) visualization and bathymetric channel surface development. Through testing with out-of-the-box Esri tools and various terrain sources, such as LiDAR and NED, several workflows and a suite of custom GIS tools were designed to automate the development of a bathymetry stream channel surface and the visualization of 3-D GIS data in Esri's desktop environment. Throughout the development process, performed extensive QC of the ArcGIS Add-in and ArcGIS toolbox to minimize user error and data input issues as much as possible. Also developed help documentation.

Dam Breach Inundation, Hazard Classification, and Spillway Design Flood Determination for Five Dams, Various Locations, VA, Virginia Department of Conservation and Recreation. GIS Analyst modeling a storm event using HEC-HMS and using that data to develop a hydraulic model using HEC-RAS. Also in charge of floodplain and inundation area mapping with the results from the hydraulic model using ESRI's ArcGIS products. The hazard classification of each dam was identified and an incremental damage analysis was performed to determine the regulatory spillway design flood. Deficiencies in spillway capacity were identified and dam failure inundation maps were prepared.

Risk Mapping, Assessment, and Planning Program Support, Harpeth River Watershed Flood Study, TN, DHS, FEMA, Region IV. GIS Analyst completing a Risk MAP watershed study in the Harpeth River Watershed in Tennessee. Tasks included hydrologic and hydraulic (H&H) analyses conducted along several flooding sources in the watershed. Assisted in the development of the hydraulic model for the Harpeth River in Williamson

County, Tennessee, using HEC-RAS, modeling five recurrence intervals based on FEMA guidelines and specifications. Additional tasks include developing a workflow to efficiently and accurately attribute the flood risk database through the creation of several custom tools to analyze the consequence assessment data from Hazus, using the results of the hydraulic model in Hazus to communicate risk and engage the communities in mitigation practices.

Mobile GIS Training, Schuylkill County, PA, Schuylkill County Municipal Authority (SCMA). GIS Analyst providing a 2-day training to the SCMA on setup of ArcPad 10.0 and Trimble software used for field collection, including how to collect information using a Trimble GeoXH model GPS and how to post-process using Trimble GPS Correct and Pathfinder Office. This training was hands-on and showed how to prepare data to be collected in the field, create a custom form using ArcPad Studio in order to efficiently input attributes while in the field, and differentially correct data back in the office using Pathfinder Office. Lastly, loaded the final data from field inventory into the master database using ArcMap 10.0, ArcPad Data Manager extension.

Rapid Response Phone Data Collection. GIS Analyst extracting names, phone numbers, and addresses for certain water and sewer authority clients in Pennsylvania. This data is needed for input into the Rapid Response system, which is a notification process that will send phone, e-mail, or text messages to everyone in the system or certain lists of people depending on how the client chooses to use the program.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 6

Years Experience with Other Firms: 3

Education:

BS, Civil Engineering, Utah State University, 2008

MS, Civil and Environmental Engineering, Utah State University, 2009

Professional Registrations:

PE: Utah - No. [REDACTED] (2013)

Certified Floodplain Manager - No. [REDACTED] (2011)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

Association of Dam Safety Officials (ASDSO)

United States Society on Dams (USSD)

Summary of Role and Experience

Hydraulic and Hydrologic Engineer responsible for management and execution of projects related to hydraulic structures such as flood control reservoirs, spillways, outlet works, stilling basins, bridges, and stream channel improvements. Technical specialties include performing hydraulic and hydrologic (H&H) analyses for dams, conducting dam assessments, completing regulatory Federal Emergency Management Agency (FEMA) floodplain analyses and map revisions, assessing bridge scour, performing dam failure inundation analyses and mapping, designing labyrinth spillways, and estimating reservoir safe yield. Proficient in the use of U.S. Army Corps of Engineers' (USACE) HEC-1, HEC-2, HEC-RAS, and HEC-HMS software; the Natural Resources Conservation Services' (NRCS) Water Resource Site Analysis (SITES) computer model; Esri's ArcGIS suite and ArcView applications; AutoCAD; and MathCAD, as well as the development of in-house computer programs for water resource engineering applications.

Related Projects

Dam Assessments, WV, U.S. Department of Agriculture (USDA), NRCS. H&H Designer preparing dam assessment reports for 66 NRCS dams and dam failure inundation mapping reports for 34 additional NRCS dams located in West Virginia. Work included performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam failure modeling using HEC-RAS; preparing inundation mapping; completing

hydraulic, hydrologic, and auxiliary spillway analyses using SITES; identifying deficiencies; and developing rehabilitation alternatives and planning-level cost estimations.

FEMA Map Modernization Program, Clarion, Franklin, and Fulton Counties, PA, U.S. Department of Homeland Security (DHS), FEMA, Region III. GIS Analyst and Hydraulic Designer delineating and editing new floodplain boundaries. Created a steady-state hydraulic model in HEC-RAS using georeferenced elevation and land data; mapped the updated floodplain in ArcView; corrected the hydraulic model based on the mapping using an iterative process; and edited the final floodplain in ArcView. The project consisted of revising Zone A Special Flood Hazard Areas based on new approximate H&H analyses along streams using customized geographic information system (GIS) tools and HEC-RAS modeling.

New Creek Site No. 14 Dam Break Analysis and Inundation Mapping, Grant County, WV, USDA, NRCS. H&H Designer conducting a detailed dam break hydraulic analysis of New Creek and its floodplain in Grant and Mineral counties. Tasks included reviewing existing H&H data; collecting topographic data; performing a site visit; completing an approximate survey of channel obstructions, including 22 bridges; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software. The model was run to simulate failure of the dam during both sunny day and hydrologic loading conditions in order to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios.

Upper Deckers Creek Site 1 Dam Rehabilitation, Preston County, WV, USDA, NRCS, West Virginia State Office. H&H Engineer overseeing the completion and review of design-phase services for rehabilitating this 55-foot-high, zoned earth embankment dam, specifically the H&H Proportioning Design Reports. The dam is a high-hazard structure with a reinforced concrete principal spillway conduit and earth cut auxiliary spillway. Final rehabilitation design includes replacement of the existing riser structure, extension of the principal spillway conduit, modification of the dam embankment to serve as an auxiliary spillway with the addition of a stepped, roller-compacted concrete (RCC) chute, flattening the downstream embankment slope for stabilization, and filling/abandoning the existing auxiliary spillway due to integrity concerns. The normal pool elevation of the





reservoir will be raised as part of the project to increase water supply storage for the local municipality.

Dam Analyses Services, Spillway Capacity and Hazard Classification Analyses, Preston County, WV, Alpine Lake Resort and Conference Center. Project Manager providing oversight of H&H analyses related to Alpine Lake Dam. Tasks included development and routing of a probable maximum flood (PMF), estimation of spillway capacity, dam failure inundation modeling, and risk analysis related to the regulatory spillway design flood. Analyses and conclusions were summarized in a brief memorandum.

Dam Analyses Services, Hazard Classification Analysis, Monongalia County, WV, Alpine Lake Resort and Conference Center. Project Manager providing oversight of H&H analyses related to Yost Heritage Inc. Pond Nos. 1, 2, and 3. Tasks included development and routing of a PMF, two-dimensional hydraulic modeling of multiple dam failure and non-failure scenarios, and assessment of hazard classification. These analyses were performed in an effort to determine the regulatory status of the water storage ponds. Analyses and conclusions were summarized in a brief memorandum.

Risk Mapping, Assessment, and Planning Program Support, Lessons Learned from Dam Incidents and Failures, RiskMAP, FEMA Headquarters and FEMA Regions IV, VIII, and IX, U.S. DHS, FEMA. Project Manager overseeing the completion of a significant research and educational outreach effort for FEMA and the National Dam Safety Program. The project includes in-depth research and prioritization of past dam failures and incidents. The primary objective is to create a website that conveys lessons learned from dam incidents and failures in an innovative, user-friendly manner that is appealing to contemporary users from a broad spectrum of dam safety professions. The website includes access to pertinent graphics, narratives, photographs, videos, best practice resources, technical papers, and other available information. The project scope includes addressing a range of failure modes, dam types, and dam safety practices, including lessons learned relating to a spectrum of dam safety topics, including engineering and design, emergency planning and response, operation and maintenance, and regulatory issues. The website that was developed by the project team is currently maintained by the ASDSO and can be accessed at www.DamFailures.org.

Dam Inundation Mapping and Emergency Action Plan (EAP) Development, Southern Region, United States, USDA, United States Forest Service. H&H Engineer providing detailed review of hydrologic calculations for Winona Reservoir Dam, Upper Sherando Dam, Sherando Dam, Spring Lake Dam, Skitty Creek Cliffside Dam, and Boykin Springs Dam. Watershed delineations, runoff curve number calculations, and time of concentration calculations were developed and reviewed in support of dam failure inundation analyses, inundation mapping, and EAP preparation for several high-hazard dams within the United States Forest Service Southern Region as part of a nationwide indefinite delivery/indefinite quantity architectural and engineering services contract.

Dam Inundation Mapping and EAP Development, Eastern Region, United States, USDA, United States Forest Service. H&H Engineer providing detailed review of hydrologic calculations for Council Bluff Dam, Celina Lake Dam, Indian Lake Dam, Day Lake Dam, Timbre Ridge Dam, and Vesuvius Dam. Watershed delineations, runoff curve number calculations, and time of concentration calculations were developed and reviewed in support of dam failure inundation analyses, inundation mapping, and EAP preparation for several high-hazard dams within the United States Forest Service Eastern Region as part of a nationwide indefinite delivery/indefinite quantity architectural and engineering services contract.

Dam Break Analysis for Lake Burnt Mills Dam, Lake Prince Dam, and Western Branch Reservoir Dam, Norfolk, VA, City of Norfolk Department of Utilities. H&H Designer reviewing the magnitude of the spillway design flood based on current state regulations and dam break analyses for three dams. Analyses included evaluation of hazard areas; field reconnaissance; hydrologic analyses using geographic information system (GIS)-based watershed models and application of HMR 51 and 52, as well as HEC-HMS; dam breach analyses and hydraulic computations using the unsteady flow component of HEC-RAS; and the development of flood inundation hazard area mapping using GIS.



Resume – Benjamin P. Israel-Devadason, PE, CFM

Architectural/Engineering Services, Solicitation Number HSE1600000002

Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 8

Years Experience with Other Firms: 3

Education:

BS, Civil Engineering, Anna University (India), 2003

MS, Civil Engineering, Texas A&M University, 2007

Professional Registrations:

PE: Texas - No. [REDACTED] (2010)

Certified Floodplain Manager - No. [REDACTED] (2008)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

American Society of Civil Engineers (ASCE)

American Water Resources Association (AWRA)

Summary of Role and Experience

Senior Hydraulic and Hydrologic Engineer responsible for performing hydrologic and hydraulic (H&H) analyses for water resources projects and design of hydraulic structures related to flood control reservoirs, dams, bridges, and channel improvements; rehabilitation and reconstruction projects including the design of spillways, outlet works, and stilling basins; flood extent delineation; assessment of hydraulic structures; scour analysis; dam failure modeling; and consequence analysis. Technical specialties include dam failure consequence assessment and hydraulic modeling of various kinds using three-dimensional (3-D) and 2-D hydraulic modeling, H&H routing of inflow hydrographs through complex reservoir systems using 1-D/2-D models, and dam breach analysis. Has developed dam breach models of more than 240 dams of various types and sizes. Also responsible for collecting best available topographic data to develop detailed 3-D and 2-D hydraulic models; performing hazard-class assessments using modeling results and the U.S. Bureau of Reclamation's Assistant Commissioner - Engineering and Research (ACER) 11 criteria; preparing reports suitable for submission to clients and regulatory agencies; performing on-site investigations, as necessary, to collect data for analysis and modeling; assisting with dam assessment inspections; and preparing maps and plans, specifications, cost estimates (PS&E) for projects and other presentations, as required. Currently serving as part of a team of national technical specialists selected by USACE to serve as pre-industry beta-testers for multiple programs, including HEC-RAS 2D and HEC-FIA.

Related Projects

Dam Assessments, Breach Modeling, and Inundation Mapping for 112 Dams Located in WV, WI, NH, ND, and NM, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). H&H Engineer developing dam failure models; preparing inundation mapping using HEC-GeoRAS, HEC-RAS, ArcGIS, and Google Earth software; and performing dam assessments for 112 NRCS dams located in West Virginia, Wisconsin, New Hampshire, North Dakota, and New Mexico. The dam breach unsteady-state hydraulic models range in reach lengths from 2 miles to 66 miles and include junctions and downstream tributaries. The H&H modeling tasks involved reviewing existing H&H data, including as-built drawings and emergency action plan (EAP) maps; collecting and processing topographic data using state-of-the-art geographic information system (GIS) tools; building and preparing dam breach models using HEC-GeoRAS and HEC-RAS software; preparing inundation mapping using ArcGIS and Google Earth tools; comparing dam breach inundation maps with existing EAP maps, relevant Federal Emergency Management Agency (FEMA) studies, and FEMA 100- and 500-year floodplain maps; and preparing user-friendly deliverables including four-dimensional inundation mapping videos using advanced ArcGIS and Google Earth tools. The dam assessment tasks also included performing dam inspections; conducting reconnaissance of downstream impact areas; preparing hydrologic and auxiliary spillway models using the NRCS SITES program to evaluate the sufficiency of the existing dams to conform to current design and analysis criteria; identifying deficiencies; preparing failure indexes; and developing and evaluating rehabilitation alternatives.

Lost River Site No. 16, Dam Break Analysis and Inundation Mapping, Hardy County, WV, USDA, NRCS. H&H Designer conducting a detailed dam break hydraulic analysis of Lost River and its floodplain in Hardy County, West Virginia. Analysis included reviewing existing H&H data; collecting topographic data from the U.S. Geological Survey digital topographic database and survey; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcView software. The model was used to simulate dam break scenarios, including sunny day failure and probable maximum flood (PMF) failure, and to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios. Tasks also included modeling temporary





structures, including bridge structures within the HEC-RAS model, and plotting the flood extents for dam breach scenarios.

New Creek Site No. 14 Hydrologic Analysis, Auxiliary Spillway Integrity Analysis, Dam Break Analysis, and Inundation Mapping, Grant County, WV, USDA, NRCS.

H&H Engineer conducting a detailed hydrologic study, auxiliary spillway integrity analyses, and detailed dam break hydraulic analysis of New Creek and its floodplain in Grant and Mineral Counties, West Virginia. Tasks included reviewing existing H&H data; collecting topographic data; developing several SITES H&H models; performing a site visit; completing an approximate survey of channel obstructions, including 22 bridges; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software. The model was run to simulate failure of the dam during both sunny day and hydrologic loading conditions in order to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios.

Upper Deckers Site 1 Hydrologic Analysis, Auxiliary Spillway Integrity Analysis, Dam Break Analysis, and Inundation Mapping, Preston County, WV, USDA, NRCS.

H&H Engineer conducting a detailed hydrologic study, auxiliary spillway integrity analyses, and dam break hydraulic analyses of Upper Deckers Site 1 dam and its floodplain in Preston County, West Virginia. Tasks include reviewing existing H&H data; collecting topographic data; developing several SITES H&H models; performing a site visit; completing an approximate survey of channel obstructions; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software. The dam breach model was run to simulate failure of the dam during both sunny day and hydrologic loading conditions in order to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios.

Salem Fork Site 11 and Site 11A Hydrologic Analysis, Auxiliary Spillway Integrity Analysis, Dam Break Analysis, and Inundation Mapping, Harrison County, WV, USDA, NRCS. H&H Engineer conducting a detailed hydrologic study, auxiliary spillway integrity analyses, and dam break hydraulic analyses of Salem Fork Site 11 and Site 11A dams and their floodplain in Harrison County, West Virginia. Tasks include reviewing existing H&H data; collecting topographic data; developing several SITES H&H models; performing a site visit; completing an approximate survey of channel

obstructions; and developing a detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software. The dam breach model was run to simulate failure of the dam during both sunny day and hydrologic loading conditions in order to predict the flood extents and water surface elevations of outflow from the reservoir for those scenarios.

Dam Analyses Services, Pond No. 1, Pond No. 2, and Pond No. 3 Dams 2-D Dam Breach Hydraulic Analysis, Monongalia County, WV, Alpine Lake Resort and Conference Center. Hydraulic Engineer conducting a detailed 2-D hydraulic analysis of Pond Nos. 1, 2, and 3 dams in Monongalia County, West Virginia. Tasks include collecting best-available topographic data and developing a detailed 2-D hydraulic model. The 2-D dam breach model was used to simulate multiple failure scenarios and various hydrologic loading conditions.

Dam Inundation and Emergency Action Plans (EAPs) – Eastern Region, Eastern Region, United States, USDA, United States Forest Service. Senior H&H Engineer conducting inundation mapping for Vesuvius Dam and Day Lake Dam, high-hazard dams within the United States Forest Service Eastern Region as part of a nationwide indefinite delivery/indefinite quantity architectural and engineering services contract.

Dam Inundation and EAPs, Southern Region, United States, USDA, United States Forest Service. Senior H&H Engineer completing inundation mapping for Sherando Dam, a high-hazard dam within the United States Forest Service Southern Region as part of a nationwide indefinite delivery/indefinite quantity architectural and engineering services contract.

FEMA, Region III Flood Studies, Luzerne County, PA, U.S. Department of Homeland Security (DHS), FEMA, Region III. H&H Designer completing a detailed H&H study in Luzerne County. Developed floodplain maps based on hydraulic model results utilizing automated procedures within a GIS environment. Developed Digital Flood Insurance Rate Maps (DFIRMs) and Flood Insurance Studies (FIS) in accordance with FEMA DFIRM GIS database specifications.





Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 3

Years Experience with Other Firms: 3

Education:

BS, Civil Engineering, Lafayette College, 2010

MS, Civil Engineering, Virginia Polytechnic Institute and State University (Virginia Tech), 2012

Professional Registrations:

EIT: Pennsylvania - No. [REDACTED] (2010)

Certified Floodplain Manager - No. [REDACTED] (2012)

Professional Affiliations:

Association of State Floodplain Managers (ASFPM)

American Society of Civil Engineers (ASCE)

American Water Resources Association (AWRA)

Summary of Role and Experience

Hydraulic and Hydrologic Designer responsible for performing hydraulic and hydrologic (H&H) analyses for water resources projects and design of hydraulic structures related to flood control reservoirs, dams, bridges, and channel improvements; rehabilitation and reconstruction projects including the design of spillways, outlet works, and stilling basins; assessment of hydraulic structures; scour analysis; and dam failure modeling. Technical specialties include the use of computer models to assist in the design and assessment of hydraulic structures, flood-extent delineation, dam failure inundation analyses, and routing of inflow hydrographs through complex hydrologic systems. Proficient in the use of U.S. Army Corps of Engineers' (USACE) HMR 52, HEC-1, HEC-RAS, HEC-GeoRAS, HEC-HMS, and HEC-GeoHMS software; Esri's ArcGIS suite (ArcInfo, ArcMap, ArcCatalog, ArcToolbox, Spatial Analyst, and ArcHydro); U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)'s Win TR-20 and Win TR-55 models; AutoCAD Civil 3D; Matlab; and other one-dimensional routing models. Also responsible for preparing reports suitable for submission to clients and regulatory agencies; performing on-site investigations, as necessary, to collect data for analysis and modeling; assisting with dam assessment inspections; and preparing maps, plans, and other presentations.

Related Projects

Modeling, Mapping, and Consequence Analyses for Dams, Various Locations, United States, USACE, Vicksburg District. H&H Designer developing four consequence assessment reports (CAR) to support the Critical Infrastructure Protection and Resilience and Dam Safety programs under the Modeling, Mapping, and Consequence Production Center for USACE. For each CAR, five dam break model scenarios were reviewed and assessed, and the results were summarized in the CAR. Data were gathered to understand the history of each dam site and the consequences from a potential dam failure. Geographic information system (GIS) data was analyzed to summarize the impacts of the inundation areas on critical infrastructure. The CARs were developed following guidelines and templates from USACE to maintain consistency.

Dam Breach Inundation, Hazard Classification, and Spillway Design Flood Determination for Five Dams, Multiple Locations, VA, Virginia Department of Conservation and Recreation. H&H Designer reviewing design calculations used in watershed modeling, reservoir routing, and dam breach inundation modeling of five dams. The project included the review of pertinent design information, dam and watershed site visits, development of a watershed model using HEC-HMS, and development of a hydraulic model for reservoir and downstream flood routing using HEC-RAS. According to current Virginia dam safety regulations, the hazard classification of each dam was identified and an incremental damage analysis was performed to determine the regulatory spillway design flood. Deficiencies in spillway capacity were identified and dam failure inundation maps were prepared.

Dam Break Analysis for Clifton Forge Dam, Clifton Forge, VA, Town of Clifton Forge. H&H Designer conducting a detailed dam break analysis of Clifton Forge Dam in Alleghany County, Virginia. Clifton Forge Dam is 54-foot-high concrete gravity dam of monolithic construction that serves as a water supply dam for Clifton Forge and surrounding areas. The dam impounds Smith Creek, which continues downstream to pass through the town and into the Jackson River. Before reaching the river, Smith Creek becomes subterranean as it flows beneath the town through a maze of building and road support pillars. Tasks included reviewing existing H&H data, providing field reconnaissance, analyzing soil, land use,



Resume – William J. Kingston III, CFM

Architectural/Engineering Services, Solicitation Number HSE160000002



and topographic data, performing hydrologic analyses using GIS-based watershed models, as well HEC-HMS, applying HMR 51 and 52 methodology to obtain probable maximum precipitation/storm estimates, developing a hydraulic computation of the study site using HEC-GeoRAS and HEC-RAS, analyzing the complex hydraulics beneath the town, conducting dam breach analyses and hydraulic computations using the unsteady flow component of HEC-RAS, identifying flood hazard areas, and developing flood inundation hazard area maps.

