



West Virginia Division of
Natural Resources (WVDNR)

December 13, 2017

Modifications and Repairs of Six (6) Dams Wildlife Resources Section

Expression of Interest

Project Number: AEOI 0310 DNR 1800000005



1000 Green River Drive, Suite 101
Fairmont, WV 26554

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

Pete Nix, P.E. - Sr. Program Mgr.
(Name, Title)

Tetra Tech, Inc.
(Printed Name and Title)

6530 W. Campus Oval, Suite 130, New Albany, OH
(Address)

614 289-0117 / 614 289-0122
(Phone Number) / (Fax Number)

43054

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(email address)

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contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated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

Tetra Tech, Inc.
(Company)

Art (Pete) Nix - Arthur (Pete) Nix
(Authorized Signature) (Representative Name, Title)

Sr. Program Mgr.
(Printed Name and Title of Authorized Representative)

12/12/17
(Date)

614 289-0117 / 614 289-0122
(Phone Number) (Fax Number)

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.:

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.

Tetra Tech, Inc.
Company

Auth Pet Nij
Authorized Signature

12/12/17
Date

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

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

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

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

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

DEFINITIONS:

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

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

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

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

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: Tetra Tech - Arthur (Pete) Nix

Authorized Signature: [Signature] Date: 12/12/17

State of Ohio

County of Franklin, to-wit:

Taken, subscribed, and sworn to before me this 12th day of December, 2017.

My Commission expires ~~December~~ October 20, 2021.



ERIN SMART
NOTARY PUBLIC - OHIO
MY COMMISSION EXPIRES
OCTOBER 20, 2021

NOTARY PUBLIC [Signature]

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APPENDIX A – RESUMES

APPENDIX B – PROJECTS

1. STAFF QUALIFICATIONS AND EXPERIENCE

Tetra Tech, Inc. has a long and successful history of providing planning and design services for dam safety projects across the country. Clients include Departments of Natural Resources in multiple states, over 30 Corps of Engineers Districts, Natural Resources Conservation Service (NRCS) offices, municipalities, conservancy districts and other dam owners. Tetra Tech has assembled a team that offers West Virginia Division of Natural Resources (WVDNR) an experienced professional group with expertise to effectively respond to the contract requirements. The following list summarizes the specialized abilities and experience of the project team that uniquely qualifies it for this important project.

- ◆ A local and centralized Tetra Tech office to manage and provide design services and construction administration for the project.
- ◆ An experienced Contract Manager that is extensively familiar with dam design, modifications, and dam safety concepts.
- ◆ Charleston-based firm to provide drilling and laboratory services, land surveys, assist with environmental permitting, and perform the construction administration services.



Tetra Tech has assembled a comprehensive team of highly-qualified and experienced professionals to provide the complete range of skills and disciplines that will be necessary to prepare the design and perform the construction administration services. The Organization Chart in Section 2 shows personnel assigned to this project. Senior experts have been assigned to the team for each of the anticipated disciplines. Perhaps most noteworthy is the work experience the Contract Manager has with dam design and other water resource related work. Resumes in Appendix A provide more details for the proposed team members and brief bios of key personnel are shown below.

Triad Engineering, Inc. (Triad) is an employee owned, regional consulting firm based in West Virginia that provides professional services in the areas of civil, environmental, geotechnical engineering; site assessment; planning and landscape architecture; geology and hydrogeology; surveying and mapping; construction inspection; and related services. Through their 40 years of service in West Virginia and surrounding states, both the number and complexity of these projects have grown. Their clients include Federal and State governmental agencies, mining and industrial corporations, contractors, architects, engineers, attorneys, developers, and commercial organizations. Triad currently includes a staff of nearly 200 personnel located in seven offices: Hagerstown, Maryland; Pittsburgh, Pennsylvania; Ashburn and Winchester, Virginia; Athens, Ohio; and Morgantown and St. Albans (Scott Depot), West Virginia.

For this project, Triad will be responsible for the survey, drilling/laboratory services, and assisting with the construction administration of the projects. It is anticipated that Triad's percentage of the work would be substantial and would range from 40% to 50% of the contract value.

Smart Services, Inc. has over 25 years of experience in the surveying field and environmental permitting consisting of but not limited to boundary surveys, topographic surveys, construction staking and preparation of record documentation such as subdivision platting, writing legal descriptions for roadway dedications, property descriptions, easement descriptions, 401/404 permits, and Section 106 applications. The firm is licensed in the State of Ohio as a surveying firm; EDGE-certified with the State of Ohio; and prequalified by ODOT for limited right-of-way plan development. Tetra Tech has worked with Smart Services on past projects in the Portage Lakes System and this subcontractor is familiar with Tetra Tech's procedures and policies.

For this project, Smart Services will be responsible for the environmental permitting for the projects. It is anticipated that Smart Services percentage of the work would be 2% to 3% of the contract value.

a. Contract Management Lead

With over 30 years of experience with dam rehabilitation design, Pete Nix, P.E. will serve as the Contract Manager for the Tetra Tech team. His experience includes managing improvement designs for two of the Ohio's largest dam projects: the dam at Buckeye Lake and the four high-hazard dams at the Portage Lakes State Park, two of which were armored with roller-compacted concrete (RCC) for overtopping protection. Mr. Nix has worked on every Corps of Engineers dam within at the State of West Virginia through his career and he has an extensive understanding of dam safety issues and current dam design practice. In addition, his geotechnical background makes him especially suited for projects with difficult subsurface conditions, stability problems, or seepage issues.

Mr. Nix is also very experienced handling projects with multiple projects. He is wrapping up the work on the Portage Lakes Project which consists of the repairs to three dams. The design work on all three designs ran concurrently through the duration of the project.

As Contract Manager, Mr. Nix will ensure that the appropriate resources are applied to each design and construction administration element, quality requirements are satisfied, schedules are met, and budgets are effectively controlled. In his management of numerous dam projects, Mr. Nix has developed a track record of delivering quality solutions on time and within budget.

b. Project Manager

David Moore, PE has over 20 years of experience with dam design and analysis and has worked on over 100 dams across the United States. He has served as a project manager on numerous dam safety rehabilitation projects since 1998 and has managed dam safety design and construction contracts and projects for multiple clients including; the U.S. Army Corps of Engineers, Ohio Department of Natural Resources, Indiana Department of Natural Resources, Muskingum Watershed Conservancy District, Puget Sound Energy and many other owners. Project types have included new dam designs, embankment armoring, spillway modifications, structural improvements, and decommissioning to meet dam safety criteria. Mr. Moore, assisted by Smart Services staff, would also be responsible for any environmental permitting required for the projects.

Mr. Moore is also very experienced in managing projects with multiple dams. He was the manager for a project recently completed for the Muskingum Watershed Conservancy District (MWCD). The project consisted of the evaluation and design repairs for four dams originally constructed by the NRCS but now owned and operated by MWCD.

c. Other Technical Staff

Tetra Tech has assembled a team of experienced interdisciplinary managers, engineers, and scientists to provide the services anticipated to be required under this RFQ. The organization chart on the following page, resumes in Appendix A, and example projects in Appendix B, demonstrate our understanding and capabilities to execute the project requirements. Beginning with the Contract Manager, Pete Nix, we have provided specialists in every discipline needed to provide the required dam-related services for the project.

We have presented the key personnel who we anticipate will provide the various engineering, design, and construction management services for the projects. These personnel shown have been selected based on their experience with these types of projects and the anticipated work items. However, the proposed project team is also supported by a large number of qualified personnel who can be made available to meet the requirements of any concern or design issue that may arise during the course of the projects.

Quality Assurance / Quality Control. Mr. Donald (Don) Thompson of Tetra Tech will lead the QA/QC efforts for the project. Mr. Thompson has over 40 years of experience with dam designs, evaluations, and inspections. Mr. Thompson will be aided by Mr. Ike Pace and Mr. David Meadows.

Mr. Ike Pace has nearly 20 years of experience with civil works projects and recently managed the QA/QC reviews for the Portage Lakes projects #4 and #6 of our example projects.

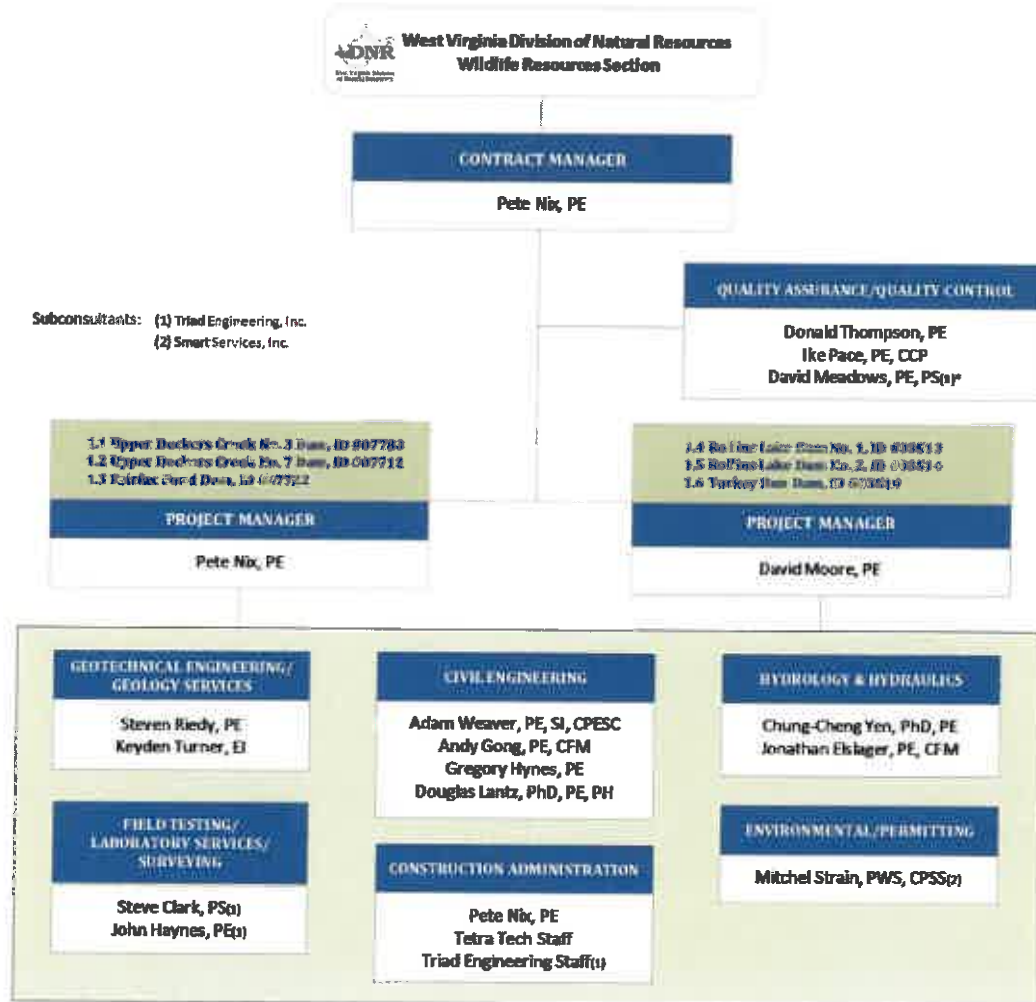
Mr. David Meadows brings over 40 years of leadership, design, construction and project management experience to Triad Engineering and will serve as the quality control reviewer for the project. Mr. Meadows joined Triad in 2013 to provide management to the southwest region which includes the southern West Virginia area and the Athens, Ohio office. Prior to coming to Triad he served in a number of technical and leadership positions at the US Army Corps of Engineers, Huntington District. His expertise includes civil design, geotechnical engineering, construction management, surveying, environmental remediation and water resources engineering.

d. Construction Administration

Construction administration will be performed by staff from Tetra Tech's Fairmont, WV office and Triad's Charleston office due to their proximity to the sites and their significant experience with dam repairs and modifications across the state. However, all of the construction administration services will be performed under the guidance of the Contract Manager, Mr. Nix.

2. PROPOSED STAFFING PLAN

a. Organization Chart



b. Team Organization and Staffing Plan

The organization chart demonstrates proposed project communication and organization for this project. Pete Nix, P.E., the Contract Manager, has the responsibility for ensuring that all company resources are made available to the project team, overseeing financial performance of the project, and coordinating the work with WVDNR. Quality Assurance/Quality Control will be provided by Mr. Donald Thompson, Mr. Ike Pace, and Mr. David Meadows. They will oversee the dam safety, civil design, and hydrology and hydraulics quality control. All three have significant and extensive experience on large, complex, water-resource projects. Additional details regarding our approaches to Project Management and Quality Assurance are detailed in the following paragraphs.

Project Management. Tetra Tech strongly supports regular project reporting and communication. At a minimum, we suggest written monthly progress reports throughout the duration of the project. However, we will communicate with WVDNR on whatever schedule and by whatever means requested to keep the Division informed about the progress of the work.

Tetra Tech also understands the complexities and sensitivities of these projects and their impacts on local stakeholders, communities, property owners, and businesses. All of our field activities will be performed with these sensitivities in mind, especially since the facilities are recreational in nature and regularly used by the public. All field work would be coordinated with any local parks personnel in addition to the WVDNR project manager.

Quality Assurance. As mentioned above, quality control will be performed by Mr. Donald Thompson, Mr. Ike Pace, and Mr. David Meadows of Triad. The proposed quality assurance program is designed to:

- ◆ Actively include all levels of project management in the quality assurance and control program.
- ◆ Ensure that quality assurance and control is an integral part of the project and not just an "end of job" review. We believe this is critical to providing a quality deliverable to the client, on time and within budget.
- ◆ Consider quality objectives and standards as equal or superior to budget and schedule considerations in all project management decisions.
- ◆ Review adequacy of budgets and schedules for performing the work.
- ◆ Commit necessary resources to achieve the project objectives.
- ◆ Ensure frequent and regular communication on progress of the work, problems, and accomplishments.
- ◆ Provide periodic review of project performance related to the planned schedule and budget goals.

Tetra Tech's quality control program requires that subcontractors provide their own quality control review. In addition, Tetra Tech provides quality assurance reviews of the subcontractor's products. When Tetra Tech provides any required quality control certification for its deliverables, it includes any work done by subcontractors.

c. Staff Availability

Staff assigned to this project have the following availability.

Name	Availability	Name	Availability
Pete Nix, PE	50%	Andy Gong, PE, CFM	40%
David Moore, PE	50%	Gregory Hynes, PE	50%
Donald Thompson, PE	30%	Doug Lantz, PhD, PE, PH	60%
Ike Pace, PE	40%	Chung-Cheng Yen, PhD, PE	40%
David Meadows, PE, PS (Triad)	40%	John Elslager, PE CFM	40%
Steven Riedy, PE	50%	Steve Clark, PS (Triad)	50%
Keyden Turner, EI	50%	John Haynes, PE (Triad)	50%
Adam Weaver, PE, SI, CPESC	50%	Mitchel Strain, PWS, CPSS (Smart)	50%

d. Additional Staffing Available

Discipline	Total Available to Team	Discipline	Total Available to Team
Biologist	529	Hydraulic Engineer	192
CADD Technician	202	Hydrographic Surveyor	23
Civil Engineer	591	Hydrologist	199
Construction Inspector	196	Land Surveyor	71
Construction Manager	672	Mechanical Engineer	517
Cost Engineer/Estimator	132	Soils Engineer	737
Ecologist	100	Structural Engineer	178
Economist	17	Water Resources Engineer	259
Foundation/Geotechnical Engineer	269	Cultural Resources Specialists	50
Geologist	373	Engineering Geologists	178
		TOTAL AVAILABLE STAFF	5,485
		TOTAL TETRA TECH STAFF	16,404

3. DESCRIPTIONS OF PAST PROJECTS

a. Experience with Similar Projects

This section and the projects presented in Appendix B demonstrate the Tetra Tech team's ability to deliver the analyses results, reports, final design documents, Emergency Action Plans (EAPs) and provide construction administration services for these types of projects. The paragraphs below present additional details regarding our team's relevant experience.

EXAMPLE PROJECTS / SELECTION CRITERIA MATRIX

Project #	Project Name	Dam Breach Analysis & Mapping	Monitoring & Emergency Action Plan	Maintenance Plan	Repairs	Seepage Monitoring & Analysis	Embankment Stability	Discharge/ Capacity Improvements	Certificate of Approval
1	Lake Lynn Dam – FERC Ninth Part 120 Inspection and Foundation Drain Report		X	X		X	X		
2	ODNR Statewide Dam Safety Design Services – Phase II	X	X	X	X	X	X	X	X
3	ODNR Dam Emergency Action Planning – Statewide Contract			X	X	X	X		X
4	ODNR Final Design of East Reservoir Dam Improvements (Akron, Ohio)	X	X	X	X	X	X	X	X
5	Parker Run Portals & Refuse – Rivesville, WV; Abandoned Mine Reclamation				X	X			
6	ODNR Final Design of Long Lake Dam Replacement (Akron, Ohio)	X	X	X	X	X	X	X	X
7	Muskingum Watershed Dam Safety Services, Chippewa Creek Subdistrict, Bethany Lake Dam Improvements Design;	X	X	X	X			X	X
8	Holmes County, Ohio				X		X	X	X
9	Sylvan Lake Spillway, Eagle, Colorado RCC for CPW				X	X	X	X	X
10	WVDNR Warden Lake Dam, Hardy County, West Virginia				X	X	X	X	X

Our dam design and rehabilitation experience includes embankment armoring (RCC and soil cement), RCC spillways, soil-cement lined spillways, gated spillways, ogee concrete spillways, earth/rock cut spillways, large diameter conduits, over 550 miles of levee design and inspection, relief well systems, toe drains, gate closures, pump stations and interior drainage. This experience extends to dam and levee safety program elements including inspections, evaluations and risk reduction planning. Our expertise includes risk assessment, inspections, levee certification, plan formulation, economic evaluations, environmental assessments, hydrologic and hydraulic evaluations, emergency action plans, geotechnical and geophysical analyses and design, and civil design of diversion structures, embankments, outlet works and primary and auxiliary spillways. We have extensive experience with geotechnical, structural, and hydrologic/hydraulic evaluations for analyzing dams and levee systems using both Corps of Engineers and local regulatory requirements.

Triad also has extensive and significant dam experience on projects across West Virginia, with numerous projects for WVDNR. This work includes investigations, evaluations, design, and construction administration.

Experience in hydrologic and hydraulic analyses. Tetra Tech's extensive experience allows us to review, and revise if necessary, any existing hydrologic and hydraulic models. This is often a critical step in the design or evaluation process of any project and David Moore, from Tetra Tech, will lead the hydrologic and hydraulic analyses. The proposed team has recently conducted similar hydrologic and hydraulic routings for the Portage Lakes System for ODNR as well as for three dams in the Chippewa Creek Subdistrict for the Muskingum Watershed Conservancy District.

The Tetra Tech team is highly experienced in performing hydrologic and hydraulic analyses for ODNR, NRCS, USACE, USIBWC, and other Federal Agencies. The Tetra Tech team has performed dam breach analyses for ODNR, NRCS, and other projects using a variety of methods. The breach hydrograph can be developed from NRCS methods in TR-60 and TR-66 or from physically based models such as the NWS BREACH program. We have also applied DAMBRK and the dam breach capabilities of HEC-RAS using empirical equations from historic dam failures to estimate breach dimensions and time of formation. Our experience has shown that all of these methods, combined with appropriate sensitivity analyses, can provide reasonable results.

Geotechnical analyses for dam safety evaluations and designs. Our geotechnical staff has extensive experience performing geotechnical evaluations and analyses for water resource and infrastructure projects. Uncertainty of geotechnical conditions presents significant risks to most water resource projects. Successfully managing the geotechnical aspects of any water resource project is often critical to the success of the entire project. At Tetra Tech, our geotechnical engineers have the experience and knowledge to investigate, evaluate, and formulate geotechnical solutions for any subsurface condition, reducing risk exposure to our clients. Our experience encompasses dam and levee inspections; subsurface explorations and in situ testing; instrumentation programs; investigation, evaluation and design of new dams; dam rehabilitations and modifications; embankment armoring (roller-compacted concrete, soil cement, and proprietary systems).

