

WEST VIRGINIA CONSERVATION AGENCY
Watershed Dam Rehabilitation Program

Solicitation # AGR1500000004

June 4, 2015



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WV Purchasing Division



submitted by
SCHNABEL DAM ENGINEERING, INC.
1380 Wilmington Pike, Suite 100
West Chester, PA 19382
610-696-6066
www.schnabel-eng.com



Schnabel ENGINEERING

June 4, 2015

Bid Clerk
Department Of Administration
Purchasing Division
2019 Washington St E
Charleston WV 25305-0130

Subject: Qualifications for Providing Professional Engineering and Technical Services for the Watershed Dam Rehabilitation Program – Solicitation No. AGR1500000004

Schnabel Dam Engineering appreciates the opportunity to submit our Expression of Interest to provide professional engineering and technical services related to the planning required for the rehabilitation of multiple Floodwater Prevention Dams including Brush Creek Site 9, Brush Creek Site 15, Potomac-New Creek-Whites Run Site 17, and Potomac-New Creek Site 1; as well as construction oversight tasks related to Upper Decker's Creek Site 1.

Selection of Schnabel provides:

■ **Qualifications and Experience Relative to Planning, Design, and Construction of Dam Rehabilitation Projects –**

- Schnabel has decades of experience working with NRCS dams. Schnabel has assessed, planned, designed, and/or provided construction services for more than 350 NRCS dams. We understand NRCS policies, procedures, and criteria.
- The Schnabel Team has strong, long-term experience with NRCS dams in West Virginia and surrounding states.
- Our Team has a large staff with complementary and overlapping capabilities to ensure **ample availability of qualified planning personnel covering all requested disciplines for multiple dams and for every day of construction.**
- Through our design of hundreds of dam rehabilitation projects for all types of clients, we have developed innovative and cost effective solutions to meet our clients' needs and regulatory requirements.

■ **Approach and Methodology for Meeting Goals and Objectives –**

- With several former NRCS engineers and scientists on our team, we will work as an extension of your staff and NRCS.
- We thoroughly understand NRCS policies, procedures, and criteria. In fact, some of us wrote some of them. **We have been down this road before.**
- Having performed quality control services for contractors and quality assurance services for dam owners, we understand both perspectives, allowing us to facilitate good communication and high quality construction.

Our references will attest to our ability to complete projects, provide high-quality service, and meet both schedule and budget. We encourage you to contact our references included in Section F.

We are excited about the opportunity to work with you and NRCS. Please do not hesitate to contact me via phone (610-696-6066) or email at pwelle@schnabel-eng.com should you have any questions or need additional information.

Sincerely,

A handwritten signature in black ink, appearing to read "Paul I Welle". The signature is written in a cursive, slightly slanted style.

Paul I Welle, PE
Senior Consultant/Project Manager



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ARCHITECT – ENGINEER QUALIFICATIONS

PART I - CONTRACT-SPECIFIC QUALIFICATIONS

A. CONTRACT INFORMATION

1. TITLE AND LOCATION (City and State)

West Virginia Conservation Agency - Watershed Dam Rehabilitation Program

2. PUBLIC NOTICE DATE

May 4, 2015

3. SOLICITATION OR PROJECT NUMBER

AGR1500000004

B. ARCHITECT-ENGINEER POINT OF CONTACT

4. NAME AND TITLE

Paul I. Welle, PE – Senior Consultant

5. NAME OF FIRM



Schnabel Dam Engineering, Inc.

6. TELEPHONE NUMBER

610-696-6066

7. FAX NUMBER

610-696-7771

8. E-MAIL ADDRESS


pwelle@schnabel-eng.com

C. PROPOSED TEAM

(Complete this section for the prime contractor and all key subcontractors.)

	(Check)			9. FIRM NAME	10. ADDRESS	11. ROLE IN THIS CONTRACT
	PRIME	JV PARTNER	SUBCONTRACTOR			
a.	<input checked="" type="checkbox"/>			Schnabel Dam Engineering, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	1380 Wilmington Pike, Suite 100 West Chester, PA 19382	Dam Engineering Services
b.	<input checked="" type="checkbox"/>			Schnabel Dam Engineering, Inc. <input checked="" type="checkbox"/> CHECK IF BRANCH OFFICE	11-A Oak Branch Drive Greensboro, NC 27407	Dam Engineering Services
c.			<input checked="" type="checkbox"/>	Civil Tech Engineering, Inc. <input type="checkbox"/> CHECK IF BRANCH OFFICE	300A Prestige Drive Hurricane, WV 25526	Construction Consultation & Survey Services
d.			<input checked="" type="checkbox"/>	Bell Engineering <input type="checkbox"/> CHECK IF BRANCH OFFICE	2480 Fortune Drive, Suite 350 Lexington, KY 40509	Water Supply Expert
e.			<input checked="" type="checkbox"/>	AllStar Ecology, LLC <input type="checkbox"/> CHECK IF BRANCH OFFICE	1582 Meadowdale Road Fairmont, WV 26554	Ecological Services
e.			<input checked="" type="checkbox"/>	Jeff Zell Consultants, Inc. <input type="checkbox"/> CHECK IF BRANCH OFFICE	1031 4 th Avenue Coraopolis, PA 15108	Laboratory Materials Testing
e.			<input checked="" type="checkbox"/>	Horn & Associates <input type="checkbox"/> CHECK IF BRANCH OFFICE	216 North Main Street Winchester, KY 40391	Drilling

e.		<input checked="" type="checkbox"/>	James Featherston – Independent Consultant <input type="checkbox"/> CHECK IF BRANCH OFFICE	1024 W. 18 th Street Sulphur, OK 73086	Economics
f.		<input checked="" type="checkbox"/>	Wade Biddix – Independent Consultant <input type="checkbox"/> CHECK IF BRANCH OFFICE	1629 Fairfield Green Rd. Richmond, VA 23238	Watershed Planning

D. ORGANIZATIONAL CHART OF PROPOSED TEAM  (Attached)



West Virginia
Conservation Agency

PRINCIPAL IN CHARGE

DAVE CAMPBELL, PE

PROJECT MANAGER

PAUL WELLE, PE

QUALITY ASSURANCE

DON BASINGER, PE
GREG PAXSON, PE

WATERSHED PLANNING

Wade Biddix
Paul Welle, PE

HYDROLOGY/HYDRAULICS

Paul Welle, PE
Laura Shearin-Feimster, PE
Brian Crockston, PhD, PE

ENGINEERING GEOLOGY

Gary Rogers, PG
John Gagnon, GIT
Susan Buchanan, PG

GEOTECHNICAL ENGINEER

Jonathan Pittman, PE
Adam Paisley, PE
Jerry Robblee, PE, PG
Horn & Associates

PLANNING/DESIGN ENGINEER

Jeremy Young, PE
Melinda Dirdal, PE
Loring Crowley, PE
Kortney Brown, PE

ECONOMICS

James Featherston

GIS

Jay Halligan, GISP
Guy Nuyda, GISP

WATER SUPPLY ENGINEERING

Ron McMaine (Bell)

STREAM AND WETLANDS

Sharon Krock, PWS
AllStar Ecology

CONSTRUCTION SERVICES

Gary Horninger, PE
Tom Mohr, SET
Aaron Collins
Doug Fairchild

Mark Landis, PE, PG
Mark Pennington (Civil Tech)
Jeff Zell Consultants

THREATENED AND
ENDANGERED SPECIES

AllStar Ecology

CULTURAL RESOURCES

AllStar Ecology

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Gary D. Rogers, PG	Engineering Geologist	31	19

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Course and School/Institution) Master of Science - Geology Bachelor of Science - Geology	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline) AK, GA, MO, TN, VA, WA - Professional Geologist NC - Licensed Geologist
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18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 Gary Rogers is a registered Professional Geologist with over 30 years of experience in engineering geology, hydrogeology, and site characterization. He has led the site exploration and characterization programs for dozens of new and existing earthen and concrete dams and has continued his support on these projects through analysis, design and construction. His responsibilities have included site characterization, stability investigations, foundation studies, hydrogeologic assessments, construction support, and follow-up presentations to expert panels and regulatory officials including the FERC. Gary has had responsibility for engineering geology investigations and/or construction related activities at over 75 dams. He has led site drilling and testing programs to characterize subsurface foundation conditions, and led the subsequent construction foundation related construction observation activities for several large dams over the past 25 years.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS COBB CREEK DAM #1, Caddo County, OK	2009	2011
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist for preparing rehabilitation plan for relief well system and reviewing the subsurface site investigation and reporting for the rehabilitation of this earthfill dam.		
b.	NRCS DEEP CREEK WATERSHED DAM 5D SITE INVESTIGATION AND DESIGN, Yadkin County, OK	2010	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Associate Engineering Geologist for the field investigation and land surveying phases of this project to construct a new 80-ft high flood control and water supply dam. The subsurface investigation included over 100 boreholes and test pits, and detailed field testing such as rock and soil permeability tests. Responsible for contracting, field supervision, field data collection, data analysis, reporting, and presentations to the clients. During construction of the RCC and earthfill embankments, Gary was responsible for geologic mapping of RCC foundation, approval of foundation prior to RCC placement, and managing the grouting program. This project was the recipient of the 2013 USSD Award of Excellence.		
c.	SHAVER'S CREEK DAM REHABILITATION DESIGN, State College, PA	2012	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Senior Associate Geologist for development of high mobility grouting specifications for this 50-ft high earth embankment dam with historical seepage and boils issues. The 650-ft long double row grout curtain included over 250 holes utilizing traditional split spacing methods.		
d.	NRCS THIRD CREEK WATERSHED DAMS, DAM SAFETY INSPECTIONS AND EVALUATION FOR 11 FLOOD CONTROL STRUCTURES, Iredell and Alexander Counties, NC	2003	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Project Geologist on dam safety inspections and site investigations at NRCS Flood Control Structures in Iredell and Alexander Counties, North Carolina. Assisted in the data analysis and report preparation for inspections of 11 earthfill dams built during the 1960s. Prepared or checked construction cost estimates for recommended repairs. Performed subsurface site investigation studies in support of remediation design.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
John Hawkins Gagnon, PG	Engineering Geologist	3	3

15. FIRM NAME AND LOCATION (City and State)  Schnabel Dam Engineering, Inc., Greensboro, NC
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16. EDUCATION (Degree and Specialization) Master of Science – Geology Bachelor of Science – Geology	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline) NC – Professional Geologist
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18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 John Gagnon has been involved in several projects related to engineering geology, hydrogeology, and environmental geology. His experience includes geotechnical subsurface investigations, site investigations, subsurface grouting, construction observation and laboratory testing. His academic background is in sedimentary geology with an emphasis on coastal geomorphology.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	GSFIC NRCS DAM REHABILITATIONS - SOQUE RIVER WATERSHED DAM NOS. 29, 34, 36, Habersham County, GA	2013	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for project tasks that included logging soil borings and auger probes, observation well installation, sample collection, and report writing. Soque River Watershed Dams Nos. 29, 34, and 36 are NRCS-assisted sediment and flood control dams which are currently being modified to meet new state standards.		
b.	COBBS CREEK REGIONAL WATER SUPPLY RESERVOIR, Columbia, VA	2012	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for project tasks that included logging auger probes, hand auger, soil and rock borings, sample collection, packer permeability tests, well construction, geologic mapping, assisting project managers with the work plan, invoicing, and report writing. Additionally, was responsible for the development, testing and analysis of a field permeability testing procedure for unsaturated wells along the proposed alignment of a new water supply reservoir using a newly developed automated-constant-head-testing apparatus.		
c.	RESTORATION OF HOPE MILLS DAM, Hope Mills, NC	2015	2015
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for project tasks that included exploration planning, logging soils, sample collection, well installation, and report writing.		
d.	CASCADE LAKE DAM, Brevard, NC	2015	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for project tasks that included logging and collecting rock and concrete core, packer testing, geologic mapping, and report writing. Cascade Lake Dam is an existing approximately 40 ft high concrete arch dam.		
e.	CITY OF ASHEVILLE DAM REPAIRS, Asheville, NC	2012	2015
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for project tasks that included logging soil and rock borings, sample collection, and invoicing. The North Fork Dam consists of an approximately 1309 foot long earthen embankment that serves as the main source of drinking water for the City of Asheville.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM *
Paul Welle, PE	Project Manager/Hydraulic Engineering	45	15

15. FIRM NAME AND LOCATION (City and State)



Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)

Bachelor of Science – Agricultural Engineering

17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)

KS, MD, NJ, PA, VA, WV – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

For more than 30 years as a Water Resources Planning Specialist and Hydraulic Engineer for the USDA Natural Resources Conservation Service (NRCS), Paul Welle served in the Northeast National Technical Center where he has developed an understanding of a wide variety of the capabilities and limitations of hydrologic and hydraulic models. At the Center, he was the Service's Technical Expert for water resources planning and surface water hydrology and hydraulics for both the New England and Mid-Atlantic Regions. His experience in virtually all aspects of watershed planning, hydrology and hydraulics, and computer modeling has provided him with an awareness of the necessity for an interdisciplinary approach to studying water resources systems. Paul has managed and reviewed projects that involved traditional hydraulic engineering studies, as well as innovative projects that concentrated on integrated water resources management, soil erosion, and conservation ecology.

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS DEEP CREEK DAM 5D , Yadkin County, NC	2010	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Lead Hydraulic Engineer performing hydrologic and hydraulic studies for this combined RCC gravity dam/earth embankment dam for the NRCS. Performed reservoir routings using SITES for alternatives analysis, structural design, hydraulic proportioning, and streamflow diversion in accordance with TR-60. Used HEC-RAS for the design of the channel downstream of the dam and to develop tailwater elevations. Evaluated physical stepped spillway models for similar dams and used them for hydraulic design of the spillway. Also conducted the dam break analysis using the Unsteady Flow HEC-RAS model.		
b.	NRCS RED LICK WATERSHED MULTIPURPOSE DAM, SITE NO. 1, PLANNING AND DESIGN FOR DAM REMEDIATION , Berea, KY	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Task Manager and Lead Hydraulic Engineer for the rehabilitation planning of the USDA-NRCS multi-purpose structure that provides flood control and 70% of the local water supply. The feasibility study evaluated alternatives for a replacement principal spillway riser, stable auxiliary spillway, and increased available water supply volume.		
c.	NRCS FOX CREEK WATERSHED DAM NO. 4 , Fleming County, KY	2012	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Lead Hydraulic Engineer for the breach analysis study and rehabilitation design for this NRCS-assisted dam. The work included dam break and alternatives analysis to confirm the hazard classification and to develop alternatives to address the inadequate capacity of the auxiliary spillway. The spillway is almost 300-ft wide and includes an ogee crest to efficiently pass the design storm.		
d.	NRCS POHICK CREEK WATERSHED DAMS, NO. 2 (LAKE BARTON), 3 (WOODGLEN LAKE), AND 8 (HUNTSMAN LAKE) REHABILITATION , Fairfax County, VA	2014	2014
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Manager and Lead Hydraulic Engineer responsible for these NRCS-assisted dams. Developed alternative for a stable auxiliary spillway, performed a dam breach analysis, designed a replacement principal spillway riser and armored auxiliary spillway, and provided construction services for Dam No. 8. Also performed H&H analyses using SITES and developed alternative plans for stable auxiliary spillways for Dam Nos. 2 and 3. An armored auxiliary spillway was constructed for Dam No. 3, and a combination of a cutoff wall and armoring was constructed at Dam No. 2. H&H and alternatives analyses were used by NRCS to develop a Rehabilitation Plan-EA for 3 dams.		
e.	NRCS WEST VIRGINIA DAM ASSESSMENTS , Multiple Locations, WV	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Leader and Lead Hydraulic Engineer to perform 59 dam rehabilitation site assessments in accordance with NRCS requirements. The purpose of each assessment is to provide an evaluation of the condition of the existing dam and appurtenances, a description and status of the operation and maintenance of the structure, failure and risk indexes, and rehabilitation alternatives (including cost estimates) for the dams.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Donald L. Basinger, PE	Quality Assurance	56	20

15. FIRM NAME AND LOCATION (City and State)  Schnabel Dam Engineering, Inc., Greensboro, NC
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16. EDUCATION (Degree and Specialization) Bachelor of Science - Civil Engineering	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline) KY, MI, NC, NM, OK, SC, TX, VA, WV - Professional Engineer
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18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 Don has been involved in the planning, foundation investigations, design and construction of concrete, earth, and rock fill dams in all geographic areas of the US and Puerto Rico. The projects included hydroelectric, flood prevention, water supply, and recreational facility structures. Experience with existing dams includes remediation work involving evaluation of seepage, stability, repair design, construction contracts, safety inspections, and development of emergency action plans. He has a working knowledge of all federal agencies' dam safety requirements, and experience in coordinating with FEMA and the North Carolina State dam safety officers for approvals of designs. As USDA Dam Safety Engineer in Washington, DC, he worked directly with FEMA from 1984 to 1990 developing dam safety criteria and guidelines.


19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS COBB CREEK WATERSHED, DAM SITE 1, PLANNING AND DESIGN FOR DAM REMEDIATION, Washita County, OK	2003 - 2008	2011
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Manager and Responsible Engineer for the rehabilitation of the high hazard 87-ft earthfill dam. The project included the rehab planning, development for alternatives, and the design of remedial repairs. The design for repairs included replacement of the principal spillway and the conversion of the 700-ft wide emergency spillway to a 300-ft wide emergency spillway with RCC lining.		
	<input checked="" type="checkbox"/> Check if project performed with current firm		
b.	NRCS LOWER EAST FORK LATERALS WATERSHED, DAM SITE 1, EMBANKMENT DAM REHABILITATION, Kaufman County, TX	2004	2006
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Manager and Responsible Engineer for the design of the modifications to upgrade the dam to meet High Hazard Potential criteria for the USDA-NRCS and State of Texas, to obtain approvals, and to provide construction oversight.		
	<input checked="" type="checkbox"/> Check if project performed with current firm		
c.	BULLOCK PEN LAKE DAM - PHASE A AND B, DAM REHAB, Crittenden, KY	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Senior Technical Reviewer for Phase A to include the assessment of the condition of the dam and spillway and to evaluate alternatives for increasing the storm capacity of the dam. The dam was constructed in 1953 for the Department of Fish and Wildlife Resources. Phase B of the project included design of the selected alternative, coordination of permitting, and producing construction drawings for the dam rehabilitation contract.		
	<input checked="" type="checkbox"/> Check if project performed with current firm		
d.	NRCS MARROWBONE WATERSHED, DAM SITE 1, DAM REHABILITATION, RIDGEWAY, Henry County, VA	2000	2001
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Senior Technical Reviewer for the alternatives evaluation, and the preliminary and final design for the upgrade of the dam to meet Virginia Dam Safety Regulations. The design involved the use of Roller Compacted Concrete (RCC) overtopping protection and closing of the existing vegetated earth spillway.		
	<input checked="" type="checkbox"/> Check if project performed with current firm		

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Gregory S. Paxson, PE	Quality Assurance	21	20

15. FIRM AFFILIATION (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Engineering – Civil Engineering Bachelor of Science – Civil Engineering	DE, MD, MI, ND, NH, NJ, OH, PA, VA – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Conferences, Journals, Awards, etc.)
 Greg Paxson has experience in analysis and design for dam engineering projects, for both evaluation and upgrading of existing dams and design of new dams. Specific experience includes hydrologic and hydraulic (H&H) analyses, gravity dam stability, labyrinth spillways, roller compacted concrete (RCC), and slope stability and seepage analyses for earth dams. Greg also has extensive experience in site layout and design for dams. Greg has authored and co-authored more than 20 technical papers, mostly on dam rehabilitation and H&H. In addition, Greg currently serves on ASDSO's Affiliate Member Advisory Committee and is the Vice Chair of the USSD Committee on Hydraulics of Dams.

19. RELEVANT PROJECTS		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a. (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Lead Designer, Project Manager, or Senior Reviewer for engineering services for more than 10 dams located in Pennsylvania State Parks or State Forests. Projects included inspections, H&H and dam breach analyses, subsurface explorations and geophysical surveys, embankment seepage and stability analyses, evaluation of rehabilitation alternatives, and design of rehabilitation, including spillway capacity upgrades using RCC.	2010	2010
(1) TITLE AND LOCATION (City and State) PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, OPEN-END CONTRACTS, DAM EVALUATIONS & DESIGN, Multiple Locations, PA	2010	2010
b. (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Engineer of Record for developing alternative plans and final design for the rehabilitation of the principal and auxiliary spillways for the dam. The rehabilitation concept includes armoring the auxiliary spillway with articulating concrete blocks (ACB) and replacement of the principal spillway riser due to seismic stability concerns. Schnabel provided plans and specifications and supported the County with permitting for the project. Schnabel provided construction observation services and technical support for administration of the construction contract.	2014	2014
(1) TITLE AND LOCATION (City and State) NRCS POHICK CREEK WATERSHED DAM NO. 8 (HUNTSMAN LAKE) REHABILITATION, Fairfax County, VA	2014	2014
c. (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Manager responsible for the rehabilitation design of four dams owned by the PFBC through a contract with the Commonwealth of Pennsylvania Department of General Services. These four high hazard earthfill dams impound recreation lakes used for fishing and boating. The high hazard dams have been found to have inadequate spillway capacity to safely pass the PMF as required by the Pennsylvania Department of Environmental Protection (PADEP), Division of Dam Safety. Projects include evaluation of rehabilitation alternatives, design of the selected alternative and development of plans and specifications, and consultation services during construction. The selected alternatives for upgrading include replacement of structural spillways and/or overtopping protection of the embankments with RCC or ACB. In addition to these four dams, Greg is serving as the Project Manager for support of PFBC designs for three other high hazard dams, including H&H and geotechnical analysis, permitting, and design support.	Ongoing	Ongoing
(1) TITLE AND LOCATION (City and State) PENNSYLVANIA FISH AND BOAT COMMISSION (PFBC), DAM REHABILITATION DESIGNS, Multiple Locations, PA	Ongoing	Ongoing
d. (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Reviewer for evaluation and design of rehabilitation alternatives to safely pass the Spillway Design Flood (SDF) for four high hazard dams with slope stability and seepage issues, and inadequate spillway capacity: Mount Laurel, Kauffman, Indian Run, and Pine Run. Several rehabilitation alternatives were evaluated based on hydraulic and hydrologic analyses and geotechnical analyses. The upgrading at these projects includes replacement of structural spillways with either labyrinth and other spillway configurations, and embankment modifications to address seepage and stability issues.	2013	2013
(1) TITLE AND LOCATION (City and State) SCHUYLKILL COUNTY MUNICIPAL AUTHORITY EVALUATION OF ALTERNATIVES OF FOUR DAMS, Schuylkill County, PA	2013	2013

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Wade Biddix	Watershed Planning Specialist	34+ with NRCS	1

15. FIRM NAME AND LOCATION (City and State)
 Wade Biddix, Richmond, VA

16. EDUCATION (Degree and Specialization) Master of Science – Public Administration Bachelor of Science – Agriculture	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
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18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Training: Multiple NRCS Planning Courses on Watershed Planning, Report Content and Preparation, NEPA Process, Principles and Guidelines, Watershed Plans and Supplements and Water Resources Program Management.
Affiliations: Member – National Watershed Coalition; Soil and Water Conservation Society; ACES – Agriculture Conservation Experienced Services

19. RELEVANT PROJECTS


	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS MARROWBONE CREEK WATERSHED DAM NO. 1 REHABILITATION , Henry County, VA	2005	
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm This was the first dam rehabilitation project planned and constructed in VA. NRCS received a Congressional Earmark to develop a rehab. plan so it was very high profile. Was Program Manager as ASTC for Water Resources and also served as NRCS Planning Team Coordinator. A Plan/EA was completed in 2003 for a roller compacted concrete spillway over the dam and the top of dam was raised 8.5 feet. Coordinated the plan development, worked with local sponsors on funding, conducted public meetings, assisted with interagency and public reviews and worked with NHQ staff to get plan reviewed, approved and authorized for construction. Managed project from start to finish.		
b.	NRCS SOUTH RIVER WATERSHED DAMS NO. 23 (ROBINSON HOLLOW); NO. 25 (TOMS BRANCH); NO. 26 (INCH BRANCH) REHABILITATION , Augusta County, VA	2007-2010	
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Completed one Supplemental Plan/EA for 3 dams in 2005. The plan included widening and/or armoring the auxiliary spillways, and raising the top of each dam through the construction of parapet walls. Coordinated the plan development, worked with local sponsors, conducted many public meetings, assisted with interagency and public reviews and worked with NHQ staff to get plan reviewed, approved and authorized for construction. Managed projects during construction.		
c.	NRCS POHICK CREEK WATERSHED DAMS, NO. 4 (ROYAL LAKE); NO. 2 (LAKE BARTON); NO. 3 (WOODGLEN LAKE), AND NO. 8 (HUNTSMAN LAKE) REHABILITATION , Fairfax County, VA	2009-2014	
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Completed 4 Supplemental Plans/EAs for dams in a very populous section of Fairfax County. Public interest was very high. Coordinated the plan development and economics portions but engineering work was performed by Fairfax County via A&E consultants. Worked with Sponsors and staff to conduct many task force meetings, public meetings and field trips on-site. Plans included armoring the spillways with articulated concrete blocks, installing cut-off wall and dredging. Assisted with interagency and public reviews and NHQ reviews and approvals.		
d.	NRCS SOUTH RIVER DAM NO. 10A (MILLS CREEK) REHABILITATION , Augusta County, VA	2013	
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Completed a Supplemental Plan/EA for this dam that was owned by Augusta County but was located on U.S. Forest Service land. Dam originally constructed for water supply purpose and flood control. Water level was lowered 24 feet and principal riser and intake system were replaced to remove water supply. ASW was armored with ACBs. Coordinated the planning process and fund management.		
e.	NRCS UPPER NORTH RIVER DAMS NO. 10 (TODD LAKE) AND NO. 77 (HEARTHSTONE LAKE) REHABILITATION , Augusta County, VA	Ongoing	
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm NRCS planning team completed supplemental plan/EA on Dam No. 10 in 2012. Worked with planning team, as needed, on program management and funding issues. Dam No. 10 is also on US Forest Service land and is under construction now. The draft supplemental plan/EA for Dam No. 77 was sent out for public review in May 2015.		