Risk Mapping, Assessment, and Planning (MAP) Program Support, Bear Branch Hydrologic and Hydraulic Technical Review, Rutherford County, TN, United States Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region IV. H&H Designer performing a detailed technical review of the H&H models developed for Bear Branch and its contributing watershed developed by USACE. The model results for Bear Branch are to be included in the FEMA Physical Map Revision for Rutherford County, under the Stones River Watershed Study. Tasks included reviewing the subwatershed delineations, associated GIS files, the HEC-HMS hydrologic model, and the HEC-RAS hydraulic model. Model parameters were evaluated for appropriateness and FEMA's cHECK-RAS application.

Risk MAP Program Support, Lake Apopka H&H Technical Review, Orange County, FL, United States DHS, FEMA Region IV. H&H Designer performing a detailed H&H technical review of the Lake Apopka Basin Interconnected Channel and Pond Routing (ICPR) model, developed by CDM Smith for flooding sources in Orange County, Florida. The ICPR model was generated in support of the larger effort to develop the Lake Apopka Basin Stormwater Management Master Plan for Orange County, which was finalized in July 2007 by CDM Smith. The review was performed to determine whether the data and modeling were consistent with FEMA standards and standard engineering practice, and whether they were sufficient to use in revising the FEMA Flood Insurance Rate Map for Orange County. This task was included under the Ocklawaha Watershed Study. Tasks included reviewing the ICPR model and associated GIS files. Model characteristics were reviewed at both a global scale (over-arching aspects that affect the entire model or multiple subbasins) and on a local scale (subbasin specific aspects that affect a single subbasin or model component).

HEC-HMS Watershed Modeling Seminar, Chicago, IL, ASDSO. H&H Designer assisting in the development of presentation materials used in a 3-day seminar on watershed modeling using HEC-HMS. The seminar, which emphasized applications for dam safety, was taught in Chicago, Illinois, by Amanda Hess, P.E., CFM, and Dr. Arthur Miller, Ph.D., P.E., DWRE. Tasks included developing presentation slides covering a number of HEC-HMS/hydrologic topics and developing a comprehensive practical workshop to test course attendees on seminar material.

Risk MAP Program Support, Little Harpeth River Tributaries 4, 5, and 6 H&H Technical Review, Williamson County, TN, United States DHS, FEMA, Region IV. H&H Designer performing a detailed technical review of the hydraulic analyses and Technical Support Data Notebook (TSDN) developed for Little Harpeth River Tributaries 4, 5, and 6 by BakerAECOM. The TSDN and hydraulic analyses were completed for the Harpeth River Watershed Study, as part of FEMA's Risk MAP program. Tasks included reviewing hydraulic model parameters, associated GIS files, and the HEC-RAS hydraulic models for each tributary.

Ryerson Station State Park Dam Operation and Maintenance Guide and First-Filling Plan, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. H&H Designer developing an operation and maintenance plan and a first-filling plan for Ryerson Station State Park Dam. Tasks included collecting and compiling pertinent dam information, detailing normal and emergency operation and drawdown procedures, describing dam facilities and related appurtenances with respect to operation and maintenance, developing a structured maintenance and physical inspection plan for the dam, appurtenant works, and reservoir, compiling a list of important contacts, including dam personnel, local emergency management agencies, state and local police, fire, and emergency personnel, Pennsylvania Department of Environmental Protection, Pennsylvania Emergency Management Agency, Dam Safety personnel, and engineers, and establishing responsibilities and developing a framework for the identification and response to conditions that require attention.

Q16-5291





Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 6

Years Experience with Other Firms: 1

Education:

BS, Environmental Engineering, Old Dominion University, 2009

MEng, Environmental Engineering, Old Dominion University, 2012

Professional Registrations:

PE: Virginia - No. [REDACTED] (2013)

First Aid: American Red Cross (2015)

Professional Affiliations:

Association of State Dam Safety Officials (ASDSO)

American Water Works Association (AWWA)

Water Environment Federation (WEF)

Virginia Lakes and Watersheds Association

Summary of Role and Experience

Engineer responsible for compiling data and performing analyses for hydraulic and hydrologic (H&H) studies, writing reports, and participating in project design. Participates in dam safety regulatory compliance projects, including dam safety inspections, preparation of inspection reports and documentation, hazard classification analysis, and monitoring and construction inspection activities. Also participates in H&H studies for bridge replacement projects and assists with various water and wastewater design projects. Technical specialties include H&H modeling, conducting dam assessments, reservoir safe yield estimation, wastewater pumping station hydraulic design, and distribution system modeling. Experienced in the use of U.S. Army Corps of Engineers (USACE)'s HEC-HMS, HEC-RAS, and HEC-geoRAS software; the Natural Resources Conservation Services (NRCS)'s Water Resource Site Analysis (SITES) computer model; ESRI's ArcGIS suite and ArcView applications; and Bentley's WaterCAD and WaterGEMS software.

Related Projects

Dam Safety Program, Newport News, VA, Newport News Waterworks. Engineer participating in the management of the clients' dam safety program. Individual tasks include participating in dam safety

inspections and preparing reports, and preparing operation and maintenance certificate applications and emergency plans for each of the six dams, as needed, to comply with state regulations. Also assists with design and construction administration of the Diascund Dam Principal Spillway Reconstruction project.

Sandy River Reservoir Dam Spillway Capacity

Alternatives Assessment, Prince Edward County, VA, Prince Edward County. Engineering Designer reviewing historic data and assessing alternatives to increase the spillway capacity of the dam using the NRCS SITES software and the USACE's HEC-HMS and HEC-RAS software. Prepared a report describing the background, analysis, and results of the modeling, as well as a discussion of the benefits and limitations of the proposed alternatives. Cost estimates were prepared for feasible alternatives, and an alternative was recommended along with considerations for future phases of design.

Dam Assessment Services and Development of Emergency Action Plan (EAP) and

Operations/Maintenance Inspection Plan, Rocky Fork Dam, OH, Ohio Department of Natural Resources. Engineer performing H&H modeling, hazard classification, and inundation mapping for Rocky Fork Dam. The project included hydrologic modeling of the watershed using HEC-HMS, unsteady hydraulic analyses using HEC-RAS to route the breach hydrograph downstream, and mapping the inundation limits using ArcGIS. A detailed report was also prepared to document the analyses.

Crippen Dam – Dam Breach Analyses Phase I, Fairfax County, VA, Potomac Recycling. Engineer performing H&H modeling, hazard classification, and inundation mapping. The project included hydrologic modeling of the watershed using HEC-HMS, unsteady hydraulic analyses using HEC-RAS to route the breach hydrograph downstream, and mapping the inundation limits using ArcGIS. A detailed report was also prepared to document the analyses.

Upper and Lower Occoquan Dams Transition to State Regulation, Fairfax County, VA, Fairfax County Water Authority. Engineer assisting in performing tasks and preparing documentation for transfer of regulatory authority from Federal Energy Regulatory Commission to Virginia Department of Conservation and Recreation, Division of Dam Safety. Assisted in annual dam safety inspections and preparation of inspection reports. Also





assisted in preparation of operation and maintenance certificate application document and operation and maintenance manual.

Clifton Forge Dam Report and Mapping Services, Clifton Forge, Alleghany County, VA, The Town of Clifton Forge, Virginia. Engineer assisting in dam safety regulatory compliance tasks. Work includes dam safety inspections; preparation of inspection report, operation and maintenance certificate application, and emergency action plan; and assisting with the evaluation and preliminary design of dam safety improvements including a preliminary engineering report for a U.S. Department of Agriculture Rural Development funding assistance application.

General Water System Annual Services, Dam Inspections, Richmond, VA, City of Richmond Department of Public Utilities. Engineer assisting with dam safety inspections and preparing inspection reports, operation and maintenance certificate applications, and record reports.

Lake Matoaka Dam Improvements, Williamsburg, VA, College of William & Mary. Engineer performing H&H analyses to confirm feasibility of articulated concrete block armoring for dam overtopping protection. Effort included reviewing existing hydrologic and hydraulic models prepared by others, updating models to reflect current conditions, evaluating model results, and preparing preliminary design report.

Lake Matoaka Dam, Williamsburg, VA, College of William & Mary. Engineering Designer assisting in the dam inspection and preparing the inspection report, as well as preparing the operation and maintenance certificate application. Reviewed online property records to identify development in the downstream inundation zone that could affect the EAP.

Raw Water Supply System, Loudoun County, VA, Loudoun Water. Engineering Designer reviewing raw water transmission main alignment to identify required permanent and temporary easements and areas where revised alignment may affect permitting, as well as assisting in the preparation of the raw water transmission main section and permitting section of the preliminary engineering report. The preliminary engineering report sections included evaluation of the preliminary design and discussion of construction methods, materials, effects of environmental limitations

on construction, additional permits to be obtained, and a preliminary cost estimate.

Western Branch Dam – On-Call Services, Suffolk, VA, City of Norfolk, Department of Utilities, Division of Engineering. Engineer assisting in construction management activities as a subconsultant on the Western Branch Dam Modification Project construction. Tasks include shop drawing review and construction inspection support. Participated in observation and sample selection of soil-cement wall coring for strength and permeability acceptance testing.

Lee Hall Reservoir Dam Improvement Project, Newport News, VA, Newport News Waterworks. Engineer conducting weekly monitoring of water levels in piezometers stationed along the dam crest and toe. Weekly monitoring included water-level measurement, as well as observations of the embankment and toe to evaluate changing conditions or presence of nuisance wildlife. Updated project database weekly and prepared summary of dam, reservoir, and weather conditions. Vibrating wire transducers with data-loggers were installed for continuous monitoring at conclusion of weekly monitoring. Performed periodic data acquisition and manual readings to verify data collected.

Wastewater Pump Station, Force Main, Gravity Sewer Replacement, and Water Distribution System Improvements, Downtown Pump Station, Norfolk, VA, City of Norfolk, Department of Utilities. Engineering Designer for a project involving an analysis of alternatives, the design and specification, and construction-phase services of a new 1,000 gpm sewage pump station to support urban development. Duties included providing cost estimating and client coordination.

**Project Role:**

GIS/H&H Professional

Years Experience with Current Firm: 1

Years Experience with Other Firms: 5

Education:

BS, Civil Engineering, Utah State University, 2014

MS, Civil Engineering, Utah State University, 2014

Professional Registrations:

EIT: (2011)

Professional Affiliations:

American Society of Civil Engineers (ASCE)

Summary of Role and Experience

Hydraulic and Hydrologic Designer responsible for performing hydraulic and hydrologic (H&H) analysis for water resources and hydraulic structure design projects. Computer models are designed and built using HEC-RAS, HEC-GeoRAS, HEC-HMS, HEC-GeoHMS, ArcGIS, and/or AutoCAD Civil 3D. Responsibilities also include collecting data on site, preparing maps and presentations, and writing and preparing reports for clients as required.

Related Projects

Dam Inundation and Emergency Action Plans (EAPs) – Eastern Region, Eastern Region, United States, U.S. *Department of Agriculture (USDA), United States Forest Service.* H&H Designer completing inundation mapping and EAPs for high-hazard dams within the United States Forest Service Eastern Region as part of a nationwide indefinite delivery/indefinite quantity (ID/IQ) architectural and engineering services contract. Work included gathering field data at the sites, determining H&H parameters using ArcGIS and HEC-HMS, performing dam failure modeling using HEC-RAS, and writing reports.

Dam Inundation and EAPs – Southern Region, Southern Region, United States, USDA, United States Forest Service. H&H Designer completing inundation mapping and EAPs for high-hazard dams within the United States Forest Service Southern Region as part of a nationwide ID/IQ architectural and engineering services contract. Work included gathering field data at the sites, determining H&H parameters using ArcGIS and HEC-HMS, performing dam failure modeling using HEC-RAS, and writing reports.

New Kernsville and Auburn Dam Breach Analysis, Schuylkill and Berks Counties, PA, Pennsylvania Department of Environmental Protection (PADEP). H&H Modeler creating computer models for the dam sites. The two structures, built in series, serve as desilting basins for the Schuylkill River. They are both concrete gravity dams Class B, high-hazard facilities. Due to the amount of new developments downstream, a new inundation report was needed to update the EAP. Responsibilities include creating H&H computer models to simulate a dam breach. Inundation reports are written and presented to the clients.

Spillway Design, Flood Estimate Assessment, Pike County, PA, Pennsylvania Game Commission – Land Management. H&H Designer performing a hydrologic assessment of the dam to verify overtopping elevations during the probable maximum precipitation event preliminary to performing a structural stability analysis.

Dam Assessments, Statewide MA, USDA, Natural Resources Conservation Service (NRCS), Massachusetts Office. H&H Designer completing hydrologic assessments for six NRCS dams in Massachusetts. Work included geographic information system (GIS) mapping, developing curve number grids, and calculating hydrologic parameters preliminary to performing dam failure modeling.

Lake Scranton Dam Rehabilitation Engineering Services, Luzerne County, PA, Pennsylvania American Water (PAW). H&H Designer designing a labyrinth spillway design on the existing dam.

Professional Engineering and Related Services, Bel Air Reservoir Safe Yield Analysis, Bel Air, MD, Virginia American Water. H&H Designer completing a safe yield analysis on a proposed reservoir as part of an investigation to determine alternatives for maintaining the Bel Air water system during periods of drought.

Upper Deckers Site 1 Dam Rehabilitation, Preston County, WV, NRCS, West Virginia State Office. H&H Designer creating hydraulic models of the dam and spillway for the preliminary and final rehabilitation design of a 45-foot-high, 600 LF, high-hazard zoned earth embankment dam, which was constructed in 1969. This project is a continuation of the planning study completed by our firm in 2011. Rehabilitation included a new stair-stepped roller-compacted concrete (RCC) spillway armoring detail on the existing embankment,





replacement of the riser structure, slope flattening, internal drainage elements, and embankment construction in the existing auxiliary spillway.

design, and testing the modifications using the physical models to reduce the amount of vortex formation in the station.

Flood Mitigation and Monitoring, Dam Safety, and Dredging Program - Basic Ordering Agreement, Fairfax County, VA, County of Fairfax, VA. H&H Designer creating H&H models in order to create a stage-discharge rating curve of the selected section of the stream as part of consulting engineering services, on an as-needed task-order basis, through a Basic Ordering Agreement with the County of Fairfax, Virginia, for flood mitigation and monitoring, dam safety, and dredging services.

Annual Water Services, Still Creek Water Treatment Plant Heating, Ventilation, and Air Conditioning (HVAC) System and Supervisory Control and Data Acquisition (SCADA) Improvements, Tamaqua, Schuylkill County, PA, Tamaqua Area Water Authority. H&H Designer performing the annual inspection of the dam.

Prior to Gannett Fleming:

Turkey Peak Dam, Palo Pinto County, TX, HDR, Inc. Research Assistant designing and constructing a physical model of the proposed dam and spillway. Tests were performed with the model to observe conditions at various flood levels. The spillway design was also tested to make sure the client knew that it functioned properly. Responsibilities included designing and constructing the models and assisting in the redesign of the spillway.

Xcel Nuclear Power Pumping Station, Monticello, MN, Xcel Energy. Research Assistant designing and analyzing collected data of the power plant pumping station. The life expectancy of the pumps within the station had been much shorter than expected. Research was performed on a physical scale model of the station to determine the cause and possible solutions. Responsibilities included designing and constructing the physical model, collecting data, writing reports, and presenting the data to the clients.

Utah Lake Pumping Station, Saratoga Springs, UT, Utah Lake Water Users Association. Research Assistant supporting the design of the proposed Utah Lake Pumping Station, intended to replace the original structure. As water levels rise, the station pumps the water down the Jordan River to prevent flooding of developed areas around the lake. Responsibilities included collecting data and modifying the proposed



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 1

Years Experience with Other Firms: 7

Education:

BS, Civil Engineering Technology, Rochester Institute of Technology, 2007

Professional Registrations:

PE: Pennsylvania - No. [REDACTED] (2013)

Sediment and Stormwater Management (Blue Card):
Delaware - No. [REDACTED] (2010)

Certified Professional in Erosion and Sediment Control
(CPESC): EnviroCert International, Inc. - No. [REDACTED] (2014)

Summary of Role and Experience

Project Engineer responsible for performing hydraulic and hydrologic (H&H) analyses for water resources projects and design of hydraulic structures related to flood control reservoirs, dams, bridges, and channel improvements; rehabilitation and reconstruction projects including the design of spillways, outlet works, and stilling basins; assessment of hydraulic structures; scour analysis; and dam failure modeling. Proficient in the use of U.S. Army Corps of Engineers (USACE) HEC-RAS and HEC-HMS software; Federal Highway Administration (FHWA) HY-8 software; Esri's ArcGIS suite and ArcView applications; and MathCAD. Areas of expertise include commercial land development permitting and design including stormwater management and erosion and sediment pollution control (E&SPC) design, natural gas pipeline permitting and design, and the use of AutoCAD Civil 3D and HydroCAD software.

Related Projects

Dam Inundations and Assessments, Statewide NH, New Hampshire Department of Environmental Services. Design Engineer, completing detailed H&H modeling for the completion of dam assessment reports for 18 state-owned dams. Work includes performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam failure modeling using HEC-RAS; preparing inundation mapping; completing hydraulic, hydrologic, and auxiliary spillway analyses using SITES; identifying deficiencies; and developing rehabilitation alternatives and cost estimations.

Beaver Creek Dam Rehabilitation Design, Chester County, PA, U.S. Department of Agriculture, Natural Resources Conservation Service, Pennsylvania State Office (NRCS PA). Review Engineer for review of hydrologic calculations and SITES hydrologic, hydraulic, and auxiliary spillway integrity analyses.

Hibernia Dam Rehabilitation Design, West Cain Township, Chester County, PA, U.S. Department of Agriculture, Natural Resources Conservation Service, Pennsylvania State Office (NRCS PA). Review Engineer for review of hydrologic calculations and SITES hydrologic, hydraulic, and auxiliary spillway integrity analyses.

Modeling, Mapping, and Consequence (MMC) Analysis for USACE-owned Dams, U.S. Army Corps of Engineers (USACE), Vicksburg District, MMC Production Center. Design Engineer for eight dam failure and consequence studies for large flood control facilities across the United States. Dam-break studies include GIS-based unsteady-flow HEC-RAS models, followed by inundation mapping in a GIS environment using HEC-GeoRAS and custom mapping tools, and a consequence analysis conducted using HEC-FIA to determine economic and human impacts. The project includes large-scale HEC-RAS models with split-flow reaches, levee overtopping, dams with rule-based gate operations, and offline storage areas and backwater areas. Consequence assessments considered economic damages, loss-of-life, and lost benefits due to dam failure. The hydraulic and consequence models support a risk-based assessment, prioritization, and management framework for the USACE Critical Infrastructure Protection and Resilience (CIPR), Dam Safety, and Levee Safety programs.

ODNR Dam Assessment Services, Salt Fork Lake Dam, Guernsey County, OH, Ohio Department of Natural Resources (ODNR). Project Engineer conducting watershed modeling, reservoir routing, and dam breach inundation modeling of the Salt Fork Lake Dam. Work has included conducting a site survey of existing bridges and structures, reviewing pertinent design information, making dam and watershed site visits, developing a watershed model using HEC-HMS, and developing a hydraulic model for reservoir and downstream flood routing using HEC-RAS. According to current Ohio dam safety regulations, the hazard classification of each dam was identified and an incremental damage analysis was performed. Spillway capacities were identified and dam failure inundation maps were prepared. Also prepared an Emergency Action Plan (EAP).





Prior to Gannett Fleming:

BL Companies, Inc., Camp Hill, PA. Project Engineer responsible for design and oversight of land development plans, reports, and permitting for commercial clients in Pennsylvania. Prepared PAG-02 National Pollutant Discharge Elimination System (NPDES) and highway occupancy permits. Additionally responsible for design and oversight of natural gas pipeline E&SPC and construction plans in Pennsylvania and Ohio. Prepared Pennsylvania Department of Environmental Protection Erosion and Sediment Control General Permits (ESCGP-2) and Chapter 105 General Permit, USACE Section 404 Joint Permit, Ohio Nationwide Permit (NWP-12) and a Pre-Construction Notification (PCN), and state and municipal permits.

Rite Aid Store Land Development, Dauphin County, PA, Rite Aid Corporation. Project Engineer responsible for site layout and design of a Rite Aid store, including grading, stormwater management, E&SPC, and all necessary utilities. Obtained Dauphin County Conservation District Erosion and Sedimentation permit, Pennsylvania Department of Environmental Protection permit, National Pollutant Discharge Elimination System (NPDES) permit, and a Pennsylvania Department of Transportation highway occupancy permit.

Retail Store Land Development, Northeastern U.S., AutoZone Inc. Design Engineer responsible for preparation of land development plans and applications for more than 20 retail auto parts stores throughout the Northeast including those in Pennsylvania, Maryland, Delaware, New York, New Jersey, and New Hampshire. Responsibilities included site layout, grading, utility layout, stormwater management and E&SCP design, on-lot septic system design, cost estimation, and preparation of specifications. Attended and presented projects at municipal meetings to obtain local government approvals.

Retail Store Land Development, Northeastern U.S., Sunoco, Inc. Design Engineer responsible for preparation of land development plans and applications for more than five gas station and convenience stores in Pennsylvania, Maryland, and Delaware. Responsibilities included site layout, grading, utility layout, stormwater management and E&SPC design, septic system force main design, cost estimation, and preparation of specifications. Attended and presented projects at

municipal meetings to obtain local government approvals.