Our geotechnical staff typically uses the load cases and safety factor requirements from the Corps engineering manuals related to stability analyses. For seepage analyses, we typically use the guidance and requirements from the Corps' various engineering manuals and technical letters related to seepage analyses, internal erosion, and piping. NRCS standards are used for filter designs and spillway erodibility studies.

Experience construction administration of dam-related projects. As mentioned above, Triad will be responsible for the construction administration on the project. As shown on the projects presented at the end of Appendix B, Triad has significant construction management experience for projects such as these.

Experience in applying for and obtaining regulatory permits for dam-related projects. Tetra Tech project staff routinely work with the USACE, Huntington District on permitting issues. Our relationships with agency staff and understanding of the permit process have allowed us to successfully permit projects in a timely fashion.

b. Budget and Schedule Management

Mr. Nix, the Contract Manager, has extensive experience on similar projects to those included in the Expression of Interest. While dam safety is paramount, recreation and public access will have to be considered in the design along with the interests of other stakeholders. A successful project will solve the dam safety issues while balancing all of these needs and performing the work on time and within the project budget.

The project team has the capacity to readily perform the design work by virtue of its large qualified staff, active quality control programs, available equipment, planning tools, and standardized procedures developed during past projects. Tetra Tech's schedule and cost controls, combined with specific project management procedures used on previous dam projects, will be employed to ensure on-time and on-budget performance. The team provides a proven track record of success in managing multi-task projects and meeting schedules and budgets.

4. ADDITIONAL REQUESTED INFORMATION

Project No.	PROJECT NAME	ENGINEERING & DESIGN		CONSTRUCTION		
		FEE Estimate Met (Y / N / NA)?	SCHEDULE Delivered on Time (Y / N / NA)?	BUDGET Bidding Within 10% (Y / N / NA)?	BUDGET Completed Work Within Budget (Y / N / NA)?	SCHEDULE Completed as Scheduled (Y / N / NA)?
1)	Lake Lynn Dam – FERC Ninth Part 12D Inspection and Foundation Drain Report	Y	Y	NA	NA	NA
2)	ODNR Statewide Dam Safety Design Services – Phase II	Y	Y	See Individual Task Orders (TOs)	See Individual Task Orders (TOs)	See Individual Task Orders (TOs)
TO1	Guilford Lake Dam; Columbiana Co., OH	Y	Y	Y	Y	Y
TO2	Zepernick Spillway Improvements; Columbiana Co., OH	Y	Y	Y	Y	Y
TO3	East Reservoir Dam Seepage Repair; Summit Co., OH	Y	Y	Y	Y	No Schedule Developed
TO4	East Reservoir Dam Preliminary Design; Summit Co., OH	Y	Y	NA	NA	NA
TO5	Stockport Dam Repair; Morgan Co., OH	Y	Y	Y	Y	No Schedule Developed
TO6	GLSM Lake Drain Rehabilitation and Construction Administration; Mercer Co., OH	Y	Y	Y	Y	Y
TO7	North Reservoir Dam Preliminary Design; Summit Co., OH	Y	Y	NA	NA	NA
TO8	Zanesville Lock No. 10 Levee Conduit Grouting; Muskingum Co., OH	Y	Y	Y	Y	Y
TO9	GLSM Parapet Wall; Mercer Co., OH	Y	Y	Y	Y	Y
TO10	Conservation Pond Dam No. 4; Harrison Co., OH	Y	Y	Y	Y	Y
TO11	Trimble Dam Breach; Athens Co., OH	Y	Y	NA	NA	NA
TO12	Conservation Pond Dams No. 1 & 2; Harrison Co., OH	Y	Y	NA	NA	NA
3)	ODNR Dam Emergency Action Planning – Statewide Contract	Y	Y	Y	Y	Y
4)	ODNR Final Design of East Reservoir Dam Improvements (Akron, Ohio)	Y	Y	Y	Ongoing	Ongoing
5)	Parker Run Portals & Refuse – Rivesville, WV; Abandoned Mine Reclamation Design; Monongalia County, West Virginia	Y	Y	Y	Y	Y
6)	ODNR Final Design of Long Lake Dam Replacement (Akron, Ohio)	Y	Y	Y	Y*	Y*
7)	Muskingum Watershed Dam Safety Services, Chippewa Creek Subdistrict, Ohio	Y	Y	Ongoing	Ongoing	Ongoing
8)	Bethany Lake Dam Improvements Design, Holmes County, Ohio	Y	Y	Y	Ongoing	Ongoing
9)	Sylvan Lake Spillway, Eagle, Colorado RCC for CPW	Y	Y	Y	Ongoing	Ongoing
10)	WVDNR Warden Lake Dam, Hardy County, West Virginia	Y	Y	Y	Y	Y

The following sections present the additional information requested in the RFQ.

a. The successful firm or team should demonstrate a clear procedure for communication with the owner during all phases of the project.

Tetra Tech recognizes that clear and regular communications between the team members and the owner are critical to the success of any project. Consequently, the sole point of contact for the Tetra Tech team will be the proposed Contract Manager, Mr. Pete Nix. Tetra Tech commits that Mr. Nix will remain the point of contact throughout all phases of the project, including the construction administration services and project close outs.

At the start of every project, Tetra Tech develops a brief project management plan (PMP) that is created with the input and consultation of the owner at a kickoff meeting for the project. The PMP presents the key personnel on the project, contact information, and the communications protocols that are to be used on the project. Since different owners have different requirements, Tetra Tech tailors the communication protocols to the owner's needs. This can range from weekly phone calls with an agenda/minutes, email updates or progress reports at regular intervals, to regularly scheduled meetings at the owner's office or the job site with an agenda/minutes. We invite and encourage you to call the Contact for each of our example projects for additional information on our work for our clients.

b. The successful firm or team should demonstrate a history of projects that met the owner's budget and a clear plan to ensure this project can be constructed within the project budget.

Tetra Tech prides itself on meeting all of our clients' needs, especially accomplishing the design and construction work within budgets. Since 2011, Tetra Tech has held a dam safety services contract with the Ohio Department of Natural Resources (ODNR), Division of Engineering. The contract value through 2015 was \$690,000 and a total of 18 task orders were performed by Tetra Tech on the contract. All of the task orders were completed within the allotted budgets for the projects.

Currently, at Portage Lakes for ODNR, Tetra Tech is designing repairs to three dam projects: a 105-foot long Class II gate structure and two high hazard embankment dams with a total construction budget of approximately \$72M. The gate structure and the first embankment will be completed on time and within the owner's budget. The third high-hazard also appears to be on track to be completed within ODNR's budget.

For the construction budget, Tetra Tech's cost estimating staff would evaluate the proposed construction cost to determine if there are any concerns, constraints, or other items of note. If this evaluation indicates any concerns, they can be addressed before construction begins so that the project budget is set accordingly.

c. The successful firm or team should demonstrate a history of projects that have been constructed in the time allotted in the contract documents and a clear plan to ensure this project will be constructed within the agreed construction period.

As mentioned above, Tetra Tech held a dam safety services contract with the Ohio Department of Natural Resources (ODNR), Division of Engineering. The contract value through 2015 was \$690,000 and a total of 18 task orders were performed by Tetra Tech on the contract. Four of these project involved construction or repairs to ODNR dams. All four of the projects were completed within ODNR's allotted time frame.

We would note that the one Portage Lakes project which has been completed was constructed within ODNR's allotted schedule. The second repair, which includes the rehabilitation of the entire dam, is also on track to be completed within the project time schedule.

In addition, both Tetra Tech and Triad have numerous dam and water-resource related projects that have been constructed within the agreed construction period. Our plan to accomplish this on this project is presented below.

1. As in initial step in the project but prior to finalizing the construction plans, we would request a meeting with the WVDNR personnel responsible for each project to discuss their requirements and operational needs. The intent would be to understand any recreational constraints that might impact the construction schedule.

2. We would evaluate the anticipated construction techniques and methods to determine if the proposed schedule could be met. As part of this evaluation, we may suggest other features, components, or techniques that could be considered and the construction documents revised accordingly. The result of this evaluation would be a schedule that can be used during construction.
 3. Finally, construction progress would be monitored against this construction schedule with appropriate milestones so that any lags or issues can be addressed quickly, before significant delays occur.
- d. **The successful firm or team should demonstrate competent and acceptable experience in all expected professional disciplines necessary for the design and completion of the project.**

Based on our review of the project information, the Tetra Tech team has all of the disciplines anticipated to be required for the project. Our experience is documented on the staff resumes and representative project descriptions in the Appendices.

In addition, as a national company with numerous offices within a day's drive of Charleston, Tetra Tech has the resources available to address any changes to the scope or accelerations to the schedule. As the contract manager, Mr. Nix has the authority to evaluate the project's resource needs and direct Tetra Tech staff as needed to meet the project requirements.

5. TECHNICAL APPROACH AND SCHEDULE

Tetra Tech's approach to the project is based on the anticipated scope of services for the projects and the desire to complete the work as quickly and efficiently as possible. We will divide the six dams by county into two groups of three. Mr. Nix will manage the work on three dams while Mr. Moore will manage the work on the other three dams.

Tetra Tech has the resources to execute and complete the work on all six dams concurrently. We routinely work on multiple projects concurrently for dam safety and water resource projects.

The table below indicates the hazard classifications, and the items of work for each project anticipated in Phase 1 and Phase 2. Details on our approach to the project follow the table.

Dam Name	Phase 1				Phase 2				
	Hazard Class	Dam Breach Analysis & Mapping	Monitoring & Emergency Action Plan	Maintenance Plan	Repairs	Seepage Monitoring & Analysis	Embankment Stability	Discharge/Capacity Improvements	Certificate of Approval
Upper Deckers #3 Dam	1	X	Update	X	X	X		**	*
Upper Deckers #7 Dam	1	X	Update	X	X	X		**	*
Fairfax Pond Dam	Unknown	X	X	X	X		X	**	X
Rollins Lake #1 Dam	2-Estimated	X	Update	X	X	X		**	X
Rollins Lake #2 Dam	2-Estimated	X	Update	X	X	X		**	X
Turkey Run Dam	1	X	Approved	X	X		X	**	X

* - Pending Review

** - Pending Hydraulic Capacity Analysis and Hazard Class Determination

It is understood that the final goal for the project is to obtain Certificates of Approval for all six dams. However, the need for Certificates of Approval for the two Upper Deckers Dams is currently under review by WVDEP. Regardless, there are several individual items of work that will have to be completed for each of the projects, as shown in the table above.

Phase 1 Technical Approach

The work items to be completed in Phase 1 consist of the following:

- ◆ Dam breach analyses and inundation mapping
- ◆ Update the monitoring and emergency action plans
- ◆ Prepare maintenance plans for each project

The steps in our approach to complete Phase 1 would consist of the following:

1. Literature Review
2. Site Visit and Hazard Class Confirmation
3. Kickoff Meeting at WVDEP
4. Survey
5. Dam Breach Analyses
6. Inundation Mapping
7. Monitoring and Emergency Action Plans
8. Maintenance Plan

Details in these steps of the technical approach are described in the following sections.

Literature Review

The literature review would consist of reviewing all available information regarding each dam. It is anticipated this information would consist of previous inspection reports, maintenance records, subsurface information, generalized geologic references, and any previous design or analyses reports. Google Earth would be used to check the downstream hazards. The goal would be to identify any data gaps that would need to be addressed at the start of the project.

Site Visit and Hazard Class Confirmation

Following the literature review, each dam would be inspected by a Tetra Tech geotechnical engineer and a Tetra Tech dam safety engineer. The intent of the site visit would be to observe the condition of the project prior to starting the work. In addition, the engineers would drive and observe the stream downstream of the project to confirm the findings from the literature review and to determine the current hazard class of each dam.

Kickoff Meeting at WVDEP

Following the site visits, we would recommend a meeting with WVDEP to discuss the findings from the literature review and site visits, including our recommendations for the hazard class of each project. We would also discuss any changes to the anticipated work items based on the findings or conditions. Since the subsequent work items will depend on these findings, we believe this kickoff meeting is very important to the success of the project.

Survey

The next task performed will be the survey at each project. If previous surveys are available, the scope for the survey services would only be to identify and confirm important measurements and elevations, such as spillway crests, outlet pipes, and embankment limits.

Field surveying will also be necessary to perform hydraulic calculations for dam break analyses. We will develop cross sections downstream of the dam and assess spot elevations at critical locations within the floodplain. We may have to obtain cross sections at regular intervals a considerable distance downstream in order to satisfy flood routing requirements. All field surveying will be performed by Triad field crews with locations and elevations tied to GPS points.

Dam Breach Analyses

Our typical approach in preparing a dam or levee breach analysis includes review of existing data including as-built drawings, geotechnical data and analyses, aerial photographs, and topographic mapping, followed by field reconnaissance of the embankment, outlet works, spillways, and the potentially affected reaches downstream. Dam breach characteristics including the failure mechanism (piping breach versus overtopping breach), breach dimensions (depth, bottom width, and side slopes), and breach-failure time can be developed using the physically based BREACH model from the National Weather Service or empirical relationships developed from historic dam failures. Several empirical relations, including those by Froehlich and MacDonald, Langridge-Monopolis, are cited in the DAMBRK User Documentation. In past projects, Tetra Tech has also used empirical relations for breach parameters developed by Von Thun and Gillette and the Federal Energy Regulation Commission (FERC). Breach parameters are developed for the Sunny-Day breach in which the dam is assumed to be filled to some level, usually the crest of the emergency spillway, and for an event-based flood, such as the PMF, that results in flows through an emergency spillway or flows that overtop the dam. Sensitivity analyses are conducted to compare differences in peak discharge and travel time to changes in the breach parameters. In addition, breach peak discharges are checked against empirical relations developed by Hagen, Froehlich and the NRCS.

Inundation Mapping

Tetra Tech has extensive experience in developing hydraulic models that will dynamically route the dam-breach hydrographs to the appropriate outfalls. In keeping with "Dam Inundation Mapping Procedures Regulations" provided by the California Office of Emergency Services (OES), we use DAMBRK or FLDWAV to generate the breach hydrograph and to route it through an initial reach to account for rapidly varying flows. From that point on, the dam-breach hydrograph can be dynamically routed through a using the 1-dimensional unsteady version of HEC-RAS, or a 2-dimensional, unsteady-flow model such as FLO-2D. Both HEC-RAS and FLO-2D lend themselves to developing GIS-based flood inundation mapping, and the preferred model can be selected after review of the available mapping and field reconnaissance.

5. Prepare Certificates of Approval

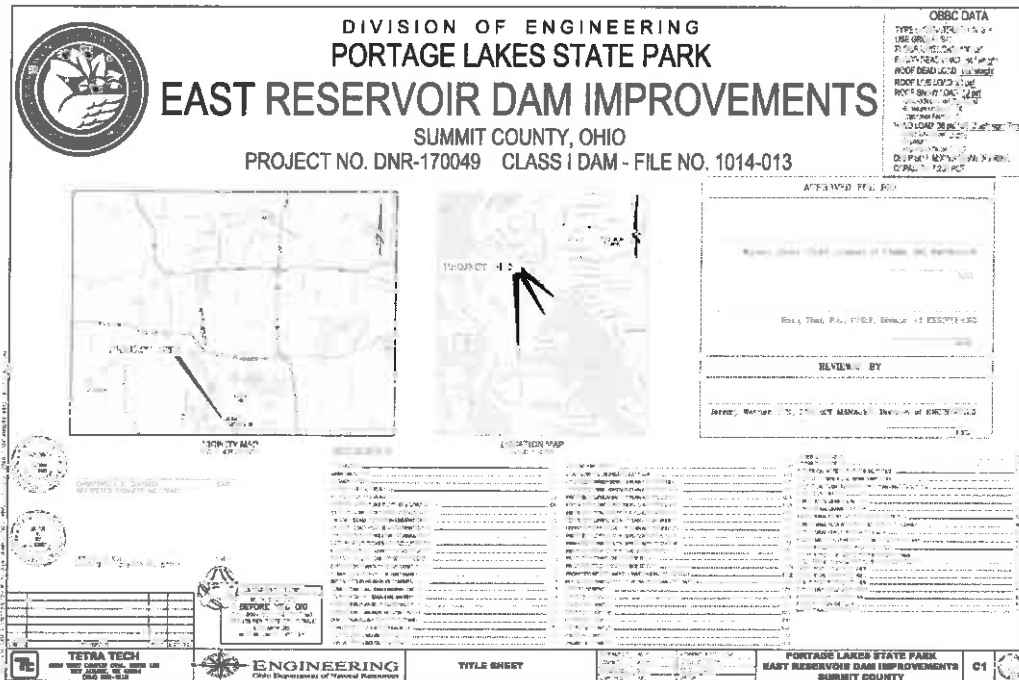
Details in these steps of the technical approach are described in the following sections.

Preparation of Construction Documents

Based on the results of the Phase I work, we will prepare a complete package of construction drawings and technical specifications which will be sufficient for the West Virginia State Purchasing Department to secure competitive bids for any modification work. We anticipate that the construction drawing package would include the following:

- ◆ Cover Sheet
- ◆ Plan of Existing Conditions
- ◆ Site Plans with Planned Modifications
- ◆ Profile Along Centerline(s) and Typical Section with Notes
- ◆ Plan(s) and Profile(s) of Outlet Structures
- ◆ Cross-Sections
- ◆ Erosion and Sediment Control Measures
- ◆ Construction Details

Technical specifications will address materials and methods which must be followed for the construction. Technical specifications for any modifications are required as part of the documentation which must be submitted to the Dam Safety Division.



We would note that repair work could occur within the streams or reservoirs, possibly requiring permits from the WVEPA and the Corps of Engineers. Any permitting work would be performed by Mitch Strain, of Smart Services. Mr. Strain has worked with state EPA offices on numerous permit applications. Mr. Strain worked for several years in the regulatory branch of the Huntington District Corps and is very familiar with the staff there.

Construction Administration Services

Bidding Services. Tetra Tech realizes the importance of having involvement from the design agency in order to respond to inquiries or changes to Final design documents in an efficient manner. Tetra Tech will provide bidding services as requested by WVDNR in an effort to ensure this vital continuity through the construction phase. Efforts during this phase of the project may consist of the following:

- ◆ Tetra Tech will attend the pre-bid meeting in order to answer Contractor questions during the bidding phase and prepare all addenda.
- ◆ Tetra Tech will assist in the evaluation of bids and recommendation of award of the construction contract(s) if requested by WVDNR.
- ◆ Tetra Tech will assist in the preparation of revised construction documents and estimates of probable construction costs for rebidding the project, if requested by WVDNR.
- ◆ Tetra Tech will review and provide recommendations to approve or reject any pre-construction submittals provided by the lowest responsive and responsible bidder, as determined by WVDNR.

Pre-Construction Meetings. Tetra Tech will support WVDNR at pre-construction meetings with the contractor. The purpose of the pre-construction meeting will be to cover the following items:

- ◆ Technical submittals and samples
- ◆ Required permits
- ◆ Material testing and inspection requirements
- ◆ Required pre-construction submittals
- ◆ Various administrative tasks (communication protocols, minutes, etc.)

Construction Phase Services. During the construction phase of the project, Mr. Nix will review and process the following: shop drawings and other submittals, contract modifications, contractor pay requests, and construction claims. If necessary, Mr. Nix and the design staff will interpret or clarify the contract documents for WVDNR or the Contractor.

Mr. Nix will assist WVDNR, if necessary, regarding any contractual issues or concerns that arise during construction. These issues or concerns could include lien affidavits, the Contractor's workmanship, materials, progress, and overall compliance with requirements of the Contract Documents, contract termination, and project acceptance and close-out. After the project is completed, Mr. Nix will obtain the original drawings from WVDNR, incorporate all as-built conditions on the original drawings, and return them to WVDNR at project close-out.

Project Representative. Tetra Tech will assign a project representative to the project who will report directly to the project manager. Tetra Tech's Project Representative will be present at the sites as needed and requested by WVDNR. If needed, the project representative can be on site full time throughout construction. He will observe, record, and report the progress and degree of compliance of each Contractor working at the site. All construction observations will be recorded in a daily log, which will be submitted to WVDNR at the project close-out. Construction administration phase tasks to be performed by the Project Representative are described in more detail below.