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Laura Shearin-Feimster, PE	Hydraulic Engineer	10	9

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Engineering – Engineering Management Bachelor of Science – Biological Engineering	IN, KY, NC, VA – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Laura Shearin-Feimster has spent the majority of her career performing the inspection, evaluation, and design of dams. Laura has extensive experience in the hydrologic and hydraulic analysis (H&H) and design of existing, rehabilitated, and new dams. She is proficient in the use of HMR-52, HEC-1, HEC-HMS, HEC-RAS, and HY-8 computer modeling and ArcGIS computer programs. In particular, she has experience developing conceptual spillway and energy dissipation configurations for rehabilitations, replacement, and new dam spillways. Laura has also performed regular and formal inspections, prepared Emergency Action Plans and Operation and Maintenance Manuals, and has been involved in flood studies in North Carolina, Kentucky, and Virginia. She also has experience with H&H modeling for new and existing dams including floodplain and floodway inundation mapping.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS DEEP CREEK DAM 5D, Yadkin County, NC	2012	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Engineer responsible for supervising the development of the GIS based annotated digital flood insurance rate maps (DFIRMs) and topographic work maps of the CLOMR for a new flood control and water supply dam. The maps showed the impacts of the proposed dam on the 100-year flood along approximately 15 miles of South Deep Creek.	<input checked="" type="checkbox"/> Check if project performed with current firm	
b.	NRCS STONY CREEK DAMS NO. 9 AND 10, Shenandoah County, VA	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Hydraulic Engineer responsible for the geotechnical design and management of the subsurface investigation and laboratory testing program to support the development of rehabilitation alternatives and rehabilitation design for these USDA-NRCS flood control dams in the Stony Creek Watershed. The rehabilitation design for Lake Laura dam includes RCC overtopping protection, and the rehabilitation design for Lake Birdhaven dam includes a structural spillway in the existing earthen auxiliary spillway.	<input checked="" type="checkbox"/> Check if project performed with current firm	
c.	NRCS FOX CREEK WATERSHED DAM NO. 4, Fleming County, KY	2012	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Hydraulic Engineer for a rehabilitation design of a USDA-NRCS dam that had been misclassified during the original design process. The work included developing alternatives to address the inadequate capacity of the structure and designing the final hydraulic configuration of the spillway and energy dissipation system. Schnabel was contracted to design a roller compacted concrete (RCC) spillway through the dam to meet the current hazard classification. The spillway is almost 300 ft wide and includes an ogee crest to efficiently pass the design storm. The downstream face of the spillway was designed as a stepped spillway to aid in energy dissipation. The dam rehabilitation was funded by the American Recovery and Reinvestment Act and had an abbreviated timetable. The rehabilitation design from site investigation through final approval, both NRCS and Kentucky Division of Water, was completed in nine months.	<input checked="" type="checkbox"/> Check if project performed with current firm	
d.	CITY OF BURLINGTON DAMS, Burlington, NC	2012	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Engineer responsible for developing the Emergency Action Plan (EAP) and dam breach analysis for the City of Burlington's three water supply dams. This included the development of a HEC-RAS hydraulic model and breach inundation maps of the impacted areas downstream of the dams. The EAPs provided emergency detection and actions for the dam operator, and notification of downstream residences across three counties downstream of the dams. Project also included developing spillway alternatives to rehabilitate Stony Creek Dam. Alternatives configurations to pass storm flows as well as minimum release requirements and a means to drain the reservoir.	<input checked="" type="checkbox"/> Check if project performed with current firm	
e.	NRCS WEST VIRGINIA DAM ASSESSMENTS, Multiple Locations, WV	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Team member for assessments of 59 NRCS-assisted dams in West Virginia. Laura performed the dam inspections and field checked the downstream impacts. She also participated in the development of alternatives and reviewing calculations.	<input checked="" type="checkbox"/> Check if project performed with current firm	

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM *
Brian Crookston, PhD, PE	Hydraulic Engineer	8	3

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
PhD – Water Engineering Master of Science – Hydraulics Bachelor of Science – Civil Engineering	DE, PA, VA – Professional Engineer


18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Dr. Crookston has six years of experience with the modeling, design, and analysis of hydraulic structures, free-surface flows, sedimentation, surface hydrology, and pressurized flows and pipelines, with considerable expertise on labyrinth spillways. At Schnabel, Brian's primary role is in the hydrologic and hydraulic (H&H) design and analyses for new dams and dam rehabilitations. He has written 20 technical documents comprised of academic journal articles, technical articles, and a Federal report. Brian also actively participates in National and International engineering organizations and their respective hydraulic committees.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	PENNSYLVANIA FISH AND BOAT COMMISSION, DAM REHABILITATION DESIGNS , Multiple Locations, PA	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
	Design Professional responsible for performing dam breach analyses for two high-hazard dams. Conducted detailed hydraulic and hydrologic modeling. Prepared design reports, inundation maps, breach layouts, OPCC, and technical drawings. These projects are ongoing.		
b.	NRCS STONY CREEK DAMS NO. 9 AND 10 , Shenandoah County, VA	2012	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
	Design Professional responsible for the technical review of the CFD hydraulic modeling of the vegetated auxiliary spillway. The model provided design insights including flow capacity, flow field, depths, velocities, shear stresses, etc. CFD and NRCS SITES model output were used for an erosion analysis.		
c.	NRCS POHICK CREEK WATERSHED DAM, NO. 8 (HUNTSMAN LAKE) REHABILITATION , Fairfax County, VA	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
	Design Professional responsible for performing channel response and maximum scour analyses of the vegetated auxiliary spillway and downstream channel, based upon NRCS methodologies and incipient motion theory. Estimated effective shear stresses at the streambed and channel velocities for hydrologic events and emergency drawdown. Designed erosion protection measures.		
d.	PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, OPEN-END CONTRACTS, DAM EVALUATIONS & DESIGN , Multiple Locations, PA	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
	Design Professional responsible for developing upgrade design alternatives for rehabilitation of Tobyhanna No. 2 Dam. Included labyrinth spillway, box-inlet, ogee, and overtopping options. Prepared final report with OPCC's, detailed Hydraulic and Hydrologic analyses, and technical drawings.		
e.	NRCS WEST VIRGINIA DAM ASSESSMENTS , Multiple Locations, WV	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
	Senior Reviewer responsible for the evaluation and cost estimating of conceptual dam rehabilitation alternatives associated with the rehabilitation site assessments of 13 dams for the WV NRCS.		


E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Sue Buchanan, PG	Engineering Geologist	8	7
15. FIRM NAME AND LOCATION (City and State)			
 Schnabel Dam Engineering, Inc., Greensboro, NC			
16. EDUCATION (Degree and Specialization)		17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)	
Master of Science – Geology Bachelor of Science – Geology		NC - Professional Geologist	
18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)			
Sue Buchanan has completed several projects related to engineering geology, environmental geology, and engineering and geologic data analysis. Her experience includes groundwater monitoring; soil and rock sampling; Phase I Environmental Site Assessments (ESAs); engineering geology support at dam construction sites; site investigations of unlined landfills; and geotechnical subsurface investigations. Her academic background is in hard rock geology with an emphasis in geochemistry and igneous petrology.			
19. RELEVANT PROJECTS			
(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED	
NRCS RED LICK SITE 1 DAM, REHABILITATION – PHASE 1 , Berea, KY		PROFESSIONAL SERVICES 2014	CONSTRUCTION (If applicable) Ongoing
a.	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Geologist responsible for geotechnical subsurface investigation that included soil and rock logging, sample collection, packer permeability tests, drilling and laboratory budgets, and report writing.		
(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED	
NRCS DEEP CREEK DAM SITE 5-D, CONSTRUCTION SERVICES , Yadkin County, NC		PROFESSIONAL SERVICES 2010	CONSTRUCTION (If applicable) 2010
b.	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for construction support during excavation for earthfill and roller compacted concrete sections of dam, and installation and development of piezometers on earthfill section of dam. Responsibilities included engineering geologic mapping, construction of cross-sections and profile maps, estimating borrow area volumes and soil types, and assistance with grouting program.		
(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED	
CATAWBA WATER TREATMENT PLAN RESERVOIR , Lancaster, SC		PROFESSIONAL SERVICES 2009	CONSTRUCTION (If applicable) N/A
c.	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for tasks that included logging soil and rock borings, sample collection, packer permeability tests, slug testing using an in situ pressure transducer, well construction and development, geologic mapping of stream beds; and assisting project managers with the work plan, invoicing, and report writing.		
(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED	
COBBS CREEK REGIONAL WATER SUPPLY RESERVOIR , Columbia, VA		PROFESSIONAL SERVICES 2011	CONSTRUCTION (If applicable) 2012
d.	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for tasks that included logging soil and rock borings, sample collection, packer permeability tests, well construction and development, and assisting project managers with invoicing, writing the Geotechnical Data Report, drilling budget management, and review of field logs and data.		
(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED	
ROCKY PEN RUN RESERVOIR , Stafford County, VA		PROFESSIONAL SERVICES 2011	CONSTRUCTION (If applicable) N/A
e.	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Engineering Geologist responsible for reviewing and completing the geologic mapping of exposed dam foundation, assisting with rock cleaning and foundation treatment, and assisting with grouting program.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT


(Complete one Section E for each key person.)

12. NAME		13. ROLE IN THIS CONTRACT		14. YEARS EXPERIENCE	
Jonathan M. Pittman, PE		Geotechnical Engineer		a. TOTAL 13	b. WITH CURRENT FIRM* 13
15. FIRM NAME AND LOCATION (City and State)					
 Schnabel Dam Engineering, Inc., Greensboro, NC					
16. EDUCATION (Degree and Specialization)			17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)		
Bachelor of Science – Civil Engineering			KY, NC, VA – Professional Engineer		
18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)					
Jonathan Pittman has experience in dam engineering, geotechnical engineering, and construction administration and monitoring. He provides office and field management on projects where Schnabel is providing these services. He specializes in water resources and electric utility projects including the evaluation and design of earthfill, conventional concrete, and roller compacted concrete (RCC) dams; ash ponds; and levees.					
19. RELEVANT PROJECTS					
a.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	NRCS RED LICK WATERSHED DAM, SITE NO. 1, PLANNING AND DESIGN FOR DAM REMEDIATION, Berea, KY		PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (If applicable) Ongoing	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
Schnabel's Project Manager for the rehabilitation planning of this USDA-NRCS multi-purpose structure that provides 70% of the Berea's water supply. The feasibility study evaluated alternatives for a replacement principal spillway riser, stable auxiliary spillway, and increased available water supply volume. The draft rehabilitation plan-EA was completed in December 2014.					
b.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	NRCS STONY CREEK DAMS NO. 9 AND 10, Shenandoah County, VA		PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (If applicable) Ongoing	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
Project Engineer responsible for the geotechnical design and management of the subsurface investigation and laboratory testing program to support the development of rehabilitation alternatives and rehabilitation design for these USDA-NRCS flood control dams in the Stony Creek Watershed. The rehabilitation design for Lake Laura dam includes RCC overtopping protection, and the rehabilitation design for Lake Birdhaven dam includes a structural spillway in the existing earthen auxiliary spillway. Mr. Pittman is also serving as the Project Engineer for the construction of the rehabilitation designs. Construction is scheduled to be completed in 2016.					
c.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	NRCS FOX CREEK WATERSHED DAM NO. 4, Fleming County, KY		PROFESSIONAL SERVICES 2012	CONSTRUCTION (If applicable) 2012	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
Project Engineer responsible for the evaluation of alternatives and the geotechnical design and management of the subsurface investigation and laboratory testing programs for the rehabilitation of this 35-ft high USDA-NRCS multi-purpose dam. Mr. Pittman also provided construction oversight and management services related to the implementation of the geotechnical engineering portions of the design. The rehabilitation design from site investigation through final approval, both NRCS and Kentucky Division of Water, was completed in nine months.					
d.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	COBBS CREEK REGIONAL WATER SUPPLY RESERVOIR, Columbia, VA		PROFESSIONAL SERVICES 2012	CONSTRUCTION (If applicable) 2012	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
Assistant Project Manager and Lead Civil Engineer for the evaluation of alternatives and design of a 160-ft high, 4,000±-ft long primary dam and concrete spillway, outlet works, and associated bridges on Cobbs Creek and a 30-ft high, 800±-ft long perimeter saddle dam. The project will be a pumped storage facility providing approximately 15 billion gallons of raw water storage within a 1,100-acre reservoir at normal pool. Raw water will be diverted to the reservoir from the James River when river flows are adequate. Mr. Pittman was responsible for managing the extensive geologic and geotechnical investigation program required to support the evaluation of alternatives and design of the proposed dams.					
e.	(1) TITLE AND LOCATION (City and State)		(2) YEAR COMPLETED		
	NRCS WEST VIRGINIA DAM ASSESSMENTS, Multiple Locations, WV		PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (If applicable) N/A	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE		<input checked="" type="checkbox"/> Check if project performed with current firm			
Senior Reviewer responsible for the evaluation and cost estimating of conceptual dam rehabilitation alternatives associated with the rehabilitation site assessments of 13 dams for the WV NRCS.					

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Adam C. Paisley, PE	Geotechnical Engineer	a. TOTAL 9	b. WITH CURRENT FIRM* 8

13. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Bachelor of Science in Civil Engineering - Geotechnical Engineering	NC - Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Adam Paisley has experience in many general areas of civil engineering including structural analysis, hydrological and hydraulic analysis, environmental assessment, contaminant transport analysis, drinking water treatment design, wastewater treatment design, Portland Cement Concrete mix design, asphalt pavement mix design, reinforced concrete design, design alternative analysis, traffic flow analysis, and circular and spiral curve design. He also has experience in geotechnical engineering areas of study including soils characterization, soils lab testing interpretation, seepage analysis, lateral earth stress analysis and earth retaining structure design, foundation design, settlement analysis, slope stability analysis, and earth embankment and dam design. Since joining Schnabel, Mr. Paisley has gained experience in drilling and subsurface investigations, performance and analysis of in-situ testing, foundation pressure grouting design and construction, erosion and sediment control design, 2-D computer-aided analysis of seepage and slope stability, and alternatives analysis.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS DEEP CREEK NRCS WATERSHED DAM 5D , Yadkinville, NC	2010	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Lead the coordination and construction observation effort for the pressure injection grouting construction for foundation preparation. Work included collection of data and observation of drilling for grout holes, water pressure testing of the rock foundation, and pressure injection grouting of the foundation. He interpreted data gathered during the foundation preparation program, presented the results of testing and grouting production, provided suggestive input for the collaborative decision making process for additions and changes to the grouting program, provided quality assurance for grout mix performance and pressure grouting/pressure testing procedures, coordinated engineering staffing, and checked and tracked payable construction quantities.		
b.	NRCS FOX CREEK MPS#4 DAM, SUBSURFACE INVESTIGATIONS, GEOTECHNICAL ANALYSES, AND REPORTS , Fleming County, KY	2012	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Coordinated and provided oversight for drilling operations, logged the drilling of boreholes, sampling of soil, and coring of rock. He assigned geotechnical laboratory testing, produced boring logs and subsurface profiles, performed seepage, slope stability, and settlement analysis for a proposed concrete spillway, analyzed slope stability of the proposed grade of the upstream slope of the existing earthen embankment during rapid drawdown conditions, analyzed the heave of the spillway foundation during construction, analyzed temporary stability of construction slopes, and produced a geotechnical design report. Also performed a SITES headcut erodibility analysis of the existing earthen auxiliary spillway as part of an evaluation separate from the geotechnical analyses.		
c.	COBBS CREEK REGIONAL WATER SUPPLY RESERVOIR, PHASE I INVESTIGATION , Columbia, VA	2011	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Provided drilling oversight during the drilling of the last four holes of the Phase I subsurface investigation, including the logging of soil and rock and installation of an observation well, developed observation wells, performed packer testing in rock, and performed aquifer testing (slug testing) in the six dam observation wells. He reviewed and provided suggestions for draft boring logs and analyzed aquifer test data.		
d.	SALEM LAKE REPLACEMENT DAM, GEOTECHNICAL ANALYSES , Winston-Salem, NC	2009	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Performed seepage and slope stability analyses of the proposed embankment section, performed a slope stability analysis on the upstream embankment wrap-around slope for rapid drawdown conditions, evaluated the settlement of the proposed mass concrete dam on its rock foundation, and produced a geotechnical design report. He also designed the drilling and pressure grouting program for the proposed mass concrete dam foundation.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Gerald C. Robblee, PE, GE	Geotechnical Engineer	16	8

15. FIRM NAME AND LOCATION (City and State)



Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Specialization)

Master of Science – Civil Engineering
Bachelor of Science – Civil Engineering

17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)

KY, NC, VA – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Gerald Robblee has extensive experience as a Project Manager and Project Engineer for a wide range of public infrastructure projects including new earthfill or roller compacted concrete (RCC) dams, rehabilitation of existing dams, water treatment plants, tunnels, pipelines, steel sheet-pile bulkhead design, and seismic studies. His responsibilities include proposal preparation, field explorations, geotechnical and structural analysis and design, report preparation, construction observation and testing, and supervision of others.

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS DEEP CREEK DAM 5D , Yadkin County, NC	2010	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Geotechnical engineer during construction of a new 74-ft high composite RCC and earthfill flood control dam. Responsibilities included consulting on foundation dewatering issues, borrow area development and management, and evaluating the impacts of proposed changes in embankment zoning on embankment seepage and stability.		
b.	NRCS STONY CREEK DAMS NO. 9 AND 10 , Shenandoah County, VA	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Senior Geotechnical Reviewer for the rehabilitation design of two USDA-NRCS flood control structures. The dams lack the required hydraulic capacity and do not meet the spillway stability and integrity requirements. The work included dam inspection, geotechnical exploration, alternatives analysis, and rehabilitation design.		
c.	NRCS FOX CREEK WATERSHED DAM NO. 4 , Fleming County, KY	2012	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Senior Geotechnical Reviewer for the design of a roller compacted concrete (RCC) spillway through the dam to meet the current hazard classification. The spillway is almost 300 ft wide and includes an ogee crest to efficiently pass the design storm. The dam rehabilitation was funded by the American Recovery and Reinvestment Act and had an accelerated field investigation and design schedule. Mr. Robblee was responsible for review of seepage, stability, and settlement analyses as well as review of the design of seepage controls and drainage systems. Mr. Robblee also served as part of the Schnabel Inspection Team at substantial completion.		
d.	NRCS COBB CREEK WATERSHED DAM NO. 1 , Washita County, OK	2009	2009
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Geotechnical Engineer for the design of rehabilitation measures that included a new principal spillway conduit and auxiliary spillway. Mr. Robblee also led the evaluation of the potential for the dam and dam foundation to experience liquefaction during the design earthquake. The design earthquake was selected in accordance with draft NRCS revisions to TR-60 and was the 5,000-year return period earthquake. The peak ground acceleration for the 5,000-year return period earthquake was determined using USGS probabilities maps and web-based seismic hazard mapping tools.		
e.	NRCS WEST VIRGINIA DAM ASSESSMENTS , Multiple Locations, WV	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Senior Geotechnical Reviewer for dam assessments for West Virginian NRCS. Mr. Robblee provided senior consulting on filter design issues, review of embankment stability and seepage issues, and on geotechnical aspects of conceptual rehabilitation design alternatives.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME <small>(Last, First, Middle)</small>	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Jeremy R. Young, PE	Planning/Design Engineer	14	14

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Engineering – Civil Engineering Bachelor of Science – Civil Engineering	DE, MD, NY, PA, VA – Professional Engineer


18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 Jeremy Young has experience with evaluation, design, and construction on a variety of dam engineering projects. Jeremy's primary role is project manager for dam rehabilitation projects and design team leader. Jeremy excels in project management and serves on Schnabel's companywide Project Management Improvement Group, tasked with improving Schnabel's tools for project management and providing training to staff. He has extensive experience preparing and reviewing construction contract documents for dam rehabilitation projects. The Construction Specifications Institute recognizes Jeremy as a Certified Construction Specifier, which demonstrates comprehensive knowledge of the design and construction process, contractual relationships, and use of construction documents. Jeremy's dam engineering experience includes hydrologic modeling, hydraulic design of dams and spillways, embankment evaluation and design, gravity dam design and stability analysis, and design of embankment overtopping protection (ACB and RCC).