Various Land Development Projects, Central PA, Various Banks and Real Estate Developers. Engineering Intern on several commercial land development projects. The majority of the projects were located in Dauphin County, with a few in Cumberland, Adams, and York counties. Responsibilities included site and construction surveys using a Global Positioning System (GPS) and total station. Some Land Development Desktop CAD support was also provided on land development drawings.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 2

Years Experience with Other Firms: 1

Education:

BS, Environmental Engineering, University of Delaware, 2014

Professional Registrations:

PE: Virginia - No. [REDACTED] (2013)

First Aid: American Red Cross (2015)

Professional Affiliations:

Association of State Floodplain Managers

Association of State Dam Safety Officials (ASDSO)

American Society of Civil Engineers (ASCE)

Summary of Role and Experience

Hydraulic and Hydrologic Designer specializing in performing hydraulic and hydrologic (H&H) analyses for dams. Responsibilities also include estimating reservoir safe yield, conducting dam assessments, assessing bridge scour, and performing historical dam failure research; writing technical documents; and performing H&H analyses for various types of water resources and hydraulic structure design projects. Experienced in the use of the U.S. Army Corps of Engineers (USACE) HEC-1, HEC-RAS, HEC-GeoRAS, and HEC-HMS software; Esri's ArcGIS suite (ArcInfo, ArcMap, ArcCatalog, ArcToolbox, Spatial Analyst, and ArcHydro); the Institute for Sustainable Infrastructure's (ISI) Envision Sustainable Infrastructure Rating System; Adobe InDesign publishing software; HTML and CSS languages for Web page development, as well as the development of in-house computer programs for water resource engineering applications. Responsible for preparing reports and other presentations suitable for submission to clients and regulatory agencies as required.

Related Projects

Lessons Learned From Dam Incidents and Failures, RiskMAP, Federal Emergency Management Agency (FEMA) Headquarters and FEMA Regions IV, VIII, and IX, Risk Mapping, Assessment, and Planning Program Support, U.S. Department of Homeland Security (DHS), FEMA. H&H Designer supervising the completion of a significant research and educational outreach effort for FEMA and the National Dam Safety Program. The project

includes in-depth research and prioritization of past dam failures and incidents. The primary objective is to create a website that conveys lessons learned from dam incidents and failures in an innovative, user-friendly manner that is appealing to contemporary users from a broad spectrum of dam safety professions. The website includes access to pertinent graphics, narratives, photographs, videos, best practice resources, technical papers, and other available information. The project scope entails addressing a range of failure modes, dam types, and dam safety practices, including lessons learned relating to a spectrum of dam safety topics involving engineering and design, emergency planning and response, operation and maintenance, and regulatory issues.

Safe Yield Investigations for Spruce Run Reservoir and White Deer Creek (Milton District), Professional Services and Permit Submittals, Union and Lebanon Counties, PA, Pennsylvania American Water (PAW). H&H Designer performing safe yield analyses of the Milton District raw water supply system. Work included review of a custom computer model in Visual Basic computer programming language and its associated hydrologic database. The model and database were used to simulate the daily operation of the reservoir for the period of transposed streamflow record from 1914 to 2014. Safe yield for multiple possible operating conditions including potential passby requirements under revised regulations was investigated based on computer model simulation. Results were summarized in a report.

Beaverdam Creek and Goose Creek Dams – Master Plan Study and Dams Operation, Ashburn, Loudoun County, VA, Loudoun Water. H&H Designer estimating the safe yield of a complex water supply and storage system as part of a master planning study. The purpose of the planning study is to optimize the integration of the Potomac Water Supply Plan, which includes a pump intake on the Potomac River to supply raw water for treatment or storage in existing quarries, with existing infrastructure recently purchased from the City of Fairfax. These assets include a water treatment plant (WTP), river intakes on Goose Creek, and more than 1.5 Bgal of raw water storage within Beaverdam Creek Reservoir. Work includes developing a complex computer model and hydrologic database to simulate the daily operation of the pump intakes and various combinations of available storage facilities and pipeline connections. Safe yield for a range of possible operating





assumptions and future conditions was investigated based on a custom computer model simulation. Optimized operation and phasing of the system were refined using model results.

Smithfield Lake Dam Spillway Capacity Upgrade Alternative Assessment, Smithfield, VA, Town of Smithfield. H&H Designer evaluating and preparing a report of the H&H characteristics unique to the Smithfield Lake Dam and watershed. Smithfield Lake Dam impounds Mount Holly Creek to create Smithfield Lake. In support of a reassessment of the dam's hazard potential classification, conducted a hydrologic assessment to determine the rainfall-runoff response of the watershed and to evaluate reservoir response under different loading conditions. Tasks included calculating watershed parameters following U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) methodology and analyzing the output from a reservoir routing model of Smithfield Lake Dam and watershed for inclusion in a report.

Kauffman and Mt. Laurel Reservoirs Safe Yield Investigations, On-Call Professional Consulting Services, Schuylkill County, PA, Schuylkill County Municipal Authority. H&H Designer supervising the technical execution of detailed safe yield analyses of the Kauffman and Mt. Laurel Reservoirs. Work included review of a custom computer model in Visual Basic computer programming language and its associated hydrologic database. The model and database were used to simulate the daily operation of the reservoirs for the period of transposed streamflow record from 1919 to 2014. Safe yield for a multiple possible operating conditions was investigated based on computer model simulation. Results were summarized in a report.

Dam Assessment Services and Development of Emergency Action Plan (EAP) and Operations/Maintenance Inspection Plan, Mahoning and Guernsey Counties, OH, Ohio Department of Natural Resources (ODNR). H&H Designer completing reservoir drawdown calculations of the Lake Milton and Salt Fork Lake Dams and summarizing them in a final report. Other elements of the assessments included watershed modeling, reservoir routing, dam breach inundation modeling, and report writing.

Dam Inundations and Assessments, Statewide NH, New Hampshire Department of Environmental Services. H&H Designer assisting in the completion of dam assessment

reports for 18 state-owned dams. Work includes performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam failure modeling using HEC-RAS; preparing inundation mapping; completing hydraulic, hydrologic, and auxiliary spillway analyses using SITES; identifying deficiencies; and developing rehabilitation alternatives and planning-level cost estimations.

Dam Emergency Intervention Toolbox, Helena, MT, State of Montana. H&H Designer overseeing the initial phase of an effort to develop a dam emergency intervention toolbox. Work included collecting and reviewing existing information on the topic and compiling, reviewing, and organizing the most useful information into a simple electronic database. Documents and other resources were collected from a broad range of sources including literature review and outreach efforts to the dam safety community. Future phases of this work may include developing a "Dam Emergency Plan" for use by dam owners and others in preparing for future incidents at dams, as well as adding this information to a website as an educational and outreach tool.

Dams Hazard Classification Review, Statewide ND, North Dakota State Water Commission. H&H Designer assisting in the review of the current hazard classifications at 90 dams located in North Dakota. Following a review of available data, the dam embankment breaches were modeled within the XPSWMM 2D hydraulic model, and the reservoir storage was released dynamically through the breach opening and routed downstream. The impacts were expressed in terms of the number of lives in jeopardy and potential for loss of life at each structure. Using the estimated level of impacts, recommendations for the hazard classification of the dams were made based on ACER 11 criteria and Federal Emergency Management Agency 333 guidelines. Tasks included the identification of structures at risk and development of final deliverables.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 1

Years Experience with Other Firms: 2

Education:

BS, Environmental Engineering, Messiah College, 2012

Professional Registrations:

EIT: Pennsylvania - No. [REDACTED] (2012)

Professional Affiliations:

Institute of Electrical and Electronics Engineers (IEEE)

Summary of Role and Experience

Civil Engineer-in-Training responsible for performing hydraulic and hydrologic (H&H) analyses and designing hydraulic structures including flood control reservoirs, spillways, outlet works, stilling basins, bridges, and stream channel improvements. Technical specialties include performing H&H analyses for dams and conducting dam assessments. Proficient in the use of Microsoft Office, AutoCAD Civil 3D, HydroCAD, HY-8, ArcGIS, and Water Resource Site Analysis (SITES) computer model.

Related Projects

Gunter Valley Dam Breach – Design, Bid, and Construction-Phase Services, Lurgan Township, Franklin County, PA, Pennsylvania Department of General Services. Civil Engineer-in-Training responsible for breach-related design services, including reservoir and stream restoration, permanent spoil of embankment material, removal of a second unused stream weir, extensive forest road improvements to facilitate public access, and expanded environmental assessments.

Open-End General Engineering Services for Water/Wastewater Treatment Facilities, Dredging of Belmont Water Treatment Plant Intake Area, Philadelphia, PA, City of Philadelphia, Philadelphia Water Department. Civil Engineer-in-Training responsible for investigations and design of dredging and disposing of 4,100 cubic yards of sediment material from the Schuylkill River. The work includes completing sediment volume calculations using AutoCAD Civil 3D and writing technical specifications.

Flood Mitigation and Monitoring, Dam Safety, and Dredging Program – Basic Ordering Agreement, Fairfax County, VA, County of Fairfax, Virginia, Department of Public Works and Environmental Services. Civil Engineer-in-Training providing consulting engineering services, on an as-needed task-order basis, for flood mitigation and monitoring, dam safety, and dredging services. Services include dredging projects, topographic surveys, geographic information system (GIS) utilization, pond retrofits, riser structure modifications, and H&H analysis including Federal Emergency Management Agency (FEMA) floodplain mapping and SITES analysis.

Six Dam Assessments, Statewide MA, U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), Massachusetts Office. Civil Engineer-in-Training responsible for the completion of dam assessment reports for six NRCS dams in Massachusetts. Work includes completing hydraulic, hydrologic, and auxiliary spillway analyses using SITES; identifying deficiencies; and developing rehabilitation alternatives and planning-level cost estimations.

Indefinite Delivery/Indefinite Quantity Architectural and Engineering Services – Assessment of Three Dams, Aroostook County, ME, U.S. Department of Agriculture, NRCS, Maine State Office. Civil Engineer-in-Training responsible for the completion of dam assessment reports for three NRCS dams in Maine. The work includes completing hydraulic, hydrologic, and auxiliary spillway analyses using SITES; identifying deficiencies; and developing rehabilitation alternatives and planning-level cost estimations.

Indefinite Delivery Contract Dam Inspection, Fort Stewart Dam Inspections, Hinesville, GA, U.S. Army Corps of Engineers (USACE), Vicksburg District. Civil Engineer-in-Training responsible for conducting periodic dam safety inspections at U.S. Army base facilities as requested by the Engineering Research and Design Center. Nine dams on the Fort Stewart, Georgia, installation were inspected in 2014. Deliverables included dam inspection reports with recommendations and cost estimates to satisfy dam safety requirements, reviews of standard operating procedures for use by base personnel, and providing updated National Inventory of Dams database entries for each structure.





Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 1

Years Experience with Other Firms: 5

Education:

BS, Civil Engineering, Shanghai Jiao Tong University (China), 2009

MS, Civil and Environmental Engineering, University of Maryland, 2011

PhD, Civil and Environmental Engineering, University of Maryland, 2015

Professional Registrations:

EIT: Maryland - No. [REDACTED] (2012)

Summary of Role and Experience

Hydrology and Hydraulics Designer responsible for providing assistance in hydrology and hydraulics (H&H) analysis related to various types of engineering projects.

Related Projects

Dam Inundations and Assessments, Statewide NH, New Hampshire Department of Environmental Services. H&H Designer conducting dam break hydraulic analysis for 9 state-owned dams. Work includes reviewing existing H&H data; collecting topographic data; developing detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software; preparing inundation mapping and summary reports.

Dam Inundation and Emergency Action Plans (EAPs) – Eastern Region, Eastern Region, United States, U.S. Department of Agriculture (USDA), United States Forest Service. H&H Designer conducting dam break hydraulic analysis for Day Lake Dam within the United States Forest Service Eastern Region as part of a nationwide indefinite delivery/indefinite quantity (ID/IQ) architectural and engineering services contract. Work includes reviewing existing H&H data; collecting topographic data; developing detailed hydraulic model using HEC-GeoRAS, HEC-RAS, and ArcGIS software; preparing inundation mapping for Day Lake Dam, and preparing a detailed report.

Dam Assessment Services, Five Dams, Various Counties in OH, Ohio Department of Natural Resources (ODNR). H&H Designer performing inundation mapping of Shreve Lake Dam, Jefferson Lake Dam, Grand Rapids Dam,

Findley Dam, and Killdeer Upground Reservoir Dam. Work included preparing inundation mapping using ArcGIS software and detailed H&H reports.

Beaverdam Creek and Goose Creek Dams – Master Plan Study and Dams Operation, Ashburn, Loudoun County, VA, Loudoun Water. H&H Designer performing hydrological analysis of the watershed contributing to the reservoir. Work includes collecting the most up-to-date landcover data and soil data, using Arc-GIS to create spatially varied land cover-soil relationship, calculating curve number using the new data, re-simulating the watershed using HEC-HMS model, and analyzing the HMS simulation results.

2-D Hydraulic Analysis, Mineral Ridge Dam and Spillway Improvement Project, Mahoning County, OH, ODNR. H&H Designer preparing dam assessment reports of Mineral Ridge Dam Project. Work includes preparing a detailed H&H report.

Prior to Gannett Fleming:

Decision Support System (DSS) for Urban BMP Selection. Research Assistant working as the solo researcher to independently develop two hydrologic models for one urban watershed and one suburban watershed with the Soil and Water Assessment Tool (SWAT). Identified the geological locations of NPS pollution hotspots where excessive sediments, surface runoff, and nutrients were generated. Maximized the NPS reduction rate on a limited budget by applying proper spatially distributed BMPs only to the identified hotspots. Independently researched and created a systematic way to quantify the long-term effectiveness of urban green infrastructure using SWAT. Expedited the hotspot identification and stormwater management decision-making process through the use of MATLAB. Conducted two conference presentations at the 2013 American Geophysical Union (AGU) Fall Meeting (Oral) and the 2014 American Water Resources Association (AWRA) Annual Conference (Poster). Submitted one first-author technique paper to the *Journal of Hydrologic Engineering* from the American Society of Civil Engineers (ASCE) (under review). Guided and supervised several graduate students on using hydrologic models and applying the DSS concept in similar NPS-related projects.

Hydrologic Modeling Using the Soil and Water Assessment Tool (SWAT). Research Assistant working as the solo researcher to build a SWAT model for a large



Resume – Yan (Vicky) Wang, PhD

Architectural/Engineering Services, Solicitation Number HSE160000002



rural watershed: the Shenandoah Valley Region. Improved the SWAT model performance in stream discharge simulation by replacing the linear groundwater calculation method in SWAT with a nonlinear one. Incorporated the nonlinear groundwater calculation algorithm into SWAT through modifying source codes using FORTRAN. Proposed a multi-objective autocalibration framework for optimization of SWAT using a gradient-based model-independent optimization tool known as PEST. Published one first-author research paper on *Hydrological Processes*. Conducted conference presentations at the 2010 Great Valley Water Resources Science Forum and at the 2011 Chesapeake Modeling Symposium. Won the Poster Competition (among 20 posters) in the 2010 Departmental Research Review Day. Wrote and defended Masters' Thesis: "Calibrating Shenandoah Watershed SWAT model using a nonlinear groundwater algorithm."

Sea-Level Rise and Coastal-Flood-Risk Modeling.

Research Assistant working as the solo researcher to gather more than 50 years of daily sea-level (stage) records and study major historical floods in Annapolis, Maryland. Wrote a MATLAB program that carried out statistical analysis on the sea-level records under different conditions and created two-dimensional and three-dimensional figures of the sea-level distribution. Developed a stage-duration sea-level probability density function (pdf) for Annapolis, which was related to the sea level and the duration of that specific stage. Further analyzed the stage-duration trends for each 10-year period during the past 50 years. Improved the stage-duration sea-level probability density model by including a third factor – time, which expanded the model's ability to predict the future-stage-duration pdf and assess the flood risk for critical infrastructure.

Teaching Assistant responsible for providing in-class assistance and step-by-step instruction to students in undergraduate-level engineering computation courses such as Geo-Metrics and geographic information system (GIS) in Civil Engineering. Directed students on model bridge construction and testing projects after class (Mechanics I & II). Invented a framework learning method to improve students' passion for learning and efficiency in perceiving knowledge.

Statistical Analysis and Modeling of the Number of Letters of Map Amendment (LOMA), Nassau County, NY, Dewberry, Inc. Intern tasked with comparing the new and the old versions of the flood maps in Nassau

County, New York, for any increase or relocation of the mapped flood zones. Successfully identified the key factors such as population, household income, river miles, and time (days from new map announcement) for LOMA number prediction. Independently searched and obtained necessary data from the U.S. Census; analyzed and calculated the geological data of the area using ArcGIS. Formulated a nonlinear regression model for LOMA number prediction using the statistical analysis tool R. Drafted a 15-page technique report on problem statement, model formulation, model calibration, and model validation. Guided one graduate student over the following 3 months to improve the model.

Maryland Water Resources Research Center, College Park, MD. Graduate Assistant responsible for building webpages, creating GIS maps, and maintaining the research center's website. Helped organize, photograph, and document the research center's annual symposiums.





Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 10

Years Experience with Other Firms: 0

Education:

AAS, Surveying Technology, Pennsylvania College of Technology, 2006

BS, Civil Engineering Technology, Pennsylvania College of Technology, 2006

Professional Registrations:

EIT: Pennsylvania - No. [REDACTED] (2006)

PLS: Pennsylvania - No. [REDACTED] (2012)

Professional Affiliations:

Pennsylvania Society of Land Surveyors

National Society of Professional Surveyors

Summary of Role and Experience

Survey Party Chief for the Environmental Resources Division responsible for the coordination of a survey crew and data collection. Directs field activities related to topographic, hydrographic, property, construction, monitoring, and specialty surveys for dam, flood control, and geotechnical projects and for many water supply projects involving the design and construction of water treatment facilities, transmission and distribution pipelines, and water storage tanks. Performs surveys and post-processes the data to prepare it for mapping.

Related Projects

Map Modernization, Various Locations, PA, U.S.

Department of Homeland Security, Federal Emergency Management Agency (FEMA). Specialist responsible for updating FEMA flood maps in accordance with FEMA's map modernization program. Responsible for interpolating data off dated floodway maps, converting it to North American Vertical Datum of 1988, updating road names, and replotting them. Performed this for York, Blair, Bradford, Huntingdon, Lackawanna, Potter, Tioga, and several other counties in the state.

Map Modernization, Surveying, Various Counties, PA,

U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA), Region III. Party Chief responsible for the collection of detailed field survey data for various streams across Butler, Lackawanna, Beaver, Fayette, and York Counties. The

field survey information was collected in the Pennsylvania State Plane North American Datum of 1983 Coordinate System with units in feet and North American Vertical Datum of 1988. Ground control was established using static Global Positioning System (GPS) survey procedures in combination with National Geodetic Survey benchmarks. First- and second-order horizontal and vertical benchmarks were used to establish ground control points throughout the detail study reach. The field survey information was collected in accordance with FEMA Guidelines, Appendix A and used the watershed information system point descriptors. Static GPS ground control was also established along Dogwood Run and Connoquenessing Creek for the collection of airborne Light Detection and Ranging terrain data and digital image mapping. Panel points were placed along the study areas and at the airports to establish ground control for the airborne data collection.

Indefinite Delivery Contract for Dams, Keyser, WV, U.S.

Department of Agriculture, Natural Resources Conservation Service, West Virginia State Office. Party Chief responsible for collecting topographic survey data of the New Creek Dam and surrounding area, including access roads and cross sections downstream of the dam, and for conducting depth-sounding surveys in the reservoir. Responsible for the collection of as-built and construction check surveys during construction.

Indefinite Delivery-Type Contract for Engineering, Design, and Associated Engineering Support Service for Dam Inspection, Port Royal, VA, U.S. Army Corps of Engineers, Vicksburg District.

Party Chief responsible for the collection of topographic survey data at eight earthen dams and in surrounding areas. Tasks included conducting depth-sounding surveys in the reservoirs and cross sections downstream.

Triennial Dam Inspections and Hydrologic and Hydraulic Analyses, Loudoun County, VA, City of Fairfax.

Party Chief responsible for the collection of topographic survey data on six structures on Goose Creek. Performed stream cross sections and road profiles for hydraulic modeling. Also performed detail sketches of each structure.

Occoquan Dam Upgrades, Fairfax County, VA, Fairfax County Water Authority.

Survey Helper responsible for collecting survey data, including topographic features around the Occoquan Dam; performing bathymetric





surveys; and creating detailed sketches of the inside of the buildings.

Nesbitt Dam Rehabilitation, Scranton, PA, Pennsylvania American Water. Party Chief responsible for collecting topographic survey data of a dam and surrounding area, including access roads and cross sections downstream of the dam, and for conducting depth-sounding surveys in the reservoir. Also served as Specialist responsible for developing erosion and sediment pollution control plans. Provided on-site engineering services pertaining to the placement of roller-compacted concrete (RCC).

Thorn Run Dam Rehabilitation, Oakland, PA, Pennsylvania American Water. Party Chief responsible for the collection of topographic and property survey data of a dam and surrounding area, including access roads and cross sections downstream of the dam, and for conducting depth-sounding surveys in the reservoir. Also served as Specialist responsible for developing erosion and sediment pollution control plans.

Ryerson Station State Park Dam, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. Survey Helper responsible for performing high-precision control and monitoring surveys of an existing dam and road network. Responsible for collecting survey data using Global Positioning System (GPS) and total station survey equipment and reducing the data. The surveys were performed every 2 months to quantify observed movements of the dam and adjacent roadways and bridges.

Gilboa Dam, CAT-211, Schoharie County, NY, New York City Department of Environmental Protection. Party Chief responsible for the collection of detailed survey data, including precision monitoring surveys of a dam, construction check surveys, mapping of landslide features, topographic mapping, and data reduction. Used both Global Positioning System (GPS) and total station surveys for the field surveys.

Indefinite Delivery/Indefinite Quantity Contract for Dam and Hydraulic Services on State Park and State Forest Lands, Ryerson Station State Park Dam, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. [2011-2012][53180] Specialist responsible for checking calculations, doing a cost estimate, and updating drawings for the design of a new dam.