Schedules. The Project Representative will review and document the Contractor's proposed schedule of technical submissions, and any specific deadlines associated with these schedules. He will also review and familiarize himself with all of the permit and

regulatory requirements for the project, and monitor and document the Contractor's compliance with those requirements.

Conferences. The Project Representative will attend all project meetings as required. The Project Representative will prepare and distribute the agendas and minutes for each meeting.

Site Visits and Construction Observation. Site visits will be made by the Project Representative to observe, document, and report to WVDNR and the Contractor whether the project is being constructed in accordance with the contract documents.

Our Project Representative will develop and implement a communications protocol acceptable to WVDNR to communicate with the Contractor. If any work is found to be unsatisfactory, faulty, or otherwise does not conform to the project requirements, our Project Representative will immediately contact Tetra Tech's Project Manager who will immediately notify WVDNR's Project Manager.

Additional Project Representative Tasks. The following additional tasks may also be performed by the Project Representative during the construction phase.

- ◆ Coordinate and document all required Contractor submittals
- ◆ Document that laboratory and field testing is being performed as required
- ◆ Assist with construction modifications
- ◆ Maintain complete and current files and documentation at the Project site
- ◆ Prepare and submit Monthly Reports
- ◆ Assist and advise WVDNR regarding the Contractor's pay requests
- ◆ Verify the suitability of certifications and O&M Manuals
- ◆ Assist and advise WVDNR regarding the Contractor's substantial/final completion request

Seepage and Stability Analyses

Seepage analyses will be performed for four of the embankments using the data obtained from the field survey work and any available subsurface information. It is anticipated that borings and laboratory testing may be required for analyses of the two high hazard structures. Two of the project will be evaluated for stability using the data obtained from the field survey work and any available subsurface information. As with the seepage analyses, borings and laboratory testing may be required since one of the two projects is a high hazard structure and the hazard class of the second project will have to be determined.

If borings are required for the work, Triad would perform the drilling and laboratory testing services. Borings would be drilled and backfilled in accordance with WVDEP regulations. All of the drilling and sampling would be performed under supervision of a Tetra Tech geologist who would report directly to the dam's Project Manager.

The following conditions will be evaluated in the seepage and stability analyses:

- ◆ Downstream slopes, steady state seepage, normal pool level and maximum pool level (current top of dam), static and seismic conditions
- ◆ Upstream slopes, rapid drawdown conditions, static and seismic conditions
- ◆ Downstream slopes with possible modifications as required to address safety concerns, steady state seepage, normal pool level and maximum pool level (i.e., revised design), static and seismic conditions.

Design of Discharge Capacity Improvements

Based on the issues which are to be addressed and the unknown hydraulic conditions of the dams, hydrologic and hydraulic (H&H) analyses will be required to assess the relative safety of the structure and downstream area during storm events. The following H&H evaluations are planned, as a minimum:

- ◆ WVDE design storm precipitation to evaluate the approximate depth of overtopping of the current dam.
- ◆ Generation of various storms to develop a maximum water level equal to the current top of dam elevation.
- ◆ Evaluation of dam breach characteristics for overtopping condition based on soil parameters.
- ◆ Routing the discharges from various storms through the downstream area without overtopping or a dam breach to evaluate potential damage within the floodplain.
- ◆ "Sunny day" breach analysis of the dam with routing of the discharges through the downstream area to evaluate potential damage within the floodplain.
- ◆ Evaluation of alternatives for modification of the dam and/or outlet works for safe passage of the applicable design storm.

Prepare Certificates of Approval

The final step will be to prepare and submit the Certificates of Approval for each project to WVDEP for review and acceptance.

Project Schedule

For these six projects, we have developed the following generalized schedule based on our approach and the required work items for the projects. Note that work on all six of the projects would occur simultaneously.

By performing the work on all six projects concurrently, we anticipate having construction documents ready by the summer of 2018 so that any repairs can be completed within the 2018 construction season. Tetra Tech's proposed schedule is below.

Phase 1 Field Work	02/01/18 to 04/01/18
Phase 1 Engineering	03/01/18 to 05/01/18
Phase 2 Field Work	04/01/18 to 06/01/18
Plans/Specs Preparation	05/01/18 to 07/01/18
Construction Administration	06/01/18 to 11/30/18
All Certificates of Approval finalized by	12/30/18

APPENDIX A –

Key Dam Safety and Dam Design Team Resumes

EXPERIENCE SUMMARY

Mr. Nix is a senior geotechnical engineer and program manager with Tetra Tech. He has extensive experience with dam safety, water resource and flood control projects, including dam and levee designs and evaluations, dam and levee inspections, levee certifications, subsurface investigations, and instrumentation system designs. His work has also included geotechnical explorations, analyses and recommendations for locks and dams, large bridges, roadway alignments, landside repairs and other large civil works projects. He has significant experience with dam safety issues and has provided dam safety training to Corps of Engineer staff under their Dam Operations and Maintenance Personnel (DOMP) training program.

Mr. Nix is also currently the project manager for the Portage Lakes Dam Improvements Project for ODNR near Akron. This project includes the replacement of a 105-foot long gate structure on Long Lake and the improvements to both North Reservoir Dam and East Reservoir Dam. Both of these high-hazard, embankment dams have severe spillway deficiencies that must be addressed. The project consists of the final designs of these improvements which include construction plans, specifications, and cost estimates. Construction of the improvements is currently scheduled to begin in 2016 and continue into 2020.

Mr. Nix has worked with a variety of clients, including the U.S. Army Corps of Engineers, ODNR, IDNR, ODOT, MDOT, INDOT, North East Ohio Regional Sewer District, American Electric Power, FirstEnergy, municipalities, counties, and conservancy districts across the Midwest. He has been involved in dam, levee, and geotechnical engineering projects for the Detroit, Louisville, Chicago, Huntington, Buffalo, Chicago, Albuquerque, Portland, Seattle, Los Angeles, Omaha, and Pittsburgh Districts of the U.S. Army Corps of Engineers.

RELEVANT EXPERIENCE

Upper Seneca Pumped Storage Reservoir – FERC Part 12D Dam Safety Inspection, LS Power (2017). Independent Consultant. Mr. Nix served as the Independent Consultant for this Part 12D dam safety inspection of the Upper Seneca Pumped Storage Reservoir near Warren, PA. This hydropower project is part of Kinzua Dam on the Allegheny River.

Seepage Investigation – Lake Christine Dam Left Abutment, Colorado Parks and Wildlife (2017). Project Manager. Directed the investigation of seepage through the left abutment of Lake Christine Dam near Basalt, Colorado. The investigation consisted of three borings and piezometers to determine the location of the seepage through the rock abutment. The work also included the preparation of a seepage collection system on the downstream side of the abutment.

Viva Naughton Emergency Spillway, Kemmerer, WY (2017). Geotechnical Manager for the design of a new labyrinth spillway at Viva Naughton Dam in Kemmerer, WY. The new spillway will replace a 23-foot high fuse plug constructed in the project's original emergency spillway. The crest length of the new spillway will be approximately 350 feet. Mr. Nix was responsible for developing the subsurface exploration program in accordance with FERC guidelines and preparing a report that presented the geotechnical recommendations for the new spillway structure. These

EDUCATION

B.S., Civil Engineering, Ohio State University, 1984

AREAS OF EXPERTISE

Dam Safety
Dam Design and Rehabilitation
Geotechnical Engineering
Instrumentation
Seepage Control Features
Dam Operations and Maintenance

REGISTRATIONS/LICENSES

Professional Engineer, Ohio, No. 53557, Michigan, No. 40150, Kentucky, No. 23190, West Virginia, No. 21697, Colorado, No. 0051673

PROFESSIONAL AFFILIATIONS

Association of State Dam Safety Officials
United States Society of Dams

TRAINING/CERTIFICATIONS

Slope Stability and Landslides Workshop, University of Wisconsin-Madison; Roller-Compacted Concrete Dam and Dam Rehabilitation Technical Short Course, Portland Cement Association; Numerous Ohio River Valley Soil Seminars; Numerous Associations of State Dam Safety Officials (ASDSO) and United States Society of Dams (USSD) Conferences

OFFICE LOCATION

Columbus, OH

YEARS OF EXPERIENCE

32

YEARS WITH FIRM

7

recommendations included bearing values, sliding coefficients, and seepage cutoff requirements, as well as the design for the seepage collection system beneath the new spillway.

Emergency Embankment Repairs – Spring Creek Dam, Colorado Parks and Wildlife (2017). Senior Geotechnical Engineer. This high-hazard project has been plagued by significant seepage at the downstream toe since it was constructed in the 1980's. During an inspection of the project, it was noticed that the source of the seepage was an inlet (an old borrow area) that curved around the left abutment. Sinkholes or vertical fractures were present in the bottom of this inlet that allowed seepage to flow down the left abutment where it was exiting near the downstream toe. The solution for the seepage was a saddle dike constructed across the entrance to the inlet to prevent the reservoir from reaching these sinkholes or vertical fractures.

Hawks Nest Dam – FERC Part 12D Dam Safety Inspection, Brookfield (2017). Independent Consultant. Mr. Nix served as the Independent Consultant for this Part 12D dam safety inspection of the Hawks Nest Dam near Glen Ferris, WV.

Overtopping Design – Sylvan Lake Dam, Colorado Parks and Wildlife (2017). Dam Safety Technical Lead. This high-hazard dam near Eagle, Colorado has a spillway deficiency and cannot pass the design storm (PMF) without overtopping. The improvements to the project consisted of using roller-compacted concrete to armor the existing embankment. A challenge on the project was the topography and remoteness of the project. Dam safety issues addressed were seepage collection, scour downstream of the toe, and settlement of the proposed armoring and soil cover.

Dam Safety Fact Sheets, South Carolina – FEMA (2016). Senior Dam Safety Engineer. The rainfall event in the fall of 2015 caused a failure of several privately-owned dams in South Carolina. Under a contract with FEMA, Tetra Tech prepared brief, four page long fact sheets to provide to private dam owners in South Carolina to educate them about the responsibilities of dam ownership. The topics of the fact sheets were Dam Decommissioning, Owner Education Resources, and Overtopping Guidelines.

East Reservoir Dam – Final Design, Ohio Department of Natural Resources – Division of Engineering (2015-current). Project Manager. Mr. Nix serves as the project manager for this large project with ODNR. East Reservoir Dam is a state-owned, high hazard dam located in Summit County Ohio. The work consists of the preparation of the final design for the project, which includes the construction plans, specifications, and cost estimates for the preferred alternative solution to correct a severe spillway deficiency. Due to the presence of a road and utilities on the embankment, as well as additional local impacts, a new overtopping structure will be constructed in the lake just upstream of the existing embankment. This new overtopping structure will typically consist of sheet pile cells, capped with concrete. Modifications to the two outlet work structures will also be performed.

North Reservoir Dam – Final Design, Ohio Department of Natural Resources – Division of Engineering (2015-current). Project Manager. Mr. Nix serves as the project manager for this large project with ODNR. North Reservoir Dam is a state-owned, high hazard dam located in Summit County Ohio. The work consists of the preparation of the final design for the project which includes the construction plans, specifications, and cost estimates for the preferred alternative solution to correct a severe spillway deficiency. Due to development very near the downstream toe of the embankment, a new overtopping structure will be constructed in the lake just upstream of the existing embankment. Modifications to the spillway and outlet works will also be performed.

Long Lake Gate Replacement – Portage Lakes State Park, Ohio Department of Natural Resources – Division of Engineering (2015-2017). Project Manager. The project consists of the investigation, preliminary design, and final design of a new gate structure to replace an 80-year old gate that is in very poor condition. The existing gate is a 105-foot long concrete structure supported on timber piles. Six slide gates are provided to control flows. The investigation consisted of the survey and subsurface exploration for the new gate. The Preliminary Design consisted of the development of alternatives, preliminary structural and geotechnical evaluations and designs, the preparation of construction cost estimates, and the selection of a preferred alternative. Final Design will consist of the final plans, specifications and construction cost estimate for the gate replacement.

Muskingum Dam #7 Emergency Repair – The Ohio Department of Natural Resources (ODNR) (2015). Project Manager. The project involved an emergency repair to a low head dam in McConnelsville, Ohio to repair a dam failure. The existing structure consists of sheet pile cells capped with concrete that have failed at several locations. Tetra Tech developed a stabilization solution that consisted of a rock fill buttress on the downstream side of the current dam and grouting the interiors of the remaining sheet pile cells. Tasks included preparing construction documents (drawings, specifications, engineer's cost estimate) for the project and assisting the Department with construction bidding services.



EXPERIENCE SUMMARY

Since 1974, Donald (Don) Thompson has experience in licensing, design and construction management of hydroelectric power facilities. His technical experience includes FERC licensing and relicensing activities, FERC dam safety inspections, PMF and Inflow Design Flood analysis, dambreak analysis, single and multi-reservoir operation analysis, risk assessment, hydraulic analyses and design of structures such as dams, spillways, outlet works, intakes, gates, fish screens, tunnels, penstocks, canals, river improvements and related features associated with hydroelectric projects.

Don performs technical analyses as well as manages multi-disciplinary project teams involving hydropower generation, flood protection, fish passage facilities, fishery PME measures and dam safety under the jurisdiction of FERC and state dam safety agencies.

RELEVANT EXPERIENCE

Wynoochee, Nisqually and Cowlitz Independent Consulting Services for 5-year Inspection and Safety Reports; Tacoma Power; Various Locations, WA (2016)

Cowlitz Hydroelectric Project. Co-Independent Consultant for inspecting the Mossyrock and Mayfield Hydroelectric Projects, review of the Potential Failure Modes Analysis PFMA for each dam and the Supporting Technical Information Documents.

Nisqually Hydroelectric Project. Co-Independent Consultant for inspecting the Alder and LaGrande Hydroelectric Projects, review of the Potential Failure Modes Analysis PFMA for each dam and the Supporting Technical Information Documents.

Wynoochee Hydroelectric Project. Co-Independent Consultant for inspecting the Wynoochee Hydroelectric Project, review of the Potential Failure Modes Analysis PFMA and the Supporting Technical Information Document STID.

Viva Naughton Emergency Spillway, Kemmerer, WY (2017). Project Manager for the design of a new labyrinth spillway at Viva Naughton Dam in Kemmerer, WY. The new spillway will replace a 23-foot high fuse plug constructed in the project's original emergency spillway. The crest length of the new spillway will be approximately 350 feet.

Lake Lynn Part 12 D Inspection; First Energy Corporation; Lake Lynn, PA (2012). Assisted in conducting a FERC Part 12 independent dam safety inspection and Potential Failure Mode Analysis (PFMA) supplemental review. The PFMA investigated triggering events, the risk of each event, and the subsequent consequences leading to an uncontrolled reservoir release.

Dahla Dam Improvements Phase One; USACE, Middle East District; Kandahar Province, Afghanistan (2015). Project Manager for design of a new 1,900 cfs capacity concrete valve house, energy dissipation chamber, 4.6-meter diameter concrete encased penstock, and rehabilitation of the existing 4.6-meter square fixed-wheel intake gate, 70-ton hoist, and existing concrete encased penstock.

Shiroro Hydroelectric Dam Evaluation of Civil Structures Phase One; North South Power Company Limited; Kaduna River, Nigeria (2015). Project Manager for inspection and design of repairs at this 400-foot high by 2,300-foot long rockfill dam and 600-MW powerhouse. Repairs to the power intake structure and spillway training wall are needed. Also investigated causes of penstock leakage, cracks in the powerhouse floor, cracks

EDUCATION

BS, Civil Engineering, University of Washington (1974)

REGISTRATION/CERTIFICATION

Professional Engineer, Civil WA
License No. 18211 (1979)

YEARS OF EXPERIENCE

42 years

YEARS WITH TETRA TECH

5 years

OFFICE LOCATION

Bellevue, WA

AREAS OF EXPERTISE

Hydropower

Fish Passage Facilities

Project Management

Construction Management

Hydraulics/Hydrology

adjacent to the left tailrace training wall, left abutment slides, and rehabilitating existing dam instrumentation and designing an emergency spillway.

Panama Canal Third Set of Locks Design-Build Project; Panama Canal Authority (ACP); Cocolí and Gatún, Panama (2014). As Civil Design Lead, managed a team of engineers for reviewing final design drawings and fabrication shop drawings of large valves, bulkheads, steel plate liners and associated embedded parts. Also assisting with preparing the reliability, availability and maintenance system for the new locks, including event trees down to the failure of machine parts.

Merwin, Yale, and Swift No. 1 Hydroelectric Projects: FERC Nos. 935, 2071, and 2011 Supporting Technical Information Document Revision; PacifiCorp Energy; Lewis River, WA (2013). Assisted the FERC Part 12 Independent Consultant with review of the original Potential Failure Modes Analysis, and revised each Supporting Technical Information Document (STID) in response to comments from FERC. The PFMA investigated triggering events, the risk of each event, and the subsequent consequences leading to an uncontrolled reservoir release.

Bull Run River Dam No. 1 and 2 Safety Review; Portland General Electric (PGE); Bull Run River, OR (2013). Managed the FERC Part 12 Independent Consultant Dam Safety Inspection and PFMA Review of a 195-foot high concrete gravity arch dam and a 145-foot high clay core rockfill dam. Don reviewed the spillway rating curves and discovered a significant error in the rating curve for Dam No. 1 and developed a more efficient new rating curve which was accepted by FERC. Conducted new PMF studies for Bull Run Dam Nos. 1 and 2 utilizing the more efficient rating curve. Also conducted a dambreak analysis of Dam Nos. 1 and 2 through a 27-mile stretch of river to the Columbia River.

Merwin, Yale, Swift No. 1 Hydroelectric Projects Revision of PFMA Report and Supporting Technical Information Document; PacifiCorp Energy; Lewis River, WA (2012). Assisted the FERC Part 12 Independent Consultant with review of the original Potential Failure Modes Analysis, and revised each Supporting Technical Information Document STID in response to comments from FERC.

North Fork Dam Floating Surface Collector VE Study; Portland General Electric (PGE); Clackamas River, OR (2012). Conducted a Value Engineering workshop at the 25 percent design completion stage of development for a 1,000 cfs floating surface collector. Facilities reviewed included the hull, fish screen channel, on-board attraction flow pump arrangement, floatation, mooring, fish transport facilities, dam penetration, electrical building arrangement, access from the dam and overall constructability.

Kajaki Generating Equipment Condition Assessment; USAID; Kajaki, Afghanistan (2011). Conducted hydraulic design of adding eight 12-meter wide radial gates and piers to the ungated service spillway, including design of the stilling basin, tailwater control weir and emergency spillway. Total spillway capacity at the PMF level is 10,480 m³/s (370,000 cfs). In 2011, reviewed plans for rehabilitating the two existing 16.5-MW turbine/generator units and installation of a new single 18.5-MW unit.



EXPERIENCE SUMMARY

Mr. Pace has over 19 years of experience providing technical support to federal, state, municipal, and private clients in the areas of water resources management, planning and designing of levees, dams, cost estimating, river restoration, fish passage, flood control and flood mitigation analysis.

RELEVANT EXPERIENCE

Muskingum Watershed Conservancy District (MWCD), Chippewa Creek Subdistrict Dam Safety Services, OH. Performed independent technical review of civil design for Dam II-A and V-D. These two dams were designed and constructed by the NRCS and required preliminary engineering assessments and final design in order to safely pass the PMF (design storm for Class I dams in Ohio). The design included dam raising, earthen spillway modifications, erosion protection and site grading.

Dam Safety Services Contract, Ohio Department of Natural Resources – Division of Engineering, Various Locations, OH. Managed the cost estimating required for any of the work orders performed for this task-order based contract with ODNR to perform civil, geotechnical, hydrologic and hydraulic engineering in support of dam safety upgrades for dams owned by the state of Ohio on an as-needed basis. Work has been performed at Guilford Dam, East Reservoir Dam, North Reservoir Dam, Zepernick Dam, Stockport Dam (Lock and Dam Number 6) and Grand Lake St. Marys Dam.

Florence Flood Retarding Structure Rehabilitation Project, A&E Services, NRCS, Florence, AZ. Senior civil engineer for this project under contract with the NRCS Arizona State Office to provide final design to rehabilitate the Florence Flood Retarding Structure, a 5-mile-long, 25-foot-high earthen dam that provides flood control to the Town of Florence, Arizona and surrounding agricultural areas. Mr. Pace oversaw the preparation of the plans, specifications, construction quality assurance plan, and the engineer’s opinion of probable cost.