19. RELEVANT PROJECTS		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a. (1) PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, OPEN-END CONTRACTS, DAM EVALUATIONS & DESIGN, Multiple Locations, PA	2010	2010
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Participated in more than 10 dam projects located in Pennsylvania State Parks or State Forests under various IDIQs with DCNR. Lead Designer, Assistant Project Manager and Assistant Construction Contract Administrator for the Rehabilitation of Poe Dam (33-ft High Earth Dam, RCC Overtopping Protection; Completed in 2010; \$4.0M). Currently, Design Reviewer for the Rehabilitation of George B. Stevenson Dam (165-ft High Earth Dam, Foundation Filter System; Est. \$5.4M)		
b. (1) NRCS POHICK CREEK WATERSHED DAM NO. 8 (HUNTSMAN LAKE) REHABILITATION, Fairfax County, VA	2014	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Associate Engineer responsible for reviewing the design of an auxiliary spillway armored with ACB. The ACB design was developed as part of major rehabilitation for this high hazard NRCS earth dam with a maximum height of 43 ft. Hydraulic modeling was performed with HEC-RAS to estimate parameters used to evaluate ACB stability. Design calculations, plans and performance specifications were prepared to support the ACB design in accordance with VA DCR and NRCS criteria. Served as Project Manager, Construction Contract Administrator and Design Liaison during construction.		
c. (1) PENNSYLVANIA FISH AND BOAT COMMISSION (PFBC), DAM REHABILITATION DESIGNS, Multiple Locations, PA	Ongoing	Ongoing
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Designer for the rehabilitation of four high hazard dams found to have inadequate spillway capacity. Maximum embankment heights for each dam range between 26.5-ft and 43.5-ft. Designed RCC overtopping protection at Colyer Lake and Speedwell Forge Dams; also designed ACB overtopping protection at Glade Run Lake Dam. Embankment drainage systems were incorporated into each design. Coordinated subsurface investigations and piezometer installations. Performed embankment seepage and slope stability analyses, and hydrologic and hydraulic analyses to support design. Two projects started construction in 2014 and another was advertised for bid in May 2015.		
d. (1) NRCS WEST VIRGINIA DAM ASSESSMENTS, Multiple Locations, WV	Ongoing	N/A
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Associate Engineer participated in site inspections at eight dams during the first year (2014) of a five year contract to prepare dam assessment reports for 59 NRCS-assisted dams. Reviewed results of alternatives evaluations to upgrade dams to current NRCS criteria. Typical dam safety deficiencies included inadequate spillway capacity, vegetated auxiliary spillway integrity and stability issues, and inadequate filter compatibility.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Melinda L. Dirdal, PE	Planning/Design Engineer	11	11

15. FIRM AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Institution)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Science – Civil Engineering Bachelor of Science – Civil Engineering	DE, PA – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 Melinda Dirdal's structural experience includes analysis and design of spillways, stilling basins, and other reinforced concrete hydraulic structures. She also has experience with designing rock anchors, performing calculations for reinforced concrete, developing structural design drawings, reviewing shop drawings, and construction observation of steel and concrete in the field. She also has experience in data collection; hydraulic and hydrologic modeling with HEC-1, HEC-HMS, HEC-RAS, and HEC-ResSim computer programs; computer modeling of seepage and slope stability with SEEP/W and SLOPE/W programs (products of GeoStudio); evaluation of erosion potential using the USDA-NRCS SITES computer program; and conceptual design and cost estimating for dam rehabilitations.

19. RELEVANT PROJECTS		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a. (1) NRCS WEST VIRGINIA DAM ASSESSMENTS , Morgantown, WV	Ongoing	N/A
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Engineer responsible for preparing Rehabilitation Assessment Reports for multiple NRCS dams. The reports assist NRCS in the prioritization of structures within the dam rehabilitation program. The project includes assessment reports for 59 dams in West Virginia. Melinda performed the formal dam inspections, field assessments, verification of structure hazard classifications, and breach analyses. She also developed potential rehabilitation alternatives and cost estimates.	<input checked="" type="checkbox"/> Check if project performed with current firm	
b. (1) SPEEDWELL FORGE LAKE DAM BREAK AND INUNDATION MAPPING , Lititz, PA	2009-2015	2015
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Performed dam breach analyses for Speedwell Forge Lake Dam. These analyses were used to develop inundation maps of the areas downstream of the dam during dam reconstruction and for the upgraded dam. The dam owner used the inundation maps to develop a temporary EAP during construction and an EAP for the upgraded dam.	<input checked="" type="checkbox"/> Check if project performed with current firm	
c. (1) COLYER DAM BREAK AND INUNDATION MAPPING , Reidsville, NC	2010	2013
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Performed a dam breach analysis for Colyer Lake Dam. This analysis was used to develop inundation maps of the areas downstream of the dam following a proposed rehabilitation. The dam owner used the inundation maps to develop an EAP.	<input checked="" type="checkbox"/> Check if project performed with current firm	
d. (1) GLADE RUN LAKE DAM , Butler County, PA	2009-2015	2015
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Developed alternatives for rehabilitation, including spillway replacement, armoring the embankment, implementing embankment drainage systems, and raising the top of dam. Project Engineer responsible for performing hydraulic and hydrologic calculations. Lead Structural Engineer for the box inlet drop spillway, stilling basin, and parapets. Melinda was responsible for preparing the design drawings and NPDES and E&S permit applications.	<input checked="" type="checkbox"/> Check if project performed with current firm	
e. (1) UPPER AND LOWER OWL CREEK DAM , Tamaqua, PA	2009-2012	2012
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Designer responsible for performing hydraulic and structural calculations. Also took part in developing design drawings and specifications for the project. Developed quantity and cost estimates for the dam rehabilitation. In addition, performed the hydrologic and hydraulic calculations for the Lower Owl Creek Dam spillway and stilling basin. She designed the structural elements in the spillway, stilling basin, and vehicular access over the spillway. Melinda also took part in developing design drawings and specifications and reviewing submittals for the projects.	<input checked="" type="checkbox"/> Check if project performed with current firm	

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Loring Watkins Crowley, PE	Planning/Design Engineer	8	6

15. FIRM NAME AND LOCATION (City and State)



Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Specialization)

Master of Science – Civil Engineering
Bachelor of Arts – Mathematics

17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)

NC – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Loring Crowley is a registered Professional Engineer with experience in hydrology and hydraulics modeling; well construction oversight; well testing; and groundwater flow and contaminant transport modeling. She is proficient in the use of HMR-52, HEC-1, HEC-HMS, HEC-RAS, MODFLOW, MT3D, Groundwater Vistas, Visual MODFLOW, WHPA, and MATLAB.

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS RED LICK DAM, NEW SPILLWAY ALTERNATIVES ANALYSIS, Berea, KY	2014	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Responsible for the hydrology and hydraulic modeling for the spillway alternatives analysis to increase the hydraulic capacity for a water supply dam. Hydraulic modeling was performed in accordance with NRCS requirements to identify a cost-effective alternative for rehabilitation of the dam.		
b.	SWEETHEART HYDROELECTRIC PROJECT, Juneau, AK	2011	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Responsible for the hydrologic and hydraulic analysis for a proposed hydroelectric dam. The hydrologic analysis included the development of runoff values from large rainfall event storms along with runoff from snowpack. The hydraulic analysis included several dam alternatives.		
c.	TROUBLESOME CREEK DAM SPILLWAY REPLACEMENT, Reidsville, NC	2010	2013
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Engineer responsible for the hydraulic design and two-dimensional seepage modeling using the finite-element model (SEEP/W) for replacement of the spillway. Ms. Crowley constructed seepage models to calculate uplift pressures beneath the spillway chute that were used in the drain system design. Ms. Crowley also conducted hydraulic modeling for the proposed ogee-crested spillway design. She also performed floodplain modeling to adhere to FEMA requirements. Ms. Crowley performed dam inspections after the new spillway construction, which includes the analysis of dam instrumentation data.		
d.	NORTH FORK DAM, Black Mountain, NC	Ongoing	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Responsible for dam spillway alternatives to upgrade an existing dam with inadequate spillway capacity. Multiple alternatives were analyzed with consideration to site conditions and project objectives.		
e.	UPPER NORTON DAM SPILLWAY UPGRADE, Norton, VA	2013	N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Engineer responsible for the hydraulic design for upgrades to the Upper Norton Dam. Analysis included hydrologic and hydraulic modeling, evaluation of the capacity of the existing spillway, and design of the labyrinth and chute spillway.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
W. Kortney Brown, PE	Planning/Design Engineer	7	7

15. FIRM NAME AND LOCATION (City and State)



Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)

Master of Science in Civil Engineering – Water Resources
Bachelor of Civil Engineering – Water Resources

17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)

PA - Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Kortney Brown's experience in water resources, geotechnical, and structural engineering includes data collection; hydraulic and hydrologic modeling with HEC-1, HEC-HMS, and HEC-RAS computer programs, as well as physical and numerical hydraulic modeling of weirs; computer modeling of seepage and slope stability with SEEP/W and SLOPE/W programs (products of GeoStudio); evaluation of soil filter compatibility using NEH Chapter 26 and USACE guidance, and evaluation of suffusive soils; conceptual design and cost estimating for dam rehabilitations including layout and detailed design for concrete spillways, embankment drainage systems, overtopping protection systems (RCC and ACBs), and miscellaneous grading using AutoCad Civil 3D®; conceptualization of dam rehabilitation alternatives using Google SketchUp Pro® with realistic image rendering software; design and fabrication of monitoring weirs for seepage evaluations.

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS RED LICK MPS #1 , Madison County, KY	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Lead planning engineer responsible for rehabilitation alternatives analysis of this NRCS earthfill embankment dam. Developed cost estimates for several alternatives, including rehabilitation of the concrete principal spillway riser. Provided inspection services of the concrete riser with a professional dive team. Developed the dive inspection report, including recommendations for design.		
b.	LAKE ONEIDA DAM , Butler County, PA	2010	2014
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Designer responsible for several rehabilitation alternatives, and Lead Designer for the final design of this earth embankment water supply reservoir dam rehabilitation. Final design included roller compacted concrete (RCC) overtopping protection, a new cast-in-place concrete spillway, positive cutoff at the embankment toe, new embankment drainage system, and low-level outlet conduit extension. Performed part-time resident project representative services during embankment drainage system and RCC construction.		
c.	INDIAN RUN DAM , Schuylkill County, PA	2008	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Performed investigations including low-level outlet conduit inspections. Lead Designer responsible for the rehabilitation design of this 90-ft high earth embankment dam. Responsibilities included hydraulic and structural design and layout of the approximate 450-ft long cast-in-place concrete replacement labyrinth spillway and chute. Designed slope modifications and the embankment filter system. Performed designs related to construction conditions with slightly lowered reservoir pool. Performed resident engineering services during construction.		
d.	MOUNT LAUREL DAM , Schuylkill County, PA	2008	2013
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Lead Designer responsible for performing the hydraulic and structural design, and the layout of the cast-in-place concrete replacement spillway, and ACB auxiliary spillway. Designed slope modifications and the embankment filter system for this earthfill embankment dam. Designed a new low-level outlet siphon conduit to be constructed without a lowered reservoir pool.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM *
James Featherston	Agricultural Economist	38	1.5
15. FIRM NAME AND LOCATION (City and State)			
James Featherston, Sulphur, OK			
16. EDUCATION (Degree and Specialization)		17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)	
Master of Science – Agricultural Economics Bachelor of Science – Agricultural Economics			
18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)			
19. RELEVANT PROJECTS			
a.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	NRCS RED LICK WATERSHED DAM, SITE NO. 1, Berea, KY	PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (if applicable) N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Working as an independent subconsultant for Schnabel Dam Engineering Inc., served as economist for the development of Supplemental Watershed Plan and Environmental Assessment for the rehabilitation of multi-purpose structure. Evaluated economic and social effects of all alternatives. Served as lead editor in preparing plan/EA document. Attended public meetings representing Schnabel. First draft completed, final planning is ongoing.			
b.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	NRCS LOWER BRUSHY CREEK FRS NO. 20, Thorndale, TX	PROFESSIONAL SERVICES 2015	CONSTRUCTION (if applicable) N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Working for a consulting firm in Texas, served as team leader and economist for development of Supplemental Watershed Plan and Environment Evaluation for the rehabilitation of floodwater retarding structure. Role as planning team leader, coordinated with local sponsors to develop steering committee and hold public meetings. Coordinated with planning team ensuring timely and accurate work by all team members. Facilitated reviews by TX-NRCS and National Water Management Center – NRCS. Role as economist, evaluated economic and social effects of all alternatives.			
c.	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	NRCS UPPER BRUSHY CREEK FRS NO. 32, Coupland, TX	PROFESSIONAL SERVICES 2015	CONSTRUCTION (if applicable) N/A
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Working for a consulting firm in Texas, served as team leader and economist for development of Supplemental Watershed Plan and Environment Evaluation for the rehabilitation of floodwater retarding structure. Role as planning team leader, coordinated with local sponsors to develop steering committee and hold public meetings. Coordinated with planning team ensuring timely and accurate work by all team members. Facilitated reviews by TX-NRCS and National Water Management Center – NRCS. Role as economist, evaluated economic and social effects of all alternatives.			

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Jay T. Halligan, GISP	GIS Specialist	9	9

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Institution) Bachelor of Science – Geographical Analysis

17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 Jay Halligan is proficient in the use of Geographical Information Systems (GIS) applications in many types of settings. He has provided GIS graphic representation, as well as analysis of electronic subsurface investigations, dam breach inundation mapping, floodplain mapping, geologic mapping, groundwater quality and quantity, and video graphical representation of dams and water supply services. Jay regularly uses ArcView 10.3 GIS, including Spatial Analyst, 3D Analyst, and Maplex, for representation of various types of technical information to perform mapping and analysis, as well as geographic mapping of properties and places. He has developed Curve Numbers, flow lengths/paths, BXBY cards, and other information to be used in conjunction with HEC-1 and HEC-RAS. He has also used HEC-GeoRAS, a third party extension for ArcGIS, to cut cross sections and develop information to be used within HEC-RAS for dam breach analyses; and to delineate inundation areas and develop dam breach inundation maps for over 40 projects in West Virginia, Georgia, North Carolina, Virginia, Indiana, Delaware, Pennsylvania, and California.

19. RELEVANT PROJECTS


	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS POHICK CREEK WATERSHED DAMS, NO. 2 (LAKE BARTON), 3 (WOODGLEN LAKE), AND 8 (HUNTSMAN LAKE) REHABILITATION, Fairfax County, VA (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Used ArcGIS for development of data for hydrology and hydraulics analyses, including computation of runoff curve number, time of concentration, and stage storage curve. For Huntsman Lake Dam, used HEC GeoRAS extension of ArcGIS to develop geographic data for HEC-RAS dam breach analysis model and to delineate dam breach inundation areas.	Ongoing	Ongoing
		<input checked="" type="checkbox"/> Check if project performed with current firm	
b.	PENNSYLVANIA FISH AND BOAT COMMISSION AND PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES, DAM REHABILITATION DESIGNS, Multiple Locations, PA (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Performed hydrology and hydraulic analysis including curve number calculation using aerial photos and soil information from NRCS Soil Data Mart. Time of concentration was calculated using procedures from Part 630 Hydrology National Engineering Handbook, Chapter 15 - Time of Concentration (May 2010). Used ArcGIS to develop spatial data. For Lake Nessmuk, Speedwell Forge Lake, and Gunter Valley Dams, developed dam breach inundation maps using ArcGIS with 3-D Analyst and Spatial Analyst Extensions. Dam breach inundation areas were delineated using exported data from HEC-RAS and interpolated using topographic digital elevation models and/or LiDAR data. Results and additional information were added to a Schnabel Template for final production.	Ongoing	Ongoing
		<input checked="" type="checkbox"/> Check if project performed with current firm	
c.	NRCS STONY CREEK DAMS, NO. 9 AND 10, Basye, VA (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Developed dam breach inundation maps using ArcGIS with 3-D Analyst and Spatial Analyst Extensions. Dam breach inundation areas were delineated using exported data from HEC-RAS, and interpolated using topographic digital elevation models and/or LiDAR data. Results and additional information were added to a Schnabel Template for final production.	2011	N/A
		<input checked="" type="checkbox"/> Check if project performed with current firm	
d.	NRCS WATERSHED DAM ASSESSMENTS, WV AND KS and KY (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Jay provided integration between the HEC-RAS hydraulic models and ArcGIS for an analysis of NRCS-assisted dams built in West Virginia and Kansas. Using an ArcGIS extension tool created by the US Army Corps of Engineers (HEC-GeoRAS), developed input data for HEC-RAS, exported the data into a HEC-RAS file, and exported the completed modeling data directly into GIS for verification, analysis, and dam breach inundation mapping.	2006	N/A
		<input checked="" type="checkbox"/> Check if project performed with current firm	

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Guy-Justin Nuyda, GISP	GIS Specialist	7	7

15. FIRM AND LOCATION (City and State)
 **Schnabel Dam Engineering, Inc., Greensboro, NC**

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Doctorate – Geography Cognitive Science Master of Arts – Geography-Economic Development, Geographic Information Science Bachelor of Arts – Geography-Environmental Science, Urban Planning	Geographic Information Systems Professional

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Trainings, Awards, etc.)
 Guy-Justin Nuyda has extensively studied the use and function of Geographic Information Science (GIS). Mr. Nuyda has experience with ERDAS Imagine and ESRI ARCGIS software, including Spatial Analyst, 3D Analyst, Geostatistical Analyst, and Network Analyst. Mr. Nuyda has experience merging innovative use of GIS with consulting corporations to achieve increased efficiency and accuracy, as well as an overall heightened capacity in spatial analysis.

19. RELEVANT PROJECTS			
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
CARVINS COVE RESERVOIR, Roanoke, GA	2011	2011	N/A
a. <input checked="" type="checkbox"/> Check if project performed with current firm Calculated the geospatial data, delineated inundation lines and produced the dam break inundation maps illustrating the 30.6 miles of downstream floodways and impacted zones, including portions of the City of Roanoke. He determined affected addresses and calculated initial impact and peak flood times for each address. Approximately 5,700 affected addresses were located within the breach inundation zone.			
VIRGINIA DEPARTMENT OF CONSERVATION AND RECREATION DAMS, Multiple Locations, VA	Ongoing	Ongoing	N/A
b. <input checked="" type="checkbox"/> Check if project performed with current firm Primary GIS support for the project in performing breach analysis and mapping of select US Department of Agriculture-Natural Resources Conservation Service flood control structures for the State of Virginia. Developed prerequisite geospatial data for hydrologic and hydraulic modeling for 18 different dams. Responsible for generating three-dimensional surfaces for topographical and flood inundation modeling.			
USACE GATHRIGHT DAM, Bath County, VA	2011	2011	N/A
c. <input checked="" type="checkbox"/> Check if project performed with current firm Derived statistical surfaces for the lithographic strata situated below Gathright Dam to assist in groundwater seepage analysis. These surfaces were exported into a three dimensional environment to allow virtual real-time subterranean exploration and visualization.			
NRCS WEST VIRGINIA DAMS ASSESSMENT, Various Locations, WV	2014	2014	N/A
d. <input checked="" type="checkbox"/> Check if project performed with current firm Part of a team assigned to assess 59 West Virginian dams for the NRCS, Guy Nuyda collected initial terrain data, performed hydrologic modelling for several of the dams, modeled Top of Dam breach, Auxiliary Spillway breach and Normal Pool breach inundation zones. As part of Persons At Risk reports, Mr. Nuyda was also responsible identifying and classifying over 2,000 impacted structures to date.			

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME Ronald C. McMaine, P.E.	13. ROLE IN THIS CONTRACT Water Supply Engineer	14. YEARS EXPERIENCE	
		14. TOTAL 41	14. WITH CURRENT FIRM 35
15. FIRM NAME AND LOCATION (City and State) Bell Engineering – Lexington, KY			
16. EDUCATION (DEGREE AND SPECIALIZATION) B.S. Mathematics, Michigan State University (Minor in Chemistry, Physics & Geology); M.S. Civil Engineering, University of Kentucky		17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE) Professional Engineer, Civil & Sanitary – Kentucky Professional Engineer, Civil – West Virginia Class IV Water Plant Operator – Kentucky Class IV Water System Operator – Kentucky	

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
Mr. McMaine is a Principal in the firm and a recognized expert in water system evaluation and planning. He has 41 years of industry experience and specializes in bringing water treatment plants into conformance with Safe Drinking Water Act requirements, especially disinfection by-products. He has written several articles which have appeared in national technical journals on topics such as emergency planning, distribution system management and hydraulic analysis of distribution systems. Prior to coming to Bell, Mr. McMaine had several years of commercial experience dealing with ion exchange softening and gained operator experience with two water systems.

Organizations: KY-TN Section AWWA; Kentucky Water & Wastewater Operators Association; Water For People
 Awards: Water For People Kenneth J. Miller Founder's Award; KY-TN AWWA Outstanding Service Award

19. RELEVANT PROJECTS

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
Kale, Cowbell & B Lake Spillway Repairs – Berea, KY	2004	2004
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm This work occurred over a period of 16 years, and addressed problems with the spillways of three of Berea's water supply dams. The scope included evaluation of the problems, design of modifications, and construction of improvements. The work at B Lake was handled as part of a larger construction contract. Cowbell spillway repairs were handled as a separate contract. Kale spillway repairs were performed by the Owner's forces. RCM was PE on B Lake repairs, and PIC/PM on the other two.		
Lake Reba Dam Modifications – Madison County, KY	1982	n/a
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Preliminary design of modifications of Lake Reba Dam to pass PMP. This included both a new spillway and raising the dam. Specific Role: Project Engineer		
Jonathan Larck Reservoir Project – Putnam County, WV	2013	2008
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Design and construction of the 106' tall high hazard Jonathan Larck Reservoir, completed in the early 1990's. Additional work has included biennial inspections, dam breach analysis and inundation report on Jonathan Larck Reservoir after construction of WV 34 located downstream of the structure, and grouting contract to reduce seepage in the left abutment. Specific Role: Project Manager Cost 2.5 million		
Poplar Fork Reservoir Improvements – Putnam County, WV	2012	1997
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Design of improvements to the Poplar Fork Reservoir to bring it into compliance with WV Dam Safety regulations. This included both raising the embankment and modifying the spillway. Triennial inspections of the dam since the early 1990's. Specific Role: Project Manager		
Laurel Branch Dam Spillway Repairs – Breaks Interstate Park; Breaks, VA	2006	2006
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Design of primary/emergency spillway repairs for Laurel Branch Dam to meet Virginia Dam Safety Regulations. Developed operations and maintenance manual and emergency operations plan for Laurel Branch Dam. Developed operations and maintenance manual and emergency operations plan for Laurel Branch Dam. Specific Role: Project Manager		
NRCS Red Lick Watershed Multipurpose Dam, Site No. 1, Planning and Design for Dam Remediation, Berea, KY	Ongoing	N/A
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Rehabilitation planning of the USDA-NRCS multi-purpose structure that provides flood control and 70% of the local water supply. The feasibility study evaluated alternatives for a replacement principal spillway riser, stable auxiliary spillway, and increased available water supply volume. The draft rehabilitation plan-EA was completed in December 2014. Specific Role: Project Manager		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
Sharon L. Krock, PWS	Wetland Scientist	a. TOTAL 16	b. WITH CURRENT FIRM * 14

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Science – Biology Bachelor of Science – Biology	Professional Wetland Scientist

18. OTHER PROFESSIONAL CREDENTIALS (Publications, Organizations, Training, Awards, etc.)

Sharon Krock has experience delineating wetland habitats throughout the eastern and southern United States. She is experienced in ecology, plant taxonomy, and community dynamics. She performs wetland delineations, coordinates Jurisdictional Determinations with the US Army Corps of Engineers (USACE), and provides consulting services to avoid and/or minimize wetland impacts. Sharon prepares wetland permits necessary to authorize unavoidable impacts to wetlands or waters associated with dam repairs/rehabilitations, utility lines, and new development. She develops Environmental Assessments and assists with Dam Permit Applications. Acting as a liaison between regulatory agencies and her clients, Sharon is instrumental in alternative analyses, assisting in developing environmental impact statements, and assessing potential impacts to existing habitats. Sharon also works with a team of Schnabel's engineers, hydrologists, and geologists to provide designs for wetland mitigation including restoration and creation, and stream rehabilitation and relocation designs, and then provides the monitoring required for those mitigation sites.