Risk Mapping, Assessment, and Planning Program Support, St. Johns, FL, U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA). Party Chief responsible for the collection post-processing of a network of monumented checkpoints over approximately 830 square miles. Managed and provided quality control for the acquisition of Light Detection and Ranging data to meet FEMA standards. A total of 27 checkpoints were established. Two National Geodetic Survey benchmarks were used as horizontal and vertical control for the project.

Annual Services - Municipal Engineering Services, Camp Hill, Cumberland County, PA, Borough of Camp Hill. Party Chief responsible for topographic survey services. Provided topographic surveys in support of MS4 Stormwater compliance activities including outfall delineation and field investigation, web-based inventory of stormwater system components (catch basins/inlets, storm sewer pipes overland swales, and manholes).

Pumping Station Rehabilitations, York Township, York County, PA, York Township Water and Sewer Authority. Survey Manager working on the design for the rehabilitation of the Honey Valley and Marlborough wastewater pumping stations.

Kentucky River and Richmond Road Water Pumping Improvements, Lexington, KY, Kentucky American Water. Specialist responsible for the hydraulic analyses for a proposed intake and pump station on the Kentucky River. The analyses were performed using the U.S. Army Corps of Engineers' HEC-RAS computer model. Used a combination of data from detailed bathymetric surveys and United States Geological Survey quadrangle topographic maps to perform the study.

Roth Lane Wastewater Treatment Plant 2011 Upgrades, Hampden Township, Cumberland County, PA, Hampden Township Sewer Authority. Party Chief responsible for the collection of topographic and property surveys related to the design and construction of new wastewater treatment plant facilities.



Project Role:

GIS/H&H Professional

Years Experience with Current Firm: 9

Years Experience with Other Firms: 0

Education:

BS, Civil Engineering Technology, Pennsylvania College of Technology, 2008

Professional Registrations:

PE: Pennsylvania - No. [REDACTED] (2014)

SIT: Pennsylvania - No. [REDACTED] (2008)

Professional Affiliations:

Pennsylvania Society of Land Surveyors

Association of State Dam Safety Officials (ASDSO)

National Society of Professional Surveyors

Summary of Role and Experience

Field Surveyor for the Environmental Resources Division responsible for performing field surveying, data collection, and data processing and reduction. Related office responsibilities include preparing engineering maps and drawings using AutoCAD, assisting with preparation of graphics and exhibits, in-house printing, and copying. Field activities include topographic, hydrographic, property, construction, monitoring, and specialty surveys for all dam and flood control and geotechnical projects and for many water supply projects involving the design and construction of water treatment facilities, transmission and distribution pipelines, and water storage tanks.

Related Projects

Upper Deckers Creek Site 1 Dam Rehabilitation, Preston County, WV, United States Department of Agriculture, Natural Resources Conservation Service (NRCS) West Virginia State Office. Project Engineer for the design of erosion and sediment (E&S) plans and reports and conducted field surveys for the mapping report for the 55-foot-high, zoned earth embankment dam. The dam is a high-hazard structure with a reinforced concrete principal spillway conduit and earth cut auxiliary spillway. Final rehabilitation design includes replacement of the existing riser structure, extension of the principal spillway conduit, modification of the dam embankment to serve as an auxiliary spillway with the addition of a stepped, roller-compacted concrete chute, flattening the downstream embankment slope for stabilization, and

filling/abandoning the existing auxiliary spillway due to integrity concerns. The normal pool elevation of the reservoir will be raised as part of the project to increase water supply storage for the local municipality.

Lost River Site 16, Hardy County, WV, U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). CADD Technician responsible for developing plans and details using AutoCAD while implementing Autodesk Civil 3D as a design tool for the preliminary layout and development of auxiliary spillway alternatives for a new 80-foot-high zoned earthfill dam. Hydrologic analyses were completed using the NRCS's SITES computer model. The model was also used to evaluate the proposed spillway's susceptibility to erosion damage and breaching. In addition, the project scope of work included establishing Global Positioning System (GPS) control, aerial mapping of the Lost River Valley, stakeout of exploratory drill holes and test pits, on-site exploration of subsurface conditions, laboratory testing of soil and rock samples, materials studies, preliminary zoning and design of the earthfill embankment, hydrologic and hydraulic analyses, and proportioning of various hydraulic structures.

New Creek Site 14 Dam Rehabilitation, Grant County, WV, U.S. Department of Agriculture, Natural Resources Conservation Service. CADD Technician/Engineering Technician responsible for preparing contract drawings, checking quantities, and reviewing cost estimates for the rehabilitation of an existing 100-foot-high, 940-foot-long zoned earthfill dam. Also performed field surveys during construction. Rehabilitation measures included slope stabilization, roller-compacted concrete (RCC) spillway armoring, a new toe-drain system, and outlet works modifications.

Dam Assessments, WV, U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS). CADD Technician assisting in preparing inundation maps for dam assessment reports for 75 NRCS dams located in West Virginia. Work includes performing dam inspections; conducting reconnaissance of downstream impact areas; performing dam failure modeling using HEC-RAS; preparing inundation mapping; performing hydrologic, hydraulic, and auxiliary spillway analyses using the NRCS SITES computer program; preparing failure risk indexes; identifying deficiencies; and developing rehabilitation alternatives.





Indefinite-Delivery Indefinite-Quantity Architect and Engineering Contract – Dam Services, Wheeling and Princeton, WV, U.S. Department of Agriculture, West Virginia Natural Resources Conservation Services.

Assistant to Survey Party Chief responsible for collecting detailed survey data, including topographic and bathymetric mapping, and performing data reduction. Used both Global Positioning System (GPS) and total station surveys for the field surveys. A survey mapping report was also generated.

Floodplain Map Modernization Program, Luzerne, Lackawanna, Washington, Beaver, Butler, and Armstrong Counties, PA, U.S. Department of Homeland Security, Federal Emergency Management Agency, Region III. CADD Technician responsible for the preparing contract drawings and CADD standards and assisting with field survey work to create stream cross sections in the update of flood insurance rate maps (FIRMs). The project involved combining flood hazard mapping information for all communities within a county into a single, countywide digital FIRM and making draft and preliminary submissions in the required geographic information system (GIS) submittal format.

Legal Land Surveys, Nationwide, US, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Pennsylvania State Office. Assistant to the Project Task Manager for legal boundary surveys at the following properties for PA NRCS: Lehman, Rynd, and Dunn properties in Crawford County; Mierly property in Huntingdon County; Lenko property in Butler County; Barr property, Venango County; YMCA property, Lancaster County; and Bencinic property, Lawrence County.

Fort A.P. Hill Survey and Hydraulic Investigations, Port Royal, VA, U.S. Army Corps of Engineers, Vicksburg District. Assistant to Survey Party Chief in performing field surveys and bathymetry surveys for seven dams at Fort A.P. Hill. Also served as the lead CADD Technician in generating drawings used for the field survey report.

FEMA Risk Mapping, Murfreesboro, TN, U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA). Assisted Survey Party Chief in performing field survey work to create stream cross sections in the update of flood insurance rate maps.

Gunter Valley Dam Rehabilitation, Franklin County, PA, Pennsylvania Department of General Services, Bureau of

Engineering and Architecture. Survey Party Chief responsible for field surveys of the access road that will be upgraded to provide better access to the dam. Assisted project manager and generated contract drawings for preliminary design of improvements at Gunter Valley Dam, which is located in Franklin County, Pennsylvania, between Blue Mountain and Kittatinny Mountain, immediately southwest of the Pennsylvania Turnpike tunnels. The Gunter Valley Dam is an 83-foot-high, 550-foot-long earth embankment structure owned by the Pennsylvania Department of Conservation and Natural Resources, Bureau of Forestry. At the beginning of the project, the Gunter Valley Dam was classified as a high-hazard dam. The Gunter Valley Reservoir was previously used for water supply for the Borough of Shippensburg. The goal of the project is to complete improvements to the existing dam impounding Gunter Valley Reservoir to bring the facility into compliance with current Pennsylvania dam safety regulations. Tasks have included the design of a 125-foot Ogee spillway with semicircular layout and a stilling basin.

Pikes Creek Dam Rehabilitation, Jackson, PA, Pennsylvania American Water. Assistant to Survey Party Chief in collecting topographic survey data of a dam and surrounding area, including access roads and cross sections downstream of the dam, and for performing depth-sounding surveys in the reservoir. Also served as CADD Technician in generating contract drawings and assisting with quantity takeoff.

Ryerson Station State Park Dam, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. CADD Technician/Engineering Technician responsible for helping with final design, bid, and construction services for a concrete gravity dam and other project features to replace the damaged existing structure, with design completion in 2010. Continuation of the monitoring program was also planned to confirm site conditions.



3. Experience



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002

Gannett Fleming has more than 40 years of Federal Emergency Management Agency (FEMA) experience and more than 20 years of experience providing engineering services related to flooding in West Virginia. This experience, as demonstrated by the project summaries provided on the following pages, includes hydrologic and hydraulic (H&H) modeling with HEC-RAS, floodplain identification and mapping, Digital Flood Insurance Rate Maps (DFIRM) development, data management, topographic data development, mitigation planning and community outreach.

Our Map Modernization experience with FEMA Region III and Cooperative Technical Partners, and our National Production and Technical Services (PTS) Risk MAP experience, required an intimate knowledge of FEMA policy, procedures, and standards, including their limitations. **To support that work, we developed custom GIS and modeling tools to improve the quality of deliverables and the flood data production efficiency. These tools ultimately resulted in cost-savings to our clients. Our services helped local communities prepare for and mitigate flood damages and better manage their future flood risk.** Since 2004, FEMA Region III has contracted with Gannett Fleming for two 5-year indefinite delivery/indefinite quantity contracts to support their flood Map Modernization program. This work involved the development of a countywide study that included Zone A mapping and redelineation of detailed studies in West Virginia.

In addition to our extensive FEMA experience providing the types of services requested by the Agency, **we have a long history of performing H&H analyses for riverine flooding in West Virginia.** Under contract to the Natural Resources Conservation Service (NRCS), **our team has modeled and mapped inundation areas for over 1,500 river miles in West Virginia.** This work included hydrologic modeling using HEC-HMS, hydraulic modeling using HEC-RAS, and inundation mapping, as well as services related to assessing, planning for and communicating flood risks.

Providing the results of our analyses and communicating them to our clients and the public is an area in which our team excels. We are experienced at developing regulatory products such as DFIRM databases, panels and reports that are traditionally required by FEMA, and alternative products such as flood risk analysis grids. **Beyond those requirements, we have**

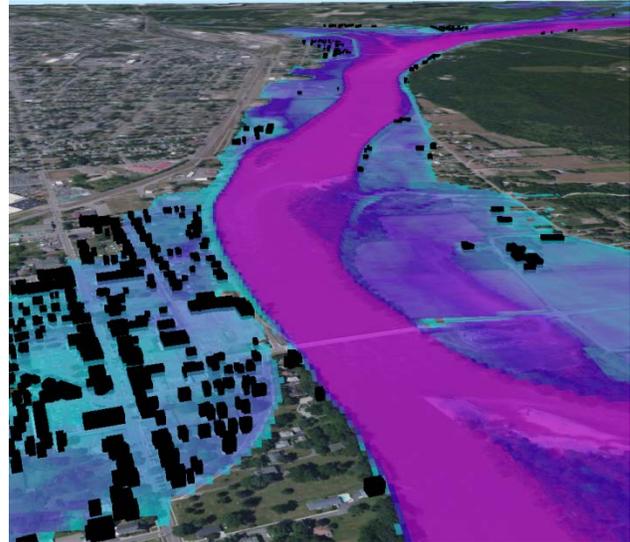


Figure 3-1: FEMA Flood Hazard Depth Grids. Gannett Fleming developed depth grids for FEMA Region III to help local officials in the Region assess and mitigate risk.

developed GIS workflows and related tools to automate key processes and trained others on the use of these tools. Our firm uses state-of-the-art technology and advanced engineering to increase quality, reliability, and availability of flood hazard maps and data, along with employing a collaborative process to involve all stakeholders. **We have cooperatively developed innovative data delivery techniques to facilitate the transmittal, storage and retrieval of deliverables in a way that met project objectives.** In our work for FEMA Region III, we compiled hydraulic model input and outputs and floodplain delineations on a single web portal to facilitate the management and dissemination of a large amount of data.

We have significant experience providing a wide range of community outreach activities. As demonstrated on our FEMA, NRCS, and Association of State Dam Safety Officials (ASDSO) contracts, we have facilitated community meetings, technical seminars, and meetings to build consensus among emergency responders. As invited speakers, lecturers and seminar instructors, **our engineers are viewed as subject matter experts in hydraulic modeling with HEC-RAS, hydrologic modeling, geospatial analyses and FEMA processes.**



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1. Past Projects

Our completed past projects described in this section include FEMA Map Mod and Risk MAP projects, GIS tool development services, modeling for West Virginia dams, and Hazard Assessment services provided for NRCS, and our personnel's HEC-RAS and HMS webinar and seminar training courses.

3.1.1. Flood Map Modernization, FEMA, Region III Location: WV, PA, VA, MD, Washington, DC

Project Manager: Nikki Roberts, PE

Contact Information: 215-931-5575,
Nikki.Roberts@dhs.gov

Type of Project: Mapping, Modeling

Goals: All-inclusive flood map production services; modeling of surface water flow in various topographic settings

Deliverables: FEMA regulatory products – Countywide DFIRM database, panels, and Flood Insurance Study Report

Gannett Fleming, as part of a Joint Venture (JV), **produced DFIRMs and Flood Insurance Studies (FIS) in accordance with Federal Emergency Management Agency (FEMA) Guidelines and Specifications** throughout FEMA Region III (West Virginia, Pennsylvania, Virginia, Maryland, Delaware, and Washington, DC). For more than 20 task orders, we provided end-to-end flood map production services which included **combining the effective flood hazard information with newly developed flood hazard information** in 22 counties, detailed field survey of more than 1,000 hydraulic structures and stream valley cross sections, H&H analyses and floodplain mapping utilizing automated tools in a GIS environment, development of FEMA's standard DFIRM database and production of hard-copy DFIRM panels, and **distribution of preliminary map products and active participation in community scoping meetings, post-disaster, flood mitigation, and Community Consultation Officer (CCO) meetings** following preliminary release.



Figure 3-2: One-Percent-Annual-Chance Depth Grid. Our firm developed flood risk analysis grids for counties across FEMA Region III and IV.

Flood Hazard Identification and Mapping: We performed floodplain analyses and **mapping for over 5,000 stream miles using in-house GIS floodplain mapping tools** integrated with U.S. Geological Survey (USGS) Regression Equations and HEC-RAS modeling. Along more than 1,000 stream miles, **we redelineated the 1- and 0.2-percent annual chance floodplain and regulatory floodway boundaries from flood profiles and LiDAR terrain data.** In addition, our team digitized effective flood hazard data along more than 2,000 stream miles in 4 counties and processed LiDAR las files, combined with field survey data, to generate a triangulated irregular network (TIN) to support hydraulic modeling and floodplain mapping.

Hydrologic and Hydraulic Modeling: Our firm also **developed detailed H&H models using custom automated GIS tools** along more than 100 stream miles in five different counties. Analyses included floodway analyses, split-flow, shallow-flooding, and typical riverine conditions. Hydraulic analyses were performed with HEC-RAS models, including CHECK-RAS review of the model results and mapping QC reviews for floodways, ineffective flow areas, and FEMA's Floodplain Boundary Standard (FBS) check. **Our GIS approach to modeling resulted in innovative data sets to support risk**

Q16-5291





3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002

assessment including multi-frequency depth and water surface elevation grids.

Additionally, we developed H&H models using custom automated GIS tools for thousands of approximate stream miles. **We developed an ArcGIS Online web map to disseminate the data, making the HEC-RAS models and TSDNs available for download:**

<http://tinyurl.com/h5qddm/>

Data Management: Our firm created a suite of custom GIS tools called the DFIRM Development Kit (DDK) **to improve DFIRM database production efficiencies and overall quality of deliverables.** The DDK includes field inventory data collection software compatible with FEMA Guidelines and Specifications; H&H tools used for rainfall runoff modeling, USGS Regression, and HEC-RAS modeling; advanced floodplain mapping algorithms that handle split flows, backwater, and roadway overtopping; DFIRM database development tools and QC routines; and tools for processing LiDAR to produce “hydrologically-correct” digital elevation models (DEMs). **This suite of tools was designed to operate on a remote server that supports a multi-user environment for real-time collaboration, production, and seamless workflow.** It includes the development and management of a three terrabyte statewide GIS database of base mapping layers including LiDAR, orthoimagery, topography, planimetrics, 1-meter DEMs, and more. **These tools were used to develop 20 countywide standard DFIRM databases, provide independent QC on dozens more, and support easy integration with FEMA’s Mapping Information Platform (MIP).**

DFIRM Production: Combining effective FEMA flood hazard information, new detailed H&H analyses, and mapping for more than 650 communities, **we produced 22 countywide DFIRM databases and FIS reports.** From these GIS databases and **using custom DFIRM mapping tools, we were able to produce more than 2,000 preliminary DFIRM panels, and distributed more than 10,000 hardcopy maps.**

Surveying: Gannett Fleming performed field surveys using conventional and Global Positioning System (GPS) techniques for bridge and culvert crossings, dams, levees and natural stream valley cross sections along more than 150 stream miles. **An automated post-processing system was developed in GIS to output FEMA’s Data Capture Standards deliverable format, and integrate survey data**



Figure 3-3: Custom Web Applications. For no additional cost to FEMA, our team developed an ArcGIS Web Application to view Zone A modeling results and disseminate data to the local stakeholders for mitigation planning.

with LiDAR terrain data to support HEC-RAS hydraulic modeling.

Community Outreach: Our personnel **actively participated in initial community scoping and project coordination meetings.** We used real-time GIS presentations to foster community input and track community concerns and observations spatially during planning process. We also **conducted presentations intended to educate the public and community officials on complex technical issues, listened and gathered feedback from meeting participants, and evaluated and incorporated community comments** into the flood study project.

Topographic Data Development: Gannett Fleming managed the acquisition of LiDAR in two Pennsylvania counties. We identified areas for acquisition, coordinated with our LiDAR subcontractor, conducted field survey of 80 checkpoints in different land cover, and **provided standard QC according to FEMA Guidelines and Specifications.**

Independent QA/QC: Our firm performed independent QA/QC of work completed by our JV partner and other Region III ID/IQ contractors in the following areas:

- Topographic data development
- Base map GIS data
- H&H analyses
- Floodplain mapping
- DFIRM database development
- Preliminary map products.



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1.2. FEMA Risk MAP Production and Technical Services, FEMA Location: Various U.S. Locations

Project Manager: Mark Vieira, FEMA Region IV

Contact Information: 770-220-5450,

Mark.Vieira@fema.dhs.gov

Type of Project: Mapping, Modeling, and Risk Assessment

Goals: Identify and mitigate flood risk through flood hazard engineering and community outreach

Deliverables: Regulatory and Non-Regulatory Products (DFIRM and FIS Reports, Flood Risk Assessment Data)

As a member firm of a JV, Gannett Fleming is providing PTS in support of FEMA's Risk MAP Program.

Task orders to-date under this five-year IDIQ contract include:

- Validating flood hazard engineering and mapping in support of FEMA's Coordinated Needs Management Strategy (CNMS)
- Topographic data development
- H&H Modeling
- Floodplain identification and mapping
- Regulatory and non-regulatory products - DFIRM development and flood risk products and consequence assessment
- Hazard mitigation planning
- Physical Map Revisions
- Special Flood Risk and Planning Projects.

Coordinated Needs Management Strategy (CNMS): Our team **determined the validity of engineering study data for over 4,200 detailed stream miles within FEMA's mapped inventory, through community outreach, review of the effective Flood Insurance Study and numerous standardized validation elements.** We developed a standardized CNMS Stream Inventory GIS database for over 70 counties and maintained consistency and quality of the GIS database through tools developed in-house incorporating SQL expressions and python scripting. **Our firm also catalogued all supporting back-up data and developed documentation spreadsheets for all validated reaches.**

Topographic Data Development: Gannett Fleming is responsible for the acquisition and processing of LiDAR

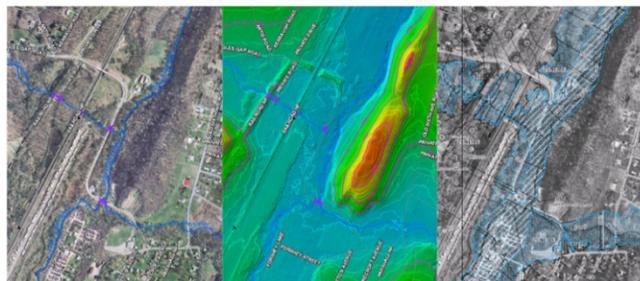


Figure 3-4: NFIP Program. Our team understands the NFIP program beginning with base map acquisition to DFIRM production and distribution.

data within FEMA Regions IV, VIII, and IX. We provided support managing three LiDAR subconsultants, field survey, and **QA/QC to verify that the LiDAR data meets the standards** outlined in *FEMA's Guidelines and Specifications (G&S), Appendix A, Guidance for Aerial Mapping and Surveying, FEMA Procedure Memorandum No. 61, and USGS LiDAR Guidelines and Base Specification, Version 13.*

Hydrologic and Hydraulic Modeling: We **conducted revised detailed riverine studies using HEC-RAS**, followed by completing consequence analyses, and **creating/distributing preliminary DFIRMs and FIS reports** for studies within Florida and Tennessee. Our services and products were provided in accordance with FEMA's G&S and Procedure Memorandums and included coordination with the USACE Nashville District and city engineers to provide technical reviews of their H&H analyses; conducting enhanced hydraulic analyses using HEC-RAS by calibrating to recent storm events.