Sandia Mount Tributaries Site 1 (Piedra Liza Dam), Plans and Specifications; NRCS; Albuquerque, NM. Tetra Tech conducted design analyses and prepared plans and specifications for Sandia Mountain Tributaries Site 1 (Piedra Liza Dam) under contract to the Natural Resources Conservation Service – New Mexico State Office. Pre-design work included and Inflow Design Flood (IDF) analyses, extended earthen spillway analysis, and additional geotechnical borings. The design included enlarging the auxiliary spillway and placing roller-compacted concrete revetment, modifying the outlet of the principal spillway outlet with a pipe drop, installing a new baffle structure for the principal spillway inlet, and the addition of an access road. Mr. Pace was responsible for the preparation of structural analysis, construction plans, bid schedule and cost estimate.

East Reservoir Improvements Final Design, Ohio DNR. Performed quality control reviews of the civil engineering and cost estimating work for this project to correct a severe spillway deficiency at East Reservoir at Portage Lakes State Park. The construction cost estimate for the project was managed by Mr. Pace. Since a Construction Manager at Risk (CMAR) is being used for the project, the construction cost estimate is being reconciled with the CMAR's construction cost estimate to determine the Guaranteed Maximum Price (CMP) for the work.

EDUCATION

B.S. Civil Engineering, Utah State University, 1996

AREAS OF EXPERTISE

- Water Resources Management
- Planning and Designing of Levees
- Cost Estimating
- River Restoration
- Fish Passage
- Flood Control
- Flood Mitigation Analysis

REGISTRATIONS/LICENSES

- Professional Engineer, Civil, CA, License No. 59152 (1999)
- Professional Engineer, Civil, WA, License No. 37694 (2001)
- Professional Engineer, Civil, UT, License No. 318738-2203 (2001)
- Certified Cost Professional, AACE International No. 64484

OFFICE LOCATION

Irvine, CA

YEARS OF EXPERIENCE

19

YEARS WITH FIRM

18

EDUCATION

M., Civil Engineering
(Geotechnical), 1981, Virginia
Polytechnic Institute and State
University

MS, Civil Engineering, 1987,
West Virginia College of
Graduate Studies

BS, Civil Engineering, 1974,
West Virginia Institute of
Technology, Graduated Cum
Laude

PROFESSIONAL EXPERIENCE

40 Years

REGISTRATIONS & LICENSES

- Registered Professional Engineer (WV)
- Registered Professional Surveyor (WV)

SKILLS

- Management and Planning of all Civil Engineering Design Projects
- Environmental Assessments
- Surveying and Mapping
- Water/Wastewater Engineering Design Projects
- Construction Monitoring and Testing Operations
- Geotechnical Investigation
- Soils and Concrete Laboratory

HIGHLIGHTS OF EXPERIENCE

Mr. David Meadows, PE, PS, is Chief Executive Officer Southwest Regional Manager, and Senior Engineer of Triad. Mr. Meadows brings over 40 years of leadership, design, construction and project management experience to Triad Engineering. Mr. Meadows joined Triad in 2013 to provide management to the southwest region which includes the southern West Virginia area and the Athens, Ohio office. Prior to coming to Triad he served in a number of technical and leadership positions at the US Army Corps of Engineers, Huntington District. His expertise includes civil design, geotechnical engineering, construction management, surveying, environmental remediation and water resources engineering.

RELEVANT PROJECT EXPERIENCE

Triad Engineering, Scott Depot, WV

Mr. Meadows has played an important role in maintaining the technical quality and management of the region, while being very active in business development. Besides managing all phases of operations for the Scott Depot, WV and Athens, OH offices, Mr. Meadows is responsible for management and planning of all civil engineering design projects; environmental assessments; surveying and mapping; water/wastewater engineering design projects; construction monitoring and testing operations; geotechnical investigation projects; and soils and concrete laboratory work in the region.

US Army Corps of Engineers, Huntington, WV

Chief H&H and Technical Support Division, Great Lakes and Ohio River Dam Safety Production Center and Dam Safety Modification Mandatory Center of Expertise. Mr. Meadows was responsible for developing and directing the Division's efforts to manage the regional execution of complex, non-routine, regional and inter-regional dam safety modifications, engineering assessments and risk and reliability analyses throughout the infrastructure capital stock portfolio of the U.S. Army Corps of Engineers. He primarily accomplished this mission through twelve senior technical staff (Hydraulic, Cost and Construction Engineers) who oversaw all complex technical aspects of modification work. He directed their work and provided them with strategic leadership, mentoring, coaching, counseling, team building, partnering, direction and management.

Chief, Engineering and Construction Division. Mr. Meadows was responsible to the District Commander for the Engineering and Construction functions associated with creating synergy between water resource development and the environment as it pertained to the Civil Works Program; responded to local, national, and global disasters; and provided full spectrum engineering and construction support to a geographic area comprising 45,000-square-miles. The district infrastructure includes 35 major flood control dams, nine locks and dam, and 29 major local flood protection projects. He provided technical, management, and strategic advice on engineering and construction matters. He directed a diverse staff of 215 team members engaged in all of the district's engineering design, construction, dam safety, levee safety, water management, flood damage reduction, navigation, flood proofing, and environmental enhancement, restoration and rehabilitation projects.

EXPERIENCE SUMMARY

Mr. Moore is a Senior Project Manager and over 22 years of experience in managing and performing hydrologic/hydraulic engineering computations required in the planning, design, construction, operation, maintenance and inspection of multipurpose dams, levees, local flood protection projects, and navigation locks and dams. He is a FERC PFMA Facilitator and has completed studies and designs on over 300 dams and levees in the United States and abroad. These studies and designs have included dam and levee inspections, levee certifications, instrumentation and monitoring, discharge-capacity analyses, emergency spillway sizing, stilling basin analysis, dam failure analyses, failure inundation mapping, risk analysis, dam armoring, outlet works design and construction inspection.

RELEVANT EXPERIENCE

Upper Seneca Pumped Storage Reservoir – FERC Part 12D Dam Safety Inspection, LS Power (2017). Potential Failure Modes facilitator and civil engineer. Mr. Moore served as the a senior civil engineer during the inspection and facilitated the review of the PFM for this Part 12D dam safety inspection of the Upper Seneca Pumped Storage Reservoir near Warren, PA. This hydropower project is part of Kinzua Dam on the Allegheny River.

Dam Safety Fact Sheets, South Carolina – FEMA (2016). Quality Control Civil Engineering. The rainfall event in the fall of 2015 caused a failure of several privately-owned dams in South Carolina. Under a contract with FEMA, Tetra Tech prepared brief, four page long fact sheets to provide to private dam owners in South Carolina to educate them about the responsibilities of dam ownership. The topics of the fact sheets were Dam Decommissioning, Owner Education Resources, and Overtopping Guidelines.

Hawks Nest Dam, FERC Part 12 Inspection, Brookfield, Glen Ferris, West Virginia, 2017 - Served as co Independent Consultant and principal Hydrologic/Hydraulic Engineer. Mr. Moore prepared the Part 12 Inspection materials and the Potential Failure Modes Analysis (PFMA) as well as writing the PFMA Section of the Part 12 Inspection Report.

Lake Lynn Dam, FERC Part 12 Inspection/Foundation Drain Investigation, First Energy, Morgantown, West Virginia, 2012 - Served as principal Hydrologic/Hydraulic Engineer. Mr. Moore participated in the Part 12 Inspection and the Potential Failure Modes Analysis (PFMA) as well as writing the PFMA Section of the Part 12 Inspection Report.

Muskingum Watershed Conservancy District (MWCD), Chippewa Creek Subdistrict Dam Safety Services, Ohio, 2015-Present - Project Manager and senior hydrologic and hydraulic engineer for this master planning and design project. Phase I included preliminary hydrologic and hydraulic (H&H) analyses on three structures in the Chippewa Creek Subdistrict to check each dam's storage/discharge capacity using the new State of Ohio specific Probable Maximum Precipitation (PMP) values. In addition, Tetra Tech prepared Emergency Action Plans (EAPs) and Operation, Maintenance, and Inspection (OM&Is) Manuals for the three structures in accordance with OAC 1501:21-21-04. Two structures were not able to pass the design storm (50% Probable Maximum Flood (PMF)).

EDUCATION

M.S., Civil Engineering, Ohio University, 1993

B.S., Civil Engineering, Ohio University, 1991

AREAS OF EXPERTISE

Dam Safety
Dam Design and Rehabilitation
Dam Operations and Maintenance
Emergency Action Plans
Dam Breach and Inundation Mapping

REGISTRATIONS/LICENSES

Professional Engineer, Ohio, No. 62256

Professional Engineer, New York, No. 095522

PROFESSIONAL AFFILIATIONS

Society of American Military Engineers
Water Management Association of Ohio
Ohio Dam Safety Organization
Association of State Dam Safety Officials
United States Society of Dams

TRAINING/CERTIFICATIONS

Numerous Association of State Dam Safety Officials (ASDSO) and United States Society of Dams (USSD) Conferences

OFFICE LOCATION

Columbus, OH

YEARS OF EXPERIENCE

23

YEARS WITH FIRM

12



EXPERIENCE SUMMARY

Mr. Riedy is a geotechnical/civil engineer with Tetra Tech. He has experience with water resource and flood control projects. Water resource experience includes inspection and evaluation of dams, as well as design of spillway/outlet structures, seepage/stability berms, dam stabilization features, overtopping protection, Periodic Inspections (levees) and levee design and certification efforts for the U.S. Army Corps of Engineers (USACE), Ohio DNR, and other clients including the Miami Conservancy District (MCD) and various municipalities. Technical dam and levee engineering evaluations include slope stability, seepage, effective uplift, and settlement analyses.

RELEVANT EXPERIENCE

Muskingum Watershed Conservancy District (MWCD), Chippewa Creek Subdistrict Dam Safety Services, OH. Geotechnical Engineer responsible for seepage and stability analyses for the design of improvements to Dam II-A and V-D. The improvements included raising the dams as well as earthen spillway improvements and erosion protection. These two dams required preliminary engineering assessments and final design in order to safely pass the PMF (design storm for Class I dams in Ohio).

Muskingum Dam No. 10 (Zanesville) Levee Conduit Grouting, Ohio Department of Natural Resources (ODNR), Division of Engineering. Project Engineer. Mr. Riedy served as the project engineer for this project. This project consisted engineering services for planning and directing the work of the Contractor in order to repair seepage that was observed passing through an abandoned conduit that passed beneath a canal-era levee. The canal-side pool level is permanently higher than that of the river (~15 feet) due to the operation of the locks. In January 2013, large amounts of uncontrolled seepage were observed emanating on the levee slope, immediately above the location of the abandoned conduit. Tetra Tech along with representatives of ODNR developed the approach to grout the suspected void. The grouting plan consisted of drilling two boreholes through the top of the abandoned sandstone arch conduit and injecting a high-mobility grout under gravity pressure to prevent hydraulic fracturing of the levee embankment.

North Reservoir Dam, Preliminary Design, Ohio Department of Natural Resources (ODNR), Division of Engineering. Project/Geotechnical Engineer. Mr. Riedy served as the project/geotechnical engineer for this project under our task-order based contract with ODNR. North Reservoir Dam is a state-owned, high hazard dam located in Summit County Ohio. The dam has been identified as having a severe spillway deficiency. H&H evaluations were conducted which substantiated the normal and PMF pool levels for design. These evaluations indicated that the dam would overtop with a relatively high frequency event. High hazard dams are required to contain or safely pass the 100 percent PMF event. Since our evaluations suggest that the dam would overtop during such an event the proposed improvements focused on protecting the dam from catastrophic failure during such an event. The considered improvements consisted of an upstream cantilevered structural wall, roller compacted concrete (RCC) to protect the downstream face, as well as a gravity wall structure consisting

EDUCATION

B.S. Civil Engineering, Ohio State University 2005

AREAS OF EXPERTISE

- Geotechnical Evaluations
- Spillway/Outlet Structures
- Seepage/Stability Berms
- Dam Stabilization and Overtopping Protection
- Levee Design and Certification

REGISTRATIONS/LICENSES

- Professional Engineer, Civil, OH, License No. 74393 (2008)
- Professional Engineer, Civil, PA, License No. 080387 (2012)
- Professional Engineer, Civil, MI, License No. 6201060216 (2013)
- Professional Engineer, Civil, DC, License No. PE906136 (2011)
- Professional Engineer, Civil, LA, License No. 39400 (2014)

PROFESSIONAL AFFILIATIONS

- American Society of Civil Engineers (ASCE)
- Association of State Dam Safety Officials (ASDSO)
- Society of American Military Engineers (SAME)
- Watershed Management Association of Ohio (WMAO)
- Ohio Dam Safety Organization (ODSO)

OFFICE LOCATION

New Albany, OH

YEARS OF EXPERIENCE

12

YEARS WITH FIRM

6

of a cellular sheet-pile wall. Mr. Riedy conducted the geotechnical slope stability and seepage evaluations of the existing dam and proposed embankment modifications. Additionally, lateral soil-structure interactions were also conducted to evaluate structural options that were considered to contain the pool in the event of an overtopping failure. Construction cost estimates were prepared for each of the alternatives considered.

East Reservoir Dam Preliminary Design; Ohio Department of Natural Resources (ODNR), Division of Engineering. Project/Geotechnical Engineer. Mr. Riedy served as the project/geotechnical engineer for this project under our task-order based contract with ODNR. East Reservoir Dam is a state-owned, high hazard dam located in Summit County Ohio. The dam has been identified as having a severe spillway deficiency as well as slope stability and seepage concerns related to the earthen dam embankments. H&H evaluations were conducted which substantiated the normal and PMF pool levels for design. These evaluations indicated that the dam would overtop with a relatively high frequency event. High hazard dams are required to contain or safely pass the 100 percent PMF event. Since our evaluations suggest that the dam would overtop during such an event the proposed improvements focused on protecting the dam from catastrophic failure during such an event. The considered improvements consisted of an upstream cantilevered structural wall, roller compacted concrete (RCC) to protect the downstream face, as well as a gravity wall structure consisting of a cellular sheet-pile wall. Mr. Riedy conducted the geotechnical slope stability and seepage evaluations of the existing dam and proposed embankment modifications. Additionally, lateral soil-structure interactions were also conducted to evaluate structural options that were considered to contain the pool in the event of an overtopping failure. Construction cost estimates were prepared for each of the alternatives considered.

Lake Lynn Dam FERC Part 12 Inspection/Foundation Drain Investigation, First Energy. Civil/Geotechnical Engineer. Mr. Riedy's effort on the project consisted of participating in the Part 12 Inspection. Additionally, Mr. Riedy conducted the investigation of the foundation drain system. In general, the dam has 84 vertical or inclined foundation drains. These drains were investigated by using a custom designed instrument consisting of a small-diameter packer, submersible pump, and pressure transducer in order to measure/observe the drawdown, recharge, and pressures in the drains and assess the efficiency of the foundation drain system.

Lake Tamarack, Dams A and B Geotechnical Investigation; Pennsylvania Fish and Boat Commission (PFBC). Civil/Geotechnical Engineer of Record. Tetra Tech was contracted by PFBC to conduct a geotechnical investigation of Dams A and B on Lake Tamarack. PFBC personnel identified seepage around an outlet conduit on one of the dams that led them to contact a consultant to investigate stability of the dams. The field work consisted of an inspection and geotechnical investigation of the dam embankments and associated features such as dikes. Voids and weak/wet zones were identified within the embankment dam, particularly along the outlet conduit. This led to an emergency dewatering of the dam in order to relieve pressures on the dam and prevent sudden failure from piping. Evaluations were conducted for the dams which included slope stability and seepage evaluations, SITES (spillway stability), H&H evaluations for PMF event. In addition to the piping issues, the results of these evaluation indicated a need to bolster the slope stability of the dam embankments as well as a severe spillway deficiency due to the erodible soils found in the emergency spillway. As part of this work, Tetra Tech developed recommendations and design alternatives to rectify the identified deficiencies. The recommended alternative consists of; replacement of outlet conduit, minor raising of dam to prevent overtopping during the PMF event, addition of a stability/seepage berm at the downstream toe of the dam, and armoring the emergency spillway to prevent a breach of the dam. Preliminary cost estimates were also developed for the alternatives considered.



EXPERIENCE SUMMARY

Mr. Turner is a geotechnical engineer with Tetra Tech responsible for performing geotechnical analyses and evaluations for water resource and other infrastructure projects. For dam and levee embankments, Mr. Turner's experience includes stability analyses to determine allowable slopes, seepage analyses to determine flow quantities and exit gradients, and settlement of embankment foundations.

RELEVANT EXPERIENCE

Viva Naughton Emergency Spillway, Kemmerer, WY (2017).

Geotechnical Engineer for this project which involved the design of a new labyrinth spillway at Viva Naughton Dam in Kemmerer, WY. The new spillway will replace a 23-foot high fuse plug constructed in the project's original emergency spillway. The crest length of the new spillway will be approximately 350 feet.

East Reservoir Dam – Final Design, Ohio Department of Natural Resources – Division of Engineering (2015-current). Geotechnical Engineer. Mr. Turner served as the geotechnical engineer for this project which involved the design of a new overtopping structure and seepage cutoff wall. Seepage analyses included finite-element evaluations of the dam foundation and the impact of the cutoff wall on seepage quantities and exit gradients at the toe of the overtopping structure. Stability analyses included limit-equilibrium, sliding, and overturning evaluations.

Levee/Floodwall Certification for SLFPA-East: 40 Arpent and Maxent Levee in Saint Bernard and Orleans Parish, LA (2014). Mr. Turner worked on the stability and seepage analyses of the levees and the stability and seepage analyses of the sheet pile I-walls on the project. Challenges for this project include the site-specific geotechnical requirements for the New Orleans region (USACE Headquarters, USACE New Orleans District) and the very soft, compressible soils in the area.

Geotechnical Engineering Services Task Order Contract, ODOT-District 5 (2014). Mr. Turner serves as a geotechnical engineer conducting evaluations for this task-order based contract with the Ohio Department of Transportation (ODOT). Efforts conducted under this contract consist of design of repairs to embankment slopes in accordance with local guidelines (GB-2), slope stability assessments, and also bridge foundation design. Foundation design efforts consisted of studies to determine the most economical foundation configuration including soil-structure interaction evaluations for laterally-loaded foundations and retaining walls.

General Engineering Services Task Order Contract, ODOT – District 2 (2014). Geotechnical Engineer. Mr. Turner serves as a geotechnical engineer providing specialized support to the design team on matters concerning geotechnical evaluations for this task-order based contract with ODOT. Efforts conducted under this contract consist of design of repairs to embankment slopes in accordance with local guidelines (GB-2), slope stability assessments, and also bridge foundation design. Foundation design efforts consisted of studies to determine the most economical foundation configuration including soil-structure interaction evaluations for laterally-loaded foundations and retaining walls. Some projects, situated on very soft or compressible foundation soils required a rigorous examination of the in-situ stresses to determine if the proposed improvements would cause consolidation of the foundation soils leading to downdrag forces on deep foundation units.

EDUCATION

M.S., Civil Engineering, University of Missouri, 2014

AREAS OF EXPERTISE

Geotechnical Evaluations
Spillway/Outlet Structures
Seepage/Stability Berms
Dam Stabilization and Overtopping Protection

REGISTRATIONS/LICENSES

EIT Ohio

TRAINING/CERTIFICATIONS

ODOT Soil and Rock Classification
NDA NHI-FHWA-132079

OFFICE LOCATION

Columbus, OH

YEARS OF EXPERIENCE

3

YEARS WITH FIRM

3



EXPERIENCE SUMMARY

Mr. Weaver has over nine years of experience as a civil engineer including site/civil design, dam and levee design and roadway design. Mr. Weaver's roles have included project management, construction document preparation, permit coordination and construction administration. He has been involved with private development, public improvement projects, state projects and federal projects. In the private market, Mr. Weaver has been involved with 32 Walmart commercial developments, four residential projects, university housing projects, a railroad extension project and various other private developers. Other projects with local municipalities, the Ohio Department of Natural Resources, the Ohio Department of Transportation and the U.S. Army Corps of Engineers have provided experience in the public sector. Mr. Weaver has been involved with providing surveying support in conjunction with engineering services on several projects. He has also worked on several environmental based projects providing engineering support services. Mr. Weaver is proficient in a number of design software systems including: Microstation, Geopak, AutoCAD, Civil 3D, ArcMap GIS, HEC-1 and HEC-RAS.

