



Armoring Lake Natalie Dam Using Articulating Concrete Blocks



Decommissioning Birch Run Dam



Decommissioning Hereford Manor Dams



Restoring Reservoir Area Following Breach of Birch Run Dam

Submitted to:



Milltown Dam

May 2015

Submitted by:



Gannett Fleming

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1. Letter of Introduction



May 29, 2015

Mr. Rick Smith, Township Manager
East Goshen Township
1580 Paoli Pike
West Chester, PA 19380

RE: Proposal for Engineering Services for Milltown Dam

Dear Mr. Smith:

The Township is taking a pro-active approach to address public safety concerns and resolve identified deficiencies (i.e., inadequate spillway capacity) associated with Milltown Dam (DEP ID No. D15-146). Ranked 11th among the Top 15 engineering firms in Dams and Reservoirs by the *Engineering News-Record*, Gannett Fleming is a nationally recognized leader in the dam industry. The firm's involvement with dams began in 1915 with the design of two flood control dams. Since that time, our completed dam projects include more than 100 new dams, modification of more than 500 existing dams and safety evaluations of more than 1,000 dams.

We are currently performing significant dam related services in Chester County, including work for the Chester County Water Resources Authority and the Natural Resources Conservation Service Pennsylvania office on Hibernia Dam and Beaver Creek Dam. For Aqua PA, we are preparing assessments of nine high hazards, including Township Line Dam located approximately two miles upstream of Milltown Dam. All of this Pennsylvania dam project experience allows us to provide dam engineering solutions that are in compliance with state and local regulatory requirements.

Point Person

One of Gannett Fleming's strongest assets is the depth and diversity of its professional in-house expertise. Our firm's Dams and Hydraulics Section has extensive experience in all areas needed to complete a dam project on schedule and within budget. We can expertly execute all phases of a project, including dam inspection, safety evaluation, geotechnical investigations, laboratory testing, preliminary and final design, permitting, and construction administration within our firm. All elements of a project are totally within our control; therefore, we can respond to the project requirements in the most efficient, timely, and cost-effective manner.

As Project Manager, *Eric C. Neast, PE* will serve as your point person for this project. Eric has more than 25 years of dam engineering experience, including providing solutions for inadequate spillway capacity and decommissioning dams. In addition to serving as Project Manager on more than 15 assignments, Eric has provided engineering services on more than 20 dam projects, with more than 10 in Pennsylvania. Under the supervision of Paul G. Schweiger, PE, Eric will lead the team to provide cost-effective services for the Township that are delivered on time and within budget.

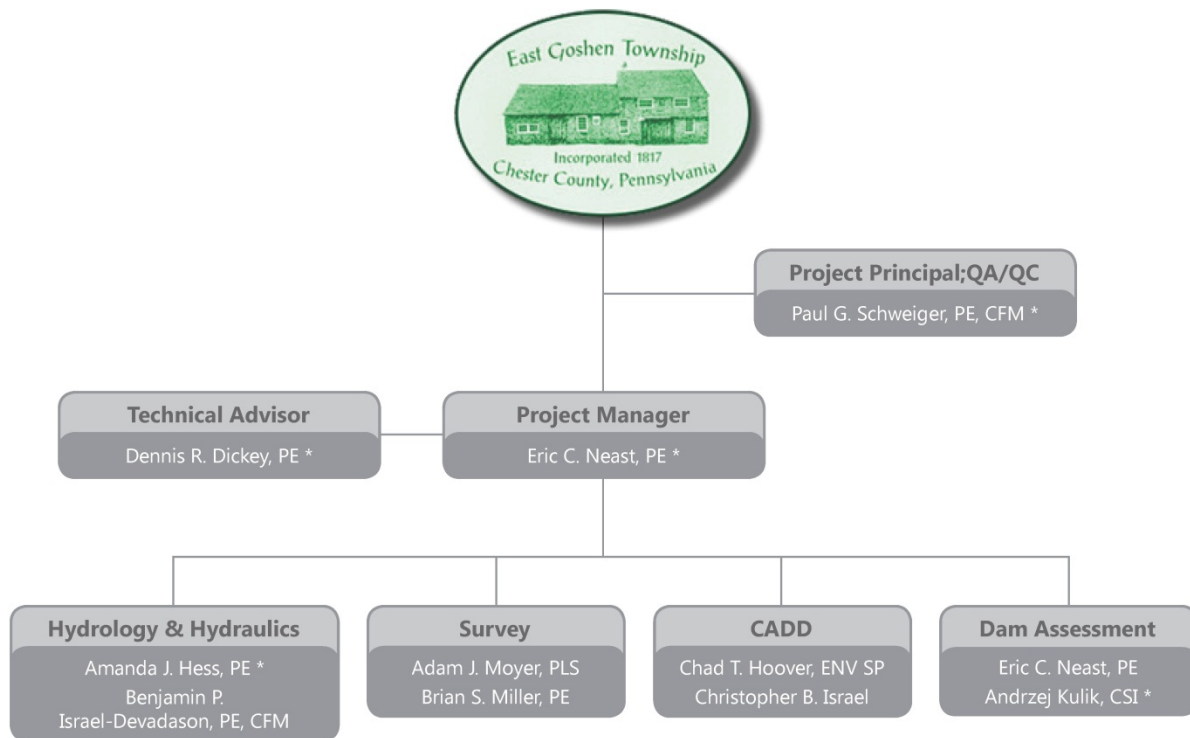
The following page includes an organizational chart of our proposed team. We have included Dennis R. Dickey, PE as Technical Advisor. Denny is the former Project Review Engineer; Section Chief of Project Review and Evaluation Section (Permitting Section); Division Chief of the Division of Dam Safety; and Acting Director, Bureau of

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Waterways Engineering for the Pennsylvania Department of Environmental Protection (DEP). He will provide advice and insight on complying with all DEP regulations. Resumes for each of the key personnel shown on our organizational chart are included in the Appendix.



* Resume Included

Figure 1: Organizational Chart. Our team includes all of the expertise needed to provide cost-effective solutions to address Milltown Dam's deficiencies.

Understanding of Township's Requested Services

The Township envisions four work phases for this project. Phase 1 is a planning level phase that involves evaluating alternatives to armor the dam to withstand an overtopping event and to breach the dam. At the completion of Phase 1, the Township will be able to make an informed decision to address the identified deficiencies at Milltown Dam. Phase 2 involves advancing the selected alternative through preliminary and final designs to the point that permit applications can be submitted. Phase 3 involves the preparation of construction documents and bid phase services, and Phase 4 involves construction phase services. In accordance with the RFP, our proposal only addresses the Phase 1 activities.

As identified in the memo included with the RFP, the estimated cost to breach the dam is significantly higher than the estimates for alternatives to reinforce the dam. If Phase 1 results indicate that breaching may be the best alternative, Gannett Fleming can assist the Township in finding alternative funding solutions to perform the breach. Many agencies and organizations serve as project sponsors for dam decommissioning projects because they can earn environmental credits from DEP or the U.S. Army Corps of Engineers (USACE). These project sponsors ultimately contribute financially towards the dam breach. We are currently providing engineering services for the removal of the Brandywine Dam for Chester County Water Resources Authority. The Pennsylvania Department of Transportation is serving as the project sponsor and financially supporting the project.

Approach to Meeting the Township's Needs


After reviewing the Phase 1 work tasks listed within the RFP, Gannett Fleming's preferred approach for this project is to first conduct an assessment of the entire dam and its features before preparing any conceptual designs to correct specific deficiencies. This assessment is intended to provide insight into the overall health of Milltown Dam and identify potential concerns (in addition to inadequate spillway capacity) that should be addressed as part of a major rehabilitation project.

Upon completion of the assessment, we will have an understanding of known or potential deficiencies. Based on the assessment results, we will develop a more comprehensive solution to provide the greatest value to the Township. This approach uses the Township's funds as effectively as possible. With that in mind, we are proposing a modified scope of work to include a high level assessment of the dam (Phase 1A). Our proposed Scope of Services is as follows:

Phase 1A – High Level Assessment of Milltown Dam: Identifying Deficiencies to Provide Greatest Value

Task 1 – Data Collection and Review

Gannett Fleming will first review available files associated with Milltown Dam. In addition to reviewing files provided by the Township, we will review files held by the Pennsylvania Department of Environmental Protection (DEP), Division of Dam Safety. We will scan pertinent information found within DEP's files and organize the scanned files to produce a permanent and complete historical record for the dam. This will expedite the assessment of the dam and make sure that all available information is considered. We will perform additional analyses only if necessary and to minimize effort.



To provide additional cost savings to the Township, we can submit the inspection report deliverable to DEP on behalf of the Township as their 2015 Annual Inspection Report for Milltown Dam.


We will also perform a visual inspection of Milltown Dam, take measurements, and read all instruments (if applicable). We will complete the inspection at a level of detail that meets or exceeds the needs for the DEP Annual Dam Inspection Report. To provide additional cost savings to the Township, we can submit the inspection report deliverable to DEP on behalf of the Township as their 2015 Annual Inspection Report for Milltown Dam.

Task 2 – Topographic Survey of Dam Site

Our in-house professional land surveyors will perform a detailed topographic survey of the dam and its appurtenances and a bathymetric survey of the reservoir. We will use the survey information to develop an existing conditions base map of Milltown Dam in AutoCAD Civil 3D and include spot elevations, topographic contours, structures, trees, utilities, and other features needed to provide an accurate representation of existing conditions. This information will aid in evaluating the existing surface condition of the dam embankment, preparing cross sections and profiles, preparing conceptual designs, and determining quantities for estimating costs. To estimate the amount of sediment which has accumulated within the reservoir, we will compare the bathymetric survey against the original design drawings. The base map will be of a quality that it can be used to prepare final design drawings.

Task 3 – Hydrologic and Hydraulic Analyses

The Township's website indicates that DEP, Division of Dam Safety has performed a hydrologic and hydraulic analysis of the Milltown Dam using the HEC-1 computer program. For the purpose of evaluating options for increasing spillway capacity and in an attempt to reduce costs to the Township, Gannett Fleming proposes to use the hydrology found within DEP's files. If desired by the Township, Gannett Fleming can perform an independent hydrologic evaluation as an additional service.