19. RELEVANT PROJECTS			
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED		
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)	
a. (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE USACE QUANTICO MARINE CORPS BASE DAMS, Quantico, VA Senior Scientist providing oversight for the permitting of the dam safety upgrades and repairs to Lunga, Breckinridge, and Gary's Reservoir Dams that provide water to MCB Quantico, but do not meet safety requirements. Ms. Krock is the liaison between the design engineers and the scientists to help streamline the permitting process.	<input checked="" type="checkbox"/> Check if project performed with current firm Ongoing	Ongoing	
e. (1) TITLE AND LOCATION (City and State) GEORGE B. STEVENSON DAM REHABILITATION, Cameron County, PA	(2) YEAR COMPLETED PROFESSIONAL SERVICES 2014	CONSTRUCTION (If applicable) 2015	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Scientist responsible for delineating wetlands/waters on the site and served as agency coordinator between the USACE, the Pennsylvania Department of Environmental Protection, the Pennsylvania Department of Conservation and Natural Resources, as well as the County Conservation District to limit the impacts to wetlands/waters and potential cultural resources to ultimately minimize permitting efforts. Developed the planting plan and stream relocation design for the relocation of Brooks Run to its historic location.	<input checked="" type="checkbox"/> Check if project performed with current firm		
d. (1) TITLE AND LOCATION (City and State) COLES RUN DAM REHABILITATION PROJECT, Augusta County, VA	(2) YEAR COMPLETED PROFESSIONAL SERVICES 2012	CONSTRUCTION (If applicable) 2014	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Scientist responsible for permitting, agency liaison, and completion of an Environmental Assessment for the Augusta County Service Authority for the proposed rehabilitation of their water supply reservoir. Coordinated with the US Forest Service, USACE Norfolk District, VA Department of Environmental Quality, VA Department of Conservation and Recreation, and several other agencies.	<input checked="" type="checkbox"/> Check if project performed with current firm		
a. (1) TITLE AND LOCATION (City and State) NRCS FOX CREEK WATERSHED MULTIPURPOSE STRUCTURE NO. 4, DAM REHABILITATION, Fleming County, KY	(2) YEAR COMPLETED PROFESSIONAL SERVICES 2012	CONSTRUCTION (If applicable) 2012	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Scientist for the wetland services associated with the rehabilitation design of a USDA-NRCS dam. Sharon delineated the regulated wetlands and waters. Sharon compiled and submitted the necessary permits to the USACE and State agencies to obtain authorization for the unavoidable impacts to regulated areas necessary to complete the project. The project was funded by the American Recovery and Reinvestment Act and had an abbreviated timetable.	<input checked="" type="checkbox"/> Check if project performed with current firm		
e. (1) TITLE AND LOCATION (City and State) SHENANDOAH CROSSING, Orange County, VA	(2) YEAR COMPLETED PROFESSIONAL SERVICES 2007	CONSTRUCTION (If applicable) 2008	
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Project Manager responsible for providing wetland delineation services, consultation during design to minimize wetland and water impacts, and permitting services as part of a 100+ acre expansion project for this existing outdoor resort property.	<input checked="" type="checkbox"/> Check if project performed with current firm		

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Gary M. Horninger, PE	Construction Engineering	25	16

15. PREVIOUS EMPLOYER (City and State)
 Schnabel Dam Engineering, Inc., West Chester, PA

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Science – Civil Engineering Bachelor of Science – Civil Engineering	AL, DE, NJ, PA, WV – Professional Engineer

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Gary Horninger has experience primarily related to construction and dam engineering. He has been involved in a wide range of dam design projects including siting studies, site investigations, alternatives assessment, preparation of drawings and specifications, and construction phase services. Gary has also been a full-time Resident Engineer for six dam construction projects, and has provided quality assurance constructability reviews and construction oversight on many other projects. He currently serves on the Board of Directors for the Eastern Pennsylvania and Delaware Chapter of the American Concrete Institute.


19. RELEVANT PROJECTS		
(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
ROCKY PEN RUN DAM , Fredericksburg, VA	2007-2014	2014
a. (3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Contract Administrator for the \$6.65M foundation excavation contract, the \$8.8M foundation grouting and preparation contract, and the \$33.6M dam and pump station construction contract. Gary was also the Project Manager for the design review phase and participated in the third-party reviews of the design for the cast-in-place concrete 5-cycle labyrinth. Duties included coordinating progress meetings, advising client on modifications, change orders, and payment estimates, as well as conducting the project meetings. Gary also served as a liaison between field staff, office engineering staff, and the designer.		
b. (1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
LAKE ONEIDA DAM , Butler County, PA	2012	2013
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Contract Administrator for this \$6.75M dam rehabilitation contract. Work on site included construction of a new cast-in-place concrete spillway, Roller Compacted Concrete (RCC) overtopping protection and piping and site work improvements. Duties included coordinating progress meetings, and advising client on modifications, change orders, and payment estimates. Gary also served as a liaison between the client, contractor, field staff, and office engineering staff, and conducted the progress meetings. He provided technical support during the RCC placement.		
c. (1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
LEASER LAKE DAM , Lehigh County, PA	2010	2013
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Project Professional responsible for interpreting contract documents and responding to contractor and client questions and requests. Responsibilities included maintaining records and providing reports, submittals and Request For Information (RFI) responses in accordance with Pennsylvania Department of General Services (PA DGS) requirements.		
d. (1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
POE VALLEY DAM REHABILITATION , Centre County, PA	2007	2008
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Project Manager for the construction phase services for this \$4M rehabilitation contract. Duties included responding to Requests for Information, interpreting the contract documents, and advising client on modifications, change orders, and payment estimates. Also served as a liaison between field staff and office engineering staff.		
e. (1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
LAKE TOWNSEND DAM , Greensboro, NC	2009	2009
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE	<input checked="" type="checkbox"/> Check if project performed with current firm	
Reviewed contract documents and plans for rehabilitation of the City's principal water supply reservoir. The project includes construction of a new 20-ft high labyrinth spillway and a new embankment section. Gary served as the Resident Project Representative (RPR) for a portion of the construction. Lake Townsend Dam was the ASDSO National Rehabilitation Project of the Year for 2012.		

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Timothy L. Mohr, SET	Construction Observation	27	27

15. FIRM NAME AND LOCATION (City and State)  Schnabel Dam Engineering, Inc., Greensboro, NC
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16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
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18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)
 Tim Mohr has experience in materials construction testing, and provides office and field management of construction projects, where Schnabel is providing resident project representative services, special inspections testing or acting as the Special Inspector. His experience includes 10 years in the field performing the testing and inspections; 15 years managing those activities on large commercial, industrial, warehouse, apartment, and municipal structures; and 3 years providing construction management and materials testing on zoned earthen Category I embankments.

19. RELEVANT PROJECTS

(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
SHOAL CREEK DAM , Clayton County, GA	2014	2015
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Provided construction management and construction observation for the seepage cut-off wall and diaphragm drain. This existing earthen embankment was approximately 50 feet in height, and classified as "High Hazard" or Category I dam as defined by the Georgia Department of Natural Resources, Environmental Protection Division, Watershed Protection Branch, Safe Dams Program (Safe Dams).		
NEW RAGGED MOUNTAIN DAM , Albemarle County, VA	2012	2014
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Provided construction management and materials testing for this 129 ft zoned earthen Category 1 embankment constructed to its full height. Construction Management comprised of being a liaison representing the Owner for the municipalities, Department of Transportation, the public, and a special needs camp located next door to the construction site; management of up to six construction field representatives; monthly review of our construction budget; quality review of field paperwork during construction; preparing the Progress Meeting Agenda's and reporting of the Progress Meeting Minutes; review of the Contractor's Change Orders and Contract Extension Requests; and reviewing the Contractor's monthly payment application. The earthen embankment was constructed downstream of the existing dam.		
SUGAR HOLLOW DAM , White Hall, VA	2013	2013
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Provided construction observations and construction management for the raw water discharge modifications for the Sugar Hollow Dam.		
ROCKY PEN RUN DAM , Stafford County, VA	2012	2013
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Provided construction materials observations and testing assistance during the embankment test pad program.		
TIRED CREEK DAM , Cairo, GA	2013	2013
(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Provided construction oversight assistance during construction of the earthen embankment.		

*Years prior to 2010 were with its sister company, Schnabel Engineering, LLC

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM *
Aaron Collins	Construction Engineering	10	7

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Specialization)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Bachelor of Civil Engineering – Civil Engineering Technology Associates – Civil Engineering Technology	

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Treatises, Awards, etc.)
 Aaron Collins has experience in civil design for residential, commercial, and water resources applications. He has over 10 years of experience in site layout, contract administration, project representation and cost estimating. 7 of the 10 years Mr. Collins has overseen the construction of several high hazard dams for Schnabel and is valued as a project representative throughout the dam construction industry.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS LAKE LAURA AND LAKE BIRDHAVEN DAM CONSTRUCTION , Shenandoah County, VA	Ongoing	Ongoing
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Responsible for Contract Administration for the construction of a new 375-foot wide roller compacted concrete auxiliary spillway and 75 foot wide concrete ogee shaped crest spillway. Both dams are being constructed within 2 miles of each other for the Virginia Department of Conservation and Recreation.		
b.	NRCS DEEP CREEK DAM SITE 5-D, CONSTRUCTION SERVICES , Yadkin County, NC	2010	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Acted as Assistant Resident Project Representative on-site primarily focused on Roller Compacted Concrete (RCC) and Contract Administrator. Deep Creek was a NRCS funded job and the specification for the construction of the dam are from the NRCS. Deep Creek is approximately 80 ft. tall and is used for flood control purposes.		
c.	NRCS FOX CREEK MPS #4 DAM , Fleming County, KY	2011	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Responsible for the site layout, erosion and sediment control design, estimating, and construction sequencing as well as all the construction drawings for the design of a new Roller Compacted Concrete overtopping structure. Mr. Collins performed the duties of Resident Project Representative and Contract Administrator during construction.		
d.	TROUBLESOME CREEK DAM , Reidsville, NC	2012	2013
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Acted as the Resident Project Representative and Contract Administrator for the construction of the 280 foot wide concrete reinforced chute spillway. The new spillway was constructed within the footprint of the old spillway and utilized a two stage ogee crested control section.		
e.	YADKINVILLE DAM REHABILITATION , Yadkinville, NC	2013	2014
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Acted as the Resident Project Representative and Contract Administrator for the remediation of the existing earth embankment. The dam was experiencing heavy seepage at its toe so new drains were installed and a low permeable liner was installed in the reservoir.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM *
Douglas Fairchild, Jr.	Resident Project Representative	28	24

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Specialization)
 Bachelor of Science – Structural Design and Engineering Technology

17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Conferences, Training, Awards, etc.)
 Doug Fairchild has extensive experience in field observation and testing during dam rehabilitation construction. Doug's duties include soil laboratory, field, concrete, and compacted structural fill testing; observation of deep foundation installation; and test boring inspection.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	LAKE ONEIDA DAM , Butler, PA	2008	2008
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Resident Project Representative responsible for full time construction observation of roller compacted concrete (RCC) armoring of downstream dam face and construction of RCC stilling basin, and demolition and replacement of cast-in-place concrete spillway.		
b.	STONEY CREEK DAM REHABILITATION , Bedford, VA	2008	2008
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Resident Project Representative responsible for full time monitoring of roller compacted concrete (RCC) armoring of downstream dam face, demolition and replacement of cast-in-place concrete chute spillway, installation of drainage systems, and installation of piezometer monitoring wells. Duties included review of submittals and review of contractor payment requests.		
c.	PINE RUN DAM, SCHUYLKILL COUNTY MUNICIPAL AUTHORITY , Schuylkill County, PA	2011	2011
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Resident Project Representative responsible for periodically observing progress on the rehabilitation of the dam. Responsibilities included coordination with consultants, implementing the design engineer's concepts, and review of site conditions and progress. Rehabilitation under construction includes a new chimney, a blanket drain section, and a new labyrinth spillway. Earth embankment sections are instrumented and monitored by inclinometers during excavation.		
d.	POE VALLEY DAM REHABILITATION, PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES , Centre County, PA	2010	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Resident Project Representative responsible for observing progress on the rehabilitation of the dam. Responsibilities included coordination with design engineers, implementing the design engineer's concepts, and review of site conditions and progress. Rehabilitation under construction included a new chimney and blanket drain section, repairs to the existing masonry spillway, construction of a new outlet tower, sliplining the existing outlet conduit, and armoring the earth embankment with RCC. Topsoil was placed over the RCC for appearance purposes in this state park.		
e.	SALLY'S POND DAM, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION , Ringwood State Park, NJ	2003	2003
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Resident Project Representative responsible for observing progress on the rehabilitation of the dam. Responsibilities included coordination with design engineers, implementing the design engineer's concepts, and review of site conditions and progress. The rehabilitation consisted of constructing an RCC replacement gravity dam with stone masonry placed on the downstream face to maintain its historic appearance.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME	13. ROLE IN THIS CONTRACT	14. YEARS EXPERIENCE	
		a. TOTAL	b. WITH CURRENT FIRM*
Mark E. Landis, PG, PE	Construction Engineer	31	8

15. FIRM NAME AND LOCATION (City and State)
 Schnabel Dam Engineering, Inc., Greensboro, NC

16. EDUCATION (Degree and Institution)	17. CURRENT PROFESSIONAL REGISTRATION (State and Discipline)
Master of Civil Engineering – Civil Engineering Bachelor of Science – Geology	NC, SC, VA – Professional Engineer NC, SC, VA – Professional Geologist

18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.)

Mark Landis is a registered Professional Engineer and Registered Professional Geologist and has experience on projects involving geotechnical engineering, geological and hydrogeological evaluations, geophysics, design, construction and rehabilitation for dams, dikes, major earthworks and water resource projects. Mark has performed evaluations, design, and routine dam inspections for earthen and concrete (conventional and RCC) dams, including evaluations, design, and construction of grout curtains, secant walls, sheet piling, slurry walls and other cutoff and seepage mitigation technologies in coastal plain settings, karstic, sedimentary, metamorphic, volcanic, and igneous rock environments. His recent focus has been associated with the design of new large earth dams, as well as rehabilitation options for existing dams.

19. RELEVANT PROJECTS			
	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)
a.	NRCS DEEP CREEK WATERSHED DAM 5D SITE INVESTIGATION AND DESIGN, Yadkin County, NC	2009	2010
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Construction Manager for this RCC and Zoned-earth dam for Yadkin County. Responsible for the construction personnel which include Resident, field technician, laboratory set up, pressure grouting of the foundation, and geotechnical consultation for this water supply and flood control dam.		
b.	RAGGED MOUNTAIN DAM, Albemarle County, VA	2012	2014
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Senior Technical Reviewer for the design of the proposed earthen replacement dam for the Lower Ragged Mountain Dam. The proposed 140-ft high replacement dam will be a water supply structure for Charlottesville and Albemarle County. A rock-cut auxiliary spillway is located in the right abutment. A new intake tower conveys water through a rock tunnel for the reservoir water supply. For control of foundation seepage for this off-line pump storage project, a double row grout curtain was installed in the foundation and a soil-cement slurry wall was installed in the overburden.		
c.	BURLINGTON DAMS, Burlington, NC	2010	2013
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Project Manager for rehabilitation of two large water supply dams in Burlington. Lake Cammack Dam is a 490-ft long concrete dam impounding 1,240 acres, and Stony Creek Dam is a 400-ft long concrete dam impounding 220 acres. The work for Old Stony Creek Dam, a 90-yr old structure that has excessively low spillway capacity (overtops by 12 ft during the design storm), included assessing rehabilitation options vs. replacement. Rehabilitation options were selected based on costs and included anchoring the concrete gravity dam to the rock foundation, installation of a concrete gravity dam on the left abutment and installation of a reinforced secant shaft wall on the right abutment.		
d.	ROCKY PEN RUN DAM, Stafford County, VA	2011	2012
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Project Manager for Schnabel's Technical Review Committee of a proposed off-line storage reservoir to augment water supply needs in northern Virginia. The proposed dam is a 120-ft high, 1,400-ft long earth dam with a reinforced concrete, labyrinth spillway on the left abutment. Duties included coordination and management of all review capacities of the Schnabel committee with the dam design engineer and owner. The dam construction has been complete, and Mr. Landis provided geotechnical consultation during the grouting phase of the first contract.		

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME Gregory L. Short	13. ROLE IN THIS CONTRACT Senior Botanist Project Manager	14. YEARS EXPERIENCE	
		a. TOTAL 12	b. WITH CURRENT FIRM 6

15. FIRM NAME AND LOCATION *(City and State)*
AllStar Ecology, LLC, 1582 Meadowdale Rd., Fairmont, WV 26554

16. EDUCATION (DEGREE AND SPECIALIZATION) A.S. Natural Resources and Wildlife, 2005, Garrett College of Maryland, McHenry, MD	17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)
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18. OTHER PROFESSIONAL QUALIFICATIONS *(Publications, Organizations, Training, Awards, etc.)*
 Society of Wetland Scientists
 USDA Forest Service Northern Research Station, Vegetation Specialist Certification
 Richard Chinn's 40 Hour Wetland Delineation Certification
 PADI Advanced Scuba Diver Certification
 Pennsylvania Wild Plant Management Permit
 Recognized botanist to conduct T&E Species by the US Fish & Wildlife, West Virginia DNR, and Pennsylvania DCNR
 Ohio Rapid Assessment Method v 5.0 Training Course (Ecological Training Services)
 Ohio Qualitative Habitat Evaluation Index (QHEI) and Headwater Habitat Evaluation Index (HHEI) Training Course (Midwest Biodiversity Institute)
 American Heart Association CPR and First Aid Training
 PEC Safeland Basic (Bickerstaff Safety Consulting)

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION <i>(City and State)</i>	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION <i>(if appl.)</i>
a.	Corridor H Botanical Surveys, Tucker and Randolph Counties, WV	2013-2014	
	(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Botanical surveys were performed throughout the proposed alignment and buffer areas within the Monongahela National Forest and private land sections for the proposed Corridor H Roadway Project. Targeted species included federal and state listed sensitive species. Various state tracked species and one federally listed species (<i>Isotria medeoloides</i>) were located during the project. Roll: Lead Botanist		
b.	Botanical Surveys (Running Buffalo Clover), Brooke County, WV	2013	
	(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE Check if project performed with current firm Field surveys were conducted in June 2013 to document the presence of rare, threatened, or endangered (RTE) plant species of special concern for a Project located along WV 88 near Bethany, WV in Brooke County. The surveys were performed in response to a request from the U.S. Fish and Wildlife Service (USFWS) to detect the presence/absence of running buffalo clover (<i>Trifolium stoloniferum</i>) throughout the Project area. Running buffalo clover had been identified by the USFWS to have potential habitat and/or vegetation associations to support the species within or around the project area. While conducting botanical surveys mesic forest communities within the ROW area were found but populations of <i>Trifolium stoloniferum</i> were not located within the project boundaries. Running Buffalo Clover surveys were performed throughout the project area for Section 7 clearance through USFWS. No federally listed species were found within the project area. Roll: Lead Botanist		
c.	Quarry Expansion, Randolph County, WV		
	(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm Running Buffalo Clover surveys were performed throughout the proposed quarry expansion for Section 7 clearance through USFWS. No federally listed species were found within the corridor.		
d.	West Fork Greenbrier Rail Trail Development Botanical Surveys Pocahontas and Randolph Counties, WV	2014	

(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE

Check if project performed with current firm

Botanical surveys conducted by AllStar Ecology, LLC (ASE) were performed to document the presence/absence of federally listed Threatened & Endangered Species (TES) and map the locations of additional state/federally listed Rare, Threatened, or Endangered (RTE) plant species within the West Fork of Greenbrier River Rail with Trail Development Right-of-Way (ROW). ASE conducted surveys within portions of the Monongahela National Forest (MNF) and within tracts of private land holdings (Appendix A). Field surveys were conducted by ASE in September and October 2014. All surveys were performed in response to requests from the U.S. Forest Service (USFS) and U.S. Fish and Wildlife Service (USFWS) to detect the presence/absence of RTE plant species throughout the ROW. The USFS provided a list of 65 sensitive plant species that have been known to occur or could occur within portions of the MNF. USFWS identified Virginia spiraea (*Spiraea virginia*) (G2, S1) as having potential habitat and/or vegetation associations to support the species within or around the ROW. In addition, ASE also surveyed for other potential federally listed species, including running buffalo clover (*Trifolium stolonifera*) (G3, S2) and small whorled pogonia (*Isotria medeoloides*) (G2, S1) where suitable habitat was deemed present.

Botanical surveys were performed throughout various forest communities within the ROW, with emphasis on the areas with habitat deemed suitable to support sensitive species. Tasks related to the documentation and mapping of the species of special concern included describing features of the habitat, identifying threats, and making management recommendations for the listed species occurring within the project area. ASE also compiled a list of all vascular plants that were observed during the field survey. A separate list was composed for each one mile section of the ROW, with Mile 1 being at the southern portion of the ROW near Durbin, WV, and Mile 26 being at the northern portion of the ROW near Glady, WV.

Roll: Lead Botanist

(1) TITLE AND LOCATION (City and State)

Hazelton FCI compensatory stream and wetland mitigation,
Preston County, West Virginia

(2) YEAR COMPLETED

PROFESSIONAL SERVICES

2011

CONSTRUCTION (if appl.)

2011

(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE

Check if project performed with current firm

AllStar Ecology completed onsite compensatory mitigation for a new prison facility in Hazelton, WV. The project included several types of mitigation activities. ASE constructed a splash pool diversion channel for existing storm water to repair significant erosion at the site. Wetland mitigation included 1.89 acres of forested wetland creation (4 separate cells), 0.86 acres of wetland enhancement (emergent to forested), and 0.54 acres of streamside wetland creation (3 separate cells). Stream mitigation activities included 2,509 linear feet of stream channel relocation/restoration of a high gradient channel, including over 100 stone and log step pool structures, coir matting, and livestaking. The project area received tree and shrub plantings. ASE reduced overall project costs by fifteen percent. Ryan Ward was the project manager and responsible for reviewing and approving daily progress.