RELEVANT EXPERIENCE

Muskingum Watershed Dam Safety Services (Phase I and II) Chippewa Creek Subdistrict, OH. Project engineer responsible for preliminary hydrologic and hydraulic analyses on three structures in the Chippewa Creek Subdistrict. Includes development of Emergency Action Plans (EAPs) and Operation, Maintenance and Inspection (OM&I) Manuals for the three structures in accordance with Ohio's dam safety regulations. Project Manager for the Phase II work which includes preliminary assessments and construction document preparation for two Class II dams. Also, performed the hydrologic analyses for each dam in this phase of work that included dam breaches and inundation mapping for two high hazard Class I dams.

Grand Lake Saint Mary's Controls; Ohio Department of Natural Resources (ODNR); St. Marys, OH. Project Engineer. The project involves modification to the existing gate controls on the principal spillway at Grand Lake Saint Mary. ODNR is rehabbing the infrastructure to include automatic gate control based on a downstream water level sensor. Tasks will include coordination with electrical and mechanical consultants to design the gate controls and sensor equipment. In addition, the gate tower is being retrofitted with a pre-cast building to protect the new equipment. Plans and specifications will be created for a 50% design milestone and then finalized for construction.

Lake Lynn Dam; FERC Part 12 Foundation Drain Investigation, First Energy; Monongalia County, WV. Project Engineer. Tetra Tech was contracted by First Energy to conduct the FERC Part 12 Inspection of the Lake Lynn Dam Hydropower Facility, located near Morgantown, WV. As part of this work, an investigation of the foundation drains was conducted. Mr. Weaver's effort on the project consisted of assisting with the investigation of the foundation drain system. In general, the dam has 84 vertical or inclined foundation drains. These drains were investigated by using a custom designed instrument consisting of a small-diameter packer, submersible pump, and pressure transducer in order to measure/observe

EDUCATION

B.S., Civil Engineering, University of Dayton, 2004

AREAS OF EXPERTISE

- Site/Civil Design
- Dam and Levee Design
- Roadway Design

REGISTRATIONS/LICENSES

Professional Engineer, OH, License No. PE 73962 (2016)

Professional Engineer, WV, License No. 019944 (2012)

Surveyor Intern, OH

Certified Professional in Erosion and Sediment Control (CPESC), License No. 5686

PROFESSIONAL AFFILIATIONS

National Society of Professional Engineers (NSPE)

Ohio Society of Professional Engineers (OSPE, Franklin County Chapter)

Association of State Dam Safety Officials (ASDSO)

OFFICE LOCATION

Columbus, OH

YEARS OF EXPERIENCE

9

YEARS WITH FIRM

3

the drawdown, recharge, and pressures in the drains and assess the efficiency of the foundation drain system.

Muskingum Dam #6 Emergency Repair; The Ohio Department of Natural Resources (ODNR); Morgan County, OH. Project Engineer. The project involved an emergency repair to the low head dam in Stockport, Ohio to repair a void in the dam. Tasks included preparing preliminary exhibits for discussion of the repair alternatives with the client and contractor. Final exhibits were prepared of the site depicting the cofferdam layout and showing the bore hole locations for the grouting repair. Daily field visits were made during grouting operations to ensure proper placement of the hole locations. Additional responsibilities included coordination in the field during construction to verify the grouting effort successfully filled in the void.

Mud Mountain Dam Fish Passage Facility; USACE, Seattle District; White River, WA. Project Engineer. Mr. Weaver's roles included updating the 35% design plan set with revised structural drawings and new construction project phasing. The project phasing is a critical element to this project based on the seasonal migration habits of the different salmon species. Included in the plan updates were new structural drawings from the sub consultant. Final plans for this design milestone were updated in Microstation and submitted to the client for review.

Zepernick Lake Wildlife Area Dam Improvements; Ohio Department of Natural Resources (ODNR); Columbiana County, OH. Project Engineer. Zepernick Lake dam is a medium hazard structure located in Columbiana County. The hazard classification was recently increased, resulting in a new design storm that must be safely passed. Mr. Weaver assisted in the hydrology and hydraulic modeling of the dam and spillway. HEC-1 modeling software was utilized to evaluate proposed improvements to the principal spillway riser, outlet pipe and emergency spillway. Final construction documents were prepared for the project including plans using AutoCAD and Civil 3D, specifications and an engineer's cost estimate.

Statewide Dam Safety Design Services IDIQ; Ohio Department of Natural Resources (ODNR), OH. Project Engineer. Mr. Weaver's roles include hydrologic and hydraulic evaluations, civil design and construction document preparation. Tetra Tech is providing dam safety services for ODNR on their projects across the state. These services include short-notice, urgent and/or emergency technical assistance, such as assessments, design services, construction documents and construction administration for repairs and/or rehabilitation of selected dams and appurtenances owned by the Ohio Department of Natural Resources. Typical technical assistance requests include issues such as excessive seepage, slope instabilities, inoperable lake drains, deteriorated concrete structures, pipe replacements/slip lining, and preparing Emergency Action/Preparedness Plans.

East Reservoir Dam Preliminary Improvements; ODNR, Summit County, OH. Project Engineer. East Reservoir is a high-hazard embankment dam from the canal era located in the Portage Lakes System just south of Akron. Mr. Weaver completed the hydrologic and hydraulic analysis on the existing conditions of the dam and north and south spillways, including combining outflows from West Reservoir dam.



EXPERIENCE SUMMARY

Mr. Gong has 22 years of experience in design and management of multimillion dollar flood control projects for various Federal and local Clients. As a Project Engineer and Project Manager, he has prepared construction design plans and specifications for various flood control projects. Design plans include U.S. Bureau of Reclamation (USBR) dam facilities, regional flood control facilities and local storm drain facilities. Construction specifications include the use of SpecsIntact, computer software developed by NASA and used in all U.S. Army Corps projects. Through his knowledge and experience in preparation construction documents, Mr. Gong has anticipated and mitigated potential problems during construction.

RELEVANT EXPERIENCE

Final Design East and North Reservoir Dams and Long Lake Gate Rehabilitation, ODNR Engineering, Summit County, OH. Long Lake Gage Rehabilitation project included a preliminary investigation, preliminary design report, final design and construction services. Mr. Gong performed and managed the civil engineering, plan production and cost estimating for Long Lake Gate Improvement project. Mr. Gong coordinated survey topographic drawings, structural drawings and civil drawings to produce final construction documents.

Robles Diversion Dam; USACE, Los Angeles District. Mr. Gong is the Project Engineer responsible for the preparation of construction documents, which include design plans, design report and construction specifications. Construction specifications were prepared using SpecsIntact computer software.

Marshburn Retarding Basin - Natural Treatment System Design; The County of Orange, California Department of Water Resources. Mr. Gong as the Project Manager was responsible for the approval of hydrology, basin routing and construction design plans. Basin improvements required the lowering of the existing basin floor to accommodate a water quality volume. The County of Orange, California Department of Water Resources, Division of Safety of Dams, and City of Irvine were all stakeholders to the improvements. The retarding basin has a storage volume of 75 AF, an multi stage outlet structure was designed to detain flows to meet the downstream design constraints.

North Simi Valley Drain Detention Basin Basis Design Report; Ventura County Flood Control District, CA. Mr. Gong as the Design Engineer was responsible for designing the outlet structures for the primary and emergency spillways. The design of these facilities required basin routing analyzes to determine the best optimum facility to satisfy all parties. Mr. Gong was responsible in preparing the design plans for the storm water detention basin and its drainage facilities. This detention basin has a total volume of approximately 37 acre-feet. The basin was designed to provide flood relief to the existing downstream properties, which are subject to flooding during large storm events.

EDUCATION

M.S., Civil Engineering, California State University – Long Beach, 1999

B.S., Civil Engineering, California State University – Long Beach, 1995

AREAS OF EXPERTISE

- Stormwater Design
- Construction Documents Preparation
- Technical Specifications
- Floodplain Delineation
- Hydrology
- Master Plan
- Levees

REGISTRATIONS/LICENSES

Professional Engineer, Civil, CA, License No. C59484 (1999)

Professional Engineer, Civil, AZ, License No. 53099 (2011)

Professional Engineer, Civil, TX, License No. 110578 (2012)

Professional Engineer, Civil, NM, License No. 20872 (2012)

Certified Floodplain Manager, License No. US-08-03661 (2008)

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers

OFFICE LOCATION

Irvine, CA

YEARS OF EXPERIENCE

22

YEARS WITH FIRM

8



EXPERIENCE SUMMARY

Mr. Hynes has almost 30 years of professional engineering experience including over 25 years in abandoned mine land reclamation. Additionally he has designed and permitted numerous mine surface facilities, oil and gas well pad sites, potable water distribution systems, stormwater conveyance systems, and developed E&S control plans.

His mine reclamation experience began in 1991 and includes acting as principal engineer or project manager responsible for design calculations, cost estimates, plans, and technical specifications for over 50 abandoned mine land reclamation project sites in West Virginia, Ohio, Pennsylvania, and Virginia for agencies including WVDEP, ODNR, USCOE, VDMME, and PADEP. Projects included reclamation of steep refuse piles, highwalls, burning refuse, exposed mine entries, abatement of acidic mine drainage, active and passive AMD treatment, and mine subsidence grouting. His responsibilities also included tracking schedules and budgets, project billing, and hiring sub-consultants. Mr. Hynes has also prepared permit applications and construction level drawings and specifications for proposed surface mine facilities in PA, WV, and NC. Projects included permitting and reclamation of various mining facilities such as pipelines, shaft sites, boreholes, preparation plants, pits, refuse storage areas, slurry impoundments, treatment ponds, stream enclosures, sedimentation ponds, E&S controls and numerous minor permit modifications.

His potable water experience includes employment as District Engineer for a public water supply and distribution system and the design of numerous large and small scale distribution projects in rural, suburban and urban locations.

RELEVANT EXPERIENCE

Mine Reclamation

Project Manager; LaRosa Fuels (2016-17); West Virginia Land Stewardship Corp. in cooperation with the WVDEP Office of Special Reclamation; Monongalia/Marion County, WV. Responsible for project management and oversight of engineering design, development of construction plans, specifications, quantities and cost estimates. The project included site characterization and development of an AMD treatment system to meet NPDES discharge limitations of a bond forfeiture site on the Monongahela River. Detailed plans and specifications are currently being developed to include site grading, drainage control, and an active water treatment system.

Project Manager; Parker Run Highwall (2013-14); WVDEP; Marion County, WV. Responsible for project management, engineering design, and development of construction plans, specifications, and cost estimates. The project included exploratory drilling, and preparation of reclamation plans and specifications for five sites containing steep refuse piles, numerous suspected mine entries, acid mine drainage, and stream impacts. Design measures included site grading of steep refuse piles to provide stable slopes and positive drainage, installation of wet and dry mine seals, bat gates, access roads, collection channels, E&S controls, preservation of mine headings considered

EDUCATION

M.S., Civil Engineering, 1997,
Youngstown State University

B.E., Civil Engineering, 1987,
Youngstown State University

REGISTRATIONS

Professional Engineer,
PE044310E, PA
E-62948, OH
013850, WV

TRAINING/CERTIFICATIONS

HES GENERAL ORIENTATION
PA DEP ESGP2, 2013

OFFICE

Canfield, OH

YEARS OF EXPERIENCE

30

YEARS WITH TETRA TECH

4

as historic structures, removal of refuse encroachments into stream banks, demolition of dilapidated buildings and foundations, and final revegetation.

Project Manager; Energy Marketing Slurry Impoundment Reclamation (2013-14); WVDEP Office of Special Reclamation; Barbour County, WV. Responsible for project management and oversight of engineering design, development of construction plans, specifications, quantities and cost estimates. The project included development of a feasibility level reclamation plan and cost estimate for dewatering the 30 acre abandoned coal slurry impoundment, grading and removal of accumulated coarse and fine coal from within the impoundment, and regarding the 130 foot tall impoundment embankment in accordance with the requirements of the original mine permit. Detailed plans and specifications were developed for rehabilitation of a dilapidated sedimentation pond and spillway located at the base of the impoundment, which would be required for future dewatering of the main impoundment.

Project Manager; Colliers Highwall Reclamation (2012); WVDEP; Brooke County, WV. Responsible for project management, engineering design, and development of construction plans, specifications, and cost estimates. The project included exploratory drilling to determine mine pavement elevations, and preparation of reclamation plans and specifications for a mile long highwall ranging from 30 to 70 feet high and containing numerous refuse piles, mine entries, and impounded water. Design measures included site grading of steep refuse piles and backfilling exposed highwalls to eliminate impounded mine water, provide stable slopes and positive drainage, installation of wet and dry mine seals, bat gates, access roads, collection channels, E&S controls, and final revegetation.

Project Manager; Simpson Creek Highwall, Tipple, and Portals (2011); WVDEP; Barbour County, WV. Responsible for project management, engineering design, and development of construction plans, specifications, and cost estimates. The project included exploratory drilling, and preparation of reclamation plans and specifications for five sites containing numerous suspected mine entries to a large underground mine complex. Design measures included elimination of impounded mine water, installation of wet mine seals, access roads, collection channels, tipple demolition, minor site grading to provide positive drainage, and final revegetation.

Project Manager; Wymer Portals and Acid Mine Drainage (2011); WVDEP; Monongalia County, WV. Responsible for project management, engineering design, and development of construction plans, specifications, and cost estimates. The project included development of site mapping, exploratory drilling, and preparation of reclamation plans and specifications for a large abandoned mine complex. Design measures included elimination of impounded mine water, installation of wet mine seals, bat gates, and access roads, elimination of highwalls by proposed earthwork and site grading with available on site refuse and spoil materials, and final revegetation. Numerous surface water and mine drainage structures including ditches, pipes, and underdrains were also required.

Project Manager; Davidson Highwall (2010); WVDEP; Monongalia County, WV. Responsible for project management, engineering design, and development of construction plans, specifications, and cost estimates. The project included development of site mapping, exploratory drilling, and preparation of reclamation plans and specifications for a large abandoned mine complex. Design measures included elimination of impounded mine water, installation of wet mine seals, stream channel restoration, elimination of highwalls by proposed earthwork and site grading with available on site refuse and spoil materials, and final revegetation. Numerous surface water and mine drainage structures including ditches, pipes, and underdrains were also required.



EXPERIENCE SUMMARY

Doug Lantz has 29 years of applied project experience in hydrologic/hydraulic analysis and design of pipes, natural and man-made channels, confluences, split flows, networks, weirs, culverts, bridges, grade control, bank protection, levees, dams, detention basins, dam removals, and dam breaches on watercourses throughout the United States. He has extensive experience with computerized hydrologic, hydraulic, and sediment models including HEC-1, HEC-HMS, SITES, WinDAM, TR-55, WinTR-20, UNET, HEC-2, HEC-RAS (steady and unsteady), FLO-2D, BREACH, DAMBRK, FLDWAV, HEC-SSP and the Advanced Interconnected Channel and Pond Routing Program (AdICPR) and has prepared detailed documentation for hydrology, hydraulics, and sediment transport. Dr. Lantz has prepared construction documents that include contract drawings, specifications, quantity estimates, cost estimates, design reports, permitting, and O&M manuals. He has provided assessments, planning, design, and construction support for the rehabilitation of dams in Arizona, California, Colorado, Hawaii, Montana, New Mexico, Ohio, Oklahoma, Oregon, South Dakota, Tennessee, Texas, Utah, Washington, and Wyoming. Dr. Lantz is currently the Tetra Tech Program Manager for an NRCS National Design IDIQ Contract that covers assessments, design, design review, and construction management for NRCS dams nationwide.

RELEVANT EXPERIENCE

Buckeye Flood Retarding Structure No. 1, Final Design, Maricopa County Flood Control District. Tetra Tech is under contract with the Flood Control District of Maricopa County to complete final design services for the rehabilitation of the Buckeye FRS No. 1, an NRCS-assisted dam, near Buckeye, Arizona. The dam is a dry, homogeneous earthen embankment, with a length of 7.1 miles, a maximum height of 36.3 feet, and a storm water storage capacity of approximately 10,010 acre-feet from a 76.2-square-mile drainage area. Major features of the project include a central filter, modifications to the principal and auxiliary spillways, removal of existing irrigation outlets structures, an east abutment structure, landscape restoration, and aesthetics. Major components of the contract include development of design criteria, geotechnical and geologic field investigations, development of plans and specification for civil and landscape designs, and engineering support during construction. Other tasks include permitting, value engineering, failure modes and effects analysis, risk assessment, and public/stakeholder coordination. The project is being implemented in multiple two phases using the Construction Manager at Risk (CMAR) alternative delivery method. Dr. Lantz is Project Manager for a multi-disciplinary design team and is responsible for all aspects of the \$4.1 million contract.

Florence Flood Retarding Structure, Final Design, NRCS Arizona. Tetra Tech is under contract with the NRCS Arizona State Office to complete final design services for rehabilitation of the Florence Flood Retarding Structure, a five-mile long earthen dam that provides flood protection to the Town of Florence, Arizona and surrounding agricultural areas. Work Assignment 1, completed in July 2016, included data collection, hydrology and hydraulics, failure modes and effects analyses (FMEA) workshop and report, and alternatives analysis. Dr. Lantz is Project Manager for a multi-disciplinary design team and is responsible for all aspects of the project. Work

EDUCATION

- Ph.D. Watershed Management (minor in Civil Engineering), University of Arizona, 1998
- M.S. Watershed Management University of Arizona, 1989
- B.S. Watershed Management University of Arizona, 1986

AREAS OF EXPERTISE

- NRCS Dam Rehabilitation
- Watershed Hydrology
- Surface Water Hydraulics
- Dam Breach Analyses
- Civil Design

REGISTRATIONS/LICENSES

- Registered Professional Engineer (Civil): Arizona No. 28850, 1995; Washington No. 34547, 1997; Oregon No. 60864PE, 1999; Idaho No. 9687, 2000; California No. 63048, 2000; Maryland No. 27328, 2002; New Mexico No. 16527, 2004; Oklahoma No. 24042, 2009
- Registered Professional Hydrologist No. 1479, American Institute of Hydrology, 1998

PROFESSIONAL AFFILIATIONS

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

OFFICE LOCATION

Tucson, AZ

YEARS OF EXPERIENCE

29

YEARS WITH FIRM

20

Assignment 2 is in progress and includes field surveys, inspection and cleanout of pipe penetrations and siphons for the principal spillway and irrigation outlets, geotechnical investigations, SITES civil design, and preparation of plans, specifications, cost estimates, construction schedules, and operation and maintenance plans.

Design Review Services, Hanksville Emergency Watershed protection Diversion Structure, NRCS NDCSMC. Tetra Tech provided review of the design documents and design folders for the Hanksville EWP Diversion Structure in Wayne County, UT. The project involves replacement of a failing diversion structure on the Fremont River. The proposed design includes a reinforced concrete labyrinth weir and energy dissipation basin designed for a 25-year flood event, a gated intake to the irrigation works, and modifications to an existing pipe bridge. Items reviewed included: hydrologic and hydraulic information, geologic and geotechnical data, labyrinth weir design, foundation design, structural design, design report and appendices, construction drawings, specifications, and construction cost estimate. Dr. Lantz was responsible for contract administrator, project management, and quality assurance.

Design Review Services, Mary's Creek Site 9 Dam Rehabilitation Project, Dam Rehabilitation, NRCS NDCSMC. Tetra Tech provided review of the design documents and design folders for the Mary's Creek Site 9 Rehabilitation Project in Shelby County, TN. The project involves rehabilitation of a 678-foot long by 23.7-foot high, high-hazard earthen dam with roller compacted concrete. Items reviewed included: hydrologic and hydraulic information, geologic design report, soil mechanics report, embankment and foundation design calculations, SITES erodibility analyses, design report and appendices, construction drawings, specifications, and construction cost estimate. Dr. Lantz was responsible for contract administrator, project management, and quality assurance.