To reduce costs to the Township, Gannett Fleming proposes to use the hydrology found within DEP's files.

Task 4 – Perform Dam Assessment and Summarize Known and Potential Dam Deficiencies

Obtaining a comprehensive understanding of known and potential dam deficiencies is critical before developing conceptual dam rehabilitation designs. Based on the review of available data, topographic surveys and the site inspection, we will develop a comprehensive list of known and potential dam deficiencies. The list will describe

each known or potential deficiency and discuss each deficiency's significance to the overall safety and performance of the dam. We will include references to current design practices and standards, where appropriate, along with recommendations to correct each deficiency. We anticipate that inadequate spillway capacity is the primary deficiency that needs to be addressed to comply with state requirements and current practice. Other modifications may be classified as potential deficiencies and may need to be addressed but could require additional investigation to determine their importance.

It is important to identify potential deficiencies as they could significantly impact the selection of the recommended rehabilitation alternative. For example, a potential deficiency within the embankment could adversely impact the feasibility of armoring the embankment to accommodate overtopping, if this alternative is considered. Implementation of some recommendations will be optional, will be provided to improve the long-term operation and performance of the dam, and should be considered if modifications to certain features of the dam are performed.

Phase 1B – Alternatives Analysis: Determining Cost-Effective Solutions to Comply with Regulatory Requirements

Task 1 – Prepare Conceptual Rehabilitation Design(s) for Overtopping Protection

Gannett Fleming will prepare conceptual design plans and sections for rehabilitation alternatives along with a list of material quantities for developing cost estimates. We will base the conceptual design cost estimate on unit prices for major work items. The conceptual design description will include a discussion of permit requirements.



Figure 2: Articulating Concrete Block (ACB) Placement at Lake Natalie Dam. ACB is one option for overtopping protection that could be considered for Milltown Dam.

Task 2 – Prepare Conceptual Breach Design

Our conceptual breach design will include a list of material quantities for developing cost estimates. Based on the bathymetric survey, we will make recommendations to address sediment deposits within the impoundment. We will prepare a conceptual design cost estimate based on unit prices for major work items. The conceptual design description will include a discussion of permit requirements.

Task 3 – Design Report

To document the Phase 1B findings and present the conceptual rehabilitation designs, we will prepare a report to include supporting plans, cross sections, and calculations, along with a discussion of the options considered. The report will include estimates of annual maintenance costs and 30-year life cycle costs along with a recommendation for final design.

Task 4 – Pre-design Meeting with DEP

Prior to meeting with the Board of Supervisors, Gannett Fleming will initiate and hold a meeting with DEP, Division of Dam Safety. The goal of this meeting is to present the analyses and the recommended alternative for Milltown Dam and obtain DEP's acceptance of the selected approach. Permit and other requirements will be discussed with DEP. The schedule for completing the modifications will also be discussed.

Task 5 – Public Meetings

Gannett Fleming will present the findings of the alternatives analysis at a public meeting of the Board of Supervisors. In accordance with the RFP, it is assumed that two meetings will be attended.

Assumptions

1. The Township will coordinate and secure the right to access all properties as needed for Gannett Fleming to perform the various field work activities as described within this proposal. Said access shall be secured prior to the start of any and all field work.
2. The topographic survey does not include underground utility or property boundary surveys. It is assumed that the Township will provide Gannett Fleming with property boundary maps prior to Gannett Fleming performing the land survey. Gannett Fleming will attempt to locate property corners (i.e., pins) located with the survey area. Preparation of easements (if required) will be performed under a future phase and may require additional survey effort.
3. Horizontal survey control will be established using GPS. Horizontal datum will be NAD83 (2011), GEOID 12A, Pennsylvania State Plane Coordinates, South Zone. Vertical datum will be NAVD88.
4. This proposal assumes the topographic survey of the dam embankment will not exceed 2 acres in size, and the bathymetric survey of the reservoir will not exceed 13 acres in size.
5. No geotechnical evaluations are proposed as part of this initial phase of work. Depending on the selected alternative and the review of available information, subsurface geotechnical investigations may be required for final design.
6. No environmental investigations are proposed as part of this initial phase of work. Depending on the selected alternative, environmental investigations may be required for final design.
7. The Township will provide copies of past annual inspection reports, underwater inspections, conduit inspections, results of instrumentation readings, etc. for Gannett Fleming's review.

Thank you for the opportunity to submit our proposal to provide engineering services for Milltown Dam. Should you have any questions regarding our submission, please do not hesitate to contact me directly at 717-763-7212, ext. 2504 or by email at pschweiger@gfnet.com or Eric Neast at ext. 2828 or eneast@gfnet.com. We look forward to working with you on this project.

Sincerely,

GANNETT FLEMING, INC.



Paul G. Schweiger, PE, Vice President

Fishing for feedback at open house for Conowingo enhancement project

Exelon Power employees recently went fishing for some answers at an open house to discuss enhancements to the recreational opportunities at the Conowingo dam.

"This open house was a great opportunity for Exelon Power to hear from fishermen and boaters about the proposed enhancements," said Colleen Hicks, manager, Regulatory and Licensing, who is overseeing the relicensing of the Conowingo Hydroelectric Station



Paul Schweiger, designer, Gannett Fleming Inc., talks with some fishermen about the proposed enhancements at the Fisherman's Pier.

Figure 3: Public Meetings. Paul Schweiger led the stakeholder outreach program for Exelon's new ADA Accessible fishing wharf at Conowingo Dam (Source: Exelon Generation Newsletter).



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2.1. Project Manager Experience

Over his 25-year career in the environmental, engineering, and construction industry, our proposed Project Manager, Eric C. Neast, PE, has developed a broad background in the management of hydrology, hydraulics, and dam assessment, rehabilitation design, and breaching projects along with specialized expertise in sedimentation erosion control for small to mid-sized recreational lake dam projects located throughout Pennsylvania. Through this experience, he has developed a specialized understanding of the PADEP and its permitting process, while successfully cultivating key relationships with regulatory, political, and local stakeholders, including local Authorities, state agencies, and local community groups. Serving as both a Project Manager and an Engineer, Eric has helped clients such as Chester County Water Resources Authority, Redbank Valley Municipal Authority, Big Bass Lake and Arrowhead Lake Community Associations, and the Bear Creek Historical Society develop and put in place best management practices to protect water quality and wildlife habitats, support flood mitigation strategies, and implement dam safety programs.

He regularly deals with complex issues required to successfully deliver local yet highly visible projects. In the past 10 years alone, Eric has served as Project Manager or Engineer on more than 15 dam assessment and engineering projects where he has successfully completed the assessment, permit preparation, and design of dams, including the Lake Natalie Dam Rehabilitation, Bear Creek Dam Replacement, and Birch Run Dam Breaching projects highlighted in Section 2.2., Firm Experience. Eric also recently completed an alternatives analysis for the U.S. Fish and Wildlife Service to evaluate options for increasing conveyance capacity at Bear Canyon Dam located in New Mexico. As Project Manager, he can leverage this experience to lead the project team to consider all practical and implementable options while achieving the objective of East Goshen Township to identify and select the best option for all of the stakeholders.

2.2. Firm Experience

Since 1915, our completed dam projects include more than 100 new dams, modification of more than 500 existing dams and safety evaluations of more than 1,000 dams. In the past 10 years, we have completed inspections, designs, and/or risk assessments for more than 800 dams throughout the U.S.

A key indicator of the extent of our specialized experience and technical competence in dams and water resources is the amount of training and technical support we provide to the dams community. Training courses offered are often custom designed for each agency. A representative list of recent relevant dam safety courses Gannett Fleming currently offers or has offered includes:

- **Inspection and Assessment of Dams, NRCS/ASDSO** – This seminar provides comprehensive instruction on inspection and evaluation techniques for dams. The target audience is state dam safety officials, however, it is also relevant for dam owners, engineers, and personnel

Figure 2-1: Gannett Fleming's Dam Engineering Experience. Gannett Fleming has extensive experience providing services in the various areas needed to complete the Milltown Dam project.

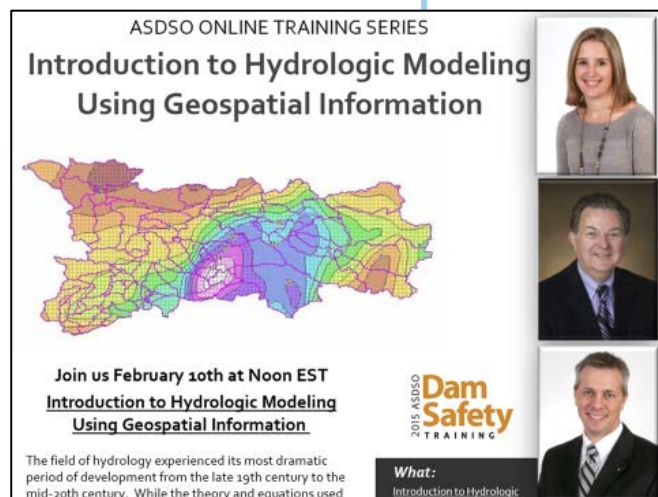
In just the *past 10 years*, we have performed:



responsible for the operation and maintenance of dams. We have provided this training across the country to over 360 attendees ranging from college professors to federal, state, and local dam owners and operators, and to engineering consultants.

- **Geotechnical Aspects of Dams, Pennsylvania Department of Environmental Protection (PADEP)** – A three-day course related to geotechnical aspects of dams for engineers and geologists.
- **Dam Owner Training, ASDSO** – One-day dam-owner seminars for state dam safety agencies throughout the United States.

This breadth of experience, coupled with our close working relationship with regulatory agencies, and our familiarity with each agency's processes, technical needs, and personnel, make Gannett Fleming your ideal candidate to successfully complete the Milltown Dam project.