Floodplain Identification and Mapping: We provided floodplain delineations for the 1- and 0.2-percent-annual-chance floodplains as well as the regulatory floodway boundaries for the revised stream reaches.

DFIRM Development and Flood Risk Products: Gannett Fleming **created and distributed preliminary DFIRMs and FIS reports.** In addition, **we developed GIS products to convey flood risks.** This included the development of the Flood Risk GIS Database, Flood Risk Report and Flood Risk Map. The standardized Flood Risk GIS Database contained "Changes Since Last FIRM" data, and Flood Depth, Velocity, Probability and Analysis Grids.

Hazard Mitigation Planning: The hydraulic modeling and mapping tasks under this contract were followed by

Q16-5291





3. Experience

Architectural/Engineering Services, Solicitation Number HSE1600000002

consequence analyses tasks. **HAZUS analyses to quantify the economic and human impacts of the annual chance flood events were conducted according to FEMA standards.** Our firm performed a refined loss estimate for the revised study area. Loss estimates were calculated for four flood recurrence intervals, 10-, 4-, 1-, and the 0.2-percent annual chance.

Physical Map Revisions: Gannett Fleming incorporated Letters of Map Revision (LOMRs) in four counties across FEMA Region IV. **Tasks included base map acquisition, topographic data development, floodplain mapping, DFIRM production and distribution and community outreach.**

Special Flood Risk and Planning Projects: Our firm prepared a new guidance document intended for state regulatory agencies to incorporate within their dam safety programs for evaluating the hydrologic safety of new and existing dams. Additionally, Gannett Fleming assisted FEMA in developing an educational website to convey lessons learned from dam incidents and failures. The "Dam Incidents and Failures" section of the "Lessons Learned Information Sharing" website (www.llis.gov) allows users to access a series of dynamic summaries relating to a selection of lessons learned and corresponding case studies.



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1.3. FEMA Region III IDIQ Contract, DHS/FEMA Region III

Location: Lincoln County, WV

Project Manager: Nikki Roberts, PE

Contact Information: 215-931-5575,
Nikki.Roberts@dhs.gov

Type of Project: Mapping, Modeling

Goals: Developing a Countywide FIS Report to include approximate Zone A analyses and redelineation

Deliverables: DFIRM Database and panels, FIS Report

Gannett Fleming, as a JV partner, **produced DFIRMs and a FIS Report in accordance with FEMA Guidelines and Specifications for Lincoln County, West Virginia.** This task order included topographic data development, developing digital special flood hazard areas along detailed studies, redelineation along the Coal River, and new approximate **Zone A analyses and mapping while utilizing automated tools in a GIS environment;** development of FEMA's standard DFIRM database and production of hard-copy DFIRMs; and distribution of preliminary map products and active participation in the Community Consultation Officer (CCO) meeting.

Topographic Data Development: We managed the acquisition of 1/9 arc sec Digital Elevation Models (DEMs) for three HUC-8 watersheds that intersect Lincoln County. Data originated from the 2003 photogrammetric-derived digital terrain models (DTM) acquired for the Statewide Addressing and Mapping Board (SAMB).

Hydrologic and Hydraulic Analyses: Our firm **mapped nearly 300 stream miles of approximate Zone A flood hazards by analyzing the relationship of depth versus drainage area.** Using custom GIS tools, the 3-meter DEMs were processed to develop a hydrologically correct DEM. We analyzed this information to identify locations where culverts need burnt in to the DEM to support proper flow paths and accurate drainage area determinations. Initially, the input polyline shapefile contained culverts and the locations of wide stream channels visible on the 2003 WV orthoimagery. Subsequent iterations, add more culverts, smaller stream channels, and flow paths through waterbodies until an

accurate representation of flow paths is derived from the DEM data. **The final output of the tool is a stream network shapefile with proper topology and flow direction.** This vector shapefile was visually reviewed against the 2003 West Virginia orthoimagery and original topographic data to make sure the stream channels are in the correct location.

For the streams studied by approximate methods, the 1-percent-annual-chance flood elevations were determined from a regression analysis. A relationship of drainage area and 1-percent-annual-chance flood depth for detailed studies within Lincoln County, and adjacent counties was **compiled using the existing FIS information.** Within GIS, drainage area was calculated for each reach using the hydrologically corrected DEM. **The approximate flood elevations were determined by computing a flood depth using the regression equation and adding it to stream invert elevation extracted from the DEM.** These computed flood elevations were used to delineate an approximate floodplain in a GIS environment using the 10-foot DEM.

Floodplain Mapping: We performed floodplain analyses and mapping utilizing in-house GIS floodplain mapping tools. We redelineated the 1- and 0.2-percent annual chance floodplain and regulatory floodway boundaries from flood profiles and the 3-meter DEM data along Coal River. **Our personnel digitized effective flood hazard data along 81 detailed stream miles.** From the results of the regression equation to determine flood depth along the Zone A reaches, **we developed custom GIS tools to map the 1-percent-annual-chance flood depth.**

DFIRM Production: Using our firm's own DDK, we created a countywide DFIRM database in accordance with FEMA's guidelines and specifications. Once the database was developed, **we produced and distributed the DFIRM panels and countywide FIS Report.**

CCO Meeting: Gannett Fleming actively participated in a CCO meeting following preliminary release. We used a real-time GIS presentation to foster community input and track community concerns and observations spatially during planning process. We also conducted presentations intended to educate the public and community officials on complex technical issues. Listened and gathered feedback from meeting participants followed by evaluation and incorporation of community comments into countywide study.

Q16-5291





3.1.4. FEMA Risk MAP- Production and Technical Services – Flood Risk Assessments, DHS/FEMA

Location: FEMA Region IV

Project Manager: Mark Vieira, FEMA Region IV

Contact Information: 770-220-5450,

Mark.Vieira@fema.dhs.gov

Type of Project: Mapping and Flood Risk Assessment

Goals: Developing Risk MAP Non-Regulatory Products

Deliverables: Flood risk databases and consequence assessments and reports

Gannett Fleming, as part of a JV, is providing Production and Technical Services (PTS) in support of FEMA’s Risk MAP Program. We developed Risk MAP Non-Regulatory Products including a Flood Risk Database, Flood Risk Report, and Flood Risk Map for numerous counties. **The standardized Flood Risk Database contains Flood Risk Assessment data developed in HAZUS and helps communities prioritize future mitigation efforts.**

We compiled and developed hydraulic analyses for the flood risk assessment. The Flood Risk Assessment Dataset reflects potential loss estimates **resulting from an analysis of flood depths within the study area using FEMA’s HAZUS program.** HAZUS provides standardized methodologies for estimating potential wind, flood and earthquake damages. **For these analyses, we used only the HAZUS flood model.** The flood model calculates potential losses along the study reach. The new HAZUS analyses are combined with an Average Annualized Loss (AAL) dataset provided by FEMA. The AAL dataset is a national dataset containing flood average annualized loss estimation using default census data and county wide flood studies, also known as a Level 1 analysis. **Our firm developed custom in-house GIS tools to seamlessly input the hydraulic results into HAZUS.**

Model Development: We performed a **refined loss estimate analysis for new and revised study reaches using HAZUS.** For previous assessments, the study area was comprised of county and watershed boundaries. When defining a study region, the appropriate HAZUS database containing all boundaries, demographic, structure, critical facility, agricultural, and vehicle data were selected from a statewide database. Currently, the

HAZUS database contains information that was analyzed from the 2010 census. Based on the location of the study region, certain assumptions were made about cost of living, and building values. This data was updated if more specific information was available to create a refined analysis. Additionally, building locations and footprints, along with any other specific structure information, were incorporated into the HAZUS model to provide more accurate results. **We calculated loss estimates for 5 flood recurrence intervals, 10-, 4-, 2-, 1-, and 0.2-percent-annual- chance flood events.**

Impact Analyses: HAZUS analyzes flood impacts and loss to better plan for flood emergencies and disasters. For each flood recurrence interval, a detailed loss estimate is calculated based on a new or revised hydraulic analysis. Flood damage estimates are relative to the depth of water as measured from the top of the first finished floor of each structure. Building losses and content losses by structure type are combined in HAZUS and summarized in the Flood Risk Dataset. HAZUS also provides ways to create thematic maps from result tables to spatially depict where damages are estimated to occur. Results for the entire study area, along with summary loss results for each flood recurrence interval, are exported to GIS. **We used custom tools to convert the HAZUS summary output tables** and to perform additional calculations to populate the Flood Risk Dataset tables and the Flood Risk Report. **Refined results were summarized and combined with AAL results to provide a more complete assessment on potential damages** from 5 flood recurrence intervals.

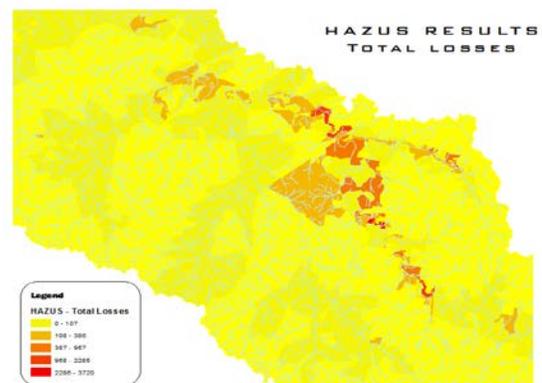


Figure 3-5: HAZUS Model. We incorporate building locations and footprints into the HAZUS model to provide more accurate results.



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1.5. MMC Production Center – 3D GIS Tools for Channel Geometry Estimation and Surface Development, USACE, Vicksburg Location: Various

Project Manager: Phil Dye

Contact Information: 601-631-7467

Type of Project: GIS Tool Development

Goals and Deliverables: Suite of GIS tools to automate the development of a bathymetric stream channel surface and visualize 3D GIS data in Esri's ArcGIS desktop environment.

Gannett Fleming, as part of a JV, **developed a suite of GIS tools to automate the development of a bathymetric stream channel surface and visualize 3D GIS data in Esri's ArcGIS desktop environment.** The GIS tools are used for both larger rivers without channel bottom elevations and smaller streams that do not have sufficient channel detail to accurately reflect channel geometry for both 1D and 2D hydraulic modeling. The project included: designing and implementing a GIS workflow for channel bathymetry estimation, developing a suite of GIS tools to accomplish the proposed workflow, performing QA/QC of GIS tools, documenting tool functionality, and developing training resources. For more information on this suite of GIS tools refer to the YouTube Channel:

<https://www.youtube.com/channel/UCnWtMw-0bG80ka0yqIK2mCq>

Designing the GIS Workflow: Gannett Fleming designed a comprehensive, flexible, automated workflow that included a custom GIS tools suite to facilitate bathymetric surface development and merger with an existing bare-earth digital terrain model. **Using out-of-the-box GIS tools and various terrain sources with a full-range of accuracies, we tested the procedures and designed a proposed workflow and new custom GIS toolsets based on the outcome of extensive testing and experiences.** We presented the workflow to USACE through a series of interactive, digital presentations. Throughout the design process, the USACE tested subsets of the GIS tools and provided feedback.

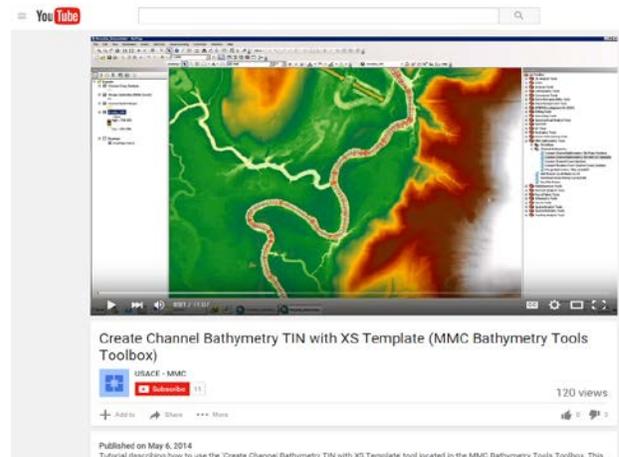


Figure 3-6: Custom GIS Tool Training. Gannett Fleming developed custom 3D analysis tools and included YouTube training videos.

GIS Tools Development: Operating in ArcGIS Version 10.1 or later, the suite of tools included an ArcGIS Python Add-in and an ArcGIS Toolbox. **For 3D visualization and to support model development, we designed a toolbar to work interactively in ArcMap with 3D line layers and terrain surfaces.** The MMC 3D Analysis Tools toolbar contains seven tools that function to better visualize 3D GIS data by digitizing a 3D Line based on surfaces within ArcMap; labeling the distance (station) along a line; computing slope along a digitized line on a surface; annotating 3D vertices; and plotting 3D lines with the ability to annotate the graph, measure, copy the XY, etc. We developed an ArcGIS Toolbox with 11 custom GIS script tools to help create a bathymetric channel surface based on the best available data to estimate the channel geometry for a range of stream sizes and DEM accuracies. Depending on available input data sources that could include field survey, known stream channel inverts, or FEMA flood studies, **two approaches were developed.** Regardless of the input data and approach, **the end result is a merged DEM with an improved channel surface burned into a bare-earth DEM to form one continuous surface used for hydraulic model development.** Additional 3D analysis tools include a tool to download USGS Rating Curve data directly from the web and perform a vertical datum conversion.

Throughout design and development, we dedicated a significant amount of effort to QA/QC. The QC process added tremendous value to the tools as user-error was minimized and potential data input issues were avoided.

Q16-5291





3. Experience

Architectural/Engineering Services, Solicitation Number HSE1600000002

3.1.6. CWMS Modeling, USACE, Vicksburg Location: Various U.S. Locations

Project Manager: Cory Winders
Contact Information: 601-631-5839
Type of Project: Modeling
Goals and Deliverables: CWMS modeling services for the Pascagoula River and Black Warrior and Tombigbee watersheds

Gannett Fleming, as part of a JV, is providing CWMS modeling services for the Pascagoula River and Black Warrior and Tombigbee watersheds within the Mobile District. After development, **the suite of H&H CWMS models will be incorporated into CWMS CAVI, along with documentation and reporting.** The JV is using the MMC Production Center's SOP for the development of all the models that will be incorporated into the CWMS model.

Gannett Fleming is developing, calibrating, and validating the hydraulic models that will be incorporated into the CWMS CAVI. The Okatibbee Creek hydraulic model for the Pascagoula River watershed simulates an approximately 41 mile long reach, which includes 11 bridges and 18 backwater storage areas. The Black Warrior/Tombigbee River hydraulic model simulates over 690 stream miles, including 17 lock and dam structures, 3 levees, 54 bridge crossings, and 164 backwater storage areas. **Gannett Fleming was also responsible for aggregating several high-resolution terrain datasets,** including 2012 and 2011 Mississippi LiDAR data, 2010 Alabama LiDAR data, photogrammetric derived terrain data provided by the Mobile District, and 10-meter USGS NED data, with channel bathymetry from a 2010 sedimentation study provided by USACE into **a seamless terrain model used for model development and floodplain identification and mapping.**

The JV has worked and coordinated closely with both the District and Alabama Power Company (APC), which operates several of dams in the systems to **ensure that the final product will be something they can use to cooperatively operate their systems.** The complete

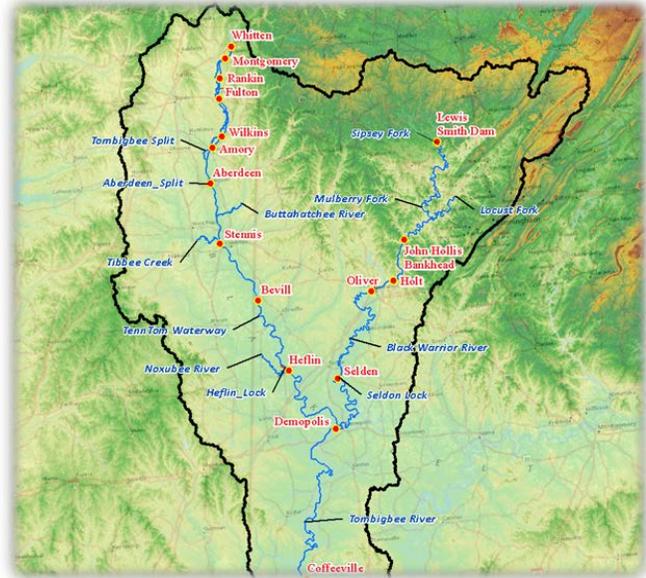


Figure 3-7: Real-time Flood Forecasting. Our Team recently completed over 700 miles of calibrated HEC-RAS modeling in the Tombigbee River Basin.

Pascagoula River and Black Warrior/Tombigbee River watershed CWMS models will include HEC-HMS, HEC-ResSim, HEC-RAS, and HEC-FIA. The JV and the District will work together to integrate these separate models into the CWMS CAVI and make sure the appropriate real-time data is available and accessible within the CAVI. **The final CWMS product will be a useful tool for the District going forward that will provide forecasted runoff as well as potential inundation and damage estimates based on the releases that are made from the reservoirs in the system.**

The JV will complete the following tasks:

- Review pre-modeling GIS data
- Develop terrain products for modeling and floodplain identification and mapping
- Develop HEC-RAS models and documentation for the Pascagoula River and Black Warrior/Tombigbee River basins in the Mobile District
- Calibrate and validate the HEC-RAS models using observed data collected during three historic storm events.



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1.7. Dam and Levee Break Modeling and Consequence Assessments, USACE, Vicksburg

Location: Various U.S. Locations

Project Manager: Robert Simrall, PE (USACE, Vicksburg)

Contact Information: 601-631-5082

Type of Project: Modeling

Goals: GIS-based H&H analyses, consequence assessments, and inundation mapping for 29 dams and levees across the United States.

Deliverables: Documentation, reports, levee failure models

Gannett Fleming, as part of a JV, completed **GIS-based H&H analyses, consequence assessments, and inundation mapping for 29 dams and levees across the United States.** The USACE Critical Infrastructure Protection and Resilience (CIPR), Dam Safety and Levee Safety programs **will use these assessments and products to support a risk-based assessment, prioritization, and management framework.** Tasks include the following: Developing HEC-RAS models that support the estimation of inundation areas based on operations of the dam over a range of hydrologic loading conditions; determining economic and loss-of-life consequences using HEC-FIA; summarizing consequences of economic and human impacts; **developing mapping products that communicate the potential inundation areas, identify critical facilities and downstream communities at risk; and developing levee failure models in HEC-RAS and FLO-2D, AdH, and TUFLOW 2D.** We completed the task orders in accordance with the MMC standard operating procedures (SOP).

Topographic Data Development: We acquired and compiled terrain data and GIS layers to perform the hydraulic analyses. **To support more accurate river channel geometry, custom bathymetry tools were used to develop a channel surface using previously developed FEMA and USACE models along the study reaches.** This bathymetric channel surface was typically combined with high-resolution LiDAR data to develop a project DEM to support detailed hydraulic modeling and inundation mapping.

Hydrologic and Hydraulic Modeling: Using HEC-GeoRAS, along with in-house custom GIS tools, **we developed**

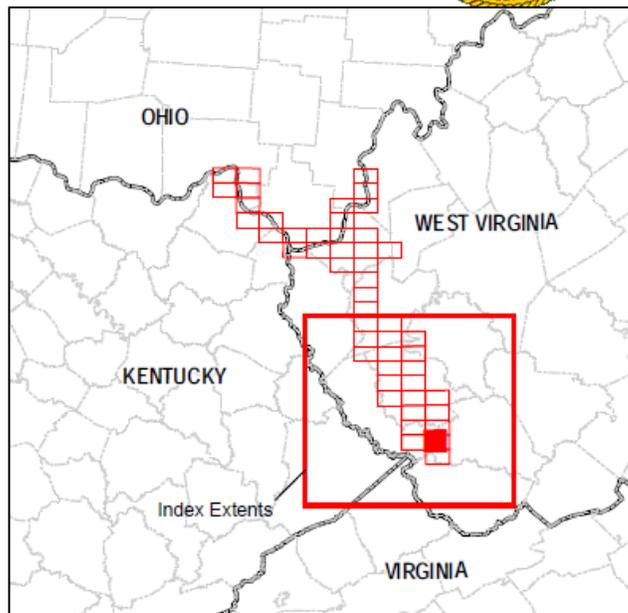


Figure 3-8: Map Atlas Development. To visualize potential downstream consequences from a dam failure, our firm developed inundation mapping products within a GIS environment covering an area of more than 30,000 square miles, including R.D. Bailey Dam in West Virginia.

HEC-RAS models for more than 1,500 river miles.

Modeled streams ranged from small tributaries with less than 100 cfs base flow to larger rivers such as the Ohio and Mississippi Rivers. Dams were often modeled as inline structures with operation rules for gated spillways. Levee systems were modeled in HEC-RAS as lateral weirs with multiple storage areas behind the levees and connections intact with lateral weir geometry.

The dam failure analyses were simulated under five hydrologic loading conditions: two dam breaches with static reservoir elevations at 90- and 10-percent annual exceedance duration pool loading conditions and three dam breaches with unsteady inflows to represent a Security Scenario Pool (1-percent annual exceedance duration pool), Top of Active Storage Pool, and Maximum High Pool, or Probable Maximum Flood event.

Flood Hazard Identification and Mapping: Our team used custom GIS tools with special floodplain mapping algorithms to delineate inundation areas from HEC-GeoRAS for all five hydrologic loading conditions. To help visualize potential downstream consequences from a dam failure along with impacted critical infrastructure, we developed inundation mapping products within a GIS

Q16-5291





3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002

environment, covering an area over 30,000 square miles. The Map Atlases display flood inundation data, arrival times, and impacted critical facilities, with corresponding pages that show the model data in a profile view. Mapping data was prepared by cleaning up inundation areas mapped from the hydraulic model results and using custom tools to develop the necessary datasets.