Dull Knife Dam Rehabilitation Project, Dull Knife Irrigation District, WY. Tetra Tech completed design analyses and final construction documents for rehabilitation of Dull Knife Dam near Buffalo, WY. The dam was originally designed and constructed by NRCS and is owned and operated by the Dull Knife Irrigation District. The proposed design includes roller-compacted-concrete (RCC) revetment to repair the deteriorated rock face and a 135-foot-wide RCC chute to convey the probable maximum flood (PMF) down the face to the exit channel. Major tasks include geotechnical investigations and analyses, hydrology and hydraulics, and preliminary and final design. Dr. Lantz was Sr. Project Engineer responsible for hydrology, hydraulics, and reviews during design.

Dam Inundation Mapping and EAPs for Regions 1, 2, 3, and 4, U.S. Forest Service. Project Manager for dam breach and inundation studies at 16 dams located in Arizona, Colorado, Montana, New Mexico, South Dakota, Texas, Utah, and Wyoming. Dam heights vary from 12 feet to 135 feet. The project was completed for the U.S. Forest Service under Tetra Tech's National Design IDIQ for the NRCS. The work included data collection, hydrologic analyses, dam breach analyses, flood inundation mapping, and Emergency Action Plans.

Santa Cruz River Watershed Floodplain Analyses, NRCS NM State Office. Dr. Lantz provided quality assurance reviews for dam breach and flood inundation studies for five watershed dams in Taos County and Santa Fe County, NM. Hydrologic analyses included development of rainfall-runoff modeling for the probable maximum flood (PMF) using the NRCS SITES program. Hydraulic analyses included review of dam breach assumptions and unsteady HEC-RAS modeling for the sunny-day and PMF breach hydrographs.

Dam Rehabilitation Planning IDIQ, NRCS Oklahoma State Office. Tetra Tech completed a 4-year IDIQ contract for Dam Rehabilitation Planning with the NRCS – Oklahoma State Office. Dam rehabilitation planning studies were completed for at four earthen dams (Sallisaw Sites 18M, 28, 29M, and 30) located in the Sallisaw Creek watershed in eastern Oklahoma, and one earthen dam (Quapaw Site 15) located in the Quapaw Creek watershed in central Oklahoma. Dam heights at the five structures varied from 41 feet to 95 feet; storage areas varied from 3,500 acre feet to 8,300 acre feet. Each study included probable maximum flood (PMF) analysis for evaluating the capacity and integrity of the auxiliary spillway at each dam. Dam breach hydrographs for each dam were computed using NRCS empirical methods in TR-60 and TR-66 and were routed as far as 18 miles downstream to evaluate impacts of flood inundation mapping. Dr. Lantz was project manager responsible for all aspects of the studies.

A&E Services IDIQ, NRCS New Mexico State Office. Dr. Lantz prepared flood dam breach, inundation mapping, hazard classifications, and incremental damage assessments at Piedra Liza Dam (Sandia Site 1) near Bernalillo, NM and Wasson Dam (Caballo Arroyos Site 2) near Garfield, NM. Dam breach parameters were developed for the sunny day event and PMF overtopping events using the NWS BREACH program. In 2010, Dr. Lantz prepared a formal inundation map for use in the Piedra Liza Dam Emergency Action Plan and a comparison of dam breach hydrographs developed using the NWS BREACH model and NRCS methods in TR-60. Both were reviewed and accepted by the New Mexico Office of the State Engineer – Dam Safety Bureau.



EXPERIENCE SUMMARY

Dr. Yen has over 30 years of experience in the field of water resources engineering, specializing in hydrology, hydraulics, and groundwater modeling. His work experience includes rainfall analysis, rainfall-runoff modeling, detention basin flood routing analysis, floodplain evaluations and mapping, and drainage facility deficiency and mitigation studies.

RELEVANT EXPERIENCE

Muskingum Watershed Conservancy District (MWCD), Chippewa Creek Subdistrict Dam Safety Services, OH. Performed independent technical review of hydrology for Dam II-A and V-D. These two dams required preliminary engineering assessments and final design in order to safely pass the PMF (design storm for Class I dams in Ohio).

Final Design of East and North Reservoir Dams and Long Lake Dam Improvements, Ohio DNR Engineering. This project consists of advancing the preliminary designs of East Reservoir and North Reservoir Dams to final design level and to provide services during construction. In addition, a preliminary investigation, preliminary design report, final design and construction services for Long Lake Flood Gates are included in this scope of work. Dr. Yen provided quality control for the hydrologic and hydraulic modeling that was performed for the dam improvement projects. Dr. Yen also performed civil design for the channel improvements at the Long Lake Gate Improvement project.

South Fork Licking River Watershed Model, Ohio DNR Division of Engineering, Licking and Fairfield Counties, OH. Civil Engineer. Dr. Yen served as the hydrologic and hydraulic quality control lead for a revised hydrology study for the South Fork Licking River and Buckeye Lake Dam Watershed. The model was developed to evaluate hydrologic and hydraulic conditions to implement Interim Risk Reduction Measures (IRRM) and to evaluate dam operations during the design and construction phases of the rehabilitation of Buckeye Lake Dam

Main Street Canyon Dam Inundation Mapping, Riverside County, CA. Tetra Tech was under contract with the County of Riverside to prepare an Emergency Action Plan (EAP) for the Main Street Canyon Dam which was constructed in 1975 in partnership with the Natural Resources Conservation Service. Dr. Yen was project engineer in charge of the hydrology and hydraulic analyses. The study included a dam break analysis and associated floodplain mapping. Several dam break scenarios and various storm events (including PMP) were used to determine the worst dam break scenario for the Main Street Canyon Dam. Due to the high urbanization of the downstream area of the Main Street Canyon Dam, FLO-2D, a 2-dimensional hydrodynamic flood model, was used for developing the inundation map.

Eagle Canyon Dam Break Inundation Study, Cities of Palm Springs and Cathedral City, CA. The study included a dam break analysis and associated floodplain mapping. Several dam break scenarios and various storm events (including PMP) were used to determine the worst dam break scenario for the Eagle Canyon Dam. The BREACH model developed by the National Weather Service (NWS) was used to determine the breach parameters for piping failures as well as overtopping failures of the Eagle

EDUCATION

Ph D., Civil Engineering,
University of CA at Irvine, 1985

M.S., Civil Engineering, University
of CA at Irvine, 1982

B.S., Hydraulic Engineering
Chung Yuan College, Chung-Li
Taiwan, Republic of China, 1975

AREAS OF EXPERTISE

Water Resources

Hydrology

Hydraulics

Computer Programming
(FORTRAN, Visual Basic)

REGISTRATIONS/LICENSES

Professional Engineer, Civil, CA,
License No. 49913, 1992

PROFESSIONAL AFFILIATIONS

American Society of Civil
Engineers

OFFICE LOCATION

Irvine, CA

YEARS OF EXPERIENCE

30

YEARS WITH FIRM

14

Canyon Dam. The breach parameters obtained from the BREACH model were compared against empirical equations developed from documented case studies. The breach parameters were used in the FLDWAV model, also developed by the NWS, to predict a hypothetical sunny day piping failure of the dam as well as a hypothetical overtopping failure for the local 6-hour storm PMF of the dam. Due to the high urbanization of the downstream area of the Eagle Canyon Dam, FLO-2D, a 2-dimensional hydrodynamic flood model, was used for the inundation mapping. Construction of the dam was completed in 2016 and a CLOMR and LOMR submittal were prepared to show the impacts of the dam on the FEMA 100-year floodplain. The FLO-2D model was used to model the 100-year floodplain. The CLOMR mapping focused on the residual flooding.

Santa Clara Creek Watershed Debris Flow Model – Development and Analysis, Rio Arriba County, NM.

This study includes development and analysis of the debris flow model to quantify the potential debris flow volume for a hypothetical storm event under post 2011 Las Conchas Fire conditions. Bulked runoff hydrographs (i.e., including debris flow volumes) at the confluence of the Rio Grande were developed as part of this work and may be used as input to the 2-dimensional hydraulic model that could be used to delineate flooding limits under post fire conditions. Dr. Yen was project engineer in charge of the debris flow model development and analysis.

Lang Creek Dam Break Study, City of Thousand Oaks, CA. The study included a dam break analysis and associated floodplain mapping. Several dam break scenarios and various storm events (including PMP) were used to determine the most realistic dam break scenario for the Lang Creek Debris/Detention Basin. This task was completed by calibrated the NWS FLDWAYV and BREACH models with the other observed dam break data and its statistical equations. A FLO-2D model was used to route the dam breach hydrograph downstream. The topographic features such as Freeway embankments, underpasses, culverts, and large buildings were included in the model. A floodplain limits with flood wave arrival and receding time were estimated at various strategic locations which provide a guideline for City's emergency operation.

Levee Certification Report, Tillman Water Reclamation Plant, Van Nuys, CA. Dr. Yen was the Project Engineer in charge of the interior drainage analysis on this levee system report. The efforts involved Sepulveda Dam combined elevation-frequency analysis and the joint probability analysis of interior drainage based on the guidelines of US Army Corps of Engineer and FEMA regulations.

Nichols Levee Flood Risk Management System - Levee System Elevation Report. Nichols, NY. Dr. Yen was the Project Engineer in charge of the interior drainage analysis on this levee system report. The efforts involved Susquehanna River elevation-frequency analysis and the joint probability analysis of interior drainage based on the guidelines of US Army Corps of Engineers and FEMA regulations.

Potomac Park Flood Risk Management System - Levee System Elevation Report. Washington, D.C. Dr. Yen was the Project Engineer in charge of the interior drainage analysis on this levee system report. The efforts involved Potomac River elevation-frequency analysis and the joint probability analysis of interior drainage based on the guidelines of US Army Corps of Engineers and FEMA regulations.



EXPERIENCE SUMMARY

Over the past decade Mr. Elslager has gained considerable experience in the analysis and design of water resource and flood control projects including channels, energy dissipators, chute spillways, dams, levee design and certification, scour and sediment transport studies, hydrology reports, and FEMA submittals. His background is in the utilization of computer/numerical modeling techniques to determine solutions to complex engineering problems in the areas of hydrology, hydraulics, and sediment transport. He is familiar with an array of methods for hydrologic and hydraulic analysis, including one-dimensional and two-dimensional computational software programs. Mr. Elslager's proficiency in numerous hydrology, hydraulic and sediment transport software programs combined with the added proficiency in the use of Geographic Information Systems and Computer Aided Design and Drafting software allow for the graphical integration of numerical modeling results for incorporation into various planning and design documents. He has supervised development of FEMA submittals, H&H reports, sediment transport and geomorphic studies, and development of plans and project specifications. Mr. Elslager has extensive experience in a wide variety of settings throughout the U.S., including the East Coast, Mid-West, Pacific Northwest and Southwest regions.

RELEVANT EXPERIENCE

Buckeye Flood Retarding Structure No. 1, Dam Rehabilitation Project, Flood Control District of Maricopa County; Buckeye, AZ. Engineer responsible for unsteady HEC-RAS analysis, local hydrology and scour analysis, and design and preparation of construction drawings, special provisions, quantities, and cost estimates for the Phase 1 and Phase 2 rehabilitation design. Phase 1 and 2 utilized Construction Manager at Risk (CMAR) alternative delivery method contracts. Construction of Phase 1 was completed in early 2015, Phase 2 is in final design. Buckeye FRS No. 1 is a 7.1-mile-long, earthen embankment dam that is classified as an unsafe, high-hazard dam by ADWR due to the presence of transverse cracks and an inability to safely pass the inflow design flood. Detailed aspects of the rehabilitation include filter trench installation, roadway crossings, O&M access ramps and roads, in addition to an inflow closure structure, principal and auxiliary spillway improvement designs.

Florence Flood Retarding Structure, FAWFCD and NRCS, Arizona State Office. Tetra Tech is completing additional planning, FMEA and design support services for rehabilitation of the Florence Flood Retarding Structure, a five-mile long earthen dam that provides flood protection to the Town of Florence, Arizona and surrounding agricultural areas. Tasks to date included hydrology (WinTR-20, SITES, FLO-2D), hydraulics (unsteady HEC-RAS, FLO-2d and RAS-2D-beta).

Design Review Services, Hanksville Emergency Watershed protection Diversion Structure, NRCS NDCSMC. Tetra Tech provided review of the design documents and design folders for the Hanksville EWP Diversion Structure in Wayne County, Utah. The project involved rehabilitation of an irrigation diversion dam by adding a 24-foot high reinforced concrete labyrinth weir and energy dissipation basin, sluice irrigation desilting chamber, and a gated intake to the irrigation works, and modifications to an

EDUCATION

B.S., Civil Engineering, University of Arizona, 2004

AREAS OF EXPERTISE

- Hydrology
- Hydraulics
- Sediment Transport
- Civil Design

REGISTRATIONS/LICENSES

- Professional Engineer, Arizona License No. 49108
- Certified Floodplain Manager, US-11-06091

OFFICE LOCATION

Tucson, AZ

YEARS OF EXPERIENCE

12

YEARS WITH FIRM

12

existing pipe bridge. Mr. Elslager was responsible for reviewing hydraulics and civil design.

Design Review Services, Mary's Creek Site 9 Dam Rehabilitation Project, Dam Rehabilitation, NRCS NDCSMC (2017). Tetra Tech provided review of the design documents and design folders for the Mary's Creek Site 9 Rehabilitation Project in Shelby County, Tennessee. The project included rehabilitation of a 678-foot long by 23.7-foot high earthen embankment dam and riser structure. Mr. Elslager was responsible for reviewing hydraulics and civil design.

Dam Inundation Mapping and EAPs for Regions 1, 2, 3, and 4; U.S. Forest Service. Project Engineer for dam breach and inundation studies at 16 dams located in Arizona, Colorado, Montana, New Mexico, South Dakota, Texas, Utah, and Wyoming. Dam heights vary from 12 feet to 135 feet. The work is being done under contract to the U.S Forest Service and includes data collection, hydrologic analyses, dam breach analyses, flood inundation mapping, and Emergency Action Plans.

Tucson Drainage Dam Breach Inundation Modeling, Pima County Regional Flood Control; Tucson, AZ. Project included unsteady HEC-RAS and FLO-2D modeling of a series of cascading dam breach scenarios for the Park Avenue Detention Basins 1, 2, and 3, and the Cherry Field Basin. The modeled area was over 3-square miles and included the city center and surrounding metropolitan area.

Bailey Lake/Leach Flood No. 1 Dam Breach Analyses and Emergency Action Plan (EAP) Preparation, Freeport McMoRan Sierrita Operations. Updated Hydrology and Hydraulics including Dam Breach Analyses for a Solution Pond in conjunction with and including a re-writing of the EAP for submittal to the Arizona Department of Water Resources Dam Safety Section. EAP was developed in accordance with local, state and federal guidance documents.

Sallisaw Sites 28, 29M, and 30; NRCS, Oklahoma State Office. Project Engineer responsible for alternative designs and cost estimates for planning level rehabilitation studies at Sallisaw Sites 28, 29M, and 30 near Sallisaw, Oklahoma.

Clearwell Reservoir Dam Breach and Flood Inundation Study, AZ. Hydraulic engineer responsible for dam breach and inundation analyses. Tasks included estimating dam-breach parameters, developing the breach hydrograph, routing the breach hydrograph downstream using unsteady one-dimensional (HEC-RAS) and unsteady and two-dimensional routing (FLO-2D) techniques, mapping the flood inundation area, and the high hazard (maximum damage) areas.

Murphy Reservoir Dam Breach and Flood Inundation Study; Pima County, AZ. Hydraulic engineer responsible for dam breach and inundation analyses on an existing water supply reservoir. Tasks included estimating dam-breach parameters, developing the breach hydrograph, one-dimensional unsteady routing (HEC-RAS) along a steep alluvial channel, and two-dimensional unsteady routing (FLO-2D) on a small alluvial fan that included several subdivisions.



PROFESSIONAL EXPERIENCE

30 Years

REGISTRATIONS & LICENSES

- Licensed Professional Surveyor-WV & PA
- Certified 40 Hr. HAZWOPER

SKILLS

- Underground Surveying
- Construction Layout
- Boundary and Road Work Surveying
- Surface Mine Surveying

PROFESSIONAL AFFILIATIONS

- WV Society of Professional Surveyors
- National Society of Professional Surveyors

HIGHLIGHTS OF EXPERIENCE

Mr. Clark is currently the Survey Supervisor for the St. Albans office of Triad. In this capacity, he is responsible for the supervision of the survey crews, overseeing the field work through drafting to the finished product delivered to the client, meeting with clients, and performing field work on large and complex projects. Mr. Clark is experienced in underground surveying, construction layout, boundary and road work surveying, photogrammetric and topographic surveying. He has supervised and/or performed survey work on various types of work including both underground and surface mine surveying for coal mine facilities, site surveys and construction layout for landfill facilities, site surveys and right of way plans for WVDOH highway projects, and site surveys and construction layout for site development projects. Mr. Clark has been involved in survey projects in several states including West Virginia, Florida, Virginia, and Ohio. In his supervisory capacity, he is responsible for schedules, project budgets, and the overall coordination of all survey projects. He works with all levels of engineering staff, the overall project team, and the project owner to produce a quality work product which satisfies all project requirements.

RELEVANT PROJECT EXPERIENCE

Dam Monitoring and Instrumentation Surveys

Mr. Clark has experience with the precise surveys required for periodical checks for movement at a large number of the flood control projects and inland navigation structures inside the Huntington District of the USACE. These surveys have required precise measurements to be made by GPS, Robotic Total Stations and Digital Levels. This data for the following projects has been processed utilizing the least squares adjustment method and compared to previous observations to check for movement:

- 2008 Capt. Anthony Meldahl Locks and Dam-USACE Huntington
- 2008 Willow Island Locks and Dam-USACE Huntington District
- 2007 Dover Dam-USACE Huntington District
- 2009 Charles Mill Dam-USACE Huntington District
- 2009 North Branch of Kokosing Dam-USACE Huntington District
- 2009 Pleasant Hill Dam-USACE Huntington District
- 2009 Mohicanville Dam-USACE Huntington District
- 2009 Pavonia Levee-USACE Huntington District
- 2009 Charles Mill Lake Dikes 1 and 2-USACE Huntington District
- 2009 Mohicanville Dikes 1 and 2-USACE Huntington District
- 2009 Nashport Dike of Dillon Lake-USACE Huntington District
- 2009 Pleasant Valley Dike of Dillon Lake-USACE Huntington District
- 2009 Silica Sands Levee of Beech City Lake-USACE Huntington Dist.
- 2009 Deer Creek Dam-USACE Huntington District
- 2009 London Locks and Dam- USACE Huntington District
- 2009 Winfield Locks and Dam- USACE Huntington District
- 2009 Racine Locks and Dam- USACE Huntington District
- 2009 Pleasant Hill Dam- USACE Huntington District.
- 2010 Bluestone Cross Sections- USACE Huntington District

WVDOT Highway Projects, Various Highway Engineering Consultants

Mr. Clark's expertise includes several WVDOH projects for various highway consulting engineering firms. He is responsible for the generation of site surveys and property boundary surveys to be used in highway planning and design. These surveys include locating all physical and topographic features, utility locations, storm drainage features, and property boundary lines. He has also supervised and performed construction layout on highway projects including bridge and structure layout. Some notable highway design projects include: Corridor D - Parkersburg, WV, I-64 Widening - Kanawha County, WV, Veterans Bridge - Clarksburg, WV, and Route 10 Upgrade - Logan County, WV, King Coal Highway - Mercer County, West Virginia. Notable construction layout projects include: Holden Bridge - Logan County, WV and Chelyan Bridge - Kanawha County, WV.

Retail Development, Construction Surveying

Mr. Clark's experience as a construction layout surveyor includes multiple site design and construction layout projects. Notable projects include the construction layout of the Nitro Market Place retail Center in Nitro, WV, Southridge Retail Center, Charleston, WV, Devonshire Luxury Housing Site, Putman County WV, Ripley Hudson Housing Development, Jackson County, WV; Donnel Kinnard Memorial Cemetery, Dunbar WV; numerous retail restaurants, including Arby's, Burger King, Wendy's, O'Charley's. Retail stores include Walgreen's, Rite Aid, Wal-Mart, Lowes. Work on these projects included establishing horizontal and vertical control, staking out the buildings as per the instruction of the Project Superintendent, laying out drainage, sewage, paving and curbing with grades.