March 4-6, 2014
Little Rock Marriot
Little Rock, AR

Sponsored by the Association of
State Dam Safety Officials



Inspection & Assessment of Dams

Figure 2-2: Training Opportunities. Gannett Fleming personnel regularly provide training to U.S. dam owners with topics including SITES and hydrologic modeling.

2.3. Project Experience

2.3.1. Dam Safety, Chester County, Pennsylvania

Client: Chester County Water Resources Authority (CCWRA)

To ensure safety at four regional flood control dams, CCWRA asked Gannett Fleming to provide dam engineering design, safety, management and operations; reservoir management and water supply release operations; wetland services; stormwater engineering design and construction management; land surveying; land management; geotechnical and foundation engineering; GIS and CADD; and other related field, engineering and technical services. Our services include:

Annual Dam Inspections: Performed annual inspections of the four existing earthen embankment dams and prepared inspection reports in accordance with Pennsylvania Department of Environmental Protection requirements.

Emergency Action Plan Revisions: Prepared draft revised EAP for the four existing dams. Revised draft EAPs included updated inundation mapping in accordance with current EAP guidelines and were submitted to CCWRA for comment.

Piezometer Monitoring at Beaver Creek and Struble Dams: Manually monitored and interpreted existing piezometric instrumentation at each dam. Twelve piezometers, two per casing, are in place at each dam. The discharge rate from the embankment drain outlets at each dam was monitored concurrent with the piezometer monitoring, and documentation was recorded in tabular and graphical form.

Embankment Stability and Drain System at Struble Dam: Performed investigations, evaluation, and monitoring at Struble Dam. Reviewed existing NRCS construction documents and records, performed topographic surveys, performed geophysical survey, and evaluated compatibility of embankment soils, fine drain fill, and coarse drain fill. Geophysical surveys included two-dimensional electrical resistivity, self-potential, and infrared thermal imaging to identify seepage along a 700-foot section of the earthen embankment. Completed the evaluation and prepared a report to recommend improvements for embankment drainage and slope stability.

Beaver Creek Dam Riser Monitoring: Surveyed six structure settlement monitoring “points” to a 0.01 horizontal and vertical accuracy with respect to established control and prepared a brief letter report summarizing the survey results.

Hibernia Dam Conservation Release Flow Control Valve: Prepared draft bid form and technical specifications for the service maintenance of the conservation release flow control valve for a three-year contract that includes two service events per year.

Hibernia Dam Piezometer and Embankment Stability: Performed investigations, evaluation, monitoring, analysis, and interpretation of elevated piezometer readings and Hibernia Dam to assist in the determination of cause and effects of the higher than normal piezometric readings.



Figure 2-3: Chester County Water Resources Authority Dam Services. Gannett Fleming performs annual inspections and dam engineering design to ensure the safety of four flood control dams.

2.3.2. Lake Natalie Dam, Gouldsboro, Pennsylvania

Client: Big Bass Lake Community Association

Big Bass Lake Community Association (Association) owns and operates a 1,500 acre gated community in Lackawanna and Wayne Counties, Pennsylvania. The Association also owns and operates three Dams (Big Bass Lake, Lake Natalie, and Lake Larsen). Lake Natalie and Lake Larsen are located directly on the Lehigh River and Big Bass Lake is located on Tamarack Creek which is a tributary to the Lehigh River.

The original Lake Natalie Dam was constructed in 1900 for the purpose of ice harvesting. The original dam was a rock filled timber crib structure with a plank sheeting cutoff wall along the upstream face of the dam. The original dewatering structure was a timber flume with stop logs along the left abutment.

Lake Natalie began experiencing several areas of subsidence along the upstream face of the right abutment of the dam, and after making temporary repairs, the Association asked Gannett Fleming to develop a more permanent solution. Our firm first investigated the causes of the problem, and then developed solutions to correct the recurring subsidence problem. In addition, we performed an overall assessment of the dam and incorporated additional improvements to the dam. These included the use of a large block retaining wall to stabilize the downstream face of the existing timber crib structure, armoring the downstream embankment slope with articulated concrete blocks for overtopping protection, and installation of a ford crossing to provide maintenance access to the right embankment.

Our work included conducting a preliminary site investigation, including surveys, geotechnical investigations, and environmental screening in order to develop a conceptual plan for the remediation. Upon completion of the conceptual plan, and approval by the Association, we completed the final design of these repairs, including the preparation of permit applications and drawings and specifications.



Figure 2-4: Lake Natalie Dam, before, during, and after Construction. Gannett Fleming determined the causes for subsidence and developed solutions to rehabilitate the Lake Natalie Dam.

2.3.3. Long Run Dam #1 Repair, Lehigh, Pennsylvania

Client: Lehigh Water Authority

An early 1900s vintage, high-hazard dam, Long Run Dam No. 1 is a composite structure with a concrete-lined upstream face and stone masonry core buttressed with an earth and rockfill embankment. The dam, 29 feet in height and 340 feet in length, provides water supply for Lehigh.

Lehigh Water Authority recognized that the dam had several problems, including: inadequate spillway capacity; severely deteriorated concrete spillway, spillway channel, and non-overflow section; cracks in upstream facing concrete allowing excessive leakage; and inoperable water supply intake facilities, no upstream closure on blow-off line, and no pass-by flow monitoring capabilities.

In order to fix these issues, Gannett Fleming:

- Reshaped the concrete principal spillway crest to improve hydraulic capacity
- Constructed a new reinforced concrete principal spillway channel
- Raised a portion of non-overflow dam crest section
- Converted 160 feet of non-overflow dam crest to an emergency spillway crest to increase the total spillway capacity to the full Probable Maximum Flood (PMF)
- Designed an armored embankment with roller-compacted concrete (RCC) downstream of emergency spillway crest
- Rehabilitated the intake tower, installed new supply and blow-off conduits, valves and downstream valve chamber
- Repaired cracks in the concrete liner wall using chemical grout injection techniques
- Constructed a reinforced concrete control section for pass-by flow monitoring weir and provided metered release capacity



Figure 2-5: Long Run Dam No. 1 Repair. Gannett Fleming designed improvements to rehabilitate the Long Run Dam No. 1 to handle the full PMF.

2.3.4. Shavers Creek Dam Repair, University Park, Pennsylvania

Client: The Pennsylvania State University

Shavers Creek Dam is owned by the Pennsylvania State University and is located in Huntingdon County, Pennsylvania. The earthfill structure is 48 feet high with an embankment length of 540 feet. Previous inspections of the dam revealed voids beneath the spillway, prompting investigations into the repair of the dam. The spillway also had insufficient capacity to pass the design discharge as required by the Pennsylvania Department of Environmental Protection (PADEP).

The 8.2 square mile drainage area produces a peak inflow discharge during the Probable Maximum Flood (PMF) of 28,000 cfs. As mandated by the Division of Dam Safety, the reservoir was drained and maintained fully empty until modifications were constructed to upgrade the dam to safely pass the 100% of the PMF.

Gannett Fleming designed improvements to the dam to meet PADEP requirements and address the voids beneath the spillway. The modifications included flattening the downstream slope from 2.5H:1V to 3H:1V and armoring the embankment with articulated concrete blocks to all embankment overtopping. This armoring system included open-celled concrete blocks cabled together to form a continuous carpet of concrete blocks over the entire armored surface of the embankment. The capacity of the existing concrete spillway was not changed; however, it was fully replaced with a new concrete spillway to remedy serious foundations and seepage problems with the existing structure. These modifications addressed the deficiencies in the existing spillway and allow the dam to safely pass the required design discharge.

The existing outlet conduit was repaired and extended and the sluice gate in the intake structure was replaced. The armoring system on the embankment was covered with topsoil and seeded.



Figure 2-6: Shavers Creek Dam Repair. Gannett Fleming designed improvements to eliminate voids under the spillway and improve the dam to meet PADEP requirements.

2.3.5. Bear Creek Dam Replacement, Wilkes-Barre, Pennsylvania

Client: Bear Creek Historical Society

In the early 1800s, a 360-foot long rock-filled timber crib dam was constructed across Bear Creek on a 35-square mile watershed located approximately 10 miles east of Wilkes-Barre, Pennsylvania. Since then, the timber crib dam and lake which it creates have become prominent and central features of the Historic Village of Bear Creek. At a height of approximately 20-feet, the Bear Creek Dam has the distinction of being the only high hazard timber crib dam in Pennsylvania.

Following a significant rainfall event, a segment of the dam collapsed, initiating implementation of emergency procedures that included notification of downstream residents. No downstream damage or loss of life occurred as a result of the partial failure of the dam, however, the PADEP, Division of Dam Safety, declared the dam to be unsafe and required the owners to empty the reservoir until the dam was either breached or repaired.

The Bear Creek Historical Society asked Gannett Fleming to help evaluate the existing dam and recommend a course of action. A dam replacement concept using RCC was developed, and maintained the historic appearance of the existing dam while satisfying modern dam design requirements. In order to accelerate construction and minimize costs, a design/build contract approach was proposed. The total project cost including design, permitting, and construction was \$920,000.

The design of the dam included determining the minimum gravity section necessary to safely pass more than 20 feet of overtopping flows during the PMF, and satisfy stability requirements. The selected gravity section consists of a formed vertical downstream face with a 12-foot wide crest and an unformed 1.0 horizontal to 0.8 vertical upstream face.

Construction of Bear Creek Dam included the installation of a rough sawn two-inch thick timber facing system. It is the first RCC dam constructed with a timber face. Anyone unaware of the dam's replacement would have a difficult time detecting any changes in the historic structure. Without the advent of RCC technology it is likely that the dam would have been breached and the historic lake setting lost. Use of RCC over conventional concrete to replace the dam resulted in an estimated savings of approximately \$500,000.

The new Bear Creek Dam is the first roller-compacted concrete (RCC) dam in the world constructed with a timber-facing system. It is safer, more reliable and maintains the original's 19th-century appearance, and also features important sustainability components. The dam not only provides a recreational pool, but many of the old dam materials were recycled. Some of the 130-year-old hand-hewn timbers were used to create a border around a new historical display and a portion of the original rock fill was also used to construct a small public viewing area at the north abutment. By using a design-build project delivery system and constructing the new structure with RCC instead of conventional concrete, there was a significant financial benefit and overall savings to the Bear Creek Community.