Additionally, GIS layers developed for the map atlases, such as inundation areas, critical infrastructure, and modeling data, were converted to KMZ files for use in Google Earth and web mapping applications. To streamline this process and to produce consistent and quality deliverables, we created custom GIS tools to automatically generate the KMZ files.

Consequence Assessment: Using HEC-FIA, we performed consequence assessments using results from all dam and levee break scenarios. HAZUS data for population information and the National Structure Inventory for building assessment values assisted with human and economic impact analysis. Simulations were included for each of the fail and non-fail scenarios modeled in HEC-RAS. Larger event failure scenarios were modeled with multiple warning times varying before and after breach initiation.

Based on the results from the HEC-FIA model, our team assessed and summarized economic and human impacts of the dam break scenarios, effects of damages to the dam facility, and monetary impacts associated with lost benefits. More than 40,000 structures for the different dams were analyzed for potential impacts from the modeled scenarios. Additionally, we calculated the population at risk and loss-of-life with consideration for the failure wave arrival time, warning times, time of day, and other variables. Lost benefits associated with potential failure of each dam included water supply, flood risk management, hydropower, navigation, and recreation.

Consequence Assessment Report: A detailed consequence assessment report (CAR) summarized the hydraulic modeling and consequence results for each dam studied. We summarized the dam break model results and determined the economic and human impacts in HEC-FIA. To provide an overview of the extent of community consequences, populated reaches downstream of the dam were described along with the impact to critical facilities. The reach extents summary

also includes failure wave arrival time and depth information beneficial to community officials for evacuation purposes.



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1.8. Flood Studies, NRCS WV

Location: Various Counties, WV

Project Manager: Andy Deichert, PE
Contact Information: 304-284-7563, andy.deichert@wv.usda.gov
Type of Project: Flood Control Studies
Goals and Deliverables: Planning, design, and construction support services for vital components of the NRCS flood control system.

Since 1993, the NRCS has continuously contracted with Gannett Fleming to provide engineering services for the West Virginia office. During that time, we have provided planning, design, and construction support services for vital components of the NRCS flood control system in nine locations in West Virginia. Each of the projects involved H&H analysis as well as community outreach. All of our work was reviewed and approved by both the West Virginia NRCS state office in Morgantown and the NRCS Technical Center in Fort Worth, Texas. This project included services related to Salem Fork Site 11, Salem Fork Site 11A, Lost River Site 16, New Creek Site 14, and Upper Deckers Creek Site 1.

Tasks included:

- Topographic data development using aerial mapping, digital terrain sources and ground survey.
- GIS Data management of the sources of terrain data, the hydraulic model output and the inundation extents.
- Hydrologic and hydraulic modeling of sites in Harrison, Preston, Hardy, and Randolph Counties. Detailed hydraulic models were developed using HEC-GeoRAS, HEC-RAS, and ArcGIS software. Flood control dams were modeled both in HEC-HMS and in HEC-RAS.
- Flood Hazard Identification and Mapping for several scenarios.
- Hazard analysis supported by the hydraulic analyses and floodplain mapping to evaluate flooding consequences for several events. Emergency response efforts were organized and documented.

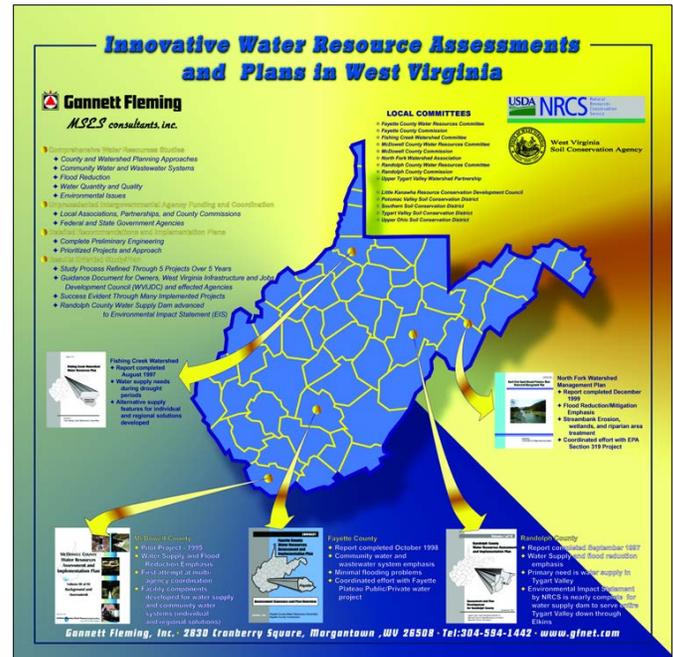


Figure 3-9: West Virginia Flood Studies. Our firm’s water resources assessment projects resulted in development plans used by all interested parties to assess future water resource-related projects and to aid in land-use and -development planning.





3.1.9. EAPs and Hazard Assessments, NRCS

Location: Various U.S. Locations

Project Manager: Andy Deichert, PE

Contact Information: 304-284-7563,
andy.deichert@wv.usda.gov

Type of Project: Mapping, Modeling

Goals and Deliverables: H&H analyses, mapping of flood hazards associated with dams and H&H model development.

Since 2009, Gannett Fleming has been a nationwide preferred provider to the NRCS for dam engineering services including hydrologic and hydraulic analyses, mapping of flood hazards associated with dams and floodplain restoration design. Services were performed on 123 dams in 6 states, including more than 100 dams in West Virginia. Tasks included:

- Topographic data development digital terrain sources.
- Data management of the sources of terrain data, the hydraulic model output and the inundation extents.
- Hydrologic and hydraulic modeling of more than 1,000 river miles using HEC-HMS, HEC-GeoRAS, and HEC-RAS. Our innovative suite of GIS tools expedites H&H model development, presenting results in a more meaningful way.
- Floodplain Inundation and Mapping using ArcGIS software and automated techniques.
- Hazard Analysis using digital mapping products that interactively depict field reconnaissance photos and inundation areas.
- Risk-based assessment based on life loss, population at risk and other categories. The results of the analysis were used to communicate risk and evaluate dam rehabilitation projects.



Figure 3-10: Hazard Analysis Services. We use digital mapping products that interactively depict field reconnaissance photos and inundation areas.



3. Experience

Architectural/Engineering Services, Solicitation Number HSE160000002



3.1.10. HEC-HMS and HEC-RAS Courses, Association of Dam Safety Officials

Location: Various U.S. Locations

Project Manager: Susan Sorrell (ASDSO)

Contact Information: 859-550-2788, ext. 2

Type of Project: Training

Goals and Deliverables: Webinars and seminars are attended by engineers, regulators and dam owners from across the United States.

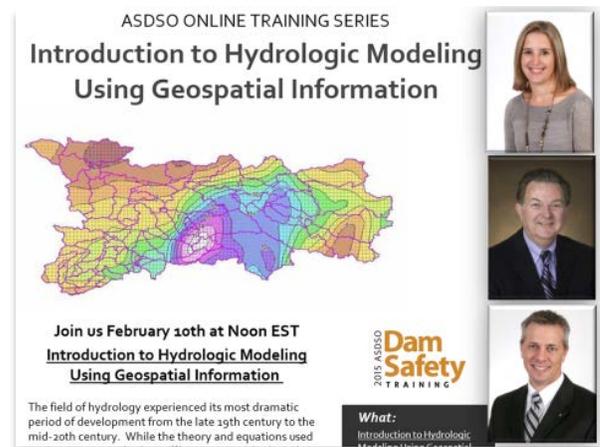


Figure 3-11: HEC-RAS, HMS Seminars and Webinars.

Key team members are seen as subject-matter experts, instructing other engineers on how to perform hydrologic and hydraulic analyses using HEC-RAS and HEC-HMS.

Our proposed personnel, Amanda Hess, Chris Krebs, and Benjamin Israel-Devadason are instructors for training offerings sponsored by the Association of State Dam Safety Officials (ASDSO) related to H&H modeling and associated analyses. The webinars and seminars are attended by engineers, regulators and dam owners from across the United States. The trainings include:

- Three-day technical seminar on HEC-HMS offered in 2013, 2015 and planned for 2017. The course focuses on hydrologic watershed modeling using the USACE’s Hydrologic Modeling System. *Instructor: Amanda Hess*
- Three-day technical seminar on HEC-RAS offered in 2014 and 2016. The course provides instruction on one-dimensional steady, unsteady and two-dimensional numerical hydraulic modeling using the USACE’s River Analysis System. *Instructor: Amanda Hess*
- Two-hour webinar on Introduction to Hydrologic Modeling using Geospatial Information presented in 2015 and available on-demand from the training ASDSO website. *Instructors: Chris Krebs and Amanda Hess.*
- Two-hour webinar on the Introduction to Two-Dimensional Hydraulic Modeling presented in 2016 and available on-demand from the ASDSO training website. *Instructors: Amanda Hess and Benjamin Israel.*
- Other training courses conducted on behalf of FEMA by *Chris Krebs* include “Using GIS to Identify Flood Hazards,” “Integrating GIS with Hydraulic Modeling,” and “Understanding the FEMA Map Revision Process.”

Q16-5291



4. Approach and Methodology for Meeting Goals and Objectives



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

The Gannett Fleming Team is excited to work with West Virginia, the Federal Emergency Management Agency (FEMA) Region III, and local stakeholders to help enhance the State's flood risk map program. We envision significant collaboration throughout the life of the project, especially at the beginning during the scoping phase where we will jointly develop a work plan that ensures a successful project. This section includes some of our ideas on how we can leverage specific expertise, local knowledge, and resources to implement a program that exceeds FEMA's typical Risk MAP project. It also addresses the goals and objectives identified in your Request for Expression of Interest, offering clear evidence of the experience, capabilities, and approach that uniquely qualify our Team to provide professional, timely, and cost-effective flood risk services.

4.1. Goal #1

This project is for the development of enhanced approximate 1 % annual chance (zone A) floodplains on the Federal Emergency Management Agency's Flood Insurance Rate Maps and/or in areas without mapped flood risks.

Probably the most important and frequently utilized dataset to support automated flood hazard identification is digital terrain data. Our Team will leverage the best available topographic data within West Virginia while ensuring it meets FEMA requirements for the intended level of floodplain analyses. With LiDAR coverage for over a third of the state, we will supplement areas where LiDAR is not available with the best available elevation data such as the 2003 photogrammetric-derived digital terrain models (DTM) acquired for the Statewide Addressing and Mapping Board (SAMB). Our team of GIS specialists will develop a seamless multi-user mosaic dataset, consisting of the various terrain data sources, including LiDAR and the 2003 SAMB DTM data. By utilizing Esri's mosaic dataset, we can easily manage a single multi-resolution terrain repository for this project that can integrate all types of elevation data besides these two commonly found datasets. Such a terrain data repository will be accessed on both the desktop by our in-house GIS and engineering staff and also via the web by the State, FEMA or other project stakeholders. This single terrain repository can be viewed and processed on-the-fly, resulting in excellent performance on both

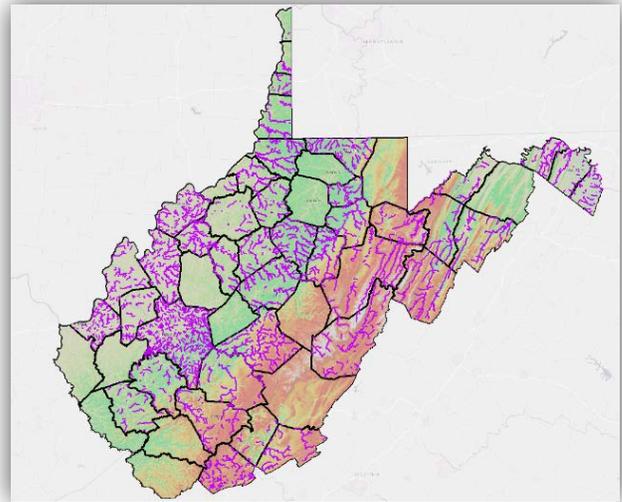


Figure 4-1: Zone A Stream Miles. After assessing FEMA's Coordinated Needs Management Strategy (CNMS) database, there are approximately 6,500 Zone A stream miles that are not modeled with a FEMA approved hydraulic model.

the desktop or over the web. Traditional raster processing would not support such a manageable seamless statewide dataset, while maintaining the highest resolution and quality elevation.

With the advanced nature of the West Virginia GIS Technical Center and our Team's automation expertise, we will work closely with the State to understand all available data, and how we can leverage these data to produce highest quality flood hazard mapping for the right price. For instance, do we include bridges and culverts in our approximate HEC-RAS analyses? For our Map Modernization work in Pennsylvania, we did not include bridge openings or culverts, however our cross section layout supported future modifications to the HEC-RAS model without having to change the cross section layout. Other areas to explore include WVDOT, and any readily available bridge/culvert datasets that may help identify bridge/culvert opening dimensions. With some minor customization, a bridge database can easily be formatted for direct import into the HEC-RAS model. We will work with the State to conduct an exhaustive search for any readily available data that could enhance our approximate floodplain analyses.

For scoping and work planning purposes, we will leverage the FEMA Region III Coordinated Needs Management Strategy (CNMS) database to review the mapping needs across the State. As of January 2016, there are over 6,500 Zone A stream miles that are not model backed,



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002



meaning the flood hazards were not determined using a hydraulic model. Using the CNMS database, in conjunction with the National Hydrography Dataset and terrain data, we will work with West Virginia to determine the scope of streams that will be included in the automated H&H and flood hazard identification efforts.

For automated hydrologic analyses, we understand the importance of a high-quality 'hydrologically-correct' DEM and how it influences all the spatial analyses and hydrologic computations that follow. The key to determining accurate physical characteristics of a watershed (i.e. drainage areas, boundaries and centroids, stream locations, longest flow paths and slopes) starts with a DEM that has been corrected to account for dams, culvert crossings, and relatively flat stream valleys. The West Virginia SAMB streams provides an extremely valuable vector dataset that matches the orthoimagery and is an accurate representation of flow paths that agrees with the underlying terrain. We can use this dataset to 'burn in a channel' and dramatically reduce the amount time required to develop a 'hydrologically-correct' DEM providing the most accurate drainage patterns. We would utilize several different third-party algorithms built into ArcHydro and supplement these with our own in-house tools to efficiently process elevation data to generate 'hydrologically-correct' DEMs.

Once the 'hydrologically-correct' DEM(s) are developed, the derived rasters, such as the flow accumulation grid, are used to develop a stream network. For this project, we suggest delineating streams that have a drainage area of 2 square miles or greater. For those streams that have unmapped flood risks and meet this drainage area requirement, our tools in GIS would utilize the stream grid and the flow accumulation grid to automatically determine where to compute flood discharges considering changes in drainage area and watershed characteristics. Utilizing the latest West Virginia United States Geological Survey (USGS) Regression Equations report from 2010, "Estimation of Flood-Frequency Discharges for Rural, Unregulated Streams in West Virginia," we would calculate all the recurrence intervals including the 1% annual chance peak flood discharge at each flow change location, with consideration of the region the watershed falls within. The computed flows would then be automatically exported to a HEC-RAS flow file. The tools we have developed have provided significant efficiencies in the past and have been used to

compute USGS peak discharges for over 6,400 locations along more than 5,000 stream miles in FEMA Region III.

For approximate Zone A hydraulic modeling on this project, we plan to leverage the custom GIS and modeling tools we developed to conduct our Region III Map Modernization work primarily used in Pennsylvania. The HEC-RAS models will be individually based for each identified stream reach. By analyzing the slope of the stream, our tools will automatically lay out cross sections along a stream, increasing the number of cross sections for steeper sloping streams. To ensure accurate floodplain mapping, we will review the proposed cross section layout prior to model development. All "floodplain" cross sections (Those that will be included in the HEC-RAS model) will be reviewed to identify cross sections that need reoriented to better represent the stream valley. During this review, we will also add "mapping" cross sections. These are cross sections that are not included in the HEC-RAS model, but are necessary for the most accurate floodplain delineation with minimal clean-up. With the use of the latest land cover dataset from 2011, we have developed tools that will assign cross sections weighted roughness coefficient for each overbank. Additionally, channel banks and reach lengths would be developed within GIS.

Although the modeling of hydraulic structures is not required by FEMA for an approximate study, we would recommend including some or all of them if deemed cost-effective given the bridge data is readily available in a GIS compatible format. Our experience has shown that some bridges and especially the culverts in smaller watersheds can have a significant impact on upstream flood elevations. Using the WV DOT bridge dataset as a reference, we would identify structures along the study reaches to include in the HEC-RAS models. Elevations from LiDAR and the SAMB DTM data would be sufficient for top of road elevations, and the bridge opening geometry could be estimated from WV DOT data, if available, or a drainage area relationship would be developed. For a minimal amount of additional effort, water surface elevations could be more accurately determined by including these structures in the hydraulic model.

Having mapped FEMA floodplains along thousands of stream miles in Region III, Gannett Fleming has developed numerous customized tools to aid in the creation of flood hazards. These tools alleviate the need

Q16-5291





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

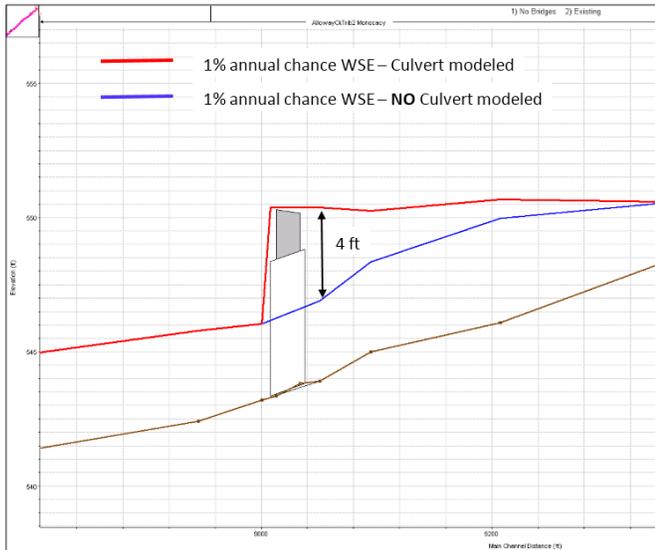


Figure 4-2: Bridge Modeling. Although bridge modeling is not required for approximate studies, it is recommended to include an approximation of the bridge geometry as water surface elevations would be more accurately determined.

for extensive clean-up, creating a consistent, quality product. For this project, the water surface elevations computed in the HEC-RAS models would be automatically delineated using the statewide DEM mosaic dataset and our advanced floodplain mapping algorithms considering backwater effects, split-flow, and roadway overtopping. The “mapping” cross sections that were added during model development are used for floodplain mapping purposes. With the use of these additional “mapping” cross sections, backwater areas and overtopping of roads are properly delineated while considering neighboring HEC-RAS cross sections. This will save a considerable amount of manual cleanup for these areas. Additional manual cleanup is also avoided through our custom mapping algorithms. Our experiences with other 3rd party floodplain mapping tools results in hundreds of tiny islands that need filled in, or a number of detached polygons. We avoid the need for this manual clean up with advanced raster processing performed on the depth grids.

After engineering review and minor clean-up is performed, the floodplains are checked against the hydraulic model and validated in accordance with FEMA’s Floodplain Boundary Standard (FBS). In addition to floodplain boundaries, water surface elevation and flood depth grids will be generated to match the

regulatory floodplain information and help communicate risk and promote sound flood mitigation strategies.

Our entire H&H workflow is tailored to FEMA’s DFIRM database. With a few minor tweaks, we are confident that we can easily make it compatible with the WV Flood Determination Tool web application. For instance, the H&H related attribute information is automatically populated throughout the modeling process, as opposed to being manually entered after the modeling is completed. Our process of linking the GIS data with the models ensures that the spatial layers in the DFIRM agree with the input and output from the models. The source and intermediate GIS data used to develop the hydraulic model and delineate the floodplain is retained for future engineering use and would be provided to West Virginia University for integration in to their website. Similarly, our seamless workflow allows for easy integration of GIS data for dissemination on the web. We incorporated our FEMA Region III Map Mod work into web application to easily view and disseminate results. The web application includes hyperlinks to the technical support data notebooks (TSDN) for each

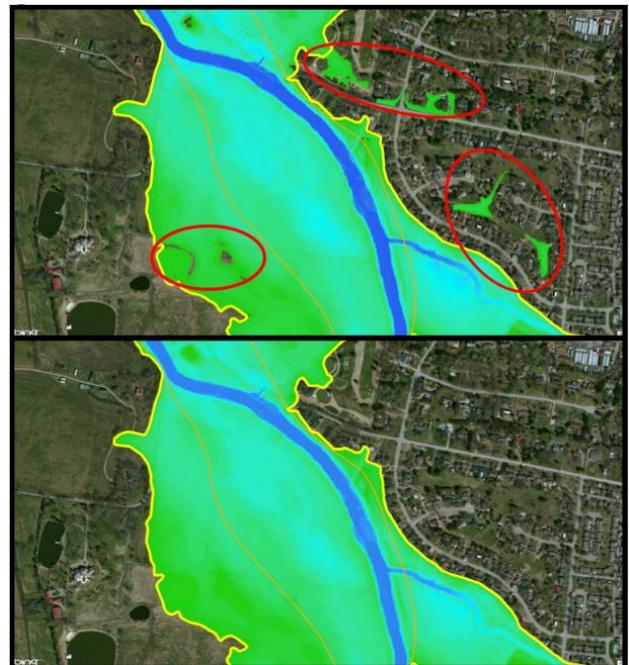


Figure 4-3: Flood Risk Products. Our team has developed Flood Risk Assessment tools, some of which develop a consistent product between the flood hazard polygons and the flood depth grids to eliminate any confusion to the end-user.