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME Steven A. Stathakis		13. ROLE IN THIS CONTRACT Principal Investigator Cultural Resources Management	14. YEARS EXPERIENCE	
			a. TOTAL 27	b. WITH CURRENT FIRM 2
15. FIRM NAME AND LOCATION (City and State) AllStar Ecology, LLC, 1582 Meadowdale Rd., Fairmont, WV 26554				
16. EDUCATION (DEGREE AND SPECIALIZATION) M.A. Anthropology, 1996, Southern Illinois University, Carbondale, IL			17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)	
18. OTHER PROFESSIONAL QUALIFICATIONS (Publications, Organizations, Training, Awards, etc.) Cultural Resource Management Certification, West Virginia University West Virginia Archaeological Society Section 106 Training Course				

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION (City and State)	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION (if appl.)
a	Phase I Identification and Phase II Testing on Oil and Gas Project Belmont County, OH	2014	
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm AllStar Ecology, LLC. (ASE) completed a Phase I cultural resources survey for an Oil and Gas Project and Phase II testing of a discovered site in Belmont County, Ohio. Land use proposed by the proponent for the project area would consist of installation of a natural gas well pad to support extraction of natural gas using hydraulic fracturing of deeply buried shale deposits. The project area is situated on property administered by the state of Ohio and was completed for compliance with the National Historic Preservation Act (NHPA) under section 149.54 of the Revised Code. Survey and testing was performed in accordance with guidelines required to identify properties eligible for the National Register of Historic Places (NR) as described in section 106 of NHPA (1966, as amended) and its implementing regulations, 36 CFR 800, following procedures and standards described in Archaeology Guidelines (OHPO 1994). The Phase I cultural resources survey included background research and field work for an area of potential effects (APE) for direct effects and an APE for indirect visual effects. Phase II testing consisted of excavation of test units and was designed to provide data which would indicate the relative age of the sampled features and to recover artifacts which might be diagnostic of a particular cultural and temporal period. No evidence of prehistoric activity was found in the direct APE during the Phase I survey. Phase II testing resulted in collection of data interpreted as evidence that stone features were associated with historic-period activities. Roll: Principal Investigator, Survey Design and Implementation, Agency Correspondence		
b	Phase 2 Testing and Phase 3 Mitigation Projects on Pre-Historic Sites in Braxton County, WV		
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Check if project performed with current firm Field supervision of Phase 2 testing and Phase 3 mitigation of multi-component prehistoric archaeological site in Braxton County, WV for Weyerhaeuser Company. Activities supervised include excavation and mapping of various features such as a stone-lined hearth dated to circa 6500 Before Present, post holes representing habitation structures, and a stone tool maintenance activity area.		
c	Phase 2 Testing and Phase 3 Mitigation Projects on Homestead Sites in Monongalia County, WV		
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Check if project performed with current firm Field supervision of Phase 2 testing and Phase 3 mitigation of an early historic-period homestead site in Monongalia County, WV for Patriot Mining Coal Company. Supervised activities included excavation of a stratified, subsurface trash midden dated to circa 1790 to 1865 and identification of subsurface features representing structural remnants.		
d	Phase I Identification and Phase 2 Testing Project on a Prehistoric Site in Putnam County, WV		
	(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE Check if project performed with current firm Field supervision of Phase 1 identification and Phase 2 testing of a multi-component prehistoric site in Putnam County, West Virginia for Toyota Corporation. Duties included supervision of a surface and subsurface archaeological survey resulting in identification of three multi-component prehistoric archaeological sites and Phase 2 testing of identified sites. Site testing duties included supervision of excavations designed to determine presence or absence of stratified archaeological deposits and		

identification of subsurface features representing habitation activities.

(1) TITLE AND LOCATION (City and State)

West Fork Greenbrier River Rail Trail Improvement Project
Randolph and Pocahontas Counties, WV

(2) YEAR COMPLETED

PROFESSIONAL SERVICES

2014

CONSTRUCTION (if appl.)

(3) BRIEF DESCRIPTION (Brief scope, size, cost, etc.) AND SPECIFIC ROLE

Check if project performed with current firm

e AllStar Ecology, LLC (ASE) has conducted a Phase 1 cultural resources survey of the proposed rail trail project area including visual inspection of previously recorded and known cultural resources, completion of West Virginia Historic Property Inventory (HPI) forms for structures greater than 50 years old within the project area or viewshed of proposed land use, assessment of the National Register eligibility of structures for which HPI forms are completed, completion of subsurface surveys on all areas located on visually undisturbed landforms with less than 20 percent slope that will be impacted by proposed ground disturbing activities.

Roll: Principal Investigator, Survey Design and implementation, Report writing and review, Agency Correspondence

E. RESUMES OF KEY PERSONNEL PROPOSED FOR THIS CONTRACT

(Complete one Section E for each key person.)

12. NAME Walter E. Veselka	13. ROLE IN THIS CONTRACT Senior Environmental Scientist / Project Manager	14. YEARS EXPERIENCE	
		a. TOTAL 15	b. WITH CURRENT FIRM 8
15. FIRM NAME AND LOCATION <i>(City and State)</i> AllStar Ecology, LLC, 1582 Meadowdale Rd., Fairmont, WV 26554			
16. EDUCATION (DEGREE AND SPECIALIZATION) M. S. Wildlife and Fisheries Resources, 2008, West Virginia University, Morgantown, WV		17. CURRENT PROFESSIONAL REGISTRATION (STATE AND DISCIPLINE)	

18. OTHER PROFESSIONAL QUALIFICATIONS *(Publications, Organizations, Training, Awards, etc.)*

The Wildlife Society
 The Society of Wetland Scientists
 Army Corps of Engineers, U.S. EPA, USDA Natural Resources Conservation Service
 —Reg V Interagency Federal Wetland Delineation Training
 WVDEP—Construction Storm Water 101 Workshop
 U.S. Forest Service/ Roane-Jackson Technical Center—Wetland Construction Workshop
 Canaan Valley Institute/ WVDEP —A New Direction: Approaches and Strategies for Stream Mitigation in West Virginia
 WVDEP—Smart Solutions: Community-based Decentralized Wastewater Management
 Ohio Rapid Assessment Method v 5.0 Training Course (Ecological Training Services)
 Ohio Qualitative Habitat Evaluation Index (QHEI) and Headwater Habitat Evaluation Index (HHEI) Training Course (Midwest Biodiversity Institute)
 American Heart Association CPR and First Aid Training PEC Safeland Basic (Bickerstaff Safety Consulting)

Veselka, W., Anderson J.T., Kordek, W. (2009). Using dual classifications in the development of avian wetland indices of biological integrity for wetlands in West Virginia, USA. *Environmental Monitoring and Assessment. Published online 29 April 2009.*

Veselka, Walter (2008). Developing Wetland Indices of Biological Integrity for Wetlands in West Virginia. M.S. Thesis. West Virginia University

Veselka, W., Anderson J.T., Kordek, W. (2008) "Getting the most from wetland Indices of Biological Integrity" A presentation to the Annual Meeting of Society of Wetland Scientists. Washington, D.C. .

Veselka, W., Anderson J.T., Kordek, W. (2007) "Comparing Cowardin and Hydrogeomorphic Classifications in Building a Wetland Bird Index of Biotic Integrity for West Virginia" A presentation to the Annual Meeting of Society of Wetland Scientists. Sacramento, CA.

Christ, M., Hansen, E., Veselka W. (2007) "A Framework for Rivers and Streams Nutrient Criteria in West Virginia." West Virginia Rivers Coalition Report submitted to WV Department of Environmental Protection.

Veselka, W., Anderson J.T., Kordek, W. (2006) "Using Landscape Characteristics to Explain Avian Communities in Wetlands of West Virginia." A presentation to the Northeast Associations of Fish and Wildlife Agencies. Burlington, VT.

19. RELEVANT PROJECTS

	(1) TITLE AND LOCATION <i>(City and State)</i>	(2) YEAR COMPLETED	
		PROFESSIONAL SERVICES	CONSTRUCTION <i>(if appl.)</i>
a	Leech Express Pipeline Project, 150 mile Pipeline Project NE Ohio and Northern West Virginia	2014-2015	
	(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE Field Data Collection including stream and wetland delineation for a 150 mile pipeline project in NE Ohio and Northern West Virginia. Roll: Project Manager		
b	West Fork of the Greenbrier River Rail Reconstruction and Trail Project Durbin and Greenbrier Valley Railroad Randolph and Pocahontas Counties, WV	2014-2015	
	(3) BRIEF DESCRIPTION <i>(Brief scope, size, cost, etc.)</i> AND SPECIFIC ROLE ASE was contracted to perform environmental assessments to aid in the National Environmental Policy Act (NEPA) process for the proposed West Fork of the Greenbrier River Rail Reconstruction and Trail Project in Randolph and Pocahontas		

Counties, WV. Services included Stream and Wetland Delineation, Acoustic Bat Surveys and habitat Assessment, Botany Surveys, Cultural Resources Surveys and Phase I Freshwater Mussel Surveys.


Roll: Project Manager, Survey Design, Data Management, Report writing and Agency Correspondence.

(1) TITLE AND LOCATION (<i>City and State</i>)		(2) YEAR COMPLETED	
Stream and Wetland Delineation and Army Corps Permitting for Oil and Gas Project Doddridge County, WV		PROFESSIONAL SERVICES 2014	CONSTRUCTION (<i>if appl.</i>)
c	(3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm One of many Stream and Wetland Delineation projects in north central WV. Site was assessed for the presence and extents of streams and wetlands and other Waters of the United States found onsite, potential habitat rare threatened and endangered species were also noted and proper channels of communication and agency correspondence were followed. Roll: Survey Design and Implementation, Report Writing and Review, Agency Correspondence		
(1) TITLE AND LOCATION (<i>City and State</i>)		(2) YEAR COMPLETED	
Hazelton FCI compensatory stream and wetland mitigation, Preston County, West Virginia		PROFESSIONAL SERVICES 2011	CONSTRUCTION (<i>if appl.</i>) 2011
d	(3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE <input checked="" type="checkbox"/> Check if project performed with current firm AllStar Ecology completed onsite compensatory mitigation for a new prison facility in Hazelton, WV. The project included several types of mitigation activities. ASE constructed a splash pool diversion channel for existing storm water to repair significant erosion at the site. Wetland mitigation included 1.89 acres of forested wetland creation (4 separate cells), 0.86 acres of wetland enhancement (emergent to forested), and 0.54 acres of streamside wetland creation (3 separate cells). Stream mitigation activities included 2,509 linear feet of stream channel relocation/restoration of a high gradient channel, including over 100 stone and log step pool structures, coir matting, and livestaking. The project area received tree and shrub plantings. ASE reduced overall project costs by fifteen percent.		
(1) TITLE AND LOCATION (<i>City and State</i>)		(2) YEAR COMPLETED	
Developing Wetland Indices of Biological Integrity for Wetlands in West Virginia West Virginia University		PROFESSIONAL SERVICES 2005-2009	CONSTRUCTION (<i>if appl.</i>)
e	(3) BRIEF DESCRIPTION (<i>Brief scope, size, cost, etc.</i>) AND SPECIFIC ROLE <input type="checkbox"/> Check if project performed with current firm This project consisted of gathering data from and developing a biological integrity index for various wetlands across the state of West Virginia using available and similar wetland evaluation metrics to apply to wetlands visited. Roll: Project Design and Implementation, Data Management and interpretation. Project Oversight.		

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT
 (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#1

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
 NRCS WEST VIRGINIA DAM ASSESSMENTS MULTIPLE LOCATIONS, WV	PROFESSIONAL SERVICES 2017	CONSTRUCTION (If applicable)

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER USDA-Natural Resources Conservation Service	b. POINT OF CONTACT NAME Andy Deichert	c. POINT OF CONTACT TELEPHONE NUMBER 304-284-7563

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

Project Manager: Paul Welle, PE
 Project Type: Dam Assessments, including Alternatives Analysis

As a member of the GSFW Engineering Joint Venture, Schnabel is performing dam rehabilitation site assessments of 59 dams for the West Virginia Natural Resources Conservation Service (NRCS).

The goals of each assessment are to provide an evaluation of the existing condition of the dam and appurtenances, a description and status of the operation and maintenance of the structure, and an evaluation of rehabilitation alternatives. The objectives of each assessment are to identify its rehabilitation needs and prioritize its rehabilitation, if required, based on the computed failure and risk index. NRCS will use this assessment as a basis for obtaining funding for the rehabilitation planning, design, and construction.

Our scope of services includes:

- Obtaining and reviewing existing data
- Conducting a field inspection
- Performing a structure hazard classification verification for the existing dam, including a breach analysis
- Evaluating hazard potential classification
- Computing failure and risk index
- Evaluating various rehabilitation alternatives to bring the structure into compliance with NRCS criteria
- Developing cost estimates for proposed alternatives

In 2014 and 2015, Schnabel conducted inspections of 26 dams, completed 9 assessment reports, and is currently developing the additional 17 draft reports. The remaining dam assessments will be completed through 2018.

Project Services

- Inspection
- File Review
- Dam Assessment
- Hydrologic and Hydraulic Analysis
- Dam Breach Analysis
- Spillway Integrity/Stability Analysis
- Evaluation of Alternatives



25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a. GSFW Engineering Joint Venture	West Chester, PA	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT
 (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#2

21. TITLE AND LOCATION (City and State)



NRCS RED LICK SITE #1 DAM FEASIBILITY STUDY
 BERE A, KY

22. YEAR COMPLETED

PROFESSIONAL SERVICES

Ongoing

CONSTRUCTION (if applicable)

2017 (anticipated)

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER

Berea Municipal Utilities

b. POINT OF CONTACT NAME

Ed Fortner

c. POINT OF CONTACT TELEPHONE NUMBER

859-986-4391

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

Red Lick Creek Multiple Purpose Structure No. 1 was constructed in 1975 as a significant hazard structure. Due to development downstream of the dam and the potential impacts that a dam breach would have on that development, the dam is currently classified as a high hazard structure and fails to comply with current state and NRCS dam safety and performance criteria. The purposes of the proposed rehabilitation of the dam are to maintain present level of flood control benefits, augment water supply, and comply with current performance and safety standards.



As a team, Schnabel and Bell Engineering completed a feasibility report as the first step in the development of a Supplemental Watershed Plan and Environmental Assessment (Plan-EA) to address the needed rehabilitation of the dam. As part of the project, a subsurface investigation was completed to support stability and integrity analysis for the dam. The results of the hydrologic analysis of the dam using the SITES computer program indicated that the existing auxiliary spillway does not meet the current capacity, stability, and integrity criteria. Because the City of Berea also needs to

increase future water supply, alternatives were developed to address hydraulic capacity, auxiliary spillway stability and integrity, and water supply.

Project Relevance

- Dam Rehabilitation Plan
- Subsurface Investigations
- H&H Analysis
- Alternatives Analysis



To establish the basis for the Plan-EA, the team analyzed alternatives in conjunction with the purpose and needs developed for the project. Six structural options to address the noted deficiencies were analyzed and presented in the feasibility report with conceptual drawings and construction cost estimates to aid the City and NRCS in evaluating funding needs for the project. Each option also included 350 MG of additional water supply storage to meet the water supply objective.

Upon completion of the feasibility report, Schnabel and Bell prepared the Plan-EA in accordance with NRCS requirements. The preferred alternative includes a fuse gate system in the existing auxiliary spillway, increasing water supply storage, and raising of the embankment. The supplemental watershed plan was submitted to NRCS in December 2014 and is currently in the NRCS review process.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	Schnabel Dam Engineering, Inc.	Greensboro, NC; West Chester, PA	Dam Engineering
	Bell Engineering	Lexington, KY	Water Supply Expert

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT


(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#3

21. TITLE AND LOCATION (City and State)

22. YEAR COMPLETED

 NRCS FOX CREEK WATERSHED MULTIPURPOSE STRUCTURE NO. 4 DAM FLEMING COUNTY, KENTUCKY	PROFESSIONAL SERVICES	CONSTRUCTION (if applicable)
	2012	2012

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER Natural Resources Conservation Service	b. POINT OF CONTACT NAME Sonya Keith	c. POINT OF CONTACT TELEPHONE NUMBER 859-224-7308
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24. BRIEF DESCRIPTION OF PROJECT AND RELEVANCE TO THIS CONTRACT (Include scope, size, and cost.)

The Fox Creek Multi-Purpose Structure #4 (MPS#4) is one of six NRCS dams in the Fox Creek watershed. Originally built in 1968 for flood control and recreation, the dam is an earthen embankment, 500 feet long and 43 feet high. The impounded 75-acre Fox Valley Lake has a total storage capacity of 4,000 acre-feet.

Fox Creek MPS#4 was designed as a Class B Significant Hazard Dam. In 1979, the NRCS determined that the structure had been misclassified during planning, and should have been designated a Class C High Hazard Dam. An updated flood study performed by Schnabel in 2009 indicated that the hydraulic capacity of the existing spillway system was less than half of what was required. Furthermore, based on an evaluation performed by Schnabel, it was determined that should the existing auxiliary spillway be activated, extensive headcutting and erosion would likely result in loss of the entire reservoir.

Through the American Recovery and Reinvestment Act (ARRA), NRCS identified a viable mechanism to complete the required rehabilitation as long as the project could be made 'shovel ready' within the ARRA timeline. Unfortunately, barriers to the successful rehabilitation of Fox Creek MPS#4 were both technical and regulatory. The NRCS applied stringent requirements on possible technical approaches. Kentucky Dam Safety regulations prohibited flow over a dam crest. Schnabel performed an extensive alternatives analysis to evaluate multiple options to address the inadequate hydraulic capacity of the structure while attempting to work within both the technical and regulatory constraints. When the Schnabel design team and the NRCS jointly concluded that the only viable alternative was the construction of a structural spillway across the crest of the dam, it was necessary to demonstrate to the Kentucky Division of Water (KY-DOW) dam safety officials that this was the only reasonable way to make Fox Creek MPS#4 safe and compliant. After extensive discussions, the KY-DOW agreed to abandoning the existing auxiliary spillway and constructing a 295-foot wide, RCC structural spillway across the dam crest as a demonstration project. As such, the MPS#4 Rehabilitation Project became the first permitted use of a structural spillway across a dam and the first RCC spillway in the State of Kentucky.

Meeting the short ARRA funding deadlines required extraordinary collaboration between the owner, the NRCS, the regulators, and Schnabel. Working together, we developed a continuous design process that eliminated the typical 30/60/90/100% reviews. The entire design process, from the alternatives assessment, conceptual through final designs, permitting, and final review and approval was completed in less than nine months and met the ARRA funding milestones. Construction, which was overseen by Schnabel personnel, was expedited by design decisions based on constructability and material availability. Over 90% of the \$4.3 million construction cost went to labor and materials obtained from within Kentucky. The project was completed within budget and on-time, and no claims were filed by the contractor.



25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a. Schnabel Dam Engineering, Inc.	Greensboro, NC; West Chester, PA	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

4

21. TITLE AND LOCATION (City and State)

22. YEAR COMPLETED



NRCS POHICK CREEK WATERSHED DAMS NO. 2, 3, 4, AND 8 REHABILITATION
FAIRFAX COUNTY, VIRGINIA

PROFESSIONAL SERVICES

Ongoing

CONSTRUCTION (If applicable)

Ongoing

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER

Fairfax County, Department of Public Works and Environmental Services

b. POINT OF CONTACT NAME

Dipmani Kumar, PE

c. POINT OF CONTACT TELEPHONE NUMBER

703-324-5500

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

The Pohick Creek Watershed Dams were designed and constructed as high-hazard dams by the Soil Conservation Service (now NRCS) in the 1970s. Schnabel has provided engineering services for Lake Barton (No. 2), Woodglen Lake Dam (No. 3), Royal Lake Dam (No.4), and Huntsman Lake Dam (No. 8). None of the dams met NRCS or Commonwealth of Virginia's safety standards for the stability or integrity of the auxiliary spillway. In addition, Dam No. 2 did not have enough sediment storage to last the design life of the project, and the principal spillway riser of Dam No. 8 does not meet seismic stability criteria.



Schnabel provided a geotechnical investigation of the auxiliary spillway for Dam Nos. 3, 4, and 8. Also, Schnabel performed hydrologic and hydraulic analyses using SITES and HEC-RAS, and developed alternative plans for the rehabilitation of the auxiliary spillways for Dam Nos. 2, 3, and 8. Auxiliary spillway rehabilitation options included: a vegetative spillway; a spillway armored with articulating concrete blocks (ACB) or roller compacted concrete following the existing ground downstream to the valley floor, concrete slurry or secant cutoff walls; and an armored spillway with a steep outlet covered with earthfill to the existing ground elevation. The recommended solution to stabilize the auxiliary spillway for Dam No. 2 included a secant wall socketed into rock to impede the progression of headward erosion, therefore preventing a breach of the reservoir. For Dam Nos. 3, 4, and 8, the selected alternative was armoring the auxiliary spillway with ACBs.



The County and stakeholders used the results of our studies to select the rehabilitation alternative for each dam and NRCS used the results to develop rehabilitation plans for all dams to serve as support for funding the final design and construction. Construction is complete for all four dams.

Schnabel provided complete design services for the replacement principal spillway riser and the armored auxiliary spillway for Dam No. 8. A dam breach analysis was performed using unsteady flow HEC-RAS. The standard riser design was modified to meet current NRCS seismic stability criteria following NRCS TR-68 analysis methods and TR-60 seismic loadings (zone maps). The seismic loading was also checked against draft NRCS NEM 536 policy citing ASCE 7 (NEHRP maps). Stability of the ACB system was evaluated using the methods presented in Articulating Concrete Block Revetment Design – Factor of Safety Method (NCMA TEK 11-12, 2002), which is also used by ACB manufacturers. The final design was completed in 2012, and Schnabel provided engineering services to support the owner and NRCS after construction for Dam No. 8, completed in 2014.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	Schnabel Dam Engineering, Inc.	West Chester, PA; Alpharetta, GA; Greensboro, NC	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT
 (Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#5

21. TITLE AND LOCATION (City and State)

22. YEAR COMPLETED



NRCS STONY CREEK DAMS #9 AND #10
BASYE, VIRGINIA

PROFESSIONAL SERVICES

Ongoing

CONSTRUCTION (If applicable)

Ongoing

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER

Virginia Department of Conservation and Recreation

b. POINT OF CONTACT NAME

Daniel Cox

c. POINT OF CONTACT TELEPHONE NUMBER

804-786-7966

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

Lake Laura and Bird Haven Lake Dams (Stony Creek Dams #9 and #10, respectively) are earth fill dams located in Shenandoah County, Virginia. The Soil Conservation Service of the US Department of Agriculture (USDA) constructed the dams in 1971 for flood control. The dams were designed as a Class C, high-hazard structures to store a 100-year storm prior to activating the emergency spillway. The dams provide protection along Stony Creek within the Bryce Resort Area and associated residences. The dams do not meet the current hydraulic capacity requirements for high hazard classification in accordance with Virginia Dam Safety Regulations or spillway integrity requirements per USDA-Natural Resources Conservation Service requirements.

In 2011, the Virginia Department of Conservation and Recreation contracted with Schnabel to evaluate options to rehabilitate the dams to meet hydraulic requirements for the high hazard classification assigned to the dams. Schnabel's scope of services included a geotechnical investigation of the dams and their associated auxiliary spillways, analysis for developing at least three alternatives to address the hydraulic capacity of each dam, design of the selected alternative, and bidding and construction phase services.

The Lake Laura alternative for rehabilitation consists of a roller compacted concrete (RCC) spillway over the embankment. The existing auxiliary spillway will be abandoned by constructing an earth embankment near the entrance of the spillway to prevent flow through the spillway. The selected alternative will provide the hydraulic capacity required to safely pass the required design flood, increase the flood storage, and limit the frequency of activation of the auxiliary spillway, thereby reducing the frequency of downstream flooding.

For Lake Bird Haven, the selected alternative was to replace the existing vegetated earth spillway with a reinforced concrete spillway. The replacement spillway will incorporate an ogee weir to improve the hydraulic efficiency allowing the replacement spillway to fit within the footprint of the existing spillway thus limiting excavation and property easement issues. Additionally, the alternative addresses both the stability and integrity issues of the existing spillway through modification of the exit channel width, shape, and alignment to provide more advantageous uniform flow patterns that, in conjunction with turf reinforcement mats, exceed the criteria established by the USDA-NRCS.