Figure 2-7: Bear Creek Dam Replacement.

Gannett Fleming designed the first RCC dam in the world constructed with a timber-facing system after the original dam partially collapsed due to heavy rains.

2.3.6. Upper and Lower Hereford Manor Lake Dams Breach Design, Beaver County, Pennsylvania

Client: Pennsylvania Department of General Services

Hereford Manor Lakes consisted of two homogeneous earthfill embankment dams that were owned and operated by the Pennsylvania Fish and Boat Commission. Both dams were located in Franklin Township, Beaver County along the north side of State Route 288. The dams served primarily as recreational facilities and were breached due to safety concerns.

Gannett Fleming analyzed the dams and discovered several challenges. Spillways of both dams had been diverting the natural stream flow across a ridge into the neighboring watershed for more than 60 years. With assistance from the U.S. Army Corps of Engineers Pittsburgh District, we had to return the stream to its original path after the dams were removed.

Gannett Fleming prepared preliminary and final designs for breaching the Upper and Lower Hereford Manor Lake Dams and construction of a new box culvert under S. R. 588 immediately downstream of the lower dam. Our firm's work included design-, bid- and construction-phase support services including topographic and bathymetric surveys, field investigations, subsurface explorations, environmental studies, permitting, cost estimating, hydrologic and hydraulic analyses, and coordination with local, state, and federal agencies. Work sharing among offices helped significantly to complete the work ahead of schedule and under budget.



Figure 2-8: Breaching of Upper and Lower Hereford Manor Lake Dams. Due to safety concerns, Gannett Fleming prepared preliminary and final designs for breaching the dams, which is shown before, during, and after construction of a new box culvert under S.R. 588 immediately downstream of the lower dam.

2.3.7. Birch Run Dam Evaluation, Breaching, and Site Restoration, Chambersburg, Pennsylvania

Client: Borough of Chambersburg

In response to the Borough's needs, Gannett Fleming performed field surveys, wetlands investigations, Bog Turtle investigations and permitting, and prepared mapping, preliminary and final design, plans, specifications, erosion and pollution control plans, and contract documents for the for the breaching, removal, and site restoration of the Birch Run Dam. Gannett Fleming also provided the Borough with bid phase and construction phase services.

After investigating alternatives, the hazard potential posed to more than 11,000 downstream residents was the primary factor in the decision to remove the dam from service. During breach design, our firm identified the location of the mainstream channel from historic documentation. This information allowed our firm to restore the stream channel, as closely as possible to its original state, prior to breaching. The project restored almost 4,000 feet of stream channel and provided for unobstructed migration of fishes to the upper reaches of Conococheague Creek. The project began a full-stream ecology restoration process.

Gannett Fleming provided the following services:

- Subsurface investigations
- Hydrologic and hydraulic analyses
- Investigation of various alternatives' impact on the stream environment, wetlands, forest, water supply system operation, and safe yield
- Completion and submission of a water allocation permit renewal application
- Final design and construction cost estimation
- Environmental impact opinion study
- Preparation of a safe yield model
- Coordination with regulatory agencies
- Bid phase and construction support.



Figure 2-9: Birch Run Dam Evaluation and Breaching. After investigating alternatives, Gannett Fleming recommended breaching the Birch Run Dam due to safety concerns.

2.3.8. Maple Lake Dam Breach, Lackawanna County, Pennsylvania

Client: Pennsylvania American Water

Maple Lake Dam, 17 feet in height, with a contributing watershed area of 2.10 square miles, was constructed in the early 1900's as an intake and source for drinking water. The dam was situated north of Scranton, Pennsylvania within South Abington Township of Lackawanna County, impounding a 4 million gallon reservoir along Summit Lake Creek approximately 2,300 feet upstream from the railway embankment along Shady Lane Road west of the intersection of Shady Lane Road and US Route 11. The dam was constructed of a stone masonry core with earthen embankments and was fitted with a stone masonry, stair-stepped spillway.

In 2005, the Pennsylvania Department of Environmental Protection (PADEP) reclassified Maple Lake Dam as a high hazard structure. As it had not been actively used as a raw water supply reservoir for several years, Pennsylvania American Water decided that, rather than rehabilitate a dam which no longer served a useful purpose for water supply, they would breach the dam.

Gannett Fleming performed site surveys and hydrologic and hydraulic computations to document breach size selection; prepared plans and specifications; and coordinated with the U.S. Army Corps of Engineers, PADEP, Pennsylvania Fish and Boat Commission, American Rivers, and local interests to design plans to breach the dam.

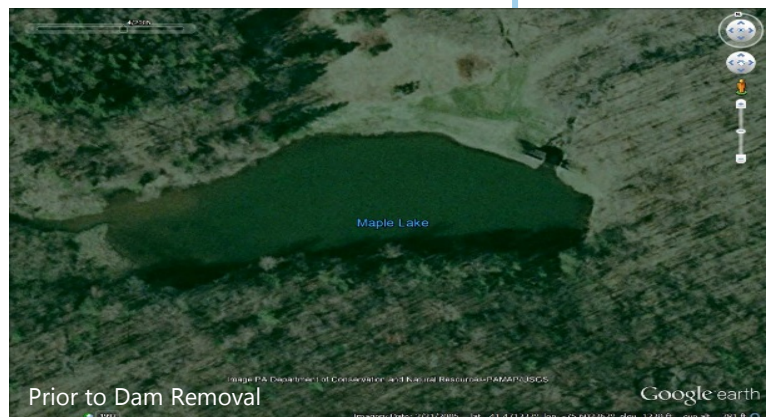


Figure 2-10: Maple Lake Dam Breach. Gannett Fleming determined that breaching Maple Lake Dam, which was no longer used for water supply, was more cost-effective than rehabilitating the high hazard structure.



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3.1. Client Satisfaction Evaluations

Each year more than 80 percent of the firm's business is derived from satisfied, repeat clients, which is a testament to our ability to provide quality work products and client-focused service. Gannett Fleming solicits Client Satisfaction Evaluations (CSEs) from every client. Our CSE form includes six individual measurement points and one "overall performance" assessment. Clients evaluate our performance on a scale of 5 (highest) to 1 (lowest). To date this year, Gannett Fleming has received 113 CSEs with an overall performance rating of 4.9, including 60 perfect scores. These scores demonstrate our commitment to our customers and our ability to complete tasks on time, within budget, and to the highest quality standards.

Table 3-1: Client Satisfaction Evaluation Statistics for 2015 Year to Date. On a scale of 1 to 5, our clients rated Gannett Fleming a 4.9 for our performance during delivery of their projects.

Measurement Points	Score
Technical Quality – Did we adhere to the scope? Was our work complete? Was our work accurate?	4.9
Timeliness – Did we adhere to the schedule? Were we prompt in dealing with other matters?	4.7
Cost Effectiveness – Did we adhere to the budget? Was the value received commensurate with the dollars spent?	4.7
Dependability/Reliability – Did we honor our commitments without reminders? Did we properly support your interests?	4.8
Cooperation – Did we display flexibility? Were we easy to approach? Were we actively helpful?	5.0
Communication – Were we good listeners? Did we ask appropriate questions? Did we provide information proactively?	4.8
Performance – Overall, how well did we serve you?	4.9

3.2. Representative Project References

We strive to serve our clients as a trusted advisor. Gannett Fleming encourages East Goshen Township to contact the references listed below to discuss our performance on similar projects.

Chester County Water Resources Authority, Chester County, PA

Janet Bowers, PG
(610) 344-5401

Upper and Lower Hereford Manor Lake Dams Breach Design, Beaver County, Pennsylvania

David S. Folk, PE
(717) 346-4021

Birch Run Dam Evaluation, Breaching, and Site Restoration, Chambersburg, Pennsylvania

Lance Anderson, PE
(717) 709-2285

Maple Lake Dam Breach, Lackawanna County, Pennsylvania

Anthony M. Nokovich, PE
(717) 691-2138

Our Mission

*Amaze our clients
with our
responsiveness and
innovation and
become their trusted
advisor, promote a
rewarding work
environment and
provide a fair return
on investment*

Lake Natalie Dam, Gouldsboro, Pennsylvania

David Ingegneri

(570) 842-6388

Long Run Dam #1 Repair, Lehighton, Pennsylvania

Armando Galasso

(610) 377-1912

Bear Creek Dam Replacement, Wilkes-Barre, Pennsylvania

Charles Katcavage

(570) 472-3609

"We were particularly impressed by the high degree of expertise demonstrated by Gannett Fleming..."