EDUCATION

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

PROFESSIONAL EXPERIENCE

26 Years

CERTIFICATIONS

- Certified Monitoring Well
Installer (WV #00225)

REGISTRATIONS & LICENSES

- Registered Professional
Engineer (WV, MD)

SKILLS

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

HIGHLIGHTS OF EXPERIENCE

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

RELEVANT PROJECT EXPERIENCE

Statewide Geotechnical Drilling IDIQ, Various Locations, WV

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

Corridor H Drilling-Kerens to Parsons, Section 2, Tucker County, WV

The project consists of the geotechnical drilling for a 3.69 mile section of a 4 lane Expressway which extends from Interstate 79 near Weston, WV east to the Virginia state line near Wardensville, WV. Mr. Haynes was the project manager for this project which consisted of 166 Borings for a total drilling footage of 10,616 feet. This project was extremely difficult due to the extremely steep terrain and strict environmental requirements.

Corridor H Drilling-Kerens to Parsons, Section 1B, Randolph, Tucker County, WV

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

Morris Impoundment, Dodridge County, WV

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

Appalachian Corridor "H", Tucker and Grant County, WV

As a Staff Geotechnical Engineer, Mr. Haynes worked closely with the field inspectors during the subsurface investigation phase by helping make decisions concerning boring locations, depths, and subsurface descriptions. He entered boring logs, assigned laboratory testing, and prepared geological stick bar borings to be placed on the project cross sections. Mr. Haynes also designed cut and fill slopes, performed slope stability analysis on critical embankment fills, estimated shrink/swell factors for excavated materials, and tabulated probable sources of select embankment for these sections of the Corridor. He compiled all information into a final geotechnical roadway report, including the three bridges in this section. Bridge reports provided foundation recommendations and bearing capacity computations for each of the bridge abutments and piers.

Western Juvenile Detention Center, Barboursville, WV

As a Project Engineer, Mr. Haynes developed and implemented the subsurface investigation for this detention facility. His responsibilities included coordination with our in-house survey department, determination of access for drill rig and equipment, and supervision of all field work.

Ohio University Southern Center for Development, Athens, OH

Mr. Haynes worked with drill teams from Triad during the subsurface investigation phase of this project, and then prepared computer-generated borings logs and assigned laboratory testing. From this, he prepared a geotechnical report including foundation recommendations, allowable bearing capacities, and estimated settlements.

St. Mary's Hospital, Huntington, WV

Mr. Haynes escorted Triad's drillers to this project site and staked the test borings utilizing measurements from existing site features. Following the subsurface investigation, Mr. Haynes then prepared a geotechnical report including foundation recommendations, allowable bearing capacities, and estimated settlements.

Cenalli Impoundment, Barbour County, WV

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

West Virginia Route 9, Jefferson and Berkeley County, WV

As a Staff Geotechnical Engineer on the first section of this project, Mr. Haynes worked as the Lead Inspector in the field during the subsurface investigation by logging soil and rock from bore holes, keeping track of drill rigs, and aiding other inspectors. He designed cut and fill slopes, performed slope stability analysis on critical embankment fills, performed settlement calculations for embankment fills, estimated shrink/swell factors for excavated materials, and tabulated probable sources of select embankment.

Coalfields Expressway, Sophia, WV

As a Project Geotechnical Engineer on this project, Mr. Haynes initially developed a boring layout based on the project cross-sections provided by the client. He also worked with field inspectors during the subsurface investigation to design cut and fill slopes, perform settlement calculations for embankment fills, estimate shrink/swell factors for excavated materials, and tabulate probable sources of select embankment. After the original subsurface investigation and geotechnical report was completed, WVDOT decided to extend the project 800 ft. in an attempt to balance borrow and waste. Mr. Haynes then developed a recall boring list in order to continue the project.

Pleasants County PSD Water Storage Tanks, Pleasants County, WV

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

Fairdale Elementary School, Fairdale, WV

Mr. Haynes escorted Triad's drillers to this project site and staked the test borings utilizing measurements from existing site features. Following the subsurface investigation, Mr. Haynes developed computerized boring logs, assigned laboratory testing, and prepared a geotechnical report including foundation recommendations, allowable bearing capacities, and estimated settlements.

Proposed Hampton Inn, Gallipolis, OH

Mr. Haynes escorted Triad's drillers to this project site and staked the test borings utilizing measurements from existing site features. Following the subsurface investigation, Mr. Haynes developed computerized boring logs, assigned laboratory testing, and prepared a geotechnical report including foundation recommendations, allowable bearing capacities, and estimated settlements.



Mitchel Strain, PWS, CPSS, CPSC Environmental / Permitting

EXPERIENCE SUMMARY

Mr. Strain is a Certified Professional Wetland Scientist (PWS); ARPAC Certified Professional Soil Scientist (CPSS), and ARPAC Certified Professional Soil Classifier (CPSC). He has OSHA Training with 40 hour hazardous waste site operations, 8 hour hazardous waste site operations refresher, and 8 hour hazardous waste operations. Mr. Strain's experience includes preparations of 401/404 permit applications, environmental, survey, utility research and mapping, topography, base map preparation, negotiations, EA and NEPA documentation, planning and studies.

RELEVANT EXPERIENCE

East Reservoir Dam – Final Design, Ohio Department of Natural Resources – Division of Engineering (2015-current). Prepared the 401/404 permit application for the Improvements to East Reservoir at Portage Lakes State Park which has a severe spillway deficiency. Improvement design consisted of an innovative gravity structure constructed using deep soil mixing techniques installed through a berm placed in the reservoir immediately upstream of the existing embankment. The work included the soil-cement mix design, internal and external stability calculations of the soil-cement gravity structure, and design and improvement of other appurtenant structures. Due to the amount of fill being placed into the reservoir, an individual permit was required. Fee for professional services: \$2900

ODNR Final Design of Long Lake Dam Replacement; Akron, Ohio (2014-2016). Prepared the 401/404 permit application this project to replace existing Long Lake Dam with a new structure. The existing 105-foot long gate was in very poor condition and had to be replaced. The new structure will use the same sized gates as the existing structure. A specific challenge with this project was the requirement for at least two gates (existing or new) being operational at all times during construction. This requirement resulted in the need for staged cofferdams, demolition, and construction. A nationwide maintenance permit was obtained for the construction.

ODNR North Reservoir Dam Replacement; Akron, Ohio (2013-2016). Responsible for research, oversight and quality control for reservoir safety study. Identify national horizontal and vertical control monuments, utility research and mapping, prepare base map showing parcels, utilities, bathymetry and topographic data. Manage and supervise multiple crews. Fee for professional services: \$6300.

EA and NEPA Documentation USACE, Huntington District, Huntington, West Virginia (2009-2013). Senior Project Manager/Ecologist with USACE, Huntington District: Mr. Strain led the completion of EA and NEPA documentation for Meldahl Hydroelectric project. Assisted in negotiating the successful mitigation of bottomland hardwood forest between the US Army Corps of Engineers, City of Hamilton, and US Fish and Wildlife Service. Mr. Strain also planned, managed, and coordinated the completion of NEPA documentation for hydroelectric projects at the Ohio River under Section 408 of the Rivers and Harbors Act and Section 404 of CWA. Led teams in conducting EA for Willow Island hydroelectric project on the Ohio River.

EDUCATION

M.S. Soil Science
B.S. Geology

AREAS OF EXPERTISE

Permitting
Environmental
Survey
Mapping
Topography
Planning Studies

REGISTRATIONS/LICENSES

Certified Professional Wetland Scientist (PWS)
ARPAC Certified Professional Soil Scientist
ARPAC Certified Professional Soil Classifier

TRAINING/CERTIFICATIONS

OSHA Training
- 40 hour hazardous waste site operations
- 8 hour hazardous waste site operations refresher
- 8 hour hazardous waste operations

OFFICE LOCATION

Newark, OH

YEARS OF EXPERIENCE

32

YEARS WITH FIRM

4

APPENDIX B –

Representative Dam Safety and Dam Design Projects

KEY PERSONNEL PARTICIPATION IN EXAMPLE PROJECTS

KEY PERSONNEL	ROLE IN THIS CONTRACT	EXAMPLE PROJECTS "X" under project key number for participation in same or similar role									
		1	2	3	4	5	6	7	8	9	10
Pete Nix, PE	Contract Manager/Project Manager/ Construction Administration	X	X	X	X		X	X		X	
Donald (Don) Thompson, PE	Quality Assurance / Quality Control	X	X	X	X					X	
Ike Pace, PE, CCP	Quality Assurance / Quality Control				X		X				
David Meadows, PE, PS (Triad)	Quality Assurance / Quality Control										X
David Moore, PE	Project Manager	X	X	X	X		X	X		X	
Steven Riedy, PE	Geotechnical Engineering / Geology Services	X	X	X	X		X	X	X	X	
Keyden Turner, EI	Geotechnical Engineering / Geology Services		X	X	X		X	X	X		
Adam Weaver, PE, SI, CPESC	Civil Engineering		X	X	X		X	X	X		
Andy Gong, PE, CFM	Civil Engineering				X		X			X	
Gregory Hynes, PE	Civil Engineering					X					
Douglas Lantz, PhD, PE, PH	Civil Engineering		X	X	X		X	X			
Chung-Cheng Yen, PhD, PE	Hydrology & Hydraulics		X	X	X		X	X			
John Elslager, PE	Hydrology & Hydraulics							X			
Steve Clark, PS (Triad)	Survey										X
John Haynes, PE (Triad)	Soils & Material Testing / Laboratory Services										X
Mitchel Strain, PWS, CPSS (Smart Services, Inc.)	Environmental / Permitting				X		X				

EXAMPLE PROJECTS KEY

NO	TITLE OF EXAMPLE PROJECT	NO	TITLE OF EXAMPLE PROJECT
1	Lake Lynn Dam – FERC Ninth Part 12D Inspection and Foundation Drain Report; Monongalia County, West Virginia	6	ODNR Final Design of Long Lake Dam Replacement (Akron, Ohio)
2	ODNR Statewide Dam Safety Design Services – Phase II	7	Muskingum Watershed Dam Safety Services, Chippewa Creek Subdistrict, Ohio
3	ODNR Dam Emergency Action Planning – Statewide Contract	8	Bethany Lake Dam Improvements Design; Holmes County, Ohio
4	ODNR Final Design of East Reservoir Dam Improvements (Akron, Ohio)	9	Sylvan Lake Spillway, Eagle, Colorado RCC for CPW
5	Parker Run Portals & Refuse – Rivesville, WV; Abandoned Mine Reclamation Design; Monongalia County, West Virginia	10	WVDNR Warden Lake Dam, Hardy County, West Virginia



1) Lake Lynn Dam FERC Ninth Part 12D Inspection and Foundation Drain Report



PROJECT DESCRIPTION

Tetra Tech was contracted by First Energy to conduct the ninth FERC Part 12D Inspection of the Lake Lynn Dam Hydropower Facility located near Morgantown, West Virginia. As part of this work, an investigation of the foundation drains was conducted.

Lake Lynn, FERC Project No. 2459-WV, is located 3.6 miles upstream from the Cheat River where it empties into the Monongahela River. The dam and powerhouse are located 2.7 miles southeast of Point Marion, Pennsylvania. There are 1,413 square miles of drainage area above the project. Lake Lynn is a concrete gravity dam approximately 125 feet and Lake Lynn consists of an integral intake/powerhouse, a gated spillway, and two bulkheads and Lake Lynn is classified as a high hazard potential dam as defined in the FERC Engineering Guidelines for the Evaluation of Hydropower Projects. The primary purpose of this project is to supply hydroelectric power to the wholesale power market through its interconnection to the PJM Interconnect, Inc.

The report presents observations made, conclusions drawn, and opinions formed from a visual inspection of Lake Lynn Dam, and a review of available pertinent documents related to performance of the dam. The purpose of the review report was to assess the adequacy of the safety of the facility for continued operation. In conjunction with the Part 12D work, an investigation of the foundation drains was conducted to assess their efficacy. Eighty-four vertical foundation drains and twelve open bore holes are situated in the base of the dam and are extended into the bedrock to reduce the uplift pressures acting on the dam. The drains were evaluated by examining their response to drawdown testing using a small-diameter packer and pump system in addition to piezometric readings.

OWNER'S SATISFACTION

The project was completed on schedule and within budget. There were no design change orders required.

PROJECT DATES

2011-2012

SERVICES PERFORMED

- Hydrologic and Hydraulic Analyses
- Subsurface Exploration
- Design and Construction Administration
- Instrumentation
- Uplift and Stability Analysis
- Structural Analysis-Concrete
- Seepage Analysis
- FERC Dam Safety Regulations
- Cost Estimate
- Dam Design

OWNER'S CONTACT

First Energy
 Monongalia County, WV
 John Ball
 (330) 451-9706

CONTRACT VALUE

\$60,000 00



BRIEF DESCRIPTION

This contract was awarded to perform planning, preliminary design, civil, geotechnical, and hydraulic engineering and hydrology work, and final designs on Ohio Department of Natural Resources' dams. Evaluating and designing dam repairs and modifications, investigating seepage and stability issues. Projects performed under this contract include:

Zepernick Lake Dam, Spillway Improvements, 2011. Zepernick Lake Dam is a 10.7 feet high earthen embankment 570 feet long impounding a 38 acre lake. Inspections indicated the existing principle spillway was deteriorated and no longer functioned as designed. The proposed improvements consisted of a new principle spillway riser, outlet conduit, graded filter at the downstream toe of the dam, a new intake pipe, lake drain and appurtenances. Additionally, the emergency spillway was widened to accommodate a larger discharge. The deliverables for this work included construction plans, specifications, and cost estimate.

East Reservoir Dam, Seepage Berm, 2011. East Reservoir Dam in Portage Lakes is a high-hazard, Class I dam. While conducting maintenance on the dam, workers observed seepage exiting the downstream face. Tetra Tech visited the site to observe the seepage. Geotechnical evaluations were conducted and slope instability and under-seepage were identified as potential concerns. Tetra Tech developed recommendations for a graded filter and stability berm. A construction contractor was quickly under contract and the berm was constructed in one week. Tetra Tech directed the Contractor's activities during the installation of the toe drain system.

East Reservoir Dam & North Reservoir Dam Safety Improvements, 2011–2013. East and North Reservoir Dams are high-hazard embankment dams with severe spillway deficiencies located in the Portage Lakes System. A report of improvements to these projects focused on planning and design features that would permit the dams to safely pass the PMF. Several alternatives were considered as part of this work including spillway modifications and overtopping protection. Work conducted consisted of site visits, survey, Hydrology and Hydraulic analysis, Geotechnical analyses, assessment of constructability issues and preparation of cost estimates. Deliverables for this work were a report summarizing the preliminary improvement alternatives, plans for each alternative and a cost estimate.

Buckeye Lake / South Fork Licking Watershed Hydrologic and Hydraulic Assessment, 2015. A Hydrologic Technical Report was prepared presenting the results of hydrologic and hydraulic analyses performed in the South Fork Licking River (SFLR) basin and Buckeye Lake Watershed. HEC-1 and HEC-RAS 2D models were developed and calibrated to evaluate hydrologic and hydraulic conditions of various frequency events and the PMF to evaluate and develop Interim Risk Reduction Measures (IRRM) and to evaluate dam operations during the design and construction phases of the rehabilitation of Buckeye Lake Dam.

Additional Task-Order Projects Executed. Guilford Lake Dam, Muskingum Dam No. 6 Repair, Zanesville Levee Grouting, GLSM Parapet Wall Repair, Grand Lake St Marys Lake Drain, and various dam decommissioning projects.

OWNER'S SATISFACTION

All work was completed on schedule and under budget. Including construction cost estimates and construction costs.

PROJECT DATES

2011 – 2016

SERVICES PERFORMED

- Engineering Assessments
- Dam Master Planning
- Hydrologic/Hydraulic Analyses
- Develop Alternatives
- Implement/Prioritize IRRMs
- Design and Construction Administration
- Geotechnical Engineering Analysis
- OH Dam Safety Regulations
- Structural Analysis - Concrete
- Lake Drain Investigation & Design
- Alternatives Development & Analysis

OWNER'S CONTACT

Ohio Department of Natural Resources, Division of Engineering

Hung Thai, PE

(614) 265-6714

CONTRACTOR'S CONTACT

Multiple – Please contact Owner for individual task order constructors



BRIEF DESCRIPTION

Tetra Tech was contracted as a sub-consultant to CEC Inc. to assess the condition of dams, determine consequences (economic impacts and population at risk), verify hazard class, and prepare Emergency Action Plans (EAPs) and Operations/Maintenance/Inspection (OM&I) Manuals for nine Class I dams owned and operated by Ohio Department of Natural Resources—Monroe Lake Dam, Jackson Lake Dam, Old Man’s Cave Lake Dam, Perry Reclamation Dam No. 3, Dow Lake Dam, Lake Rupert, Lake Alma Dam, Wolf Run Lake Dam, Highlandtown Lake Dam.

Major items of work performed under this contract to support master planning of Class I dams include the following:

- Preliminary site investigation and dam assessment.
- Perform hydrologic analyses (HEC-1 and HEC-HMS) and hydraulic and flood routing analyses (HEC-GeoRAS, and HEC-RAS), based on existing dam configurations and the updated statewide Probable Maximum Precipitation (PMP) data.
- Based on the results of the hydrologic/hydraulic analysis, identify any deficiencies and corrective measures necessary to bring the dam and associated structures (spillways, lake drain, etc.) into compliance with State of Ohio Dam Safety Laws and Rules.
- Prepare a hydrologic and hydraulic technical report for the revised hydrology and spillway capacity analysis. This will include a summary of findings for all hydrologic and hydraulic investigations, hazard classification, and recommendations on corrective actions to address any spillway deficiencies noted with the dam.
- Prepare EAPs, including inundation mapping, and an OM&I in accordance with OAC Rule 1501:21-21-04.
- Determine consequences from the inundation resulting from the PMF dam breach using HAZUS, GIS and determine the population at risk (PAR) using Census data.
- Performed Independent Technical Review of the following dams where CEC performed the above work items: Stewart Lake, Caldwell Lake, Adams Lake, Rush Run Lake, Cowen Lake, Wolfden Lake, Bear Creek Lake and Turkey Creek Lake Dams.

PROJECT DATES

2014 – 2016

SERVICES PERFORMED

- Dam Condition Assessment
- Emergency Action Plans
- OM&I Manuals

OWNER’S CONTACT

Ohio Department of Natural Resources, Division of Engineering

Jeremy Wenner (ODNR)
(614) 265-6719

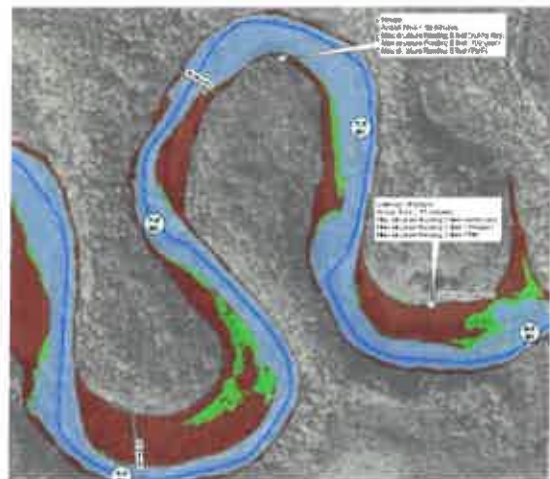
CONTRACTOR’S CONTACT

No Construction

Based on the results of the inundation mapping prepared for each dam, Tetra Tech was responsible for preparing an Assessment Report for each dam that includes an estimate of the total population, number of critical development sites and economic loss incurred due to a catastrophic failure of the dam. For the purpose of this contract, critical development sites were defined as those facilities essential to a community’s public health and safety or continued function, store or produce highly volatile/toxic/water reactive materials, or house occupants that may be insufficiently mobile to avoid loss of life or injury. Examples include jails, hospitals, schools nursing homes, fire/police stations, chemical storage sites and water treatment facilities.