In addition to meeting the technical objectives related to hydraulic capacity, the completed designs incorporate the recreational and aesthetic qualities currently enjoyed at both dams. Construction will begin in late summer 2015.



The upstream slope of the Stony Creek #9 Dam.



Embankment downstream slope and auxiliary spillway at Stony Creek #10 Dam

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	Schnabel Dam Engineering, Inc.	Greensboro, NC; West Chester, PA	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

6

21. TITLE AND LOCATION (City and State)

22. YEAR COMPLETED



NRCS DEEP CREEK WATERSHED DAM 5D
YADKIN COUNTY, NORTH CAROLINA

PROFESSIONAL SERVICES

2010

CONSTRUCTION (If applicable)

2010

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER

Yadkin County

b. POINT OF CONTACT NAME

Jason Walker

c. POINT OF CONTACT TELEPHONE NUMBER

336-679-8052 ext 3

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

Deep Creek Watershed Dam 5D is a new 72-ft high and 1,490-ft long high hazard dam recently constructed in Yadkin County, NC. The dam is a composite structure consisting of a 742-ft long roller compacted concrete (RCC) section that includes a 300-ft wide auxiliary spillway. The remainder of the dam is an earth embankment that wraps around the left end of the RCC gravity section. The dam was constructed in accordance with NRCS and North Carolina dam safety criteria.

The goal of the project was to provide an economical project to reduce the severity of flooding from the Deep Creek watershed and to provide a future source of water supply for Yadkin County. This was accomplished by evaluating 12 alternatives and selecting a design option that was the least expensive by taking advantage of the shallow competent rock on the right side of the stream channel to construct an RCC gravity dam and the design of a zoned earthen embankment on the left side where the foundation was more variably weathered and the depth to competent rock was significant.

Subsurface investigations of the dam site and borrow areas were conducted in two phases. The initial phase of field investigations was conducted to help establish the most cost-effective dam and spillway system. The second phase, completed after the alternatives analysis, provided specific data required to complete the design for the selected alternative.

The design for the selected RCC/earth embankment alternative required consideration of the following issues: complex subsurface geology and variable depth to rock; unique valley topography; RCC-earth embankment interface issues; foundation seepage concerns; unusually high tailwater conditions; water supply and flood storage capabilities; RCC facing issues; design of spillway using available physical modeling from other dams; and value engineering to meet construction budget requirements. Construction was completed between 2008 and 2010. Schnabel provided construction administration, a resident project representative, and full time quality assurance testing services for foundation grouting, foundation preparation, roller compacted concrete, conventional concrete, and earthwork operations. **This project was awarded the USSD Award Excellence in the Constructed Project (2013); ACEC National Recognition Award, Engineering Excellence Awards (2012); and ACEC North Carolina, Engineering Excellence Award, Grand Award for Engineering Excellence (2012).**



25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT


	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a.	Schnabel Dam Engineering, Inc.	Greensboro, NC; West Chester, PA	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#7

21. TITLE AND LOCATION (City and State)		22. YEAR COMPLETED	
 NRCS COBB CREEK WATERSHED SITE NO. 1 WEATHERFORD, OKLAHOMA	PROFESSIONAL SERVICES	CONSTRUCTION (If applicable)	
	2009	2011	
23. PROJECT OWNER'S INFORMATION			
a. PROJECT OWNER	b. POINT OF CONTACT NAME	c. POINT OF CONTACT TELEPHONE NUMBER	
Natural Resources Conservation Service	Heath Sand	405-742-1262	

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

Cobb Creek Fish and Wildlife Service (FWS) No. 1 is located in west central Oklahoma south of Weatherford. FWS No. 1 is an earthfill structure with a drainage area of 16,704 acres (26.10 square miles). The embankment has a maximum height of 80 ft, is 1849-ft long, and required approximately 230,000 cy of fill.

The auxiliary spillway has a width of 700 ft with a maximum design flow depth of 9.3 ft. The principal spillway consisted of a 36-inch diameter reinforced concrete pipe with riser. FWS No. 1 was designed as a low-hazard dam, but was changed to a high-hazard dam due to downstream development. This increased the corresponding design storm and required additional spillway capacity. In addition, the existing emergency spillway did not meet stability and integrity requirements based on an analysis using the Natural Resources Conservation Service (NRCS) SITES program.



This project was challenging due to the height of dam and a failing principal spillway conduit. This required a creative solution to repair/replace the conduit while not lowering the reservoir and adversely impacting the bass fishery. The rehabilitation plan/environmental assessment and final design included lowering the auxiliary spillway crest by five feet and narrowing the width from 700 ft to 300 ft together with paving the spillway surface with roller compacted concrete. The remaining 400 ft of the auxiliary spillway is blocked with an earthen berm to the elevation of the top of the dam. The 36-inch diameter principal spillway barrel and the existing riser were replaced with a 42-inch diameter barrel and a new riser. The NRCS construction contract to complete the rehabilitation project was completed in 2012.

Schnabel also performed a seismic evaluation to determine the liquefaction potential and stability of the dam and foundation in accordance with Draft TR-60 criteria as requested by the NRCS. The results of the liquefaction evaluation indicated that alluvial soils in the foundation could experience cyclic liquefaction during the 5,000 year return period earthquake and that post-earthquake stability would not meeting NRCS criteria. We understand NRCS planned to conduct an additional evaluation internally regarding any decision to design and install seismic stabilization measures to address liquefaction of alluvial soils in the foundation of the dam.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT


a.	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
	Schnabel Dam Engineering, Inc.	West Chester, PA	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#8

21. TITLE AND LOCATION (City and State)	22. YEAR COMPLETED	
 PENNSYLVANIA FISH AND BOAT COMMISSION, DAM REHABILITATION DESIGNS, MULTIPLE LOCATIONS, PA	PROFESSIONAL SERVICES Ongoing	CONSTRUCTION (If applicable) Ongoing

23. PROJECT OWNER'S INFORMATION		
a. PROJECT OWNER Commonwealth of Pennsylvania, Fish and Boat Commission	b. POINT OF CONTACT NAME Jerry Woomer	c. POINT OF CONTACT TELEPHONE NUMBER 814-359-5893

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

Schnabel is providing engineering services for the rehabilitation of seven dams owned by the Pennsylvania Fish & Boat Commission (PFBC). **Project Goals and Objectives:** These high hazard earthfill dams impound recreation lakes and have been found to have inadequate spillway capacity to safely pass the Probable Maximum Flood (PMF) as required by the Pennsylvania Department of Environmental Protection (PADEP), Division of Dam Safety. Deficiencies related to embankment seepage and stability, as well as spillway structural damage, are also being addressed at several of the dams. **Solutions:** For four of the dams, Schnabel is providing complete design, permitting, and construction phase services to achieve regulatory compliance.

Project Services

- Hydrologic and Hydraulics
- Alternatives Evaluation
- Conceptual Designs
- Subsurface Exploration
- Roller Compacted Concrete
- Geotechnical Engineering
- Wetlands and Permitting
- Plans and Specifications
- Bid and Construction Services

- **Minsi Lake Dam:** Rehabilitation includes replacement of the spillway with a labyrinth weir and raising the dam by two feet.
- **Speedwell Forge Lake Dam:** During design, deficiencies with the structural spillway were identified and the spillway was damaged during Tropical Storm Lee. Concerns with the spillway prompted PFBC to breach the embankment until funds for the complete dam rehabilitation could be obtained. Schnabel designed the temporary breach as well as a replacement structural spillway in conjunction with RCC embankment armoring. A filter diaphragm was incorporated into the design for seepage control around the conduit. Construction of the replacement spillway is underway.
- **Colyer Lake Dam:** The rehabilitation includes replacement of the spillway with a new concrete weir, chute, and stilling basin, along with armoring the embankment with RCC. A filter diaphragm was incorporated into the design for seepage control around the conduit. Construction is underway.
- **Glade Run Lake Dam:** Modifications include replacement of the spillway with a box drop inlet spillway in conjunction with armoring the embankment with articulating concrete blocks. Seepage control measures, which included a filter diaphragm, chimney, toe and foundation drains, were designed to address concerns related to fine grained (dispersive) clays.



Minsi Lake Dam



Speedwell Forge Lake Dam

For Nessmuk, Lower Woods, Belmont Lake Dams, Schnabel is supporting designs being developed by PFBC engineering staff. This includes a hydrologic and hydraulic analysis, subsurface explorations and geotechnical evaluations, evaluation of alternatives and conceptual designs, and permitting support. For Nessmuk Dam, an NRCS-assisted structure, Schnabel also performed a SITES analysis which demonstrated that the auxiliary spillway would not fail for the PMF. The analysis supported a design that included a combination of spillway expansion and raising the top of dam to provide adequate hydraulic capacity. PFBC prepared the design, which included an embankment drain and filter diaphragm. Schnabel provided a technical design review.

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
a. Schnabel Dam Engineering, Inc.	West Chester, PA; Greensboro, NC	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#9

21. TITLE AND LOCATION (City and State)



PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES OPEN-END CONTRACTS, DAM EVALUATIONS AND DESIGN, MULTIPLE LOCATIONS, PA

22. YEAR COMPLETED

PROFESSIONAL SERVICES
Ongoing

CONSTRUCTION (If applicable)
Ongoing

23. CONTACT INFORMATION

a. PROJECT OWNER
PA DCNR

b. POINT OF CONTACT NAME
Edward Raptosh

c. POINT OF CONTACT TELEPHONE NUMBER
717-783-3329

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

Schnabel provided dam and geotechnical engineering services as a subconsultant on two separate open-end contracts with the DCNR. Based on our strong performance under these contracts, DCNR selected Schnabel in 2009 for a five-year contract to provide dam engineering services. Since 2000, Schnabel has provided engineering services on 17 DCNR-owned dams, including the following:

- **Poe Valley Dam:** Performed comprehensive assessments of the earth dam to address seepage and spillway capacity concerns. Schnabel was later selected to provide design and construction engineering services for the rehabilitation of the dam, which included RCC embankment armoring to meet spillway design flood criteria.
- **Gunter Valley Dam:** Subsurface exploration, seepage evaluation, H&H analysis, and evaluation of alternatives to address embankment seepage and spillway capacity concerns. Schnabel also performed a dam breach analysis and inundation mapping for use in the EAP.
- **Promised Land, Little Buffalo, and Memorial Lake Dams:** Performed geophysical surveys to evaluate seepage conditions.
- **Gouldsboro and Lower Lake Dams:** Designed spillway modifications to address concrete deterioration and inadequate spillway capacity.
- **Ryerson Station Dam:** Assisted DCNR in evaluation of ground-movement damage to a 40-ft high concrete gravity dam.
- **Chapman Dam:** Geophysical surveys, test borings, seepage analyses, spillway (SITES) erodibility evaluation, and conceptual design of RCC armoring of the embankment to meet spillway capacity criteria.
- **Tobyhanna Dam:** Alternatives evaluation for replacement of deteriorated concrete spillway with inadequate capacity.
- **George B. Stevenson Dam:** Extensive subsurface exploration, installation of automated web based instrumentation system to monitor phreatic levels in the embankment and foundation. Schnabel also facilitated a risk analysis to evaluate a previously identified potential failure mode related to seepage. The results of the risk analysis indicated that this failure mode was not credible. Finally, Schnabel prepared plans and specifications for dam safety modifications to the embankment and for dredging of the lake and stream realignment.
- **Pymatuning Dam:** Design of structural rehabilitation of the existing inlet tower, site drainage improvements, and stream restoration.

PROJECT SERVICES

H&H Analyses
Dam Breach Analysis
EAPs
Subsurface Investigation
Seepage & Stability Analysis
Alternatives Evaluation
Structural Design for Intake Tower
Rehabilitation
Risk Assessment
Plans and Specifications
Construction Services



"This letter...recognizes the exemplary service that [Schnabel] has provided to DCNR...your firm has provided DCNR with outstanding geotechnical and dam design expertise...I look forward to working with [Schnabel] on future projects" – Edward Raptosh, PE, DCNR Bureau of Facility Design and Construction

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

a.	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
	Schnabel Dam Engineering, Inc.	West Chester, PA; Alpharetta, GA; Greensboro, NC	Dam Engineering

F. EXAMPLE PROJECTS WHICH BEST ILLUSTRATE PROPOSED TEAM'S QUALIFICATIONS FOR THIS CONTRACT

(Present as many projects as requested by the agency, or 10 projects, if not specified. Complete one Section F for each project.)

20. EXAMPLE PROJECT KEY NUMBER

#10

21. TITLE AND LOCATION (City and State)

22. YEAR COMPLETED



SCHUYLKILL COUNTY MUNICIPAL AUTHORITY, SCHUYLKILL COUNTY, PA

PROFESSIONAL SERVICES

2013

CONSTRUCTION (If applicable)

2013

23. PROJECT OWNER'S INFORMATION

a. PROJECT OWNER

Schuylkill County Municipal Authority

b. POINT OF CONTACT NAME

Jennifer Kowalonek
c/o Aldred Benesch & Company

c. POINT OF CONTACT TELEPHONE NUMBER

570-622-4055

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

When their client found they had dam safety issues, Alfred Benesch & Company turned to Schnabel Engineering for our expertise in geotechnical and dam engineering. As a subconsultant to Benesch, Schnabel provided geotechnical and dam engineering services for four high hazard dams owned by the Schuylkill County Municipal Authority. **Project Goals and Objectives:** All four of these earth embankment dams were found to have inadequate spillway capacity to pass the Probable Maximum Flood, as required by the dam safety regulations of the Pennsylvania Department of Environmental Protection (PADEP). At the time, upgrading Mount Laurel Dam was considered a top priority by PADEP due to significant seepage issues. Seepage and stability issues were also identified at the other three dams. Schnabel was initially tasked with evaluating upgrading alternatives which included: geotechnical explorations and evaluation; hydraulic and hydrologic analyses; and development and evaluation of alternatives to upgrade the dams to meet PADEP Dam Safety criteria for spillway capacity and embankment stability.

Solutions: Schnabel designed all dam and spillway improvements at each site, which included the following creative and cost effective approaches to upgrade spillway capacity:

- **Pine Run Dam (2010):** labyrinth replacement spillway
- **Indian Run Dam (2012):** labyrinth replacement spillway
- **Mt. Laurel Dam (2013):** replacement drop spillway, articulating concrete block armored auxiliary spillway, and a siphon low level outlet
- **Kauffman Dam (2013):** labyrinth replacement spillway

Geotechnical investigations were conducted at each site, including test borings, test pits, and piezometer installations. Data obtained from the explorations, soil laboratory testing program, and piezometer monitoring supported evaluation of the embankment stability and design of seepage control measures. Seepage analyses were performed using the finite element software program, SEEP/W. The results were used in the slope stability analyses using the SLOPE/W computer program for various loading conditions including steady-state seepage, earthquake (pseudostatic analysis), and rapid drawdown.

Embankment chimney, blanket, and toe drains; stabilization berms; and seepage monitoring systems were designed and constructed at each dam. The drainage systems included two-stage graded filters and slotted pipes, designed in accordance with the NRCS's National Engineering Handbook, Chapter 26, Gradation Design of Sand & Gravel Filters (1994).

The modifications at each site were completed with limited reservoir drawdown to maintain water supply throughout construction. Schnabel provided observation services and technical support during construction.

The completed work resulted in over \$13M in construction savings over estimates prepared by the Owner's previous consultant. ACEC recognized the rehabilitation of Indian Run Dam with a Diamond Honor Award in 2013.

Project Services
Subsurface Investigation
Seepage & Stability Analysis
Alternatives Evaluation
Hydrology and Hydraulics
Replacement Spillway Design
Plans and Specifications
Construction Services
PADEP Division of Dam Safety
Approvals



Mount Laurel Dam



Pine Run Dam

25. FIRMS FROM SECTION C INVOLVED WITH THIS PROJECT

a.	(1) FIRM NAME	(2) FIRM LOCATION (City and State)	(3) ROLE
	Schnabel Dam Engineering, Inc.	West Chester, PA	Dam Engineering

G. KEY PERSONNEL PARTICIPATION IN EXAMPLE PROJECTS

26. NAMES OF KEY PERSONNEL (From Section E, Block 12)	27. ROLE IN THIS CONTRACT (From Section E, Block 13)	28. EXAMPLE PROJECTS LISTED IN SECTION F <small>(Fill in "Example Projects Key" section below, before completing table. Place "X" under project key number for project participation same or similar role.)</small>										
		1	2	3	4	5	6	7	8	9	10	
Paul Welle	Project Manager	X	X	X	X	X	X	X	X	X	X	X
Brian Crookston	Hydrology & Hydraulics	X	X		X	X			X	X		
Laura Shearin-Feimster	Hydrology & Hydraulics	X	X	X		X	X	X				
Gary Rogers	Geology		X	X		X	X	X			X	
John Gagnon	Geology		X									
Sue Buchanan	Geology	X	X			X	X					
Jonathan Pittman	Geotechnical Engineer	X	X	X	X	X	X					
Adam Paisley	Geotechnical Engineer	X	X	X		X	X					
Alex Rutledge	Geotechnical Engineer		X	X		X	X	X				
Jerry Robblee	Geotechnical Engineer	X	X	X		X	X	X			X	
Melinda Dirdal	Planning Engineer	X	X		X				X	X	X	
Jeremy Young	Planning Engineer	X	X		X	X			X	X	X	
Loring Crowley	Planning Engineer	X	X	X		X	X					
Kortney Brown	Planning Engineer		X		X				X	X	X	
Don Basinger	QA	X		X	X	X	X	X				
Greg Paxson	QA	X	X	X	X	X			X	X	X	
Sharon Krock	Wetland Delineation		X	X	X				X	X	X	
Gary Horninger	Construction Services				X				X	X	X	
Tim Mohr	Construction Services					X	X					
Aaron Collins	Construction Services			X		X	X	X				
Doug Fairchild	Construction Services									X	X	
Mark Landis	Construction Services			X			X					

29. EXAMPLE PROJECT KEY

No.	TITLE OF EXAMPLE PROJECT (FROM SECTION F)	No.	TITLE OF EXAMPLE PROJECT (FROM SECTION F)
1.	NRCS West Virginia Dam Assessments, Multiple Locations, VA	6.	NRCS Deep Creek Watershed Dam 5D, Yadkin County, NC
2.	NRCS Red Lick Site #1 Dam Feasibility Study, Berea, KY	7.	NRCS Cobb Creek Watershed Site No. 1, Weatherford, OK
3.	NRCS Fox Creek Watershed Multipurpose Structure No. 4 Dam, Fleming County, KY	8.	Pennsylvania Fish and Boat Commission, Dam Rehabilitation Designs, Multiple Locations, PA
4.	NRCS Pohick Creek Watershed Dams No. 2, 3, 4, and 8 Rehabilitation, Fairfax County, VA	9.	Pennsylvania Department of Conservation and Natural Resources Open-End Contracts, Dam Evaluations and Design, Multiple locations, PA
5.	Stony Creek Dams #9 and #10, Basye, VA	10.	Schuylkill County Municipal Authority, Schuylkill County, PA



INTRODUCTION

Schnabel Dam Engineering (Schnabel) as the lead firm provides the West Virginia Conservation Agency with exceptional capabilities in all aspects of dam rehabilitation planning, design, and construction services. The credentials presented by the **Schnabel Team**, which substantiate selection for this contract, include:

- **Strong Project Management** – The Project Manager, Paul Welle, PE has managed complex water resources projects with an outstanding record of **cost control, technical excellence, client collaboration, and meeting deadlines.**
- **Experience** – The Schnabel Team has strong, long-term experience with NRCS dams in West Virginia and surrounding states.
- **Capacity to Perform** – The Team has a large staff with complementary and overlapping capabilities to ensure **ample availability of qualified personnel covering all requested disciplines.**
- **Safety** – Our Team's safety metrics are better than industry peers because of a consistent proactive approach to **health and safety training and workplace performance.**
- **Technical Excellence and Innovation** – Our Team applies innovative approaches to complex engineering and environmental issues to achieve **sound, cost-effective, and sustainable solutions.** We regularly participate in **research and development activities that elevate the standards of practice in dam engineering.**
- **Geographic Location** – We have three offices in West Virginia, two in Pennsylvania, six in Virginia, and two in Kentucky. We have experience on several projects in West Virginia, including Rehabilitation Assessments of 59 dams throughout the state.

When evaluating **Schnabel** for this contract, consider the following:

- Schnabel has **decades of experience working with the NRCS**, including several former NRCS engineers.
- Schnabel has investigated, analyzed, and/or designed more than 350 NRCS dams. **We understand NRCS policies, procedures, and criteria.**
- The Schnabel Team has a history of both project and professional collaboration, working together delivering successful projects for the NRCS and other clients and advancing cooperative efforts between firms to enhance dam engineering policies, practices and procedures.
- The Schnabel Team brings together nationally known NRCS experts, as well as world renowned water resources and dam safety experts.
- Our Team has the experience and expertise to provide rehabilitation solutions similar to those that will likely be required for this project, both in West Virginia and nationwide. **We have been down this road before.**

The requested supplemental information follows, organized by the selection criteria provided in the solicitation.



1. QUALIFICATIONS AND EXPERIENCE RELATIVE TO PLANNING, DESIGN, AND CONSTRUCTION OF DAM REHABILITATION PROJECTS

From our experience on NRCS projects, the Schnabel Team recognizes that work is executed most effectively and efficiently when project staff is familiar with the NRCS organization, and its goals, policies, and procedures. In addition, in-depth knowledge of West Virginia dam safety regulations is crucial to a successful project. Most of the proposed Team members for this project are Schnabel engineers and scientists from Schnabel's Pennsylvania and North Carolina offices, supplemented by engineers and scientists from Bell Engineering's Lexington, KY office, AllStar Ecology's Fairmont, WV office, Civil Tech Engineering's Hurricane, WV office, Horn & Associates' Winchester, KY office, and Jeff Zell Consultants' Coraopolis, PA office.

Schnabel is a nationally recognized leader in dam engineering. Since 1994, Schnabel has provided engineering services for over 1,000 dams, including more than 350 NRCS-assisted dams. Satisfied clients for these projects include federal, state, and local governments, water suppliers, lake associations, and other consulting engineers. Dam engineering comprises about 35% percent of Schnabel's total business, illustrating our strong commitment to this service area. Schnabel is a sustaining member of the Association of State Dam Safety Officials (ASDSO) and the United States Society on Dams (USSD), and several of our dam engineers are active in various committees within these organizations. Schnabel is also an active participant in the National Watershed Coalition.

Schnabel has five offices that are dedicated to dam engineering: West Chester, PA; Albany, NY; Alpharetta, GA; Greensboro, NC; and Knoxville, TN.

Schnabel's staff of nearly 100 dedicated dam engineering professionals work on dam projects full time, not as an occasional sideline. Our staff has experience in all engineering disciplines relevant to dams, including civil engineering, hydrology and hydraulics, geotechnical and geologic engineering, structural analysis and design, and construction engineering. We advocate this interdisciplinary approach and our dam engineers "see the big picture" to best serve our clients. Our dam engineers are supported by extensive additional staff credentials in geostructural engineering, geotechnical engineering, geology, geophysics, and environmental permitting.

As presented in Section E – Resumes of Key Personnel, we have a Team with a solid background in the service and discipline areas required for your project. The Schnabel Team's reputation has been built on the commitment and quality of our people, the quality of work we provide to our clients, and the high level of service we provide in helping our clients achieve their needs. The Schnabel Team is comprised of well-respected individuals having experience working with NRCS in their respective disciplines, many of whom have developed industry standards by which local, state and federal regulations/guidelines are based and/or have advanced principles, practices, and applied technologies for dam engineering.