— Charles Katcavage
Bear Creek Historical Society



Gannett Fleming

100 Years

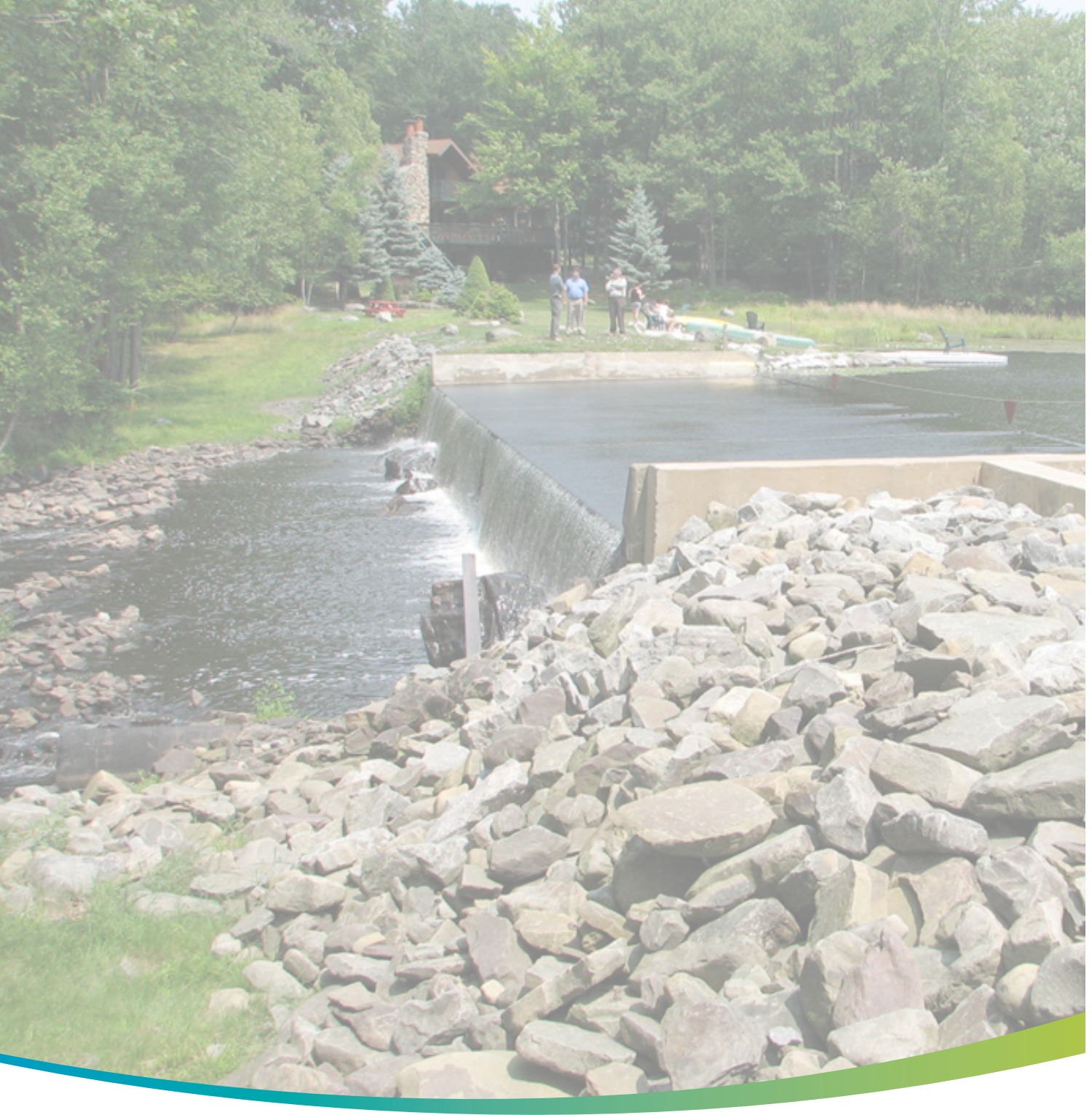
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4. Schedule

Tasks	Month								
	1	2	3	4	5	6	7	8	9
Notice to Proceed	◆								
Phase 1A - High Level Assessment of Milltown Dam									
Task 1 - Data Collection and Review									
Task 2 - Topographic Survey of Dam Site									
Task 3 - Hydrologic and Hydraulic Analyses (none proposed)									
Task 4 - Perform Dam Assessment and Summarize Known and Potential Dam Deficiencies									
Phase 1B - Alternatives Analysis									
Task 1 - Prepare Conceptual Design(s) for Overtopping Protection									
Task 2 - Prepare Conceptual Breach Design									
Task 3 - Design Report									
Task 4 - Pre-Design Meeting with DEP									
Task 5 - Public Meetings									◆





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Our proposed fee to perform the aforementioned scope of services as described within this proposal is \$83,265 as a lump sum. We include a detailed breakdown of this fee on the following page. Billings shall not exceed this amount without written authorization from the Township.

Milltown Reservoir - Alternatives Analysis

Estimated Level of Effort By Task

Item and Task Descriptions	Total Cost	Subtotal Labor	Subtotal Sub Costs & Expenses	Subtotal Hours	Principal-In-Charge	Senior Project Manage	Senior Project Engineer	Project Engineer	Staff Engineer	Surveyor	Senior Technician	Technician	Clerical	Expenses
Project Management														
a. Develop BST & Project Execution Plan	\$825.00	\$825.00	\$0.00	5	1	3							1	\$0.00
b. Preparation for Project Kick-Off Meeting	\$330.00	\$330.00	\$0.00	2			2							\$0.00
c. Project Kick-Off Meeting	\$795.00	\$795.00	\$0.00	5	1	1	1	1		1				\$0.00
d. Project Kick-Off Meeting Minutes	\$165.00	\$165.00	\$0.00	1			1							\$0.00
e. Client Coordination	\$540.00	\$540.00	\$0.00	3	1		2							\$0.00
f. Invoice Preparation	\$330.00	\$330.00	\$0.00	2			2							\$0.00
	\$300.00	\$300.00	\$0.00	4									4	\$0.00
Total	\$3,285.00	\$3,285.00	\$0.00	22	3	4	8	1	0	1	0	0	5	\$0.00
Phase 1A														
1.a Review and Scan Files	\$1,620.00	\$1,620.00	\$0.00	16			2		8				6	\$0.00
1.b Inspection and Assessment of Milltown Dam	\$7,230.00	\$6,960.00	\$270.00	42		2	40							\$270.00
2.a Topographic Survey	\$10,415.00	\$9,525.00	\$890.00	81			1			34	38	8		\$890.00
2.b Bathymetric Survey	\$9,025.00	\$8,205.00	\$820.00	70			1			29	32	8		\$820.00
3 Hydrologic and Hydraulic Analysis	\$480.00	\$480.00	\$0.00	4				4						\$0.00
4 Dam Assessment Report	\$10,200.00	\$10,200.00	\$0.00	68	4		40	20				4		\$0.00
Total	\$38,970.00	\$36,990.00	\$1,980.00	281	4	2	84	24	8	63	70	20	6	\$1,980
Phase 1B - Alternatives Development														
1&2 Hydraulic Analysis	\$2,430.00	\$2,430.00	\$0.00	19		1	2	16						\$0.00
1&2 Develop Base Mapping	\$1,050.00	\$1,050.00	\$0.00	8			2	2			4			\$0.00
1&2 Brainstorm Alternatives	\$870.00	\$870.00	\$0.00	5	1		4							\$0.00
1&2 Conceptual Design Alternatives (Assume 3 Rehab and 1 Breach)	\$18,480.00	\$18,480.00	\$0.00	132	4	8	40				80			\$0.00
1&2 Prepare Cost Estimates	\$2,790.00	\$2,790.00	\$0.00	21	1		4	16						\$0.00
3 Summary Report	\$9,010.00	\$8,910.00	\$100.00	58	4	4	30	12			8			\$100.00
3 QA-QC	\$1,110.00	\$1,110.00	\$0.00	6	2	2	2							\$0.00
4 Meeting with DEP Dam Safety (1)	\$2,190.00	\$2,190.00	\$0.00	13	1		12							\$0.00
5 Meeting with Township (2)	\$3,080.00	\$2,640.00	\$440.00	16			16							\$440.00
	\$0.00	\$0.00	\$0.00	0										\$0.00
Total	\$41,010.00	\$40,470.00	\$540.00	278	13	15	112	46	0	0	92	0	0	\$540
Total Estimated Effort	\$83,265.00	\$80,745.00	\$2,520.00	581	20	21	204	71	8	64	162	20	11	\$2,520.00



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Summary of Qualifications and Experience

As Project Manager, Eric will serve as your primary point of contact and will provide consistent oversight and leadership throughout the project to meet the County's budget and schedule requirements. Eric has more than 25 years of engineering experience including breach design, permitting, and overtopping protection for dam rehabilitations. In addition to serving as Project Manager on more than 15 assignments, Eric has provided engineering services on more than 20 dam projects, more than 10 in Pennsylvania.

Relevant Projects

Breaching of Upper and Lower Hereford Manor Lake Dams, Beaver County, PA, Pennsylvania Department of General Services. Design Engineer responsible for the preparation of a comprehensive plan for control sediment-laden runoff from the breach of two earth embankment dams located on Doe Run. The dams are homogeneous earthfill dams 40 feet high by 450 feet long and 37 feet high by 1,000 feet long, respectively. The erosion control plan covered both the breach and the disposal areas and included diversion of water measures to convey offsite flow around the work areas. Responsibilities also included preparation of final construction documents and cost estimates.

Lake Natalie Dam Rehabilitation, Gouldsboro, PA, Big Bass Lake Community Association. Assistant Project Manager responsible for the rehabilitation design of Lake Natalie Dam, including armoring the downstream slope of the 10-foot-high earthen embankment with articulated concrete blocks (ACBs); stabilizing the 80-foot-long timber-crib spillway by installing an extension of the reinforced-concrete cap and placing precast-concrete buttress blocks; and installation of a reinforced-concrete cut-off key, ACB downstream channel protection (which also functions as a ford crossing of the Lehigh River), and an impervious liner adjacent to the right upstream slope of the embankment.

Shenango Intake Dam Rehabilitation Project, Sharon, PA, Aqua Pennsylvania, Inc. Assistant Project Manager for an Alternatives Analysis featuring dam modifications to address structural and public safety concerns at Shenango Intake Dam, a 110-foot-long low-head dam on the Shenango River in Sharon, Pennsylvania. Alternatives considered included grouted boulder fill on the downstream face, a rock-ramp fishway, and structural modifications to the dam. Hydropower alternatives were also analyzed from a regulatory, construction, and cost-feasibility perspective. The rock-ramp fishway was designed using technology developed by Dr. Luther Aadland of the Minnesota Department of Natural Resources, who participated as technical advisor to the design team. Responsibilities included permitting and construction-phase services.