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE160000002

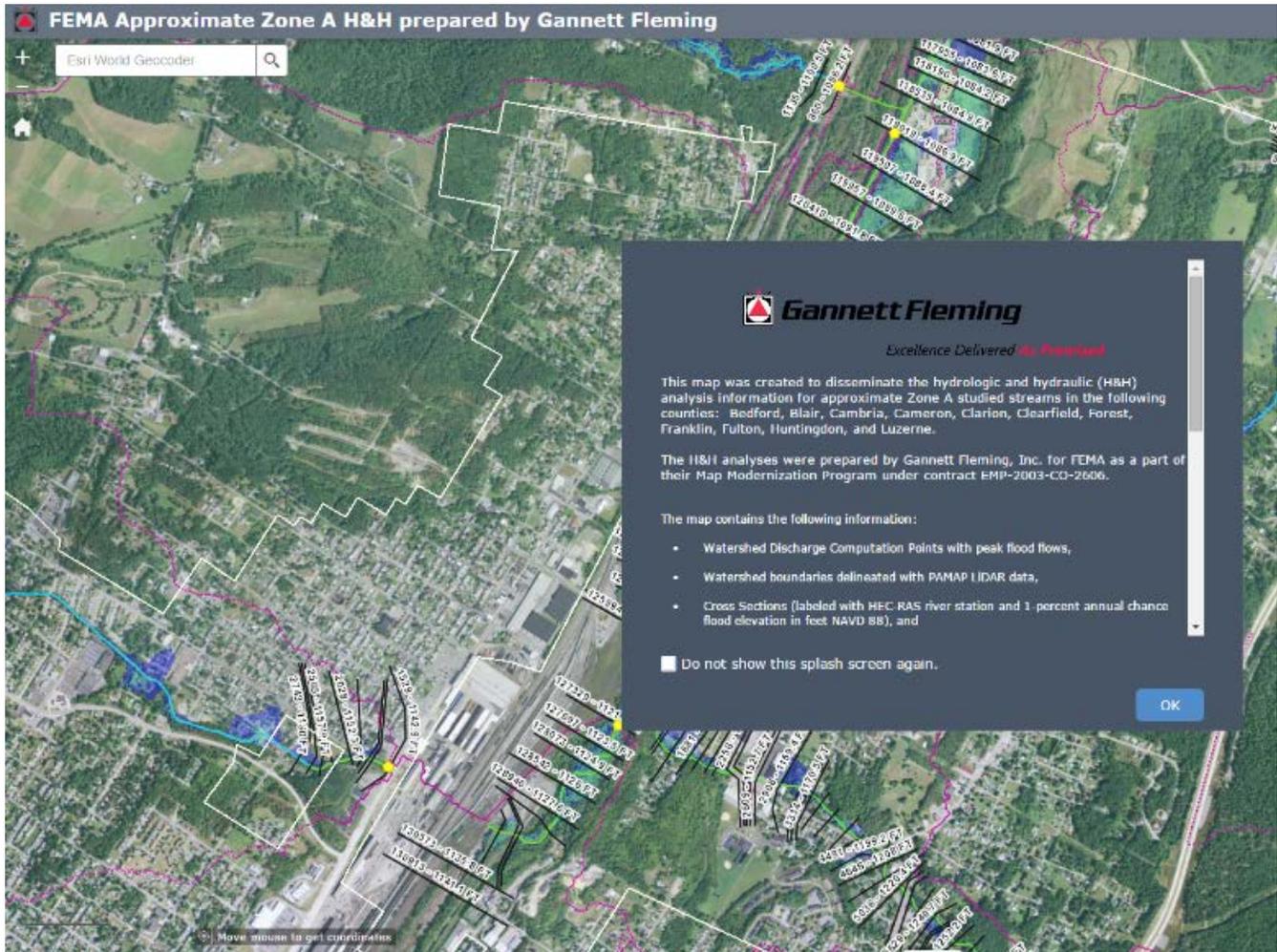


Figure 4-4: Data Dissemination using ArcGIS Online. We developed an ArcGIS Online Web Application to disseminate and view data developed during Map Mod. It includes results from the H&H analyses completed on the Zone A streams in PA.

county, and allows users to download the Zone A HEC-RAS models. To view the web application, navigate to this site: <http://tinyurl.com/h5qddm>. Additional data included are the 1% annual chance flood depth grids and peak flow discharge locations along the Zone A flooding sources. Communities have found this site extremely valuable to assess their flood risks in more detail than what the DFIRMs are able to provide.





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

4.2. Goal #2

The agencies goal is to create a comprehensive flood risk map program including but not limited to: Hydrologic and hydraulic modeling; Floodplain identification and mapping; DFIRM development; Flood risk assessment and communication; Data management; Topographic data development; Hazard mitigation planning; and Community outreach.

4.2.1. Topographic Data Development

With the likelihood of using different sources of terrain data for this project, our team has extensive experience developing large-scale bare-earth terrain models to support automated H&H analyses. These sources include all types of accuracies, file formats and native resolutions including conventional photogrammetry derived mass points and breaklines, field survey points, topographic contours, USGS elevation data, and data derived from LiDAR and Interferometric Synthetic Aperture Radar (IFSAR). We understand the limitations of certain formats, data integration issues and its impact on H&H modeling and mapping, vertical accuracies, the appropriate use and how different types impact 3D surface models and the inaccuracies associated with drainage area determinations, hydraulic model development, and floodplain delineation.

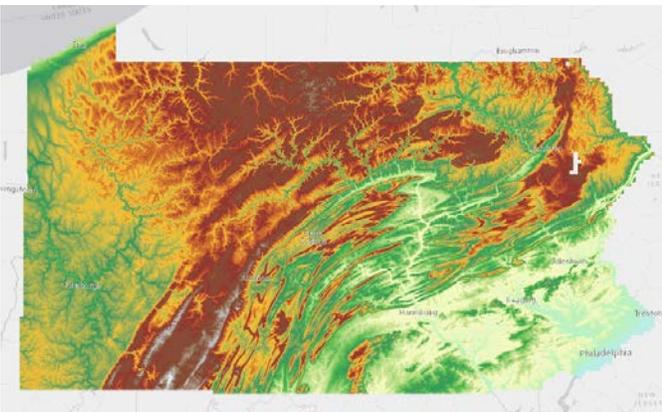


Figure 4-5: Managing Statewide LiDAR. Made possible with our in-house IT infrastructure and data management knowledge, we have a collection of statewide datasets, such as LiDAR point clouds, which are readily accessible for efficient use.

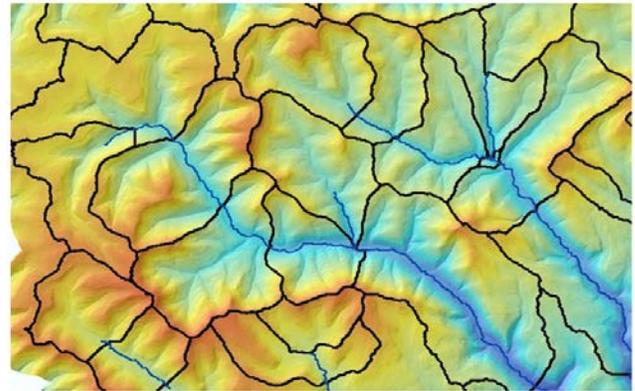


Figure 4-6: Gannett Fleming has processed terabytes of terrain data in support of automated H&H analyses.

With advances in remote sensing technology, terrain data is becoming more and more detailed with higher degree of accuracy. Airborne and terrestrial LiDAR can contain billions of bare-earth points used to represent the ground surface. Instead of simplifying the data and losing crucial detail by resampling, our team's approach utilizes the latest advancements in terrain data management to maintain the native resolution and highest quality elevation data covering vast collections of rasters and LiDAR data. Similar to our past projects for FEMA and USACE, we would anticipate developing a seamless DEM for the entire project to support both automated H&H and floodplain analyses. Our terrain management approach would reduce data storage requirements by using on-the-fly processing of hillshades and automatic generation of topographic contours, and support a multi-resolution terrain repository preserving the native accuracy and providing the highest quality elevation data where it's available.

For a current USACE project covering a 21,300 square mile river basin in eastern Mississippi and Alabama, we collected and compiled over a dozen different terrain sources including river bathymetry and several different LiDAR datasets into a seamless DEM. The resulting mosaic dataset is over 255 GBs in size with a 1-meter ground resolution and was used to support over 700-streams miles of unsteady flow modeling in HEC-RAS for real-time flood forecasting. For other recently completed USACE modeling projects, we have acquired and processed LiDAR or conventional photogrammetry data at no extra cost over using the 10-meter National Elevation Dataset. In most cases, these hydraulic models extended hundreds of miles downstream of a dam such



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

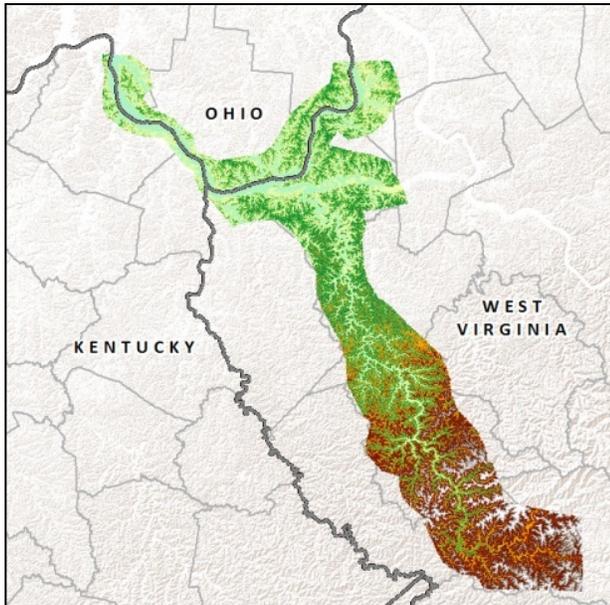


Figure 4-7: R.D. Bailey Dam Break Modeling. Our team has the ability to process large GIS datasets without degrading accuracy such as the MMC study for R.D. Bailey Dam in West Virginia.

as R.D. Bailey Dam in West Virginia, where our team developed a 10-ft resolution DEM larger than 8 GBs, covering 1,350 square miles extending across 3 states more than 120 miles downstream of the dam.

4.2.2. Data Management

Our Team realizes the importance and potential value of previously developed data. Our GIS professionals possess a solid technical understanding of the types of data needed to support automated H&H, and can effectively coordinate with the different agencies and local communities to obtain the best available data. All acquired data will be combined with other types of FEMA data including the Hazus Average Annualized Loss Estimate Study (AAL), claims data, repetitive loss data, high water marks, and disaster relief information to help identify high risk areas. For DFIRM production efforts, we will acquire and utilize all preliminary and effective base map information, including use of the National Flood Hazard Layer (NFHL).

Our H&H engineering and GIS staff conduct their daily work using a dedicated multi-user server that supports real-time collaboration and a seamless workflow

between GIS and engineering staff. It also provides a centralized data management, backup, and archive system with direct access to terabytes of digital data including LiDAR and imagery, and much more. The dedicated 32-core server has cut GIS processing times by more



Figure 4-8: Dedicated Application Servers. Our staff GIS professionals and H&H engineers work on application servers with over 14 TB of storage, supporting a collaborative multi-user environment.

than 10 times and allows us to effectively manage large data intense projects involving multiple disciplines. This server environment has promoted cohesiveness amongst our Team by simplifying data sharing, and effective knowledge transfer between GIS and engineering staff, while increasing production efficiencies and consistency of our work products.

Gannett Fleming will also utilize FEMA's Mapping Information Platform (MIP) as a means of project

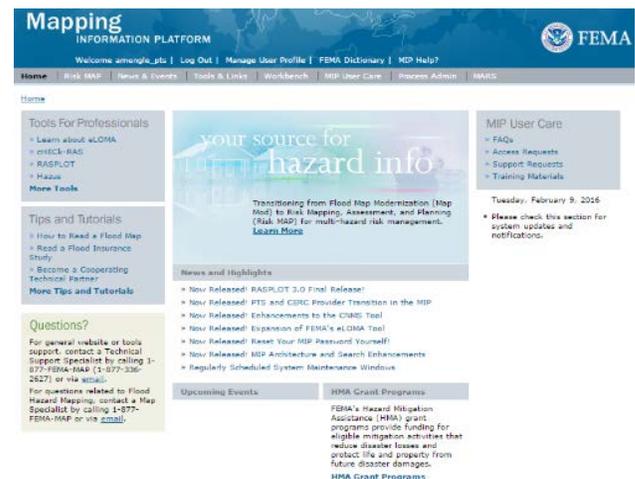


Figure 4-9: Mapping Information Platform (MIP). Gannett Fleming will utilize FEMA's MIP for project tracking and submittals as it relates to FEMA's workflows.





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

tracking and submittals for FEMA. Through our work in FEMA Region III and IV, we thoroughly understand the MIP workflows and the Data Capture Standards (DCS) required for deliverables starting at the beginning of a project with Base Map Acquisition to the end, Submit MSC Deliverable. Our local data management practices and workflows are already designed to ensure DFIRM database integrity and conduct consistency checks above and beyond the automated QC tools on the MIP.

4.2.3. Hydrologic and Hydraulic Modeling

Our team has extensive experience utilizing GIS to support H&H modeling, flood inundation mapping, and flood risk assessments. Mr. Krebs, our Project Manager, has led training seminars on behalf of FEMA on integrating GIS with HEC-RAS hydraulic modeling and using ArcGIS for floodplain mapping. Ms. Hess, our H&H lead, has conducted several technical training workshops on HEC-RAS and HEC-HMS.

For more than 15-years, our Team has been integrating GIS technology into their H&H modeling and floodplain mapping services. Members of our team have extensive experience with applying commonly used third-party automated H&H applications such as HEC-GeoRAS, HEC-GeoHMS, and ArcHydro Tools. Our experiences over the years with these commonly used GIS tools has helped us identify areas for improvement, often resulting in the development of our own custom tools to support automated H&H and floodplain mapping. Our custom tools are continuously evolving to include the latest advancements in GIS technology and H&H modeling. For example, our tools support the BETA version of HEC-RAS 5.0 and both LAS and Mosaic datasets in the latest version of Esri’s Desktop software, Version 10.3.1. Starting nearly a decade ago, these tools were originally developed to support countywide modeling and mapping projects for FEMA Region III under their Map Modernization Program and are currently being utilized on our Risk MAP projects in FEMA Region IV, and most recently our H&H modeling and mapping projects for the USACE’s Mapping, Modeling and Consequences (MMC) Center. These tools focus on specific tasks designed to further streamline our H&H model development tasks and provide more meaningful visualization of modeling results. Subsequently, this helps us reduce our modeling and mapping costs while consistently providing high

quality deliverables across multiple projects. Some of these GIS tools include:

- Automatically identify areas of a terrain dataset within smaller watersheds (less than 5 square miles) that require further investigation for developing the most accurate ‘hydrologically-correct’ DEM and stream networks;
- Hydrologic processing of gridded datasets across multiple server cores to reduce geoprocessing times;
- Hydrologic pre-processing tools that analyze a dendritic stream network to determine where to compute USGS Regression flows based on user defined drainage area criteria;
- Hydrologic modeling tools to support automated computation of USGS regression flows and development of HEC-RAS flow files for entire watersheds (advance StreamStats);
- Incorporating stream channel bathymetry data (surveyed or approximated) into a seamless bare-earth terrain model;

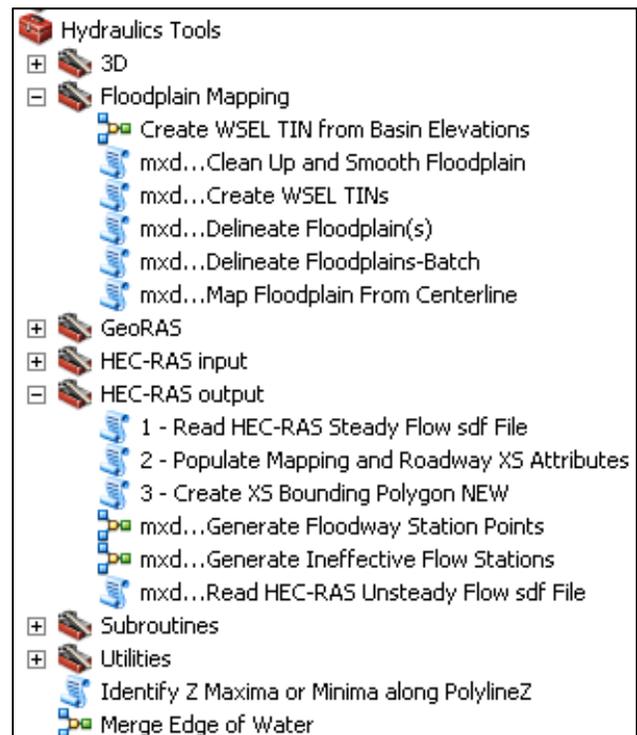


Figure 4-10: Custom GIS H&H Tools. Gannett Fleming will utilize the custom GIS tools that have been developed over the years for H&H modeling, floodplain mapping and DFIRM production.



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002



- Hydraulic tools to automatically compute and map normal depth along streams to generate preliminary approximate flood depth grids used to help layout HEC-RAS cross sections;
- HEC-RAS outputs viewed spatially in GIS, such as roughness coefficients, channel bank locations, levees, block obstructions and ineffective flow limits;
- Advanced flood inundation mapping algorithms considering roadway overtopping, backwater areas, and automated clean-up to remove small islands and disconnected polygons;
- GIS tools to automatically generate certification data required to comply with FEMA's Floodplain Boundary Standard (FBS);
- Development of other assessment and risk communication layers such as water-surface elevation and flood depth grids and % chance of flooding rasters that match the DFIRM data; and
- Modeling tools to batch extract unsteady flow model output to identify high velocity hazards, peak time of arrival, and rate of rise.

4.2.3.1. Hydrology

Our extensive experience in processing terrain data for both large and small watershed models has given us a thorough understanding of the elevation accuracy and

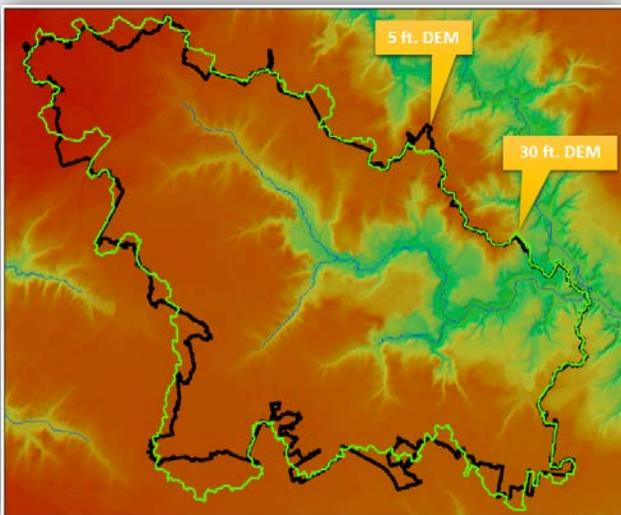


Figure 4-11: Watershed Delineation. Our team understands the importance of maintaining small cell sizes for hydro-DEM processing, as increasing cell sizes for small drainage basins can have a significant impact.

cell size required to produce accurate hydrologic modeling results while minimizing computer processing time and data storage requirements. Since the contributing drainage area for the streams with unmapped flood risks is often near the headwater of a watershed, we would maintain a small cell size for hydro-DEM processing. Our experiences and research indicate that increasing the cell size for hydroDEM processing can have a significant impact on small drainage areas less than a few square miles, often resulting in drainage area errors in excess of 10%.

Regardless of whether a tool is developed in-house or from a third-party, our H&H engineers have a thorough understanding of the automated techniques and algorithms behind each tool. With the help of our GIS specialists, they understand how the automated technique accomplishes each specific task, the spatial analyses it employs, and its GIS data requirements. With such an understanding of the applications inner workings, our engineers are able to foresee possible shortcomings with available input data and the H&H methodologies being applied, while establishing expectations for the quality and accuracy of the results it produces. Such foresight has eliminated rework in the past and has continuously produced high quality models.

4.2.3.2. Hydraulics

The development of the hydraulic modeling parameters would also be generated through our automated GIS tools. Our workflow for hydraulic modeling and floodplain mapping are seamlessly integrated, therefore we approach modeling and flood hazard identification as an iterative process. For instance, upon completion of an initial hydraulic model, we would delineate a floodplain and then identify areas of ineffective flow. These areas identified in GIS would be automatically imported in to HEC-RAS, and the model would be re-run. Barring any changes to the model, this process is repeated to ensure proper placement of ineffective flow limits. For example, our tools will map an ineffective flow limit only if it is being used in HEC-RAS, i.e. the ineffective limit elevation is high enough to block the water surface elevation. As opposed to other 3rd party mapping applications, this removes any misconceptions when viewing the RAS output data in GIS. We also spatially review other RAS outputs every time we delineate a floodplain, such as n-values, channel bank locations, blocked obstructions and flow discharge locations. This has been valuable for

Q16-5291





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

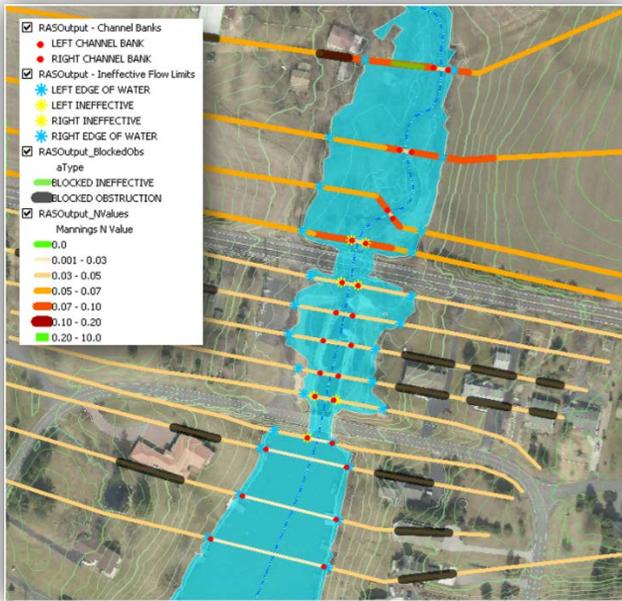


Figure 4-12: HEC-RAS Outputs. Our team has developed a suite of GIS tools specific to hydraulic modeling. Our tools include visualizing RAS outputs in GIS instead of viewing the data in a tabular form.

quality control, as opposed to reviewing this data in a tabular format within HEC-RAS.