OWNER’S SATISFACTION

The contract started with Tetra Tech providing the services listed above for 2 dams. The additional 7 dams were added resulting from the work quality and delivery of the first two. The work was completed under a tight deadline and all products were delivered on schedule and under budget.



BRIEF DESCRIPTION

East Reservoir Dam is a state-owned, high hazard embankment dam located in Portage Lakes State Park in Summit County Ohio. The existing embankment has a maximum height of 23 feet and is roughly 1,400 feet long in three embankment segments (south, main, and north). The embankment is constructed of sand and is founded on a sand and silty sand foundation. The project has a severe spillway deficiency and currently can pass only about a quarter of the design storm, the PMF. Due to the granular nature of the embankment and foundation materials, an overtopping event would result in the failure of the embankment.

The work initially consisted of planning and evaluating alternatives for the final design of the dam improvements to bring the project into compliance with the state's dam safety regulations. The deliverables for the work include the construction plans, specifications, and cost estimates for the proposed improvements. A number of alternatives were considered to provide overtopping protection to the embankment, including RCC of the existing embankment and various types of overtopping structures constructed in the lake upstream of the embankments. Due to the presence of a heavily-travelled road and utilities on the crest of the embankment, as well as additional local impacts, a new overtopping structure, constructed in the lake just upstream of the existing embankments, was considered to be the best solution for the project. As part of the design work, Interim Risk Reduction Measures were implemented to reduce the risk of the project. These measures included additional instrumentation to monitor the embankment and modifications to the spillway to increase the discharge capacity in the event a large storm is forecast.

For the overtopping structure, Tetra Tech developed an innovative construction sequence and design section consisting of a soil-cement cutoff wall and soil-cement gravity section. These elements will be constructed through a granular berm placed in the lake immediately upstream of the existing embankments. The gravity section was sized based on the stability requirements of the Corps EM Design of Concrete Dams. Internal stability of the individual soil-cement elements were also considered. A reinforced concrete cap will be placed on the surface of the soil-cement gravity section to protect it from overtopping flows. The final design of the overtopping structure is currently being performed and construction is scheduled to begin in fall 2017.

OWNER'S SATISFACTION

The project is on schedule and within budget. There were no design or construction change orders required for Tetra Tech. The bids came in under the construction cost estimate. The project just started construction.

PROJECT DATES

2015 – Present

SERVICES PERFORMED

Engineering Assessments
Implementation of IRRMs
Dam Master Planning
Geotechnical Engineering
Structural Engineering
Mechanical/Electrical Engineering
Hydrologic/Hydraulic Services
Alternatives Development & Analysis
OH Dam Safety Regulations and Permitting
Construction Administration

OWNER'S CONTACT

Ohio Department of Natural Resources, Division of Engineering
Jeremy Wenner, PE
(614) 265-6719
jeremy.wenner@dnr.state.oh.us

CONTRACTOR'S CONTACT

The Ruhlin Company
Jim Ruhlin, Jr.
(330) 350-1470





TETRA TECH

5) Parker Run Portals & Refuse – Rivesville WV Abandoned Mine Reclamation Design



CLIENT

West Virginia Department of
Environmental Protection

LOCATION

Rivesville, West Virginia

DURATION

2013 – 2015

COST

\$58,300

PROJECT TEAM

Greg Hynes, PE – Project Manager

Keith Lutz – Senior CAD Designer

REFERENCES

Ron Lane, Regional Engineer
WVDEP, AML&R
304-842-1900, EXT 3208
Ronald.D.Lane@WV.Gov

PROJECT DESCRIPTION

Tetra Tech was awarded an engineering contract for design of mine reclamation measures for five sites located near Rivesville in proximity to the Monongahela River. The design work included surveying and preparation of topographic mapping, and development of plans and specifications including grading layouts, earthwork design to provide positive drainage of spoil and refuse areas, eliminating designated highwall areas, and balancing earthwork considering soil cover requirements and shrink/swell factors. Grading design included cutting back the steep refuse piles along Parker Run Stream and removal of refuse materials encroaching on the bank of Parker Run. The proposed design minimized encroachments into Parker Run and limited disturbances below the ordinary high water mark. Highwall backfill design required a combination of mine seals, underdrains, conveyance piping, and open channels to convey mine water seepage away from the highwall before exiting the site at a stable point of discharge, and all refuse materials were required to be covered with topsoil. Mine seals and modified seals were designed for AMD collection. Five bat gate mine seals for mine portals were also required. Due to some mine entries having been designated as historic structures by the WV SHPO, site specific designs including self-supporting structures constructed of metal posts and fabricated steel angles were provided to prevent unwanted entry by people but allowing for the passage of bats.

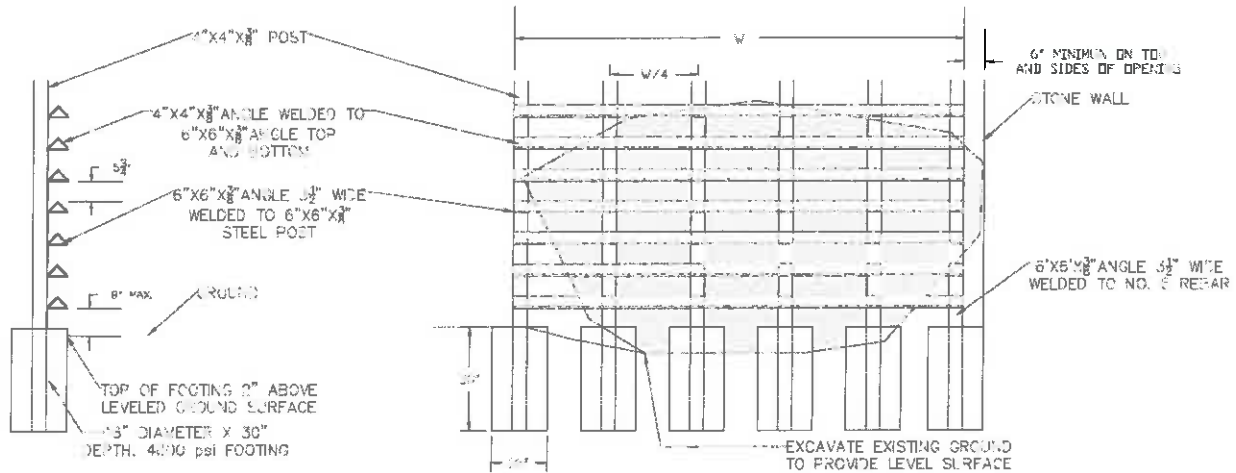
Erosion and sedimentation control design included filter socks, diversions, silt fence, sediment traps, water bars consistent with best management practices and the requirements of the WV Construction Stormwater General Permit. Highwall backfill slope design included benches graded such that surface runoff flowed back towards the highwall and was contained within the limits of disturbance and controlled with appropriate BMP's to avoid the need for sediment ponds which were not practical to construct due to the steep terrain.

Hydrologic and hydraulic design of channels and culverts was performed in accordance with the WV Erosion and Sediment Control Best Management Practices Manual and the WVDOH Design Manual. The project also included

Project Profile

design and permitting of aggregate access roads, construction entrances, buried PVC conveyance pipes, and demolition, removal, and disposal of abandoned structures.

During the construction bidding process, TetraTech provided engineering support to the WVDEP by answering technical questions and providing a detailed explanation of the project construction requirements and pay items at the pre-bid and pre-construction meetings.



BAT GATE - P3
NOT TO SCALE



BRIEF DESCRIPTION

The project consisted of the planning, geotechnical and structural investigation, preliminary design, and final design of a new gate structure at Long Lake to replace a 50-year old structure that was in very poor condition. The existing gate was a 105-foot long concrete structure supported on timber piles with six slide gates are provided to control flows. The Preliminary Design consisted of the planning and development of alternatives, preliminary structural and geotechnical evaluations and designs, the preparation of construction cost estimates, and the selection of a preferred alternative. Final Design included the final plans, specifications and construction cost estimate for the selected dam replacement alternative. The selected alternative consisted of a similarly-sized structure, founded on driven pipe piles, with three rolling gates to replace the original six gates. Interim Risk Reduction Measures implemented on this project included gate operations and water controls during construction, as well as additional sheet pile cutoff walls.

Of particular note, ODNR required that the water levels in Long Lake be maintained throughout construction and that a minimum of two gates were to be in service at all times. These requirements resulted in a staged construction for both the new dam structure and the cofferdam upstream of the new structure. Other project elements of note include the north weir rehabilitation and the channel improvements immediately downstream of the new dam structure.

The project is 98% complete.

OWNER'S SATISFACTION

The project is on schedule and within budget. There were no design or construction change orders required for Tetra Tech. There were construction change orders for Beaver Excavating that were required to add additional features that the owner requested during construction.



PROJECT DATES

2015 – 2017

SERVICES PERFORMED

- Engineering Assessments
- Implementation of IRRMs
- Dam Planning & Design
- Geotechnical Engineering
- Structural Engineering
- Mechanical/Electrical Engineering
- Hydrologic/Hydraulic Services
- OH Dam Safety Regulations and Permitting
- Cost Estimates
- Construction Administration
- Alternatives Analysis

OWNER'S CONTACT

Ohio Department of Natural Resources Division of Engineering

Jeremy Wenner, PE

(614) 265-6719

jeremy.wenner@dnr.state.oh.us

CONTRACTOR'S CONTACT

Beaver Excavating Company

Brooks Stingel, PE

Office: (330) 478-2151

Cell: (330) 933-7664



BRIEF DESCRIPTION

Phase I (2013-2014). MWCD selected Tetra Tech to perform preliminary hydrologic and hydraulic (H&H) analyses on three structures in the Chippewa Creek Subdistrict to check each dam’s storage/discharge capacity using the new State of Ohio specific Probable Maximum Precipitation (PMP) values. In addition, Tetra Tech prepared Emergency Action Plans (EAPs) and Operation, Maintenance, and Inspection (OM&Is) Manuals for the three structures in accordance with OAC 1501:21-21-04. Two structures were not able to pass the design storm (50% Probable Maximum Flood (PMF)). Conceptual and final design alternatives were developed for these structures (see Phase II).

Phase II (2015-Present). Based on the results from the Phase I work, Tetra Tech prepared preliminary engineering assessments and final design for two dams in the Chippewa Subdistrict to repair the storage/discharge deficiencies. In addition, full hydrologic and hydraulic assessments for two high hazard Class I dams were prepared in order to develop downstream inundation mapping. H&H Technical Reports were prepared for each dam. EAPs and OM&Is were developed for the two Class I dams. For both Class II dams, construction documents (plans and specs) were prepared.

PROJECT DATES

2013 – Present

SERVICES PERFORMED

- Dam Master Plan Services
- Engineering Assessments
- Design Alternative Analysis
- Geotechnical Analysis
- Cost Estimating
- Hydrologic/Hydraulic Analysis
- Dam Breach Analysis
- EAP and OM&I Manuals
- Topographic Surveys
- Construction Documents
- Construction Administration

OWNER’S CONTACT

Muskingum Watershed Conservancy District (MWCD)
 Boris Slogar
 (877) 363-8500 x2241
 BSlogar@MWCD.org

CONTRACTOR’S CONTACT

No Construction to date

Chippewa Creek Subdistrict Dam	Class	Phase I	Phase II	Scope Elements
Structure II-A Buck Creek Dam	II	X	X	Phase I: Hydrologic investigation of the dam's storage/discharge capacity using new Statewide PMP values. Develop EAP and OM&I manuals. Alternative analysis with cost estimates for Phase II final design. Phase II: Full hydrologic and hydraulic analysis for final design to correct the dam's storage/discharge deficiency. Topographic Survey, Construction Plans and Specs and Construction Administration.
Structure V-C Steele Ditch Dam	II	X		Phase I: Hydrologic investigation of the dam's storage/discharge capacity using new Statewide PMP values. Develop EAP and OM&I manuals.
Structure V-D Steele Ditch Dam	II	X	X	Phase I: Hydrologic investigation of the dam's storage/discharge capacity using new Statewide PMP values. Develop EAP and OM&I manuals. Alternative analysis with cost estimates for Phase II final design. Phase II: Full hydrologic and hydraulic analysis for final design to correct the dam's storage/discharge deficiency. Topographic Survey, Construction Plans and Specs and Construction Administration.
Structure VII-C Little Chippewa Creek Dam	I		X	Phase II: Full hydrologic and hydraulic analysis to develop inundation mapping. Develop H&H Report, EAP and OM&I Manuals.
Structure VIII-C River Styx Dam	I		X	Phase II: Full hydrologic and hydraulic analysis to develop inundation mapping. Develop H&H Report, EAP and OM&I Manuals.

OWNER’S SATISFACTION

“Tetra Tech’s knowledge of the new Probable Maximum Precipitation Study and Ohio Dam Safety Laws was critical to successfully completing hydrologic studies, Emergency Action Plans and Operations, Maintenance and Inspection Manuals for three dams in the Chippewa Creek Subdistrict. They produced high quality work products that were delivered on time and on budget.”

Boris Slogar, PE, Chief Engineer, Muskingum Watershed Conservancy District





8) Bethany Lake Dam Improvements Holmes County, Ohio Design



PROJECT DATES

2016– Present

SERVICES PERFORMED

- Dam Site Assessments
- Ohio Dam Safety Regulations
- Structural Engineering
- Geotechnical Engineering
- Final Design
- Construction Monitoring
- Materials Testing
- Hydrologic and Hydraulic Engineering
- Interaction with State Regulators

PROJECT OWNER

Mrs. Myra Sarafiri

OWNER'S CONTACT

Mr. Phil Blum – Agent
 (614) 307-6244
 6blums@gmail.com

CONTRACT VALUE

\$14,000.00

PROJECT DESCRIPTION

Bethany Lake Dam is a privately-owned, High-hazard (Class I) earthen dam situated in Holmes County, Ohio. In 2016 Tetra Tech was contacted by a private owner of a high hazard dam. The most recent ODNR Dam Safety Inspection revealed a section of heaved concrete that needed Engineering plans in order to repair. Tetra Tech's work on this project consisted of conducting a site assessment, review of available project information (including ODNR's Dam Safety file), as well as previous design calculations. Additional tasks include performing engineering in order to produce a design to repair a portion of heaved concrete revetment, situated near the left abutment of the auxiliary spillway.

In addition to the concrete repair, the owner asked Tetra Tech to design a replacement for the principal spillway. The existing spillway weir has deteriorated since its construction, 55 years ago. Tetra Tech designed a replacement weir, with the crest situated at the same elevation. Tetra Tech engineers also evaluated flow through the principle spillway to ensure that the proposed design would not impede the ability of the dam to pass the PMF without overtopping. The initial



OVERVIEW

The project consisted of modifications to an existing earthen dam to comply with current WVDEP Dam Control Regulations. The upgrade construction consisted primarily of roller compacted concrete.



Overall services provided by TRIAD consisted of surveying and mapping, a subsurface investigation, hydrologic/hydraulic evaluation, engineering design, construction administration, and construction monitoring and materials testing.

Services provided by TRIAD specific to roller compacted concrete (RCC) consisted of preparation of the roller compacted concrete (RCC) mix design, materials testing and monitoring during test pad construction, quality control testing and monitoring during RCC placement, and submittal of a final report upon completion of RCC placement and testing.



CLIENT:
WVDNR
Charleston, WV

PROJECT TYPE:
Dam Rehabilitation

- TRIAD SERVICES:**
- Surveying
 - Geotechnical Engineering
 - Quality Control
 - Quality Assurance

OVERALL DAM EXPERIENCE

Since the inception of the firm in 1975, TRIAD has been involved in numerous dam projects in varying capacities ranging from design of new facilities to safety evaluations and rehabilitation of old structures. We have extensive experience in preparing and securing dam permits with agencies in several different states. Below is a list of dams for which TRIAD has provided varying types of services in several states.

West Virginia Dam Projects:

Deegan Dam – Bridgeport, Harrison County, WV
Mt. Storm Lake Dam – Mt. Storm, Grant County, WV
Mountain Top PSD Dam – Mt. Storm, Grant County, WV
Bailey Dam – Mingo County, WV
Hinkle Dam – Bridgeport, Harrison County, WV
Longview Power Plant – Monongalia County, WV
Markwood Cedar Lake Dam – Mineral County, WV
Alpine Lake Dam – Terra Alta, Preston County, WV
Cobun Creek Dam – Morgantown, Monongalia County, WV
Willow Island Locks and Dam – Willow Island, Pleasants County, WV
Silver Creek Dam – Snowshoe, Pocahontas County, WV
Shavers Dam – Snowshoe, Pocahontas County, WV
Duncan Run Estates Dam – Berkeley County, WV
Lake Forest Estates Dam – Jefferson County, WV
Lake Ferndale Dam – Hampshire County, WV
U.S. Silica Dam – Berkeley Springs, Berkeley County, WV
Bruceeton Mills Dam – Bruceeton Mills, Preston County, WV
Loveridge Dam – Marion County, WV

Triad has worked on numerous dams for Consolidation Coal Company in Marion County, WV

Castleman Run Dam – Brooke County, WV
Bee Run Dam – Clay & Roane Counties, WV
Boley Dam – Babcock State Park, Fayette County, WV
Wilson Big Hollow Dam – Hampshire County, WV
Warden Dam – Hardy County, WV
Union Carbide Holtz Impoundment – Kanawha County, WV
Union Carbide Ward Pond – Kanawha County, WV
McClintock Dam – Mason County, WV
Burches Run Dam – Marshall County, WV
Anawalt Dam – McDowell County, WV
Pinnacle Rock Lake Dam – Mercer County, WV
Lemley Dam – Monongalia County, WV
Hurricane Water Supply Dam – Hurricane, Putnam County, WV
Mary Beth Dam – Putnam County, WV
Glade Springs Dam – Raleigh County, WV
Little Beaver Dam – Raleigh County, WV
PPG Earthen Dam – Wetzel County, WV
Shannondale Dam – Jefferson County, WV
Sleepy Hollow Dam – Berkeley County, WV
Coolfont (Lake Siri) Dam – Morgan County, WV
City of Thomas Reservoir – Thomas, Tucker County, WV
Lakewood Dam – Mineral County, WV



Blacksville No. 1 Fine Refuse Impoundment – Monongalia County, WV
Blacksville No. 2 Fine Refuse Impoundment – Monongalia County, WV
Tibbs Run – Monongalia County, WV
Neeley Hollow AMD – Mannington, Marion County, WV
Lowe AMD – Mannington, Marion County, WV
Snowshoe Resort Snowmaking Dam – Marlinton, Pocahontas County, WV

Virginia Dam Projects:

Apple Mountain Lake Dams – Warren County, VA
Blue Mountain Deer Lake Dam – Warren County, VA
Cove Dams – Frederick County, VA
Coventry Dam – Stafford County, VA
Deep Run Farm – Culpeper County, VA
Hideaway Hills Dam – Fauquier County, VA
JMU (Newman) Dam – Rockingham County, VA
Lake Front Royal – Warren County, VA
Lake Isaac Dam – Frederick County, VA
Lake of the Clouds, Shenandoah Farms – Warren County, VA
Lake Serene – Frederick County, VA
Lake St. Clair – Frederick County, VA
Lawrence Dams – Loudoun County, VA
Loch Linden Dam – Warren County, VA
Long Pond – Clarke County, VA
McGhee Dam – Loudoun County, VA
Oliver Dam – Loudoun County, VA
Peaceful Valley Dam – Frederick County, VA
Sheppard Lake Dam – Frederick County, VA
Silver Lake – Frederick County, VA
Spring Lake, Shenandoah Farms – Warren County, VA
Sullivan Dam – Warren County, VA
Whippoorwill Dam, Washington County, VA
Zuckerman (Meadow Lake) Dam – Frederick County, VA



Pennsylvania Dam Projects:

Capitol Camps Dam – Waynesboro, PA
Whitetail Pond Dam – Mercersburg, PA
Burchianti Dam – Smithfield, PA
Pittsburgh Airport Dam – Pittsburgh, PA
Bailey Freshwater Impoundment – Greene County, PA
Blacksville #2 Impoundments – Greene County, PA
Colvin Dam – Greene County, PA
Hughes Hollow Slurry Impoundment – Greene County, PA

Maryland Dam Projects:

Smithburg Lagoon and Edgemont Reservoir – Washington County, MD