Breaching of Birch Run Dam, Adams County, PA, Borough of Chambersburg. Design Engineer responsible for preparation of an erosion control plan and NPDES general permit application for the breaching of an existing water supply dam on the Conococheague Creek. The existing earthfill dam contained a concrete core wall and was approximately 60 feet in height. The breach required the removal of approximately 74,000 cubic yards of material and resulted in a 130-foot-wide (bottom width) opening in the existing structure. Preventing sediment from entering the existing stream was of utmost importance as the Borough's water supply intake is located immediately downstream. The design included a detailed staging and diversion-of-water plan, located haul roads, avoided environmentally sensitive areas, and utilized sediment traps to



Project Assignment:

Project Manager

Years Experience with

Current Firm: 25

Years Experience with

Other Firms: 1

Education:

BS, Civil Engineering, The Pennsylvania State University, 1989

Professional

Registrations:

PE: Pennsylvania - No. PE055653E (2000)

control sediment from both the breach area and five identified spoil locations. Responsibilities also included preparation of final construction documents and cost estimates.

Bear Creek Dam Replacement Project, Bear Creek, PA, *The Bear Creek Historical Society*. Design Engineer responsible for preparing an E&SPC plan for the dam replacement project. The design included the layout and design of stockpile/waste areas, silt fence, rock construction entrances, site stabilization, and the protection of environmentally sensitive areas. A staging of earthmoving activities schedule was developed as part of the erosion control plan, which included a detailed diversion-of-water plan for maintaining off-site clean flows through the project site.

Conowingo Dam Fishing Enhancements, Cecil and Harford Counties, MD, *Exelon Power*. Project Manager responsible for the design and permitting of various recreational improvements located along the Susquehanna River downstream of the Conowingo Dam hydroelectric power plant. Improvements in Cecil County included a new 2,400-foot walking trail, a trail head parking area, and an associated driveway entrance off S.R. 222. Improvements in Harford County included a new Americans with Disabilities Act (ADA)-accessible fishing wharf located approximately 500 feet downstream of the dam. The fishing wharf design included an overlook area, a 250-foot-long ADA-accessible walkway, sculptural oversized steps for able-bodied fishermen, and a 160-foot-long fishing pier containing 14 ADA-accessible fishing stalls. The operation of the hydroelectric power plant created water elevations at the fishing wharf that varied by as much as 9 feet every day. A post-and-lagging wall design was used for the fishing wharf, which allowed construction to be performed in the wet. Construction activities were scheduled to comply with instream work restrictions associated with migratory fish. The design was completed in 2008 and construction was completed in 2009.

Dam Design Services, Springton Dam Rehabilitation, Delaware County, PA, *Aqua Pennsylvania, Inc.* Project Manager responsible for the proposed rehabilitation of the Springton Dam, an earthen embankment approximately 70 feet high and 1,600 feet long. The project includes replacing and widening a Pennsylvania Department of Transportation (PennDOT) bridge spanning the spillway outlet channel, widening and deepening the spillway outlet channel under the new PennDOT bridge, and replacing the existing fixed-crest ogee spillway control section with a fusegate spillway system.

New Creek Site 14 Dam Rehabilitation, Keyser, WV, *U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), West Virginia State Office*. Project Engineer responsible for providing design and construction-phase support services to the NRCS for the rehabilitation of an existing 114-foot-high, 940-foot-long zoned earthfill dam. Design-phase support included the preparation of an erosion control plan and permitting. The construction-phase support services included shop drawing reviews; on-site coordination meeting with client and contractor; coordination with survey subconsultant; and response to requests for information. Rehabilitation measures included slope stabilization, roller-compacted concrete (RCC) spillway armoring, a new toe-drain system, and outlet works modifications.

Redbank Valley Intake Dam Rehabilitation, Armstrong and Clarion Counties, PA, *Redbank Valley Municipal Authority*. Erosion Control Designer responsible for the rehabilitation of a new concrete gravity dam, water supply intake, and Denil-type fish passage facility to replace the existing dam and eliminate hazardous hydraulic backwash. Responsibilities included preparation of an erosion control plan, care and diversion of water plan, and associated permit applications.

Summary of Qualifications and Experience

In his role as Project Principal, Paul will provide project oversight, assistance, and leadership with the aim of improving project outcomes for East Goshen Township. As a Vice President, he is authorized to commit the firm and will regularly monitor the project team's performance to ensure that optimum resources are available at all times. Paul has 31 years of experience working on more than 440 dams of various types and sizes, including providing dam assessments, designs, design reviews, reports, construction drawings, and specifications. His expertise also includes providing construction contract administration services for dam and flood control projects, hydrologic and hydraulic (H&H) studies for dams and bridges, dam rehabilitation, and new hydraulic structures.

Relevant Projects

Design of Breaches for Upper and Lower Hereford Manor Lake Dams, Beaver County, PA, Pennsylvania Department of General Services. Senior Project Engineer responsible for providing technical support and reviews of breaches for the Upper and Lower Hereford Manor Lake Dams located on Doe Run in Beaver County. The Upper and Lower Hereford Manor Lake Dams are homogeneous earthfill dams 40 feet high by 450 feet long, and 37 feet high by 1,000 feet long, respectively. The project included subsurface investigations; bathymetric and land topographic surveys; hydrologic and hydraulic analyses; gas, electric, and communications utility relocations; preparation of design reports, contract drawings, and specifications; and permitting coordination with the Pennsylvania Department of Environmental Protection, the U.S. Army Corps of Engineers, the Federal Aviation Administration, and the Pennsylvania Department of Transportation. The project also included reestablishing Doe Run downstream of the Lower Dam and designing a new 8-foot-high by 12-foot-wide box culvert to convey the reestablished stream under a state highway.

Dam Engineering Services, Rehabilitation of Lake Natalie Dam, Gouldsboro, PA, Big Bass Lake Community Association. Senior Project Manager responsible for preparing an engineering study, final design, and construction-phase services for the rehabilitation of Lake Natalie Dam, which included stabilizing the existing timber-crib structure; addressing seepage and sinkholes in the dam; improving site access; and increasing discharge capacity to safely pass the probable maximum flood. The selected alternative included installing an impervious liner within the embankment and armoring the embankment with articulated concrete blocks. Prepared design drawings and specifications for the selected alternative.

Pikes Creek Dam Rehabilitation (PADEP D40-018), Luzerne County, PA, Pennsylvania American Water. Project Principal responsible for the completion of planning and design-phase services for rehabilitating the 65-foot-high, 2,155-foot-long homogenous earthfill dam. Pikes Creek Dam is a high-hazard structure with an ogee crest principal spillway and flashboard/ogee crest auxiliary spillway. Engineering studies and construction plans were reviewed and augmented with subsurface explorations, site reconnaissance, and field surveys to assess the dam's condition and compliance with current dam safety design criteria. Alternative design solutions were developed and critiqued relative to costs and construction practicality. Two-dimensional hydraulic analyses were also performed to identify downstream infrastructure at risk to inundation during activation of the auxiliary spillway. Alternative solutions evaluated included embankment armoring and the application of crest gates, fuse gates, and labyrinth spillways to increase spillway capacity. Compiled a preliminary design memorandum presenting preliminary design construction plans, design analyses documentation, and estimated cost of construction for the recommended design solution. The selected dam rehabilitation includes the use of



Project Assignment:

Project Principal; QA/QC

Years Experience with Current Firm: 28

Years Experience with Other Firms: 3

Education:

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

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

Professional Registrations:

PE: Pennsylvania - No. PE040000E (1990)

ASFPM Certified Floodplain Manager: Association of State Floodplain Managers, Inc. - No. US-12-06194 (2012)

Professional Affiliations:

United States Society on Dams (USSD)

Hydraulics and Spillways Committee

Committee for Dam Rehabilitation Using RCC

Association of State Dam Safety Officials (ASDSO)

Technical Training Program Committee

Affiliate Member Advisory Committee

Chairman of Distance Learning Subcommittee

**Professional Affiliations
(cont.):**

Technical Advisor for
Natural Resources
Conservation Service
(NRCS) Study Work Group
Evaluate Design Tools for
Roller-Compacted
Concrete Stepped
Spillways and Roller-
Compacted
Concrete Stepped
Embankment Armoring
Federal Emergency
Management Agency
(FEMA) Dam Safety
Review Board Private
Sector Representative
(2009-2011)

Hydroplus Fuse gates, underwater installation of upstream closure gates of the outlet conduits, and modification of the embankment to include an internal chimney drain and filter with flatter slopes.

Various Dam Safety and Water Resources Engineering Assignments, Specific Outlet Works Inspections at Dams, Chester County, PA, Chester County Water Resources Authority.

Project Principal responsible for preparing technical specifications and bidding quotations; coordinating with contractors; and observing the inspection of Beaver Creek Dam's 30-inch-diameter principal spillway conduit and impact basin. To date, a manned-entry inspection of Barneston Dam's 4-foot by 4-foot principal spillway conduit during low-flow conditions has been completed. The inspection was performed from downstream proceeding upstream, with each joint inspected along its perimeter. Joint gaps were recorded at each conduit joint. Senior Project Manager responsible for performing various dam safety and water resources assignments, including the rehabilitation of Bernhart Dam, a more than 100-year-old earth embankment structure. Our firm designed a safe means to dewater the reservoir and inspect the dam and also developed long-term solutions to the dam's problems, which included inoperable outlet works, embankment seepage, and sinkholes in the embankment.

Ryerson Station State Park Dam, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. Senior Project Manager responsible for reviewing hydraulic analyses for the conceptual design of dam rehabilitation alternatives for the existing concrete gravity dam. Prepared spillway discharge rating curves for the existing spillway based on the U.S. Department of the Interior, Bureau of Reclamation's methodology presented in *Design of Small Dams*. Performed hydraulic analyses using the U.S. Army Corps of Engineers HEC-RAS computer model to assess tailwater conditions during extreme flood events.

Dam Design Services, Designing Roller-Compacted Concrete (RCC) Overtopping Protection for Springton Dam, Delaware County, PA, Aqua Pennsylvania, Inc. Senior Project Manager responsible for preparing hydraulic analyses and conceptual designs of roller-compacted concrete (RCC) overtopping protection and spillway enlargement for Springton Dam, an earthen embankment approximately 70 feet high and 1,600 feet long. The project involved performing a detailed topographic and feature survey, a jurisdictional wetland determination, a bog turtle habitat assessment, and an environmental assessment. Work also included highway bridge replacement and traffic detour studies. Conceptual design drawings and detailed planning-level cost estimates were also prepared.