The Schnabel Team is able to provide for all A-E service components required for dam rehabilitation planning, design and construction. We deliver the full range of engineering and construction management services, along with an understanding of local, state, federal, and NRCS regulations, policies, and programs. Team members have overlapping and complementary capabilities that will allow the Team to offer the WVCA multiple task order managers and abundant support staff, thereby allowing us to sustain a high level of technical and administrative quality on multiple concurrent assignments.



We recognize that experienced and effective leadership is essential to the success of the Schnabel Team and ultimately to our services to the WVCA.

Mr. Paul Welle, PE, will serve as **Project Manager** for the contract, leading our Team and serving as the technical point of contact between WVCA, NRCS, the local Sponsors and the Schnabel Team. Paul has extensive project management experience, both with NRCS and Schnabel. As Acting Head of the Northeast National Technical Center (NNTC) Engineering Staff for one year, he managed a 15-person staff that reviewed designs and provided technical assistance and training to 13 states in the Northeast. Paul has more than 45 years of diversified experience in the fields of water resources planning and H&H, which includes more than 30 years as a Water Resources Planning Specialist and Hydraulic Engineer with NRCS. At the NNTC, he was the Service's Technical Expert for surface water H&H and water resources planning for both the New England and Mid-Atlantic regions. At Schnabel, he has successfully managed similar projects, including the ongoing Dam Rehabilitation Site Assessments for 59 dams in West Virginia; the ongoing NRCS rehabilitation plan development for Red Lick Multipurpose Dam # 1 in Kentucky; the rehabilitation assessment of NRCS dams in Kansas; dam safety services for U.S. Navy and Marine Corps dams; and comprehensive evaluation, design, and construction services for NRCS dams in Fairfax County, Virginia. He understands the policies and criteria of NRCS, can lead a Team that will be a seamless extension of the WVCA and NRCS, and will keep communication lines open between WVCA, NRCS, the local Sponsors and the individual Team members.

Mr. Dave Campbell, PE, will serve as the **Principal in Charge** for the contract to ensure client and stakeholder relations remain strong with the Schnabel Team. As Schnabel's Director of Dam Engineering Services, Dave has 39 years of dam engineering experience. In this role, he is in charge of all dam engineering personnel and services throughout Schnabel. He is dedicated to validating that Schnabel has the manpower and associated resources needed to meet or exceed WVCA expectations. He has been honored with several awards for his contributions to the dam engineering community, including the ASDSO National Award of Merit, Villanova University's John Gallen Memorial Award, ASDSO's Terry L. Hampton Medal, and most recently, he was the inaugural recipient of the AAWRE Outstanding Practitioner in Water Resources Engineering Award.

Mr. Wade Biddix will be the **Lead Watershed Planning Specialist**. Wade retired from the NRCS in Virginia, where he most recently served as Assistant State Conservationist (Programs), managing the Water Resources Programs in Virginia and completing nine dam rehabilitation plans, designs, and construction projects since 2003. From 1990 to 2001, Wade served as the Planning Coordinator for all types of Watershed Planning in Virginia, including flood control, water quality, and land treatment projects. In 2011, Wade also served a 4-month detail as National Dam Rehabilitation Program Manager in Washington, DC. Wade not only fully understands NRCS watershed rehabilitation policies and procedures and NEPA requirements, he is a hands-on water resources planning coordinator and program manager and is experienced in working with sponsors, stakeholders, the general public, and state, federal, and local regulatory agencies.

Mr. James Featherston will be the **Agricultural Economist** for our Planning Team. James served as an Agricultural Economist for NRCS in Texas for more than 33 years, where he performed economic analyses for 11 dam rehabilitation projects since 2001. Currently, James is serving as Agricultural Economist with Schnabel to develop a Draft Rehabilitation Plan – Environmental Assessment for the Red Lick Creek Multipurpose Structure No. 1 in Kentucky, currently under review by NRCS. The plan includes



an upgrade of the dam to meet current state and NRCS criteria as well as adding municipal water storage to meet future demands of Berea and Madison County. James fully understands the economic evaluation requirements of both NRCS and Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies (PR&G).

Planning/Design Engineering Team

Jeremy Young, PE will serve as **Lead Planning/Design Engineer**. Jeremy's experience includes preparing and reviewing construction documents for over 30 dam rehabilitation projects, most of which are in Pennsylvania. These rehabilitation projects have included embankment and spillway upgrades for capacity, stability, and integrity. He was the lead design engineer for the rehabilitation of Glade Run Dam in Butler County, PA, which includes embankment filters to address concerns related to fine grained dispersive soils. He is recognized by the Construction Specifications Institute as a Certified Construction Specifier, which substantiates his knowledge of the design and construction process, contractual relationships, and proper use of construction documents. He recently served as the lead design engineer for spillway capacity upgrades for six dams located in Schuylkill County, PA.

Our core planning/design engineering team is an energetic and dynamic group of specialized engineers and scientists who have worked together on many dam rehabilitation planning, design, and construction projects, with similar seepage, slope stability, and spillway stability and integrity issues. We are prepared to creatively develop **practical and economical solutions that work**.

Environmental Resource Team

Ms. Sharon Krock, PWS will be the Environmental Liaison between Schnabel and AllStar Ecology LLC., located in Fairmont, WV, which will provide comprehensive environmental resources services, including wetland delineations, threatened and endangered species and cultural resources surveys. Sharon has 15 years of experience with Schnabel providing wetland delineations, environmental permitting and specifically for dam rehabilitations, designing and monitoring mitigation sites, and providing additional environmental services in coordination with all of Schnabel's service areas.

AllStar Ecology has over 35 trained and certified wetland delineators, threatened and endangered species botanists recognized by WV Department of Natural Resources, and WV-approved archaeological surveyors. AllStar Ecology was founded in 2007 to provide environmental consulting on natural resource issues and efficient solutions to permitting constraints. AllStar Ecology takes pride in its willingness and flexibility to ensure that the goals of its clients are met along with compliance with natural resource regulations.

Quality Assurance Team

Don Basinger, PE has 30 years of NRCS experience, including serving as State Design Engineer in North Carolina, State Conservation Engineer in New York and Massachusetts, Head of Design and Engineering for the South National Technical Center, and finally, National Director of Engineering in Washington, DC. He is extremely familiar with NRCS standards and criteria. Don is well known for the keenness and thoroughness of his reviews of dam designs. He served as Schnabel's Project Manager and Responsible Engineer for the Deep Creek Watershed Dam 5D Site for the North Carolina NRCS (2013 USSD Award for Excellence in a Constructed Project), as well as the Cobb Creek Watershed Site 1 in Oklahoma.



Gregory Paxson, PE, has 20 years of experience in analysis and design for dam engineering projects, for evaluation and upgrading of existing dams, and for design of new dams. He has served as project manager, reviewer, lead inspector, or lead engineer for more than 50 dam projects, including serving as the Project Manager for the design of spillway and embankment rehabilitations for four Pennsylvania Fish and Boat Commission Dams, for which designs are complete and construction is ongoing or scheduled for 2015. Greg was Project Manager for the most recent Peer Review of the USACE Nationwide Dam Safety Program. He was the lead design engineer for the Huntsman Lake Dam (Pohick Creek No. 8) rehabilitation in Virginia, which included replacement of the principal spillway riser and armoring of the auxiliary spillway. He is also the project manager for the evaluation of seepage-related concerns and the design of seepage controls for the 166-ft high George B. Stevenson Dam in central Pennsylvania; construction is scheduled for 2015. Greg has authored or co-authored more than 30 technical papers, mostly on dam rehabilitation and H&H. This includes developing and presenting workshops on spillway capacity upgrades for both USSD and ICOLD.

Construction Services for Upper Deckers Creek Site 1

Gary Horninger, PE, will serve as **Project Manager for the Construction Services** for this project, supervising the Schnabel staff and coordinating the work of Civil Tech Engineering (surveying and consultation) and Jeff Zell Consultants (laboratory materials testing). Gary has more than 25 years experience providing design and construction services such as Resident Engineer, Contract Administrator and Construction Services Project Manager. In addition to those projects included in his resume, Gary serves as Project Manager for the contractor's Quality Control (QC) services for construction of the North Fork of the Hughes River Dam, an 86-ft high RCC NRCS-assisted dam in Ritchie County, WV.

Experience with NRCS-Assisted Dams

Schnabel has provided engineering services for more than 350 NRCS dam projects, including:

- West Virginia – Dam Rehabilitation Assessments for 59 dams (ongoing from 2014 – 2018)
- Ritchie County, WV – North Fork Hughes River Dam Contractor Quality Control Services
- Albemarle County, VA – Preliminary Rehabilitation Design of RCC Spillway for Beaver Creek Dam No. 1
- Shenandoah County, VA – Development of Alternatives, Design, and Construction Services for Stony Creek Dams 9 and 10
- Fairfax County, VA – Rehabilitation Planning, Design, and Construction Services for Huntsman Lake
- Henry County, VA – Rehabilitation Design and Construction Services for Marrowbone Lake
- Tioga County, PA – Support to owner for design and construction of modifications (including SITES auxiliary stability analysis and dam breach analysis) to Lake Nessmuk Dam, PA 601
- Berks County, PA – Condition assessment of Kaercher Creek Dam, PA 478
- Venango County, PA – Dam breach inundation analyses and mapping, subsurface exploration (including piezometer installation), laboratory soil testing (including dispersion tests), and annual inspections for Two Mile Run Dam, PA 101
- Madison County, KY – Dam Rehabilitation Plan-EA development for Red Lick Creek Multipurpose Dam No. 1
- Fleming County, KY – Design and construction services of RCC spillway, including wetland delineation and permitting services, for Fox Creek Dam No. 4
- Gwinnett County, GA – Design of auxiliary spillway expansions and control section modifications for No Business Creek No. 1 and Yellow River No. 16

H. ADDITIONAL INFORMATION

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- Georgia – Design of labyrinth weir spillways for Yellow River Dam No. 3, South River Dam No. 4, and South River Dam No. 29
- Georgia – Design of RCC overtopping spillways for Yellow River No. 16, Soque River No. 29, Soque River No. 36, and Noonday Creek No. 4
- Georgia – Assessment of 166 NRCS small watershed dams to evaluate their potential for conversion from flood control to water supply
- Yadkin County, NC – Design and construction services for the new Deep Creek Watershed Dam 5D, a composite RCC gravity and earth embankment dam for water supply and flood control
- Iredell County, NC – Inspection and remediation of 11 NRCS-designed flood control dams
- North Carolina – Design of five small farm ponds (EQIP program)
- Washita County, OK – Rehabilitation planning and design of modifications to Cobb Creek Dam #1 to meet spillway capacity requirements
- Kaufman County, TX – Rehabilitation Design and Construction Services for Lower East Fork Laterals Site 1





Expertise

Schnabel has significant experience with the components of the anticipated rehabilitation planning, design, and construction of NRCS-assisted dams:

- **NRCS H&H procedures, including the SITES computer program** – Schnabel regularly uses NRCS H&H procedures, even for non-NRCS-assisted dams. We have used SITES for dam design and evaluation of auxiliary spillway stability and integrity for more than 75 dams. Our engineers and geologists are well-versed in the field procedures required to estimate the headcut erodibility index and other parameters required by SITES.
- **Seepage and Slope Stability for Embankment Dams** – As shown in Section F, Schnabel has performed seepage and embankment stability analyses and developed rehabilitation designs to address geotechnical issues for numerous dams. Our recent and ongoing experience includes subsurface exploration and instrumentation, seepage and stability analyses, and rehabilitation designs (filters, drains, slope modifications and foundation grouting) for Shaver's Creek Dam, four dams in Schuylkill County, Leaser Lake Dam, George B. Stevenson Dam, Hamburg Dam, Glade Run Lake Dam, and other DCNR and PFBC dams.
- **Structural Concrete Design** – Schnabel has a full range of concrete structure analysis capabilities from routine to finite element analysis as needed for designing principal and auxiliary spillways. In the past five years, Schnabel has designed more than 60 new reinforced concrete spillways. In addition, Schnabel engineers have designed more than 60 principal spillway risers and eight impact basins. Construction was recently completed on the NRCS Deep Creek Dam, an 80-ft high RCC gravity dam that received the 2013 USSD Award of Excellence in the Constructed Project Category.
- **Auxiliary Spillway Hydraulics** – Schnabel has in-house one-dimensional (HEC-RAS) and Computational Fluid Dynamics (CFD) capabilities to model and evaluate complex spillway flows. These techniques can be used to evaluate the stability of the entire auxiliary spillway, including the downstream portion of the exit channel, where major discontinuities of flow cannot be adequately considered using SITES. The model results can assist us in developing an effective and efficient design.
- **Auxiliary Spillway Design** – Schnabel has extensive experience designing **cost-effective** auxiliary spillways that **meet NRCS capacity, stability, and integrity criteria and that fit the site**. As shown in Section F, we have designed spillway armoring with either RCC or ACBs, cutoff walls, reinforced concrete spillways, and turf reinforcement (for stability, not integrity).

Capacity to Perform

Although the timeline for delivering the four rehabilitation plans is staggered, multiple teams will be required to achieve the desired timeline. As a result, we have shown multiple individuals for several disciplines in Section D. Schnabel's staff of nearly 100 dedicated dam engineering professionals has the redundancy required to simultaneously develop four rehabilitation plans.

The Schnabel Team has a **proven ability to provide superior people**, as clearly demonstrated by our previous and on-going tasks with NRCS, USACE, and other local, state and federal contracts. We provide project managers, technical specialists, and administrative support personnel **for short or long term assignments**. Our roles with our clients have grown significantly because of our ability to provide well-



qualified staff in a wide range of technical and management specialties. We are repeatedly asked to extend the contract and task scope of work on many projects.

Paul Welle, PE, Project Manager for this project is currently serving as Schnabel's project manager for the development of the rehabilitation plan for Red Lick MPS #1, an NRCS multipurpose structure in Madison County, Kentucky. With the draft rehabilitation plan currently being reviewed by NRCS, the workload for this project is significantly reduced. He is also project manager for assessments of NRCS-assisted dams in West Virginia; however, the flexibility in the schedule for the assessments and the depth in staffing will allow these projects to be performed concurrently.

Coordination and Leadership of Projects with Multiple Partners

We recognize that, while NRCS provides funding and technical criteria for the rehabilitation of dams, the Conservation Districts and WVCA cooperatively operate and maintain the dams, and both NRCS and the West Virginia Department of Environmental Protection – Dam Safety (WV DEP) establish dam safety criteria and review and approve construction plans and specifications.

As with our previous planning and design projects, we are prepared to effectively coordinate and lead this project with multiple partners and stakeholders. Our coordination and leadership of similar projects typically include funding and contracting agencies; dam owners; other sponsors; state dam safety agencies; local communities; and local, state, and federal permitting agencies. To address environmental issues and obtain permits, we perform environmental studies and assessments, including wetland delineation; develop permit applications; and work with the USACE to obtain 404 permits, state agencies to obtain dam construction and rehabilitation permits and to meet NPDES and other water quality management requirements; and various counties or conservation districts to obtain erosion and sediment control permits during either planning or design, as appropriate.

Examples of our collaborative project experience include:

- Multiple Task Orders ranging from geotechnical and design support to development of complete plans and specifications and support during construction for the upgrading of seven Pennsylvania Fish and Boat Commission (PFBC) dams. These projects include coordination with PA DGS as our client, PBFC as dam owner, and PA DEP, USACE, and conservation districts as permitting agencies.
- Two ongoing Task Orders under a dam engineering contract with the Pennsylvania Department of Conservation and Natural Resources (PA DCNR). These projects include coordination with PA DCNR as our client and dam owner, DCNR staff at the various park locations throughout the Commonwealth, and PA DEP, USACE, and conservation districts as permitting agencies.
- Completed and ongoing services for 16 Task Orders under our prime IDIQ contract for Independent External Peer Reviews for Design and Construction Projects within the USACE Civil Works Mission Boundaries (Dams and Levees). As part of this contract, Schnabel completed an independent review of the USACE Dam Safety Program, requiring coordination with the USACE's risk management center, district offices, division offices, and HQ.
- Ongoing design for rehabilitation of three dams located on the Quantico Marine Corps Base under a design-build contract with the USACE Norfolk District. This includes coordination between multiple partners, including USACE, the Marine Corps, the design builder, the environmental subconsultant, and state and federal permitting agencies. Because of its proximity



to the Chesapeake Bay, special environmental considerations are required under the Chesapeake Bay Preservation Act.

- Rehabilitation plan development for Red Lick MPS #1. This includes coordination with Bell Engineering, our client; Berea Municipal Utilities, the water supplier; Berea College, the owner of the dam; other consultants for threatened and endangered species, cultural resources, and wetlands; and multiple local, state, and federal stakeholders and permitting agencies. We participated in an interagency on-site meeting where we worked with state and federal agency representatives to identify project impacts and mitigation requirements, and conducted two public meetings, where we solicited local concerns and explained the need for dam rehabilitation and the planning, design, and construction processes that will be followed. We will present the draft plan at another public meeting after reviews and approval of the plan by NRCS.
- Engineering services for the USACE Norfolk District for 19 dams located on Navy and Marine Corps bases in Mississippi, California, Indiana, and Virginia including hazard classifications and Emergency Action Plans (EAPs); geotechnical explorations and analyses; and preparation of plans and specifications for repairs for concrete and earth dams. This required coordination with USACE and multiple Navy and Marine Corps bases and state dam safety agencies.

Recent Successes

Schnabel's past performance on previous contracts with respect to cost control, quality of work, and compliance with performance schedules includes success with federal, municipal, and private sector clients. The following notes of commendation from dam owners and NRCS mean that you can expect to be as pleased with our work as are these clients.

<p><i>"This letter of reference recognizes the expertise, ingenuity and professionalism that Schnabel Engineers exercised in the development of the aforementioned dam rehabilitation projects for the Pennsylvania Fish and Boat Commission (Commission). The level of service demonstrated on all three projects is characteristic of the service you provided the Commission on design services for over ten years."</i></p>	<p>Jerry Woomer, PE, Senior Civil Engineer Pennsylvania Fish & Boat Commission Colyer Lake, Speedwell Forge Lake & Glade Run Lake Dam Rehabilitation Projects Letter dated June 10, 2014</p>
<p><i>"This letter of recommendation and appreciation recognizes the exemplary service that Schnabel Engineering has provided to the Department of Conservation and Natural Resources (DCNR) during the design and construction of dams owned by the Bureaus of State Parks and Forestry...Throughout the years, your firm has provided DCNR with outstanding geotechnical and dam design expertise to rehabilitate these structures...I look forward to working with Schnabel Engineering on future projects. You have proven to be very responsive, knowledgeable and professional."</i></p>	<p>Edward E. Raptosh, PE, Civil Engineer Manager Division of Design Department of Conservation and Natural Resources Multiple Pennsylvania Projects Letter dated June 2, 2014</p>
<p><i>"...Schnabel was chosen to provide design and construction phase services for the project due to their knowledge of dam engineering and commitment to balancing cost and value. Now that the project has concluded, I can say that we made the correct decision to utilize Schnabel for the work. They exhibited professionalism throughout the project and worked as an extension of our staff...I would recommend Schnabel on future projects without any reservations and look forward to working with them again."</i></p>	<p>Anthony Nokovich, P.E., Senior Engineer Pennsylvania American Water Company Lake Oneida Dam Rehabilitation Project, Butler County, PA Letter dated May 16, 2014</p>

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<p><i>"...Schnabel Engineering provided exceptional Professional services for the Leaser Lake Dam Rehabilitation project. This project was completed on time and within the budget allowed. Schnabel personnel served as integral assets for this project's successful design...It's refreshing to have such a Team of Professionals working together to accomplish a common goal."</i></p>	<p>J. Andrew Banner, CIS Commonwealth of Pennsylvania Department of General Services Leaser Lake Dam Rehabilitation Project, Lehigh County, PA Letter dated April 5, 2013</p>
<p><i>"...the Wilson & Company Team (which included Schnabel Engineering and John Reh) completed the 27 watershed dam rehabilitation assessment projects (3 task orders) on-time, efficiently and effectively."</i></p>	<p>Edward Radatz, PE, State Hydraulic Engineer USDA NRCS Kansas State Office Letter dated January 30, 2012</p>
<p><i>"Schnabel Engineering provided timely, efficient, consistent and creative design solutions to support this construction effort and maintain project schedule and continuity. Their expertise with Roller Compacted Concrete (RCC) overlay provided worry free quality control. Together, they met the schedule, budget and quality targets while consistently meeting, and often exceeding, expectations."</i></p>	<p>Tony J. Petulla, Construction Inspection Manager Commonwealth of Pennsylvania Department of General Services Poe Dam Rehabilitation Project, Centre County, PA Letter dated January 10, 2010</p>

A History of Success

The single best indication of past performance is longevity and repeat business from existing clients. Schnabel's company culture and business model puts a priority on providing high-quality, on-schedule and on-budget service to our existing clients so that they will seek our services time and again. A testament to Schnabel's water resources work is our relationships with clients for whom we have been the **engineer of choice for dam projects** over an extended period of time. It is not uncommon to perform all dam related services for a single client for multiple decades.

Quality Control

To provide high quality work products to the WVCA, Schnabel will adhere to internal project management procedures and quality control procedures. Our procedures provide detailed policies and actions for defining the scope of a project (at the proposal stage and then on-going re-evaluation during the project), the policies, procedures, and criteria of the client and regulatory agencies, and measures necessary to meet project deadlines and deliverables such as reports, drawings, and correspondence (i.e., internal resource allocation). The standard also includes details concerning the review of all project related work products and deliverables by senior technical staff, budget control procedures, and regular updates to the client regarding budget versus project completion status.

Schnabel invests heavily in technical, project management, and quality practices training for our staff. Regular project file reviews are performed to validate adherence to quality technical and business practices. All computations, analyses, designs, reports, and official correspondence are peer reviewed in accordance with written Policies and Procedures. Beyond these procedural checks and balances, we regularly perform internal audits to ensure our project documentation, processes and technical procedures are in alignment with the goals of our project management procedures.