4.2.4. Floodplain Identification and Mapping

The Gannett Fleming Team uses the latest technologies to delineate and visualize flooded areas for different types of projects. Over the past 10-years, our team has mapped tens of thousands of stream miles primarily for FEMA, NRCS, USFWS, and USACE. We understand the importance of accurately representing the hydraulic model results and also presenting them in a way that stakeholders can easily understand.

Prior to developing any maps, animations or other GIS derived products, our team ensures that the hydraulic modeling results are properly represented by correctly delineating inundation areas. We instill quality and results using the following workflows and custom GIS tools:

- Checks for consistency of the GIS data that is used to build HEC-RAS models
- Advanced flood inundation mapping algorithms considering split-flow, roadway, dam, and levee

overtopping; backwater areas and automated clean-up tools to remove small islands and hydraulically disconnected polygons based on user-defined criteria

- Water-surface elevation and flood depth grid tools to verifying that they match their respective inundation polygons after any manual adjustments are performed
- Automated QC tools to ensure the hydraulic model results agree with the underlying terrain data.

4.2.5. DFIRM Development

Our Team will utilize years of DFIRM production experience as well as our DFIRM Development Kit (DDK) to create quality DFIRM databases and hard-copy map panels. Our approach to DFIRM map production is to first develop a quality, seamless countywide DFIRM database and then drive the hard-copy DFIRM maps from this database using automated mapping tools. This approach ensures that any changes to the database are instantaneously reflected on the map and mismatches between the two are eliminated. For instance, if stream or road name attributes are changed in the database, the map will automatically reflect these new names as a result of feature linked annotation. Because the majority of the information presented on a DFIRM is found in the database, our map production process is almost entirely automated. Our consistency between map and database is demonstrated by our Independent Quality Review history (QR3, 5 and 7), where we rarely receive comments identifying mismatches between the database and hard-copy maps.

Over the past 15 years, Gannett Fleming's map production environment has evolved from Esri's ArcView 3.x environment to DS MapBook to currently utilizing Esri's latest map production technologies in ArcMAP. With Esri's ArcGIS 10.0 release a few years ago, the software made significant advancements in automated map production using the arcpy mapping module. As a result, we leveraged these advancements in the re-write of our own map production environment, initially developed for our FEMA DFIRM production work in FEMA Region III. These technologies include "out-of-the-box" data driven pages and dynamic text to support DFIRM development, Esri's Mapping Production extension for the grids and graticules, and custom python programming for automated map production within ArcMap. This time tested map production





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE160000002

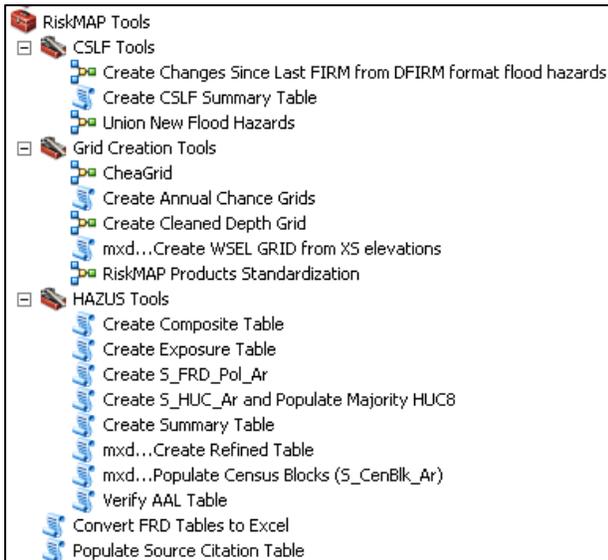


Figure 4-14: Flood Risk Assessment. With our Risk MAP experience, we have developed a suite of custom GIS tools to streamline the development of flood risk products. These products are essential to communities for mitigation planning.

extracting detailed information from hydraulic models for risk assessment and emergency action purposes. Flood depth, velocity and water surface elevations grids have been developed on past projects and compiled into an interactive GIS map. More often these days, we are utilizing 3D animations to convey complex technical issues related to rise and fall of flood waters. With orthoimagery draped over high-resolution LiDAR data, combined with an interactive online GIS environment, one can quickly understand the impacts of flooding on a per structure basis.

Gannett Fleming utilizes a variety of software products as a collaborative and visualization environment on our projects. We regularly conduct weekly progress meetings utilizing WebEx or Skype for Business that allows us to easily share our work with a project team. Over the past few years, we began to use 3D web scenes in Esri’s ArcGIS Online to communicate site specific flood hazards. ArcGIS Online’s cloud based environment and seamless integration with the new ArcGIS Pro and ArcMap software on the desktop, provides secure access for our project teams and clients to effectively share our work and convey complex 3D issues not easily communicated from 2D maps. Using only a web browser team members across offices can dynamically view our geo-referenced HEC-RAS models and provide comments on specific

model features that are shared with the entire team. Users can click on model features and access any web based content such as photos, reports, and videos. After completing thousands of miles of approximate Zone A analyses in Pennsylvania, we have been inundated with requests from local surveyors and engineers requesting approximate base flood elevation along these Zone A flooding sources. To alleviate the burden on us to locate individual properties and estimate computed base flood elevations, we decided to provide our approximate Zone A analyses via the web. Using this link (<http://tinyurl.com/h5qddml>) engineers can search for properties and review the results of our Zone A analyses and click on a stream and download our approximate HEC-RAS models.

Since our engineering modeling process incorporates 3D technology, we can quickly generate these realistic displays that provide clarity especially for our non-technical stakeholders. For past litigation support work, we were tasked with analyzing the impacts of spillway gate operations on downstream flooding conditions. This work included detailed hydrologic and hydraulic analyses simulating historic flood events under multiple operation scenarios. The results of which were conveyed to the court via 3D GIS animations. The realistic animations simplified the detailed engineering analyses and were instrumental in demonstrating the technical evidence. These animations were developed using multiple software packages including Esri’s ArcGlobe and ArcScene software. The animations included a fly-through of the river valley depicting multiple dam

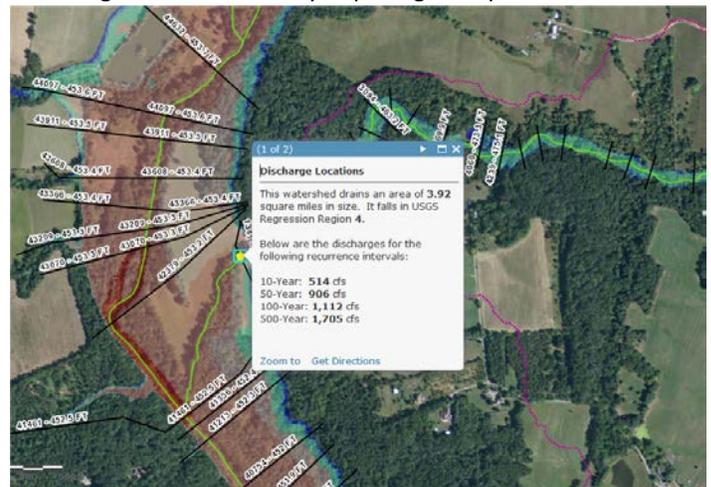


Figure 4-15: Cloud Based Environments. For community outreach, our team has been using ArcGIS Online and other cloud based environments to communicate site specific flood hazards.



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

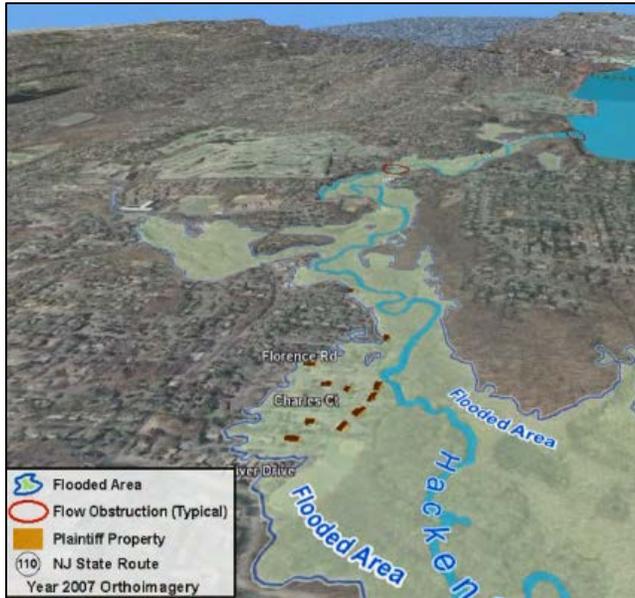


Figure 4-16: Fly-through Animations. For litigation support, fly-through animations were developed using ArcGlobe and ArcScene to depict historical flood events.

locations relative to the plaintiff's properties, and time animations that simulated the actual rise and fall of the flood waters during the contested storm event.

For recent Emergency Action Plans and tabletop exercises for dams, Gannett Fleming has used state-of-the-art multimedia to provide emergency responders with clear, easy-to-understand maps depicting the failure hazard over time. For clients such as the National Resources Conservation Service (NRCS) and U.S. Fish and Wildlife Service (USFWS), we have provided other alternatives in interactive media such as dam breach animations, interactive 3D GIS viewers for downstream consequences, and simple layered GeoPDFs. Not only can information be conveyed, such as time of peak arrival, rate at which water level rises, and flood depths, but also collectively in an interactive environment it can provide a more comprehensive understanding of overall risk.

4.2.7 Hazard Mitigation Planning

Our Team is experienced with engaging project stakeholders to identify issues and develop support for an approach or project that results in a "win-win" situation for all parties involved. All of our past FEMA Region III studies involved community engagement.

Under our current Risk MAP contract in Region IV and for hundreds of dam risk assessments, our Team has worked with local and state governments to increase awareness of their flood risk and help them develop strategies to reduce current and future vulnerabilities. Following the flood hazard identification phase of some of our Risk MAP projects in Region IV, we have developed a complete suite of Risk MAP products including the consequence analyses and identification of viable mitigation measures that are both structural and non-structural in nature.

Analyzing, documenting, explaining and planning for flood risks are the objectives of the Emergency Action Plans that are required for dams, and our Team has prepared hundreds of these plans. Developing the plan involves working with regulatory agencies as well as local emergency responders to identify the resources that would be available to respond to an emergency and then strategically assign responsibilities in the plan to optimize those resources. Following the development and review of the plan, our Team follows through with gaining concurrence for the plan, distributing the plan and ensuring that the plan is available to the parties with responsibility. Finally, our Team provides training and opportunity to test the plan through exercises and drills. This part of the emergency planning process is key to exposing critical weaknesses in the plan and identifying strategies for mitigating risks.

Our Team was also selected to provide unique services to FEMA related to flood risk. We performed extensive research and prepared a comprehensive report documenting the current state of the practice for the risk-based hydrologic safety of dams. Based on that research, our Team prepared a new guidance document for state regulatory agencies to incorporate within their dam safety programs. A second project involved developing tools to share knowledge of dam failures as a way of mitigating future disasters. Our team developed a section of the FEMA's "Lessons Learned Information Sharing" website (www.llis.gov) that shares case studies and lessons learned in a user-friendly, electronic format with access to pertinent graphics, narratives, photographs, videos, and other resources. Reaction to the availability of this useful resource from the emergency planning and hazard mitigation community has been affirmative.

Q16-5291





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

4.2.8. Community Outreach

While developing these models and delineating flood hazards offers a platform to close some of the data gaps that remain after Map Mod and updated countywide DFIRMs and FIS reports, an equally important aspect of flood hazard identification is to be able to convey these products to various stakeholders and communities and provide them in a format that can be used by various entities for various purposes. Therefore, efforts to tie the technical aspects of this project, with a focus on outreach and risk awareness, and integration with mitigation planning takes front stage.

Our Team's unique ability to follow a specified planning process, an open public involvement process, and a comprehensive approach to reducing the effects of natural disasters helps us strengthen the link between mapping products and local mitigation efforts.

We understand that broad participation is crucial to ensure that the goals and objectives of any process are achieved and that it has to represent the actual needs and desires of the community. When public planning is based on a consensus of community opinion, there is an increased chance of organizing resources, taking action, and achieving community goals. For any community planning project to be successful, one of the most critical elements is the involvement of key stakeholders. The team is experienced at working with the public to identify issues and develop support for projects that results in a "win-win" situation for all parties involved. Our past FEMA projects included a public involvement strategy that provides a method for receiving and addressing citizen issues, concerns, and input on the project. We pay careful attention to identify specific techniques to receive input, disseminate information, and develop public acceptance of viable solutions. While the techniques selected may vary with each project and client, we ensure that the end result is that the plan has had active participation and has been well received.

Our outreach efforts will commence prior to any Discovery/Scoping Meetings when we contact communities to inform them of the project and request data, and continue through the flood hazard development phase to the Flood Risk Review Meeting. We will prepare materials for all meetings and actively participate during the meetings. Under Map Mod and more recently during a Risk MAP Discovery meetings, our



Figure 4-17: Community Outreach. Our team has conducted numerous community meetings that include scoping and discovery to resilience and flood risk review.

public outreach efforts have consisted of successfully communicating technical aspects with residents and local governments, creating effective partnerships and alliances between key organizations and government, and improving communications between different stakeholders. A variety of public outreach avenues are offered based on the needs of West Virginia and FEMA such as focus groups, charrettes, stakeholder meetings, collaborative web sites, open houses, and steering committees.

Our Team recognizes the importance of effective involvement of the community and developing a sense of ownership in the flood study at the local level to promote future flood mitigation. Our goals for the stakeholder meetings are to achieve the greatest possible input, a clear presentation, and a simple procedure. Policy makers, government officials, organizational leaders, planners, citizens, taxpayers, and developers must be satisfied, at least minimally, in order for FEMA initiatives to succeed.

Opportunities will be given to neighboring communities, local, and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, to become involved in the planning process.

In order to ensure the success of various meetings, our Team will ensure the following:

- Determine effective means to notify the constituents of the meeting;



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002



- Develop easy-to-understand educational materials for the meeting;
- Ensure proper facilitation of the meeting;
- Develop clear, media-rich presentation of the issues;
- Provide opportunity for audience to voice concerns;
- Identify use of other media to communicate post-meeting decisions to the stakeholders; and
- Develop final deliverables in a user-friendly format and ensure they are easily accessible to the public.

The Gannett Fleming Team understands how flood hazard identification fits into the larger process of planning and how it ties directly to West Virginia's Hazard Mitigation Plan.

4.3. Goal #3

The successful firm must demonstrate a clear procedure for communication with the Agency during all phases of the project.

Communication among the Agency and Gannett Fleming team members is key to a successful project outcome. This begins with the Agency and the project team jointly preparing a well-defined scope of work. Communication must continue frequently throughout the project as coordination of the various work activities proceeds.

Chris Krebs, as Project Manager, will be your primary point of contact throughout this project.

Communications will be clear, concise, and precise. We will use proven in-place vertical lines of communication and data transfer procedures from the Agency to Chris, proceeding down to the professional staff, technicians, and inspectors.

Lines of communication with the Agency will be through Chris, unless otherwise designated where technical team members may need to interact directly with the Agency. For such situations, we will document and distribute all communication to the Agency's Project Manager.

The Gannett Fleming team sends and receives e-mail and electronic data files to and from clients through our Internet connection. For transferring large files, we will establish a secure file transfer protocol (FTP) site for this project to be accessed by authorized project team members including Agency personnel.

4.3.1. Project Initiation Meeting

Gannett Fleming's responsiveness to projects begins with a firm initial understanding of the task. In our initial communication, we will discuss the project and address staffing needs and Agency schedule and budget expectations. Prior to the initial meeting, we will follow up on any initial conversations, and provide a draft work plan that details how we will approach the enhanced approximate Zone A analyses.

Figure 4-18: Lines of Communication. Communication between the Agency and the project team will be proactive and transparent.



Q16-5291





4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002

4.3.2. Project Execution Plan

Gannett Fleming develops and uses a succinct Project Execution Plan (PEP) to perform efficiently and effectively. It is the tool we use to ensure we do what we say we will do. It is the approach we use to communicate project requirements to our entire project team.

The detailed work plan described above serves as the bulk of the PEP. It will describe what we will do, who will do it, when we will finish each task and how much effort it will take. The key is to package it into a process, the Project Execution Plan, and make sure the entire team understands these expectations. We employ a document management system and strict project management guidelines to make sure this happens.

Upon receipt of Notice-to-Proceed, our key personnel also hold an in-house kick-off meeting to present the Project Execution Plan. Then it is each team member's responsibility to adhere to the plan. Although we all hold ourselves accountable to the plan, this requires the Project Manager to perform regular progress checks.

We also address project controls routinely and use earned value tools to make sure we are progressing on or ahead of budget. Continuous application of this process throughout the assignment allows us to see if difficulties are arising and address them before they become problems. Overall, use of these tools allows the Project Manager to make sure all necessary resources are available to the task manager to make sure the team is communicating and performing together.

4.3.3. Project Updates

The type and frequency of project updates to the Agency will be agreed upon at the project initiation meeting. For the enhanced Zone A development work, we would anticipate more frequent updates and communication initially until a pilot project, perhaps a county of HUC-8 watershed, is completed and accepted by the State. Once the technical details are ironed out and approved and production starts following the pilot project, updates

via WebEx or Skype will most likely diminish. However, we will plan to depict progress in real-time using our ArcGIS Online resources, where we plan to upload completed streams weekly to our online mapping environment for review by authorized users. For other assignments, the Project Manager will maintain close contact with the Agency Project Manager to make sure that efforts continue according to plans.

If necessary, for more complex assignments involving more team members, we will develop the appropriate communications plan with the Agency Project Manager and make adjustments as required. Project Managers vary in their communication expectations and requirements. Our team will adapt to the requirements of the Agency and its project management team.

4.4. Goal #4

This Engineering firm should have professional disciplines necessary for the project needs.

The Gannett Fleming team brings together the necessary disciplines needed to provide the Agency with accurate floodplain mapping and other Risk MAP program support.

Nearly a dozen of our project team members hold Certified Floodplain Manager certifications, and more than half are Professional Engineers or Professional Land Surveyors. Their particular areas of expertise include well-documented hydrologic and hydraulic modeling, floodplain identification and mapping, DFIRM development, data management, topographic data development, hazard mitigation planning, community outreach, surveying, and aerial mapping.

All Team members possess strong technical skills and exemplary records of successfully delivering projects. They will be supported by our national staff of nearly 2,000 professional engineers, GIS specialists, surveyors, and other professional and technical staff. Table 4-1 presents personnel by discipline throughout the firm.



4. Approach and Methodology for Meeting Goals and Objectives

Architectural/Engineering Services, Solicitation Number HSE1600000002



Table 4-1: Gannett Fleming Personnel by Discipline. Gannett Fleming employs nearly 2,000 staff in nearly all the disciplines required for this project.

Number	Discipline	Number	Discipline
4	Acoustical Engineer	43	Geographic Information Systems Specialist
323	Administrative	41	Geologist
3	Archaeologist	35	Hydraulic Engineer
42	Architect	6	Hydrogeologist
2	Biologist	2	Hydrologist
88	CADD Technician	6	Industrial Engineer
2	Chemical Engineer	2	Industrial Hygienist
118	Civil Engineer	1	Interior Designer
117	Computer Programmer	7	Land Surveyor
160	Construction Inspector	2	Landscape Architect
79	Construction Manager	28	Mechanical Engineer
4	Cost Engineer/Estimator	1	Mining Engineer
23	Driller	38	Planners
1	Ecologist	2	Risk Assessor
18	Economist	23	Sanitary Engineer
99	Electrical Engineer	2	Specification Writer
107	Engineering Technicians	130	Structural Engineer
31	Environmental Engineer	16	Technicians/Analysts
52	Environmental Scientist	190	Transportation Engineer
18	Facilities/Maintenance Support	15	Vertical Transportation Engineer
54	Foundation/Geotechnical Engineer	50	Water Resource Engineer
1,986 Total			



5. Forms

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 exceeds 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: Gannett Fleming, Inc.

Authorized Signature: *Paul Fleming* Date: 2/12/2016

State of Pennsylvania

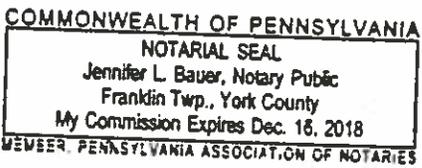
County of Cumberland, to-wit:

Taken, subscribed, and sworn to before me this 11 day of February, 2016.

My Commission expires December 18, 2018.

AFFIX SEAL HERE

NOTARY PUBLIC *Jennifer L. Bauer*
Purchasing Affidavit (Revised 07/01/2012)



ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: CEOI HSE160000002

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)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Addendum No. 1 | <input type="checkbox"/> Addendum No. 6 |
| <input checked="" type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input checked="" type="checkbox"/> Addendum No. 3 | <input type="checkbox"/> Addendum No. 8 |
| <input type="checkbox"/> Addendum No. 4 | <input type="checkbox"/> Addendum No. 9 |
| <input type="checkbox"/> Addendum No. 5 | <input type="checkbox"/> 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.

Gannett Fleming, Inc.

Company


Authorized Signature

2/29/2016

Date

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



*Excellence Delivered **As Promised***

ISO 9001:2008
CERTIFIED

Christopher D. Krebs, PE, CFM, GISP
207 Senate Avenue
Camp Hill, PA 17011
717.763.7211 x2756
ckrebs@gfnet.com

Q16-5291