Final Design of Fish Passage Facilities at Black Rock and Norristown Dams, Philadelphia, PA, Exelon Power. Project Manager responsible for evaluating fishway types and managing final design for two new Denil-type fishways. Services included ground surveys and bathymetric surveys; subsurface exploration and testing of soil and rock materials; hydrologic and hydraulic analyses; preliminary design and layout; final design; preparation of plans and specifications; environmental assessments; historical research of cultural resources; permitting; and bid-phase, construction-phase, and start-up services. The Norristown Fishway project was the recipient of the 2008 Association of Conservation Engineers Carl V. Anderson Award of Merit. Both projects were selected to receive a 2009 American Council of Engineering Companies of Pennsylvania Diamond Award for Engineering Excellence.

Summary of Qualifications and Experience

Dennis' responsibilities for this project will involve technical review. Dennis has nearly 40 years of experience providing engineering services for water resources, including providing dam analysis and design, performing quality assurance and peer reviews, conducting field reconnaissance, and preparing or reviewing reports for clients or regulatory agencies. He has provided dam-related services on more than 100 projects at Gannett Fleming for clients such as the Borough of Chambersburg, Chester County Water Authority, and Pennsylvania American Water. Prior to joining Gannett Fleming, Dennis worked at the Pennsylvania Department of Environmental Protection (PADEP) for 30 years, where he was involved in thousands of dam safety and construction inspections, reviews of dam rehabilitation plans, and public meetings concerning dam safety issues and issues pertaining to wetland impacts by dams.

Relevant Projects

Elmhurst Dam, Lackawanna County, PA, Pennsylvania American Water. Participated in a Risk Analysis Workshop for the evaluation of the Elmhurst Dam. This dam is 64 feet high and 380 feet long and provides 2,115 acre-feet of water supply storage at normal pool elevation. In addition to having a spillway that can only pass 24 percent of the spillway design flood standards, recent inspections had identified a hole that had formed next to the northwest corner of the dam; concrete spalls, hairline cracks, open masonry joints, and masonry dislocation on the concrete portions of the right upstream wing wall; settlement at the concrete chute spillway wall joints; scattered open joints on the masonry spillway channel walls and steps; and sediment deposits at the dry masonry wall between the upstream and downstream blow-off valve chambers. Served as one of a team of dam safety experts conducting a joint risk analysis of the dam. Failure modes were first identified and ranked, event trees were developed for each mode, actions were identified to reduce uncertainties, and actions were identified to reduce risks of each failure mode.

Long Pine Run Dam, Chambersburg, PA, Borough of Chambersburg. Senior Engineer working with a team of engineers responsible for evaluating the significance of tension cracks on the crest of a 120-foot-high water supply dam. Used observations from site visits and a review of the design plans in the development of the evaluation. The team developed a monitoring plan that included the installation of several surface monuments on the downstream slope. Responsible for the development and delivery of a *Supplement to the 2011 Annual Dam Inspection for Long Pine Run Dam* presenting a summary of the embankment monitoring program of seven embankment monuments, an evaluation of the observed irregularities, and recommendations for further action by the Borough of Chambersburg.

Springton Dam Rehabilitation Project, Delaware County, PA, Aqua Pennsylvania, Inc. Senior Engineer involved with the proposed rehabilitation of the Springton Dam, which includes replacing and widening a Pennsylvania Department of Transportation (PennDOT) bridge spanning the spillway outlet channel, widening and deepening the spillway outlet channel under the new PennDOT bridge, and replacing the existing fixed-crest ogee spillway control section with a fusegate system spillway from Hydroplus, Inc. Responsibilities include peer-reviewing the new spillway and outlet channel modification design and facilitating the permitting of the bridge and spillway projects through the Pennsylvania Department of Environmental Protection's Dam Safety Program.

Ryerson Station State Park Dam Final Design, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. Senior Engineer involved with the design of the planned



Project Assignment:

Technical Advisor

Years Experience with Current Firm: 4

Years Experience with Other Firms: 35

Education:

BS, Civil Engineering, The Pennsylvania State University, 1975

Professional Registrations:

PE: Pennsylvania - No. PE029537E (1980)

Delaware - No. 18064 (2012)

Professional Affiliations:

Association of State Dam Safety Officials (ASDSO)

Dam Owner Outreach Committee

Peer Review Committee

Training Committee, current member

American Society of Civil Engineers

reconstruction of an existing concrete gravity dam. Improvements include removing the damaged portion of the concrete structure and reconstructing the overflow and non-overflow sections of the dam, stilling basin, and outlet works facility. Responsibilities include peer review of the technical design of the project.

Long Pine Run Dam Valve Replacement and Conduit Repair, Franklin County, PA, Borough of Chambersburg. Senior Engineer working on the development and delivery of plans and specifications for the replacement of a valve and conduit repairs at the Long Pine Run Dam. The project included demolition of an existing needle valve, valve stem, guides, operator, outlet pipe, and concrete pipe support associated with the existing needle valve. The project also included installation of a new 10-inch cone valve, valve stem, guide, operator, structural support for the valve, and a ladder Saf-T-Climb system. In addition, work involved repairs to the existing 54-inch reinforced-concrete outlet conduit and repairs to the existing reinforced-concrete transition section from the outlet tower to the outlet conduit. Responsible for peer-reviewing the plans and specifications and facilitating the permitting of the project through the Pennsylvania Department of Environmental Protection's Dam Safety Program.

Boil Investigation at Bear Gap No 2 Dam, Northumberland County, PA, Aqua Pennsylvania. Senior Engineer involved with a team of engineers investigating the potential source of seepage forming a boil in the abutment area downstream of the subject high-hazard dam. Work of the team included a field inspection, a review of historical design and construction information, a determination of potential sources/seepage path of the boil, development of a means to investigate the potential sources/seepage path, and development of a remediation plan to address the sources/seepage path of the boil.

Experience Prior to Gannett Fleming:

PADEP, Division of Dam Safety

Served as **Project Review Engineer; Section Chief of Project Review and Evaluation Section (Permitting Section); Division Chief of the Division of Dam Safety; and Acting Director, Bureau of Waterways Engineering.** Involved in thousands of dam safety inspections, dam construction inspections, reviews of new dam construction plans and specifications, reviews of dam rehabilitation plans, dam owner and owner/engineer meetings, and public meetings concerning dam safety issues and issues pertaining to wetland impacts by dams. Facilitated dam-owner workshops; training seminars; public information meetings with media; radio and TV broadcasts related to dam safety issues; and legislative liaison meetings. Developed emergency action plan guidelines; managed a staff of 26 engineers, inspectors, biologists, emergency management specialists, enforcement specialists, and administrative staff; developed dam safety regulations and commonwealth policies concerning dam safety; developed needs documents and a ranking protocol for state funding of dam rehabilitation projects. Served as the Pennsylvania delegate to the Association of State Dam Safety Officials and Mid-Atlantic Council for Safe Dams and served as the Pennsylvania member of the U.S. Department of Homeland Security, Office of Infrastructure Protection, Dams Sector, Government Coordinating Council. Directly involved in or had oversight responsibilities for the authorization of approximately 1,230 projects related to the original construction or rehabilitation of high-hazard dams in Pennsylvania. In addition, directly involved in or had oversight responsibilities for the authorization of the breaching of 49 high-hazard dams in Pennsylvania. Also directly involved in or had oversight responsibilities for the jurisdictional review, authorization review, and/or other regulatory review of the original construction, rehabilitation, or breaching of an estimated 3,400 additional projects related to significant or low-hazard dams in Pennsylvania.

Summary of Qualifications and Experience

Amanda will provide hydrologic and hydraulic (H&H) services for the project. Amanda has more than 15 years of experience in hydrologic and hydraulic/2-D modeling, including performing H&H analyses for water resources projects and designing hydraulic structures related to dams, flood control reservoirs, bridges, and channel improvement construction, rehabilitation, and reconstruction projects, including the design of spillways, outlet works, and stilling basins. Her technical specialties include conducting two-dimensional (2-D) hydraulic modeling, developing dam break inundation mapping based on unsteady hydraulic models, performing hydrologic analyses to route inflow hydrographs through complex reservoir systems, assessing bridge scour, assessing hazard classification of hydraulic structures based on failure consequences, and determining the reservoir safe yield. Her experience on more than 120 projects has given her proficiency in using the U.S. Army Corps of Engineers (USACE) HEC-1, HEC-2, HEC-RAS, and HEC-HMS software; the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Water Resource Sites Analysis (SITES) computer model; PondPack; and the Watershed Modeling System, as well as developing in-house computer programs for water resource engineering applications.

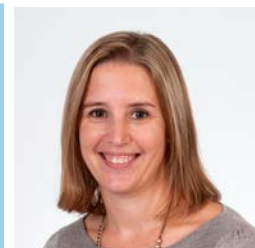
Relevant Projects

Removal of Upper and Lower Hereford Manor Dams, Beaver County, PA, Pennsylvania Department of General Services. Senior Project Engineer responsible for assessing the effect of removing two dams for public safety purposes and constructing a new box culvert under S.R. 0288. The analyses included a hydrologic analysis, hydraulic modeling of existing and proposed conditions, and an analysis of results to demonstrate possible effects.

Miscellaneous Hydraulic Analyses for Pine Grove Dam, Chester County, PA, Chester Water Authority. Project Manager responsible for the preparation of various hydraulic analyses including gage calibration, spillway rating, bridge analysis, and flood risk assessment for the Authority. The development of the spillway and outlet discharge rating curve was complex because of the possibility of outlet structure submergence from downstream backwater. The discharge tables were provided to the client in the form of computer software with an easy-to-use interface. The software adjusts outflow from the dam based on downstream submergence in an iterative process.