Company Awards

As substantiation of the Schnabel Team's history of success and past performance, long-term client relationships, and being leaders within the dams and water resources industry, following is a sampling of awards that Schnabel has received for dam projects:

- Ragged Mountain Dam, Virginia Lakes and Watersheds Association, Best Major Construction Award (2015)
- Coles Run Dam Upgrading, Virginia Lakes and Watersheds Association, Most Improved Dam (2015)
- Stoney Creek Dam Rehabilitation, Virginia Lakes and Watersheds Association, Most Improved Dam (2015)
- Deep Creek Watershed Dam 5D, Yadkin County, North Carolina
 - USSD, Award of Excellence in the Constructed Project Category (2013)
 - ACEC, National Recognition Award, Engineering Excellence Awards (2012)
 - ACEC, North Carolina, Engineering Excellence Award, Grand Award for Engineering Excellence (2012)
- Lower Lake Dam, Pike County, Pennsylvania
 - ACEC, Pennsylvania, Diamond Award Certificate (2013)
 - ABCD, Susquehanna Chapter, Medium Span Bridge Award (2013)
- Lake Townsend Dam, Greensboro, North Carolina
 - ACEC, National Recognition Award, Engineering Excellence Awards (2013)
 - ACEC, North Carolina, Engineering Excellence Award, Grand Award for Engineering Excellence (2012)
 - ASDSO, National Rehabilitation Project of the Year (2012)
- Linville Land Harbor Dam Rehabilitation, Linville, North Carolina – ACEC North Carolina, Engineering Excellence Award, Honor Award for Engineering Excellence in Water Resources (2011)
- Sally's Pond Dam Rehabilitation, Ringwood, New Jersey – Eastern Pennsylvania-Delaware Chapter ACI, Grand Prize Award in the Civil/Site Construction Category (2010)
- Hickory Log Creek Dam, Georgia – Honor Award from ACEC Georgia Engineering Excellence Awards (2008)
- Yahoola Creek Dam, Georgia – Outstanding Achievement Award from Georgia Chapter ACI (2005)
- Bee Tree Dam Rehabilitation, North Carolina – Carolina Association of General Constructors (AGC's) Pinnacle Award "Best Utility Project of the Year" (2003). Runner up for ASDSO's National Rehabilitation Project of the Year (2003)

"THE REHABILITATION PLANS SUBMITTED BY THE COUNTY ARE EXCELLENT. WE COMMEND THE COUNTY AND [SCHNABEL] FOR THE HIGH QUALITY OF WORK EXHIBITED IN THE REHABILITATION PLANS"

- KIRK KREIDER, PE
PA DEP DIVISION
OF DAM SAFETY



2. APPROACH AND METHODOLOGY FOR MEETING GOALS AND OBJECTIVES

Dam Rehabilitation Planning (Brush Creek 9, Brush Creek 15, New Creek 1, and New Creek 17)

Schnabel can provide the professional engineering and technical services needed for the development of Supplemental Watershed Plans for multiple dams in West Virginia. We will utilize an Interdisciplinary Planning Team approach and methodology. The Planning Team has the required make-up and expertise to prepare the needed documents for these dam rehabilitation projects. The team members bring many years of professional experience working with NRCS and/or A&E firms on similar projects across the United States. These individuals have the necessary knowledge, skills, and abilities to evaluate and develop dam rehabilitation plans. We are familiar with NRCS policies and procedures, NEPA, P&G, PR&G, and other applicable federal and state laws governing NRCS water resources projects and can deliver high quality products in a timely manner.

The Planning Team fully understands the NRCS 9-step planning process for the planning and implementation of dam rehabilitation plans. The planning will include the preparation of a watershed supplemental plan and quality assurance project plan for each project. It will also include the project documentation and the entire process will follow the NRCS policy in the National Watershed Manual, NEPA policy, Principles, Requirements and Guidelines For Water and Land Related Resources Implementation Studies (PR&G), Endangered Species Act, Section 106 of the National Historic Preservation Act and other applicable state and federal laws governing NRCS water resources projects.

The Planning Team will utilize the NRCS 9-step planning process for the development and implementation of these dam rehabilitation projects. For the development of the plans, this planning process will be grouped into the following three phases:

Phase I - Data Collection and Analysis (about 4-6 months)

Phase 2 - Formulate and Evaluate Alternatives (about 4-6 months)

Sponsor makes final decisions

Phase 3 - Plan Development, Reviews and Approvals (about 4-6 months)

The development of a completed and authorized dam rehabilitation plan will take between 12 and 18 months, depending on the degree of complexity with each project. The specific completion date for each plan will depend upon the date of receipt of a Notice of Award and the detailed schedule that will be developed, and agreed upon for each project, by the Sponsors, NRCS and the West Virginia Conservation Agency.

The design and implementation steps can follow plan approval and authorization.



The Schnabel Planning Team consists of the following individuals and disciplines along with their key performance tasks:

- Wade Biddix, Watershed Planning Specialist - Coordinate the overall planning activities with the Sponsors, NRCS, and other agencies and organizations, develop and implement public participation plans which include conducting scoping meetings and public meetings and coordinating the interagency and public reviews of the documents, and the development of the Draft and Final Supplemental Plans and Quality Assurance Project Plan.
- James Featherston, Economist - Gather and analyze cultural, social and economic data of existing and future with project conditions, evaluate various alternatives, complete benefit/cost analyses, and provide needed economic inputs into the plan.
- Paul Welle, Hydrology and Hydraulic Engineer - Coordinate the required engineering data gathering and analyses to establish the base flow, flood flows and other hydrology and hydraulics of the existing conditions and future with and without project conditions. Propose and evaluate various alternatives for rehabilitation of the dams.
- Jeremy Young, Planning / Design Engineer - Coordinate any required surveying of the dams; evaluation of the existing principal spillway riser and pipe via a camera survey of the internal components of the dam; determine various modes of dam failure; propose various alternatives for rehabilitation of the dams; develop cost estimates for the alternatives; and establish the footprint of the proposed project.
- Gary Rogers, Geologist - Conduct a sediment survey of the permanent pools; determine past sedimentation rates and predict future rates; and work with the geotechnical engineers in developing an understanding of the foundations and embankments of the dams.
- Jonathan Pittman, Geotechnical Engineer - Coordinate geotechnical investigations with Horn & Associates, observe geotechnical borings of the embankments and spillways, perform a seismic evaluation of the existing risers and embankments.
- Sharon Krock, Environmental Specialist / Biologist - Coordinate environmental services with AllStar Ecology for the gathering and analyzing of environmental data in preparation of the required NEPA documents and Supplemental Watershed Plans. This includes cultural resources, wetland delineations, threatened and endangered species, and other environmental resources governed by applicable state and federal laws for NRCS water resources projects. We will provide needed environmental input into the plans and also assist with environmental permits as needed.
- Ronald McMaine, Bell Engineering, Water Supply Specialist - Will work with sponsors to develop water supply needs and evaluate alternative plans for meeting these needs.
- Mark Pennington, Civil Tech Engineering - Will provide field surveys and construction service consultation as needed.

Hydrologic and Hydraulic Analyses

Hydrologic and hydraulic analyses will follow NRCS policies and procedures contained in TR-60, the National Engineering Handbook, and related documents.

We will use SITES to evaluate the frequency of operation, capacity, stability, and integrity of the auxiliary spillways. We will use the NRCS field procedures to estimate the headcut erodibility index. Should the auxiliary spillways not lend themselves to full evaluation of their stability and integrity, we will use our in-house Computational Fluid Dynamics capabilities to model and evaluate complex spillway flows. Model results assist us in developing efficient designs. This could be used to evaluate curved or non-uniform spillway outlets.



We will use either TR-20 or HEC-HMS in conjunction with HEC-RAS to evaluate the flooding downstream of the dams for those alternatives studied in detail, providing input data for the economic analyses. We will use either unsteady flow HEC-RAS or a two-dimensional hydraulic model to develop dam breach hydrographs.

Planning Engineering / Alternatives Analyses

An alternatives analysis will be performed in order to recommend an appropriate and economical dam rehabilitation design that meets NRCS criteria for hydraulic capacity, stability, and integrity, along with achieving other project objectives that may include additional or continued flood protection, additional water supply storage, etc. Design alternatives may include modifications to the auxiliary spillway geometry (e.g., lowering, raising, and/or widening), armoring the auxiliary spillway with Roller Compacted Concrete (RCC) or articulated concrete blocks (ACBs), cutoff walls in the auxiliary spillway to prevent the upstream progression of headcut erosion, reinforced concrete spillways in the existing auxiliary spillway or over the embankment, raising of the embankment, closure of the existing auxiliary spillway, or a combination of these methods. The technical merits of each of the alternatives will be evaluated in combination with the project objectives, environmental considerations, constructability constraints, property ownership constraints, operation and maintenance issues, and cost to allow selection of the most appropriate option for each site. The site-specific information gathered during the Phase 1 geologic and geotechnical investigation will be carefully considered in the development of potential alternatives. Hydraulic routings will be performed to develop preliminary sizing and layout of potential rehabilitation alternatives, and plan sketches and updated construction cost estimates will be developed for each alternative considered in detail.

Economic Analyses

Economic analysis of NRCS water resource projects follows federal policies, procedures, and requirements that are outlined in the NRCS, National Watershed Program Manual, the NRCS, National Watershed Program Handbook, and the The Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies (PR&G) (December 2014). We understand that the USDA needs to develop implementation guidelines before PR&G can be used. As a result, we are prepared to use either PR&G or its predecessor, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (March 1983). NRCS planning requirements under the National Environmental Policy Act are also followed.

Specifically, analysis involves quantification (and preferably when possible, monetization) of floodwater effects and damages with and without project conditions. Damages include floodwater effects to:

- Urban properties - residential, commercial, and public structures, vehicles, utilities, roads and bridges, pipelines, etc.
- Agricultural properties - cropland, grazing land, woodland, farm equipment, livestock, fences, barns, etc.
- Soil displacement (erosion and sediment)

Other components of the economic analysis (as relevant to the purpose and need of the project) include recreation issues (quantifying direct or incidental needs), rural water supply issues (i.e. planning for projected needs, protecting current/future supply, planning for augmented supply), drainage of flood-prone agricultural lands, and cultural resources and fish and wildlife consequences. For rural water supply, benefits are separated based on cost allocation of identified purposes.



Damages for all alternatives are evaluated and compared to project condition, the difference resulting in benefits (quantified and/or qualified). Once alternatives' costs are estimated, benefit/cost analyses are performed. The preferred alternative is identified as the one that maximizes net benefits.

Risk and uncertainty of a flood damage reduction analysis is also evaluated. Risk is a potential outcome that can be described in a reasonably well known probability distribution. Uncertainty is potential outcomes that cannot be described in objectively known probability distributions. Both of these exist for water resources projects.

Geologic and Geotechnical Analyses

Based on our review of the Rehabilitation Site Assessment Reports, we understand very little subsurface information is available for the dams. The Rehabilitation Site Assessment Reports identify several potential issues that need to be further evaluated at each of the dams including the filter compatibility of embankment zones, inadequate seepage control and drainage systems, slope instability, and the lack of information required to prepare an accurate subsurface profile through the auxiliary spillway.

As part of the planning phase for these dams, we propose to implement a Phase 1 geotechnical investigation to better define the subsurface conditions at the site and to support more detailed evaluations of the existing conditions and potential rehabilitation alternatives. A Phase 2 geotechnical investigation would be required during the design phase to support the final design of the preferred alternative.

File Review and Site Reconnaissance

The first task associated with the geotechnical investigation will include research and review of available data on the dam. We will review the construction record drawings, the geologic design reports prepared by NRCS, the USACE Phase 1 inspection reports, and other applicable reports prepared since the construction of the dams.

An understanding of the regional and site geology is also essential to planning an investigation and to evaluating the condition of a dam. Therefore, available geologic maps and other references will also be reviewed as part of this process. This review will be a collaborative effort between our geotechnical engineers and geologists. As a part of this review, our engineers and geologists will visit the site.

Geotechnical Exploration Program

A geotechnical field exploration will be developed for each dam site after the site visit and review of the available reports. The field investigations will generally include the items described below and will be refined as needed to meet the needs of each dam.

- Perform test borings along the crest of the dam. The test borings will be advanced through the embankment into the foundation soils and/or rock.
- Perform test borings near the downstream toe of the dam. The test borings will be advanced into the foundation soils and/or rock.
- Perform test borings along the auxiliary spillway alignment. The test borings will be advanced to the level of the stream channel or at least 10 feet into competent rock, whichever comes first.



The geotechnical drilling and sampling will be performed by our subcontractor, Horn & Associates, and Schnabel will provide a representative to observe drilling operations, collect soil and rock samples, and log the test borings.

Drilling in embankment dams requires extreme care to avoid hydraulic fracturing. Drilling, sampling, and in-situ testing in the embankments will be performed using methods to avoid hydraulic fracturing, in accordance with the recently revised guidance from the US Army Corps of Engineers in ER-1110-1-1807, Drilling in Earth Embankment Dams and Levees dated December 31, 2014. Therefore, our drilling subcontractor will drill through the embankment using hollow stem auger techniques. Standard Penetration Tests (SPTs) will be performed through the hollow stem augers using a split-barrel sampler at selected locations. The SPTs will be used to estimate the strength and consistency of the subsurface materials and collect samples for laboratory index testing. We will also collect relatively undisturbed samples of the embankment and foundation soils at select locations by pushing Shelby tubes. Rock coring of the dam foundation bedrock will be performed using NQ double core barrels, with the embankment soils protected from hydraulic fracturing through the use of surface casing.

Soil samples taken from the borings will be sent to our geotechnical laboratory in Blacksburg, Virginia, for strength, consolidation, and index testing. Rock samples will be sent to the laboratory for unconfined compression testing. We will base the quantity of laboratory tests on the findings of the field exploration program.

Open standpipe piezometers will be installed in selected borings. These wells will be used to estimate the phreatic surface through the dam. Long-term water level readings will be obtained for several months after installation. Borings in which piezometers are not installed will be backfilled with cement/bentonite grout by tremie pipe from the bottom of the borehole or backfilled with bentonite chips.

The hydraulic conductivity of the bedrock will be measured at various depth intervals in the borings using the permeability test method described by the US Bureau of Reclamation Ground Water Manual (1985). Pneumatic, inflatable packers will be temporarily placed in the borings to isolate a test section; and a water pump, flow meter, and pressure gauge will be used to measure the test parameters at discrete zones at varying water pressures. For this test, it is essential to have a thorough understanding of the geologic conditions at each location in order to select appropriate test pressures and existing condition input for the calculations. The minimum pressure should exceed the hydrostatic pressure that exists under non-pumping conditions due to the water column in the bore hole. The maximum pressure must be selected with extreme care to minimize the potential for hydraulic fracturing of the dam foundation.

Geotechnical Engineering Analysis and Reporting

Upon completion of our geotechnical field investigation and laboratory testing program, we will use the SEEP/W and SLOPE/W modules within the Geostudio 2012 software suite to perform seepage and slope stability analyses, respectively. Our approach to computer modeling is much more than input and output of results. Accurate modeling of a dam and its foundation requires a holistic understanding of the site and subsurface conditions, and soil and rock behavior. Our engineers and modelers will work closely with the geologists who drilled and sampled at the site to select the appropriate input values and model layers. The results of the seepage analyses will be used to evaluate the need for improvements to the existing seepage collection and drainage system.



We will analyze the stability of the maximum section of the dam under steady-state seepage conditions, rapid drawdown conditions, and earthquake loading. We may also evaluate the stability of the embankment under flood loading conditions if the results of our seepage analyses indicate that the flood conditions affect the water pressures in the downstream portion of the embankment. The pore water pressures used in our stability analyses will be obtained directly from the results of our seepage analyses.

In addition to these analyses, we will also evaluate the filter compatibility between adjacent embankment zones and drainfill layers, and provide the revised subsurface profile and material erodibility indices required to update the auxiliary spillway integrity analyses.

The results of our geotechnical exploration and analysis program will be summarized and incorporated into the applicable sections of the planning document. These results will also be used to further refine the potential rehabilitation alternatives for each dam.

Biological and Environmental Data Analyses

With our guidance and oversight, AllStar Ecology will document existing biological conditions and analyze the impacts of the alternatives on the biological resources in preparation for National Environmental Protection Act (NEPA) analysis. Wetland delineations will be performed at each site using the current US Corps of Engineers (USCOE) Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region. AllStar Ecology is based in West Virginia with experience in numerous ecological systems within the state so they are well-suited to accurately determine wetland boundaries at each of the sites. We will secure Preliminary or Approved Jurisdictional Determinations from the USCOE, as determined by the SCC, for the wetlands delineated at the sites.

AllStar Ecology will complete a WV Stream and Wetland Valuation Metric for the selected alternative and, if necessary, will develop an appropriate mitigation plan to compensate for any impacts due to the selected alternative.

AllStar Ecology will complete the preparation of the NEPA documents and ensure compliance with applicable state and federal laws governing NRCS water resources projects such as the Endangered Species Act; Section 106 of the National Historic Preservation Act; NRCS Title 390, National Watershed Program Manual, Part 505; and PR&G.

Water Supply Planning

NRCS is encouraging evaluating the potential for adding water supply storage to existing reservoirs by providing cost sharing for either adding water supply as a purpose or providing additional water supply storage where water supply is already a purpose. If desired by the sponsors, we will evaluate the water supply needs and develop alternatives for providing additional water supply.

Development and Implementation of a Public Participation Plan

We will work with NRCS and Sponsors to develop a Detailed Public Participation Plan for each project.

- Determine the purpose and objectives of the Rehabilitation Project and the Public Participation Plan.
- Establish a basic timeline and the responsible parties for the planning process that includes the data gathering, data analysis, development of alternatives, public input via meetings, plan development, public and interagency reviews, and Sponsor and NRCS approval and authorization of the completed supplemental plans.



- Establish a Watershed Committee for each dam that is comprised of representatives of the Sponsors, NRCS, SWCD, local conservation agencies and organizations, elected officials, and interested landowners. This Watershed Committee will serve as a "sounding board" and help make decisions and recommendations to the Planning Team and to the Sponsors and NRCS.
- Identify what information is needed to be provided to the public, when and by what methods - radio, newspapers, newsletters, public notices, flyers, etc.
- Develop a mailing list of stakeholders (agencies, groups, individuals, libraries, newspapers, and landowners - including those in the upstream watershed, those around the dam, and those downstream in the breach inundation zone of the dam). NRCS and the Sponsors will assist by providing any available stakeholder contact information.
- Complete the Public Participation Plan for Sponsors and NRCS review and concurrence.
- Hold a Scoping Meeting with the environmental agencies, organizations, and sponsors to identify the issues and concerns to be addressed and to narrow the focus of the project. Identify agencies that should be requested to participate in the planning process as Cooperating Agencies.
- Hold a minimum of two public meetings in the watershed. One initial public meeting will be held early in the planning process to introduce the project, discuss the planning process, and to solicit the public's interest and any issues and concerns for rehabilitation of this dam. Another one will be held to present the findings, alternatives considered, and the preferred alternative along with the environmental, social, cultural and economic impacts.
- Solicit review and input from the NRCS National Water Management Center for the "In-House" Draft of the Plan.
- Conduct interagency and public review of the Draft plan for a 45 day public comment period. Incorporate comments received, as deemed appropriate.
- Update the Public Participation Plan as needed.

Environmental Permits

We will assist the Sponsors with the needed environmental permits by doing the following:

- Establish a positive working relationship with the environmental agencies and organizations early in the planning process and during the Scoping Meetings for the various projects.
- Invite the key agencies that have affected resources in this project to be Cooperating Agencies in the development of the Supplemental Plans.
- Identify the key staff persons, points of contact, and decision-makers for each agency.
- Conduct field trips to the sites with the key agency staff to gather data and to analyze the existing resources.
- Keep the agency staff informed and involved in the decision-making regarding the effects and impacts of the various alternatives being considered for rehabilitation of these dams.
- Provide the needed technical information for the permits to the Sponsors and assist them with filling out the applications for any required environmental permits.
- Serve as the Sponsors' Point of Contact for technical questions from the agencies on various environmental concerns and issues.
- Work to resolve any limitations for project implementation by working to avoid, minimize or mitigate the environmental impacts of the projects.

**Construction Services (Upper Deckers Creek Dam #1)**

Schnabel has extensive experience performing the activities related to the goals identified for the Upper Decker Creek Dam #1 project. We regularly provide Quality Control and Quality Assurance observations and testing for clients on dam rehabilitations and new dam construction. We propose to team with Civil Tech Engineering and Jeff Zell Consultants to accomplish the goal of overseeing the quality control inspections by the contractor. Our staff has the mobility and qualifications to make your project a smooth success. We understand that communication between a Design Professional and Contractor has the potential to cause delays and disruptions to the project, and we have experience and the attitude to keep the project moving and the members working together as a team to complete the work in a timely manner.

We offer the added benefit that our Resident Project Representatives hold certifications from the Construction Specifications Institute, American Concrete Institute, NICET and/or other related organizations that will allow our field staff to immediately interpret the field test results and respond appropriately and quickly. We will supplement our field staff with technicians from Jeff Zell Consultants as needed. Jeff Zell is also proposed to perform the soil and laboratory testing.

We are familiar with the requirements of preparing record drawings and already have processes and procedures in place to accomplish these goals. In addition, as engineers and designers of dams, we are aware of pertinent features and characteristics of record drawings and will take note of significant changes to be included in the documents for future reference.

Schnabel can review, log and coordinate the contractor's shop drawings and submittals with the design engineer. We have successfully performed this activity before, utilizing a cloud or server based database (Microsoft Sharepoint) to expedite the submittal review and transmittal process while also being cost effective.

Schnabel does not employ licensed surveyors, but is able to verify survey notes and procedures. We will team with Civil Tech Engineering to verify more complex survey data and procedures through their licensed surveyors.

As previously noted, Schnabel field staff has credentials from the Construction Specifications Institute, indicating that we possess the knowledge of industry standards for recording construction activities. We have developed our own daily field report format and Resident Project Representative Procedures Manual that includes daily reporting, review of pay applications for progress and quantity verification. As part of our daily monitoring, we note erosion control device condition and function, general safety plan compliance as well as the contractor's progress, manpower, material deliveries, field test results, and weather and site conditions. Field conversations, work deficiencies, and corrections are also noted in the Daily Field Reports.

Our offices have experienced engineers, scientists and technicians who are able to review and comment on construction schedules. Because we design dams and water resource structures, we are able to identify potential scheduling sequence irregularities that others less familiar with this type of work may miss. These capabilities also become useful in reviewing change order requests and developing independent cost estimates to verify proposed or submitted costs.

Schnabel has experience in developing and implementing Quality Assurance Plans. We propose to team with Civil Tech Engineering for surveying and field observation support and Jeff Zell Consultants for



laboratory materials testing. We have successfully implemented Quality Control and Assurance programs for clients in Virginia, Pennsylvania and other states that have been accepted by State Dam Safety officials and the Army Corps of Engineers.

We propose to staff the project with a full time Resident Project Representative (RPR) who will temporarily relocate to the project area. Our RPR staff include technicians, scientists and technologists with experience in cast-in-place concrete, earthwork placement and compaction, Roller Compacted Concrete (RCC), asphalt paving, inclinometer installation, rock anchor installation and testing, and other dam-related construction experience. The RPR on site will be supported by a project manager who will assist with review of daily field reports, pay applications, construction cost estimates, schedule reviews, Contractor coordination, submittal review, and progress meetings. Field staff will be supplemented with technicians from other Schnabel offices and Jeff Zell Consultants as needed.

Based on our past experiences, we believe that utilization of a web-based submittal database would serve the project well, and we have the capability and experience to implement such a program. The web-based submittal database will allow the Design Engineer, Contractor, Schnabel and you to view and track the project documents and provide a more timely and more efficient (and less expensive) way of transmitting project information among the project team. The Schnabel Projnet allows the team to log into a website and view submittals and data related to the work, and download and/or print as needed. For those clients who request hard copies, Schnabel is adept at maintaining the electronic database and providing hard copies in a timely manner as well.

Schnabel also has the capability to set up an on-site construction materials laboratory for soils and concrete testing if the project warrants such facilities.

One of the advantages of working with us is that we have other groups to draw upon if complex geotechnical or geologic issues are encountered with the soil conditions, groundwater intrusion, geologic discontinuities, or concrete construction related problems. We have this knowledge base and staff in-house so additional contracts for other specialty consultants aren't necessary. This depth of experience and technical know-how have enabled us to effectively team with clients and contractors to quickly resolve problems and keep the project moving, which ultimately benefits you, the owner.

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: AGR1500000004

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 type="checkbox"/> Addendum No. 2 | <input type="checkbox"/> Addendum No. 7 |
| <input 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 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.

Schnabel Dam Engineering, Inc.

Company



Authorized Signature

June 4, 2015

Date

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

Revised 6/8/2012