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

Redbank Valley Intake Dam Rehabilitation, Armstrong and Clarion Counties, PA, Redbank Valley Municipal Authority. Project Engineer responsible for completing H&H analyses and preparing cost estimates for the Redbank Valley Dam rehabilitation, which was completed to address several dam deficiencies at the 8-foot-high, run-of-river dam. Work entailed modifying the dam with conventional cast-in-place concrete steps on its downstream face to minimize or eliminate the development of a hydraulic roller; providing a new water supply intake; and



Project Assignment:

Hydrology and Hydraulics

Years Experience with Current Firm: 15

Years Experience with Other Firms: 1

Education:

BS, Civil Engineering, The Pennsylvania State University, 1997

MS, Civil Engineering, The Pennsylvania State University, 1999

Professional Registrations:

PE: Pennsylvania - No. PE070894 (2004)

Texas (inactive) - No. 95983 (2005)

New Hampshire - No. 14353 (2014)

ASFPM Certified Floodplain Manager: Association of State Floodplain Managers, Inc. (2009)

Professional Affiliations:

American Society of Civil Engineers

Association of State Dam Safety Officials (ASDSO)

Virginia Lakes and Watersheds Association

United States Society on Dams (USSD)

Member, Committee on Hydraulics

designing a Denil-type fish passage facility. Performed H&H analyses to assess the impact of the proposed dam rehabilitation, as well as a proposed pump station and proposed water treatment plant upgrades on the water surface profiles of the Redbank Creek. Prepared an engineer's estimate of probable construction cost.

Dam Safety Improvements for Springton Dam, Delaware County, PA, Aqua Pennsylvania, Inc.

Project Engineer responsible for preparing and reviewing hydraulic analyses and conceptual designs of dam safety improvement alternatives for Springton Dam, an earthen embankment approximately 70 feet high and 1,600 feet long. Improvement alternatives included providing roller-compacted concrete (RCC) overtopping protection on the earthen embankment; installing Hydroplus fusegates on the spillway crest; and constructing a labyrinth weir on the existing emergency spillway. hazard area mapping using GIS.

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

Future Operating Plan Development, Chester County, PA, Pennsylvania American Water.

Hydrologic and Hydraulic Task Manager responsible for the development of a Visual Basic model to simulate the Coatesville raw water supply system. The model was used to develop possible future operating plans to maximize system yield while complying with permits and maximizing other desired outcomes. The model and hydrologic database simulated the daily operation of the reservoir for the period of record from 1911 to 2010. Results were summarized in an engineering report.

Reservoir Fluctuation Study, Chester County, PA, Chester County Water Resources Authority.

Senior Project Engineer responsible for assessing the reservoir pool fluctuations of Chambers Lake (impounded by Hibernia Dam). Work included developing a computer model and hydrologic database to simulate the daily operation of the reservoir for the period of transposed streamflow record from 1912 to 2010. Minimum reservoir pool level was investigated based on computer model simulation and was used to design improvements to the outlet works to be able to reliably supply water to a downstream intake. Results were summarized in an engineering report.

Octoraro Reservoir Hydraulic Investigations, Chester County, PA, Chester Water Authority.

Project Manager for investigation of flooding along the Octoraro Creek. Octoraro Reservoir is the source of raw water for the CWA's Pine Grove water treatment plant, located immediately downstream from Pine Grove Dam. Flooding of Octoraro Creek is a concern for the CWA. Responsible for technical review of HEC-RAS hydraulic analyses along Octoraro Creek and hydraulic investigations to develop stage discharge relationships for two staff gages upstream of the reservoir. Field measurements of total stream flow were taken. A computer model application was prepared to compute the discharge over the ogee spillway and through the tainter gates based on hydraulic conditions in the reservoir and in Octoraro Creek. This task included field of survey streams, the spillway, a bridge, and the staff gages.

Summary of Qualifications and Experience

In his role for this project, Andrzej will provide dam assessment services. With more than 10 years of experience, Andrzej's expertise includes performing on-site investigations to collect data for analysis and modeling; performing or checking engineering analyses; and preparing maps and plans, specifications, and cost estimate (PS&E) packages for projects. Andrzej has provided engineering services for nearly 15 dam projects, more than half of them in Pennsylvania.

Relevant Projects

Hibernia Perimeter Dike Culvert Replacement and Crest Grading, Chester County, PA, Chester County Water Resources Authority. Hydrologic Designer responsible for assessing the adequacy of an earthen perimeter dike for flood protection, developing plans, specification and cost estimate for culvert replacement, refurbishing of flap gates and crest grading. Providing bid and construction phase services.

Beaver Creek, Hibernia and Struble Dams Outlet Works Inspections, Chester County, PA, Chester County Water Resources Authority. Hydrologic Designer responsible for performing manned confined space inspection of dam outlet works, including sluice gates and appurtenances. Providing technical oversight during remote operated vehicle (ROV) inspection of outlet works. Preparing inspection reports that include repair/replacement recommendations.

Beaver Creek, Hibernia and Struble Dams, 2012-2015 Annual Dam Inspections, Chester County, PA, Chester County Water Resources Authority. Hydrologic Designer responsible for inspecting dams, reviewing conservation release data, reviewing tabulated and plotted piezometric data and preparing inspection reports with Pennsylvania Department of Environmental Protection (PADEP) requirements.

Hibernia Dam Riser Modification/Water Supply Valves, Chester County, PA, Chester County Water Resources Authority. Hydrologic Designer assigned to project as task manager. Responsibilities include aiding in developing plans, specifications, and cost estimate to modify existing dam outlet works by installing a 12-inch siphon, 14-inch gravity line and valve chamber to provide reliable water release for water supply and lake drawdown purposes. Providing bid and construction phase services and serving as primary point of contact between client and design team.

Long Pine Run Dam Repairs, Chambersburg, PA, Borough of Chambersburg Water and Sewer Department. Hydrologic Designer responsible for inspecting the 54-inch discharge conduit by performing a confined space entry. Work included assessing the condition of the conduit and preparing design drawings, specifications, and a cost estimate for repairs of deficient concrete surfaces within the conduit.

Ryerson Station State Park Dam, Greene County, PA, Pennsylvania Department of Conservation and Natural Resources. Hydrologic Designer assisting in the design, bid, and construction services for a concrete gravity dam and other project features to replace the damaged existing structure. Responsible for analyzing monitoring data, which includes both survey and crack-gate data; performing and checking stability analysis; and assisting with the creation of specifications, drawings, quantities, and cost estimates.



Project Assignment:

Assessment

Years Experience with Current Firm: 6

Years Experience with Other Firms: 4

Education:

BS, Civil Engineering, Minor in Engineering Leadership and Development, The Pennsylvania State University, 2008

Professional Registrations:

EIT: Pennsylvania - No. ET013273 (2009)

First Aid: American Red Cross (2015)

Adult CPR/AED: American Red Cross (2015)

Construction Specifications Institute (CSI): Construction Documents Technologist (CDT) (2013)

Professional Affiliations:

Recipient of Best Poster Award, Association of State Dam Safety Officials (ASDSO) National Conference, 2012

Association of State Dam Safety Officials

Order of the Ring, Civil Engineering Society

Lee Hall Reservoir Dam Improvement, Newport News, VA, City of Newport News. Hydrologic Designer responsible for assisting with the design of dam rehabilitation features for the earth embankment dam. Responsible for the preparation of plans and technical specifications, as well as assisting in addressing technical issues and permitting.

Upgrades and Modifications to Lower North River Dam #78 (Briery Branch), Phase I, Ashby, VA, Virginia Department of Conservation and Recreation. Hydrologic Designer responsible for field coordination and oversight of the principal spillway conduit inspection through the use of a remote-operated vehicle. The goal of Phase I of the project was to visually inspect the condition of the site and the impoundment structure, assess site conditions, and identify any potential access issues. The deliverable to the client included an assessment report and video of the field reconnaissance.

New Creek Site 14 Rehabilitation, Keyser, WV, U.S. Department of Agriculture, Natural Resources Conservation Service. Hydrologic Designer responsible for tasks that included performing and checking various calculations, designing and drafting an erosion and sediment pollution control plan, assembling a cost estimate, and assisting in creating contract drawings.

Gilboa Dam and Associated Facilities Reconstruction, Gilboa County, NY, City of New York Department of Environmental Protection. Hydrologic Designer responsible for tasks that include designing various drainage systems, calculating quantities, assembling cost estimates and other reports, and performing and checking calculations using MathCAD. Responsibilities throughout the duration of the project include drafting contract drawings, both two-dimensional and three-dimensional, using AutoCAD and Google SketchUp; designing stairway and handrail systems; laying out and specifying fall protection systems and requirements; designing discharge and drainage pipes; and designing weirs. Performed a scour analysis, which included calculations and design. Designed siphons to allow reservoir discharge to bypass construction activities. The design of the two siphons included researching the design of siphons; performing hydraulic calculations; and drafting design drawings, quantities, and specifications.

Lake Marburg EAP Seminar, Hanover, PA, P.H. Glatfelter. Hydrologic Designer responsible for assisting with coordination, preparation, and execution of an emergency action plan (EAP) exercise. The EAP exercise was to inform the general public and local rescue services of the tasks involved during the event of a dam failure of Lake Marburg Dam.

FEMA Region III Floodplain Map Modernization Program, Philadelphia, PA, U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA), Region III. Hydraulic and Hydrologic Designer responsible for tasks that included delineating floodplain and floodplain mapping using ArcView, ArcMap, and HEC-RAS software. The project involved field surveys, flood hazard mapping, and FEMA Digital Flood Insurance Rate Map database development for numerous counties throughout the commonwealth.

Dam Safety Services, Nationwide, U.S. Department of the Interior, U.S. Fish and Wildlife Service (USFWS). Hydrologic Designer responsible for performing nationwide dam safety services for a 5-year indefinite delivery contract. Work required performing Safety Evaluation of Existing Dams inspections for small- and intermediate-sized dams and preparing inspection reports to document the field inspections and subsequent meetings with USFWS personnel. Inspection reports included a list of observations collected during the inspections; recommendations for future maintenance, operations, and construction; and cost estimates for recommended repairs and engineering studies. Tasks also included performing emergency action plan and preparedness exercises. Inspected USFWS dams in Pennsylvania and New York.